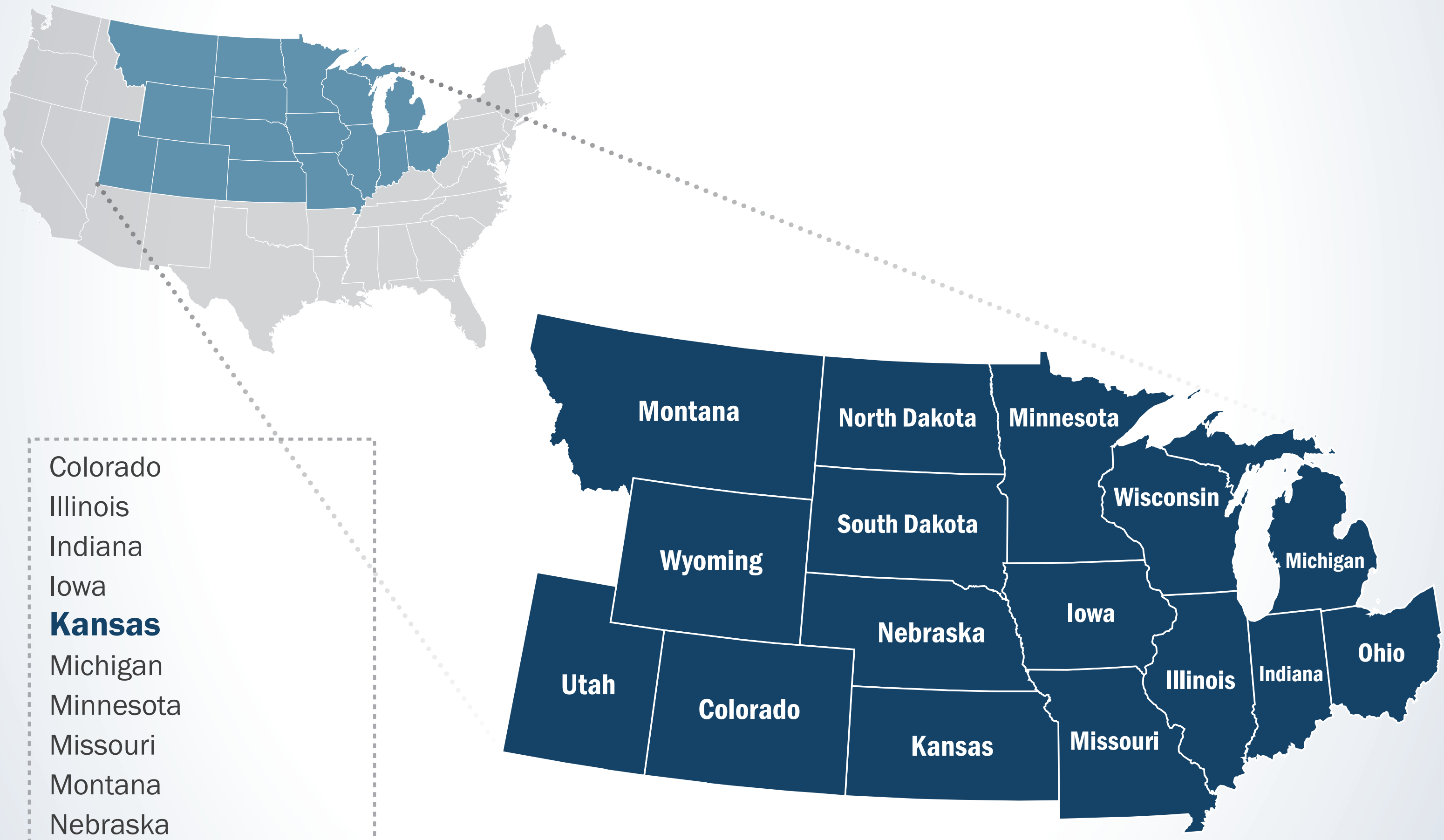
FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Central United States

VOLUME 5 - CHAPTER 7



Colorado
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Minnesota
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Montana
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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 5 - CHAPTER 7

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

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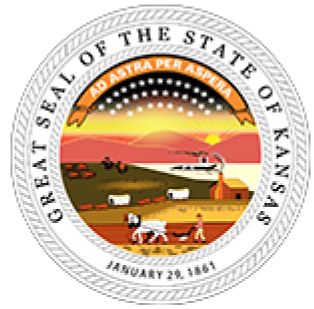
7. KANSAS



Human beings have occupied the area that is now the state of Kansas for approximately 11,000 years. American Indian tribes with a rich cultural history lived in what is now Kansas for centuries before the 1500s (Kansas Historical Society 2014). The first Europeans to visit the area arrived in the early 1540s. Kansas's road to statehood was contentious due to slavery concerns; the state was referred to as "Bleeding Kansas" for the violent confrontations that broke out between the "freestaters" and pro-slavery camps. In 1861, Kansas was admitted into the Union as a free state (Kansas Office of the Governor 2016). Kansas is bordered by Nebraska to the north, Colorado to the west, Oklahoma to the south, and Missouri to the east. This chapter provides details about the existing environment of Kansas as it relates to the Proposed Action.

General facts about Kansas are provided below:

- **State Nickname**: The Sunflower State
- **Land Area:** 81,758.72 square miles; **United States** (**U.S.) Rank**: 13 (U.S. Census Bureau, 2015w)
- **Capital:** Topeka
- **Counties:** 105 (Kansas Office of the Governor 2016)
- **2014 Estimated Population:** Over 2.9 million people; **U.S. Rank:** 34 (U.S. Census Bureau, 2015w)
- **Most Populated Cites:** Wichita, Kansas City, and Topeka (Kansas Office of the Governor 2016)
- **Main Rivers:** Arkansas River, Kansas River, Missouri River, Republican River, Smoky Hill River
- **Bordering Waterbodies:** Missouri River
- **Mountain Ranges:** Smoky Hills, Flint Hills, and Red Hills
- **Highest Point:** Mt. Sunflower (4,039 ft) (Kansas Office of the Governor 2016)

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7.1. AFFECTED ENVIRONMENT

7.1.1. Infrastructure

7.1.1.1. Definition of the Resource

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

Section 7.1.1.3 provides an overview of the traffic and transportation infrastructure in Kansas, including road and rail networks and airport facilities. Kansas 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 Kansas are presented in more detail in Section 7.1.1.4. Section 7.1.1.5 describes specific public safety communications infrastructure and commercial telecommunications infrastructure in Kansas. An overview of utilities in Kansas, such as power, water, and sewer, are presented in Section 7.1.1.6.

7.1.1.2. Specific Regulatory Considerations

Multiple Kansas laws and regulations pertain to the state's public utility and transportation infrastructure and its public safety community. Table 7.1.1-1 identifies the relevant laws and regulations, 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.] § 140126)).

Table 7.1.1-1: Relevant Kansas Infrastructure Laws and Regulations

State Law / Regulation	Regulatory Agency	Applicability
KS: Chapter 48 Militia, Defense, and Public Safety	Office of the Adjutant General, Division of Emergency Management	Oversees emergency management activities and plans and provides for rapid and efficient communications during a disaster.
KS: Chapter 3 Aircraft and Airfields; Chapter 8 Automobiles and Other Vehicles; Chapter 68 Roads and Bridges	Kansas Department of Transportation	Oversees the state transportation system and regulates automobiles and other vehicles, aeronautics, and road use within the state.

7.1.1.3. Transportation

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

The Kansas Department of Transportation (KDOT) has jurisdiction over freeways and major roads, airports, railroads, and mass transit in the state; local counties have jurisdiction for smaller streets and roads. The mission of the KDOT is to “provide a statewide transportation system to meet the needs of Kansas” (KDOT 2009).

Kansas has an extensive and complex transportation system across the entire state. The state’s transportation network consist of:

- 140,687 miles of public roads (FHWA 2014a) and 25,085 bridges (FHWA 2015a);
- 4,721 miles of rail network that includes passenger rail and freight (KDOT 2011);
- 368 aviation facilities, including airstrips and heliports (FAA 2015a); and
- No major harbors or ports.

Road Networks

As identified in Figure 7.1.1-1, major urban centers of the state from north to south are Manhattan, Kansas City, Topeka, Salina, Hutchinson, Garden City, and Wichita. Kansas has two 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 7.1.1-2 lists the interstates and their start/end points in Kansas. 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 2016).

Table 7.1.1-2: Kansas Interstates

Interstate	Southern or western terminus in KS	Northern or eastern terminus in KS
I-35	OK line in Guelph	MO line in Kansas City
I-70	CO line at Kanorado	MO line in Kansas City

In addition to the Interstate System, Kansas has both National and State Scenic Byways. National and State Scenic Byways are roads that are recognized for one or more archaeological, cultural, historic, natural, recreational, and scenic qualities (FHWA 2013). Figure 7.1.1-1 illustrates the major transportation networks, including roadways, in Kansas. Section 7.1.8, Visual Resources, describes the National and State Scenic Byways found in Kansas from an aesthetic perspective.

National Scenic Byways are roads with nationwide interest; the byways are designated and managed by the U.S. Department of Transportation's (USDOT) Federal Highway Administration (FHWA). Kansas has two National Scenic Byways (FHWA 2015b):

- Flint Hills Scenic Byway: 48 miles in eastern Kansas.
- Wetlands and Wildlife Scenic Byway: 76.7 miles in central Kansas.

State Scenic Byways are roads with statewide interest; State Scenic Byways are designated and managed by KDOT. Some State Scenic Byways may be designated on portions of National Scenic Byways. Kansas has nine State Scenic Byways that crisscross the entire state[2] (Travel KS 2015a):

- Frontier Military Historic Byway
- Glacial Hills Scenic Byway
- Gypsum Hills Scenic Byway
- Native Stone Scenic Byway
- Post Rock Scenic Byway
- Prairie Trail Scenic Byway
- Route 66 Historic Byway
- Smoky Valley Scenic Byway
- Western Vistas Historic Byway

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

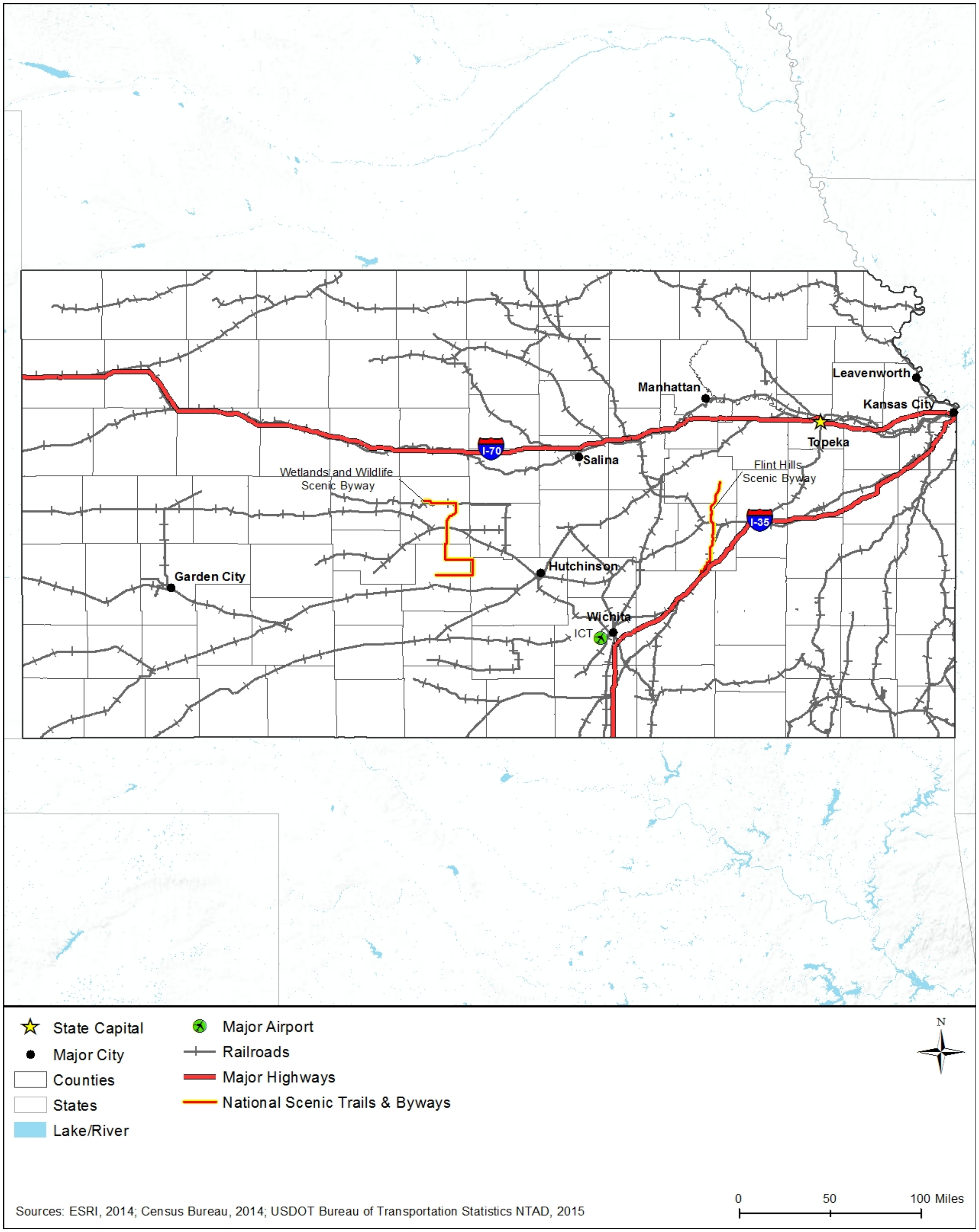


Figure 7.1.1-1: Kansas Transportation Networks

Airports

Wichita Dwight D. Eisenhower National Airport (ICT) provides air service to the state, which is the largest airport in Kansas. ICT is west of the City of Wichita. In 2014, the airport served 757,695 passenger enplanements, making it the 99th busiest airport in the nation (FAA 2015b). Also in 2014, ICT handled 211,328,367 pounds of cargo (FAA 2015c). Figure 7.1.1-1 illustrates the major transportation networks, including airports, in the state. Section 7.1.7, Airspace, provides greater detail on airports and airspace in Kansas.

Rail Networks

Kansas is connected to a network of passenger rail (Amtrak) and freight rail. Figure 7.1.1-1 illustrates the major transportation networks, including rail lines, in Kansas. Amtrak runs one line through Kansas: the Southwest Chief, which travels between Chicago and Los Angeles once per day and makes six stops in Kansas. In Kansas, Amtrak operates on about 463 miles of tracks that are owned by Burlington Northern and Santa Fe (BNSF) Railway (KDOT 2011). In 2010, Amtrak served over 44,000 passengers in Kansas (KDOT 2011). Table 7.1.1-3 provides a complete list of Amtrak lines that run through Kansas.

Table 7.1.1-3: Amtrak Train Routes Serving Kansas

Route	Starting Point	Ending Point	Length of Trip	Cities Served in Kansas
Southwest Chief	Chicago, IL	Los Angeles, CA	40+ hours	Lawrence, Topeka, Newton, Hutchinson, Dodge City, Garden City

Source: (Amtrak 2015)

The Federal Railroad Administration (FRA) classifies railroads as Class I, Class II, or Class III based on corporate revenue thresholds (FRA 2015a). Of the 4,721 miles of railroad track in Kansas, Class I freight rail companies own and operate on 2,790 miles of track and Class III railroads own and operate on an 1,931 miles of track (KDOT 2011). The Class I railroads in Kansas are BNSF Railway, Union Pacific Railroad, Kansas City Southern Railway, and Norfolk Southern Railway (KDOT 2011). In 2008, approximately 24 million tons of freight rail originated in Kansas, of which 52 percent was farm products (KDOT 2011). Also in 2008, another 24 million tons of freight rail terminated in Kansas, of which 52 percent was coal (KDOT 2011).

Harbors and Ports

Kansas is landlocked and has no large bodies of water or harbors and ports (World Port Source, 2016).

7.1.1.4. Public Safety Services

Kansas public safety services generally consist of public safety infrastructure and first responder personnel aligned with the demographics of the state. The general abundance and distribution of public safety services may roughly follow key state demographic indicators. Table 7.1.1-4 presents Kansas'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 7.1.9, Socioeconomics.

Table 7.1.1-4: Key Kansas Indicators

Kansas Indicators	
Estimated Population (2014)	2,904,021
Land Area (square miles) (2010)	81,758.72
Population Density (persons per sq. mile) (2010)	34.9
Municipal Governments (2013)	627

Sources: (U.S. Census Bureau, 2015w) (U.S. Census Bureau, 2013) (National League of Cities 2007)

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

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

Infrastructure Type	Number
Fire and Rescue Stations [a]	859
Law Enforcement Agencies [b]	371
Fire Departments [c]	502

[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' office, primary state law enforcement agencies, special jurisdictional agencies, and other miscellaneous agencies, collected by the U.S. Bureau of Justice Statistics in 2008.
[c] Data collected by the U.S. Fire Administration in 2015.

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

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

First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers [a]	1,140
Fire and Rescue Personnel [b]	12,002
Law Enforcement Personnel [c]	11,232
Emergency Medical Technicians and Paramedics [d e]	2,740

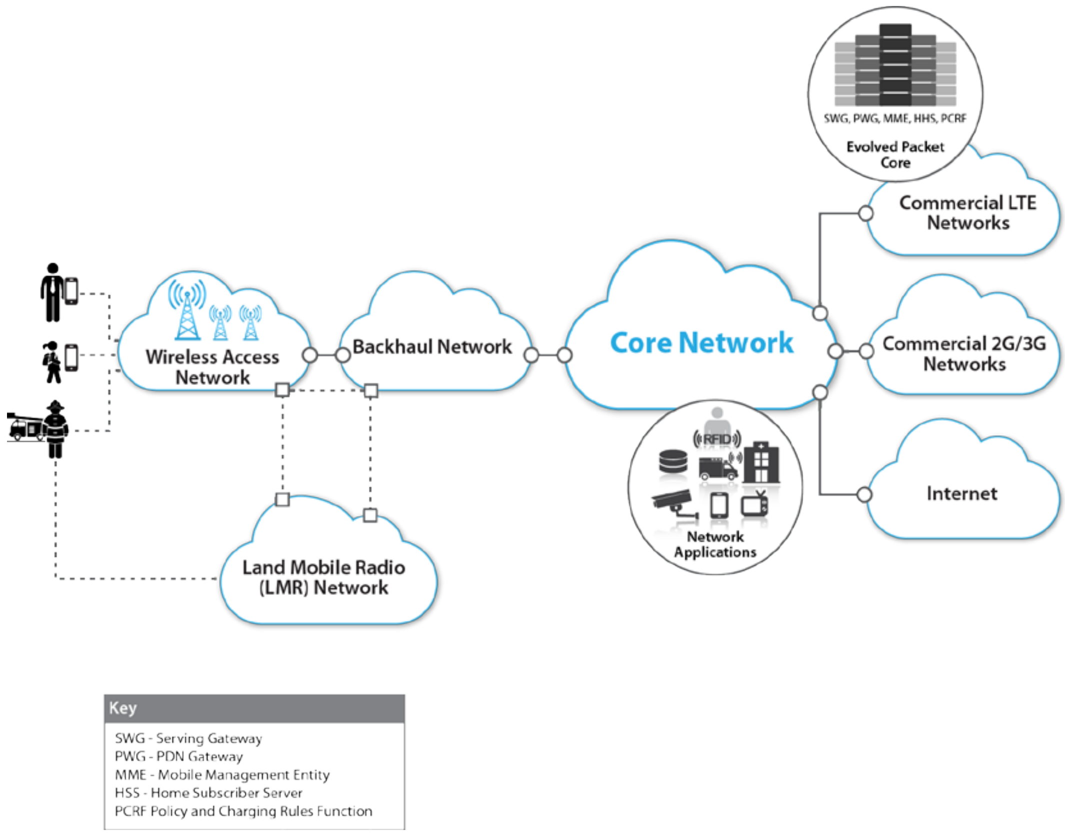
[a] BLS Occupation Code: 43-5031
[b] BLS Occupation Codes: 33-2011 (Firefighters), 33-2021 (Fire Inspectors and Investigators), 33-1021 (First-Line Supervisors of Fire Fighting and Prevention Workers), and 53-3011 (Ambulance Drivers and Attendants, Except Emergency Medical Technicians). Volunteer firefighters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

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

7.1.1.5. Telecommunications Resources

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

Communications throughout the state are based on a variety of publicly- and commercially-owned technologies. Figure 7.1.1-1 presents a typical wireless configuration including both a narrowband public safety land mobile radio network (traditional radio network) and a commercial broadband access network (wireless technology); backhaul (long-distance wired or wireless connections), core, and commercial networks including a long term evolution (LTE) evolved packet core (modern broadband cellular networks); and network applications (software) delivering voice, data, and video communications (FCC, 2016a).



Prepared by: Booz Allen Hamilton

Figure 7.1.1-2: Wireless Network Configuration

Public Safety Communications

In order to protect and best serve the public interest, first responder and law enforcement communities must be able to communicate effectively. The evolution of the communications networks used by public safety stakeholders toward a broadband wireless technology, such as LTE (see Section 7.1.1), 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 impacting information sharing are network coverage gaps, land mobile radio system infrastructure diversity, insufficient budgets, and diverse radio frequencies. Communication interoperability has also been a persistent challenge, along with issues concerning spectrum availability, embedded infrastructure, and differing standards among stakeholders (NTFI, 2005). This has caused a fragmented approach to communications implementation across the U.S. and specifically in Kansas.

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. The program also forecasts the evolution of LBS capabilities and gaps, and identify potential research and development opportunities that would improve the public safety community's use of LBS within operational settings. This is the first of several technology roadmaps that PSCR plans to develop over the next few years to better inform investment decisions (PSCR 2015).

Like most states, Kansas' public safety Land Mobile Radio (LMR) network environment is facing transition and reflects the challenges of the need for greater system capabilities. These increasing capabilities require investment in site maintenance and upgrades, incremental site resiliency and reliability improvements, as well as sustainment of analog to digital Project 25 (P25) conversion and planning for adoption of broadband and technology modernization (Kansas Adjutant General's Department 2014).

Statewide public safety LMR communications is provided over the P25 Kansas State Interoperable Communication System (KSICS), which is a 76-tower 700 MHz/800MHz system across Kansas as Figure 7.1.1-2 indicates (Kansas Adjutant General's Department 2014).

KSICS tower sites are owned by KDOT and interoperability communications operations is run by the Kansas State Patrol (Kansas Department of Emergency Communications 2012).

Statewide Networks

KSICS provides coverage across the State's 105 counties. The system operates on digital P25 technology and Figure 7.1.1-2 indicates the KDOT LMR-equipped towers. These towers were enabled from 2006-12 in a phased deployment and now operate with the new digital P25 equipment (RadioReference.com 2015a).

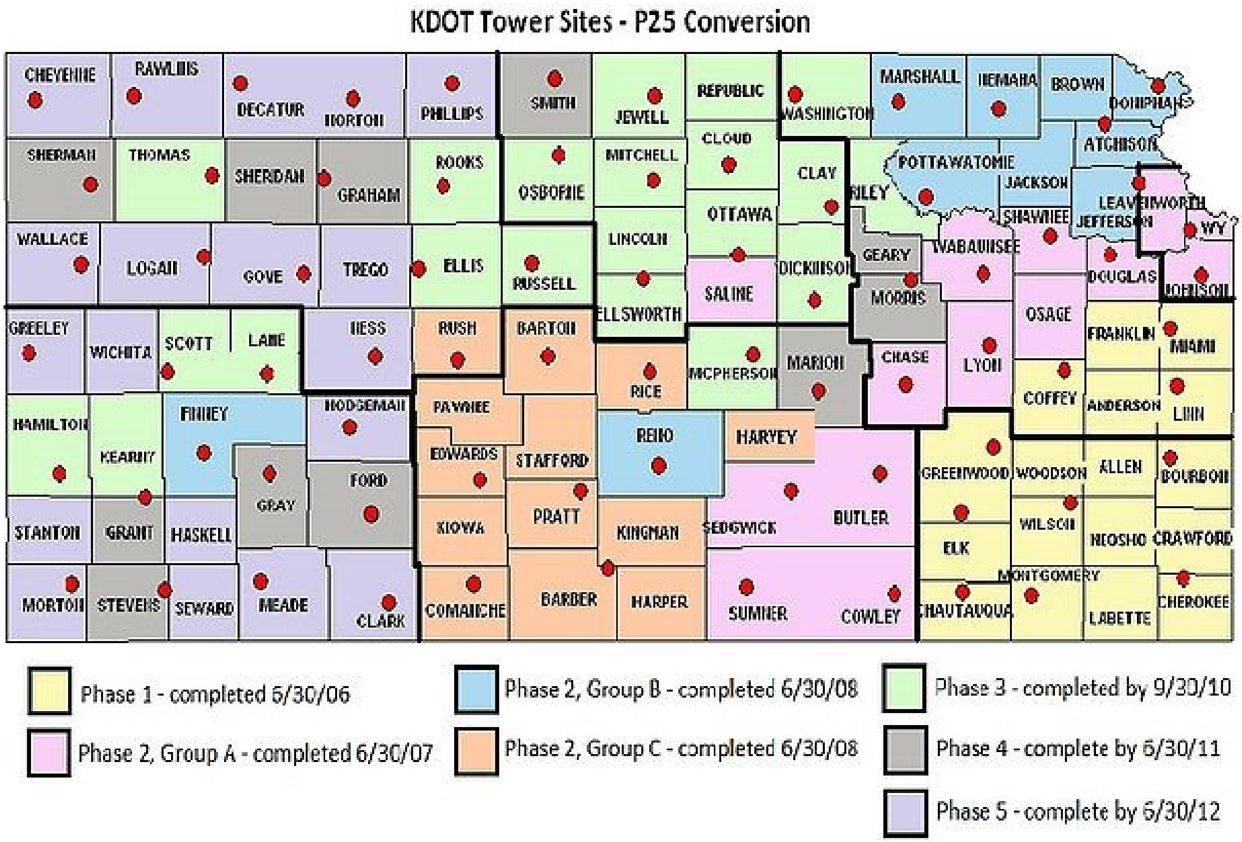


Figure 7.1.1-3: Kansas KDOT P25 Tower Sites

The KSICS system supports a wide variety of public safety users including the Kansas Highway Patrol (KHP), emergency management, state Fire Marshall, and county talk groups including police and fire. In addition, KSICS provides LMR communications to state agencies including KDOT, Attorney General's Office, and the Juvenile Justice Authority (KSICS 2015).

Interoperability in Kansas is supported based on a gateway system; MOTOBRIDGE[3] is deployed at the KDOT LMR tower sites to enable call-in, mutual aide, and incident response communications across diverse radio systems. This gateway system supports communication across multiple frequencies: Very High Frequency (VHF)[4] (State Channel and National Channels), UHF,[5] and 800 MHz (National Channels), as well as KSICS talk group channels (Kansas Department of Emergency Communications 2012).

The Kansas Office of Emergency Communications (OEC) maintains two Cell on Wheels (COW) deployable systems to support ad hoc emergency communications needs in the state, which

[3] MOTOBRIDGE is a Motorola gateway system facilitating LMR cross-band (multiple frequencies) communications

[4] VHF band covers frequencies ranging from 30 MHz to 300 MHz (NTIA 2005)

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

operate on 700 MHz and interworks with the KSICS statewide system (Kansas Adjutant General's Department 2014).

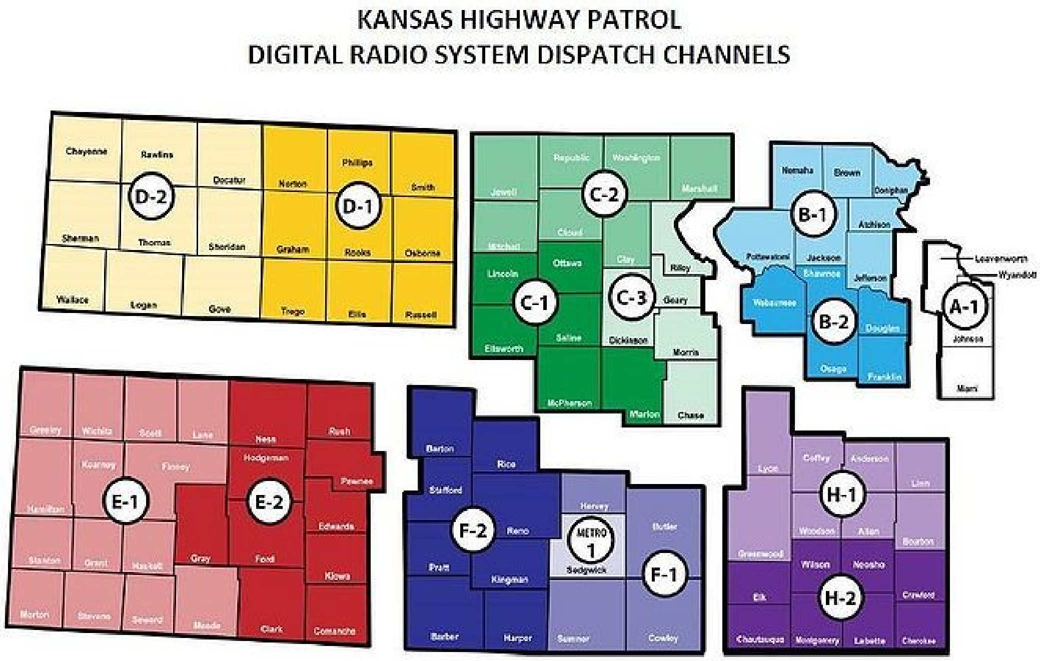


Figure 7.1.1-4: Kansas Highway Patrol Dispatch Regions

Statewide interoperability talk groups are available throughout Kansas due to its deployment of 76 gateways on all of its KDOT LMR-enabled towers, which provide for cross-band communications during mutual aid and incident response communications. The KHP operates the gateway communications dispatch system in the state and dispatch channels are provided based on the regional structure illustrated in Figure 7.1.1-3 (RadioReference.com 2015a).

County and City Public Safety Networks

In addition to the KSICS statewide P25 network, there are three county and regional P25 public safety networks in Kansas; the systems and their respective frequencies are listed below in Table 7.1.1-7.

Table 7.1.1-7: Kansas Project 25 Networks

Kansas P25 Public Safety Systems	Frequency Band
Kansas City Metropolitan Area Regional Radio System (MARRS)	700 MHz/800MHz
Kansas State Interoperable Communication System (KSICS)	700 MHz/800 MHz
Sedgwick County P25 Emergency Service Radio System	800 MHz
Topeka/Shawnee County (P25)	800 MHz

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

The Kansas City Metropolitan Regional Radio System (MARRS) covers two Kansas counties, (Johnson and Wyandotte), as well as three Missouri counties (Jackson, Platte, and Clay) (Project 25.org 2015).

The 800 MHz P25 Sedgwick County system supports public safety LMR communications for Sedgewick County Sheriff, Emergency Medical Services (EMS), and fire as well as Wichita Police talk groups (RadioReference.com 2015b).

The Topeka/Shawnee County 800 MHz P25 network supports Shawnee County public safety users (sheriff, fire, EMS), the city of Topeka (police, fire, EMS), and surrounding townships (RadioReference.com 2015c).

The majority of county and city public safety networks in Kansas, which are not digital P25, are a diverse combination of VHF and Ultra High Frequency (UHF) legacy (predecessor) networks. There is wide variation, on a county-to-county basis, in both the mix of frequencies used by public safety and the individual user segments using different frequencies and systems. For example in Greely County, in western Kansas, the sheriff department accesses KSICS and also uses VHF for dispatch. Whereas public safety communications in the town of Tribune are supported by VHF (RadioReference.com 2015d). By contrast in Barton County, in central Kansas, public safety communications are nearly all on UHF systems (RadioReference.com 2015e).

Public Safety Answering Points (PSAP)

According to the Federal Communication Commission's (FCC) Master PSAP registry there are 149 PSAPs in Kansas, serving Kansas' 105 counties (FCC 2015a).

Commercial Telecommunications Infrastructure

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

Carriers, Coverage, and Subscribers

Kansas's commercial telecommunications industry provides the full spectrum of telecommunications technologies and networks, including coaxial cable (traditional copper cable), fiber optics, hybrid fiber optics / coaxial cable, microwave, wireless, and satellite systems. Table 7.1.1-8 presents the number of providers of switched access[6] lines, Internet access[7], and mobile wireless services including coverage.

[6] "A service connection between an end user and the local telephone company's switch; the basis of plain old telephone services (POTS)" (FCC, 2013).
[7] Internet access includes Digital Subscriber Line (DSL), cable modem, fiber, satellite, and fixed wireless providers.

Table 7.1.1-8: Telecommunications Access Providers and Coverage in Kansas (2013)

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage of Households
Switched access lines [a]	159	97.4% of households
Internet access [b]	88	52% of households
Mobile Wireless [c]	11	98% of population

[a] Switched access lines are a service connection between an end user and the local telephone company's switch (the basis of older telephone services); this number of service providers was reported by the FCC as of December 31, 2013 in Table 17 in "Local Telephone Competition: Status as of December 31, 2013" as the total of ILEC and non-ILEC providers (FCC, 2014b).
[b] Internet access providers are presented in Table 21 in "Internet Access Services: Status as of December 31, 2013" by technology provided; number of service providers is calculated by subtracting the reported Mobile Wireless number from the total reported number of providers (FCC, 2014a).
[c] Mobile wireless provider data is provided by the FCC in the sources identified. However, NTIA's National Broadband Map provides newer data, so FirstNet is using NTIA's GIS-based data from the National Broadband Map instead of the data reported by the FCC. The process for retrieving the National Broadband Map data is explained in detail in a subsequent footnote in Section 7.1.1.5, Last Mile Fiber Assets.

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

Table 7.1.1-9 shows the wireless providers in Kansas along with their geographic coverage. Figure 7.1.1-4, Figure 7.1.1-5, Figure 7.1.1-6, and Figure 7.1.1-7 show the combined coverage for the top two providers; Sprint and T-Mobile's coverage; United Wireless', Wheatland Broadband, U.S. Cellular's, and KanOkla Networks' coverage; and the coverage of all other providers with less than 5 percent coverage area, respectively.[8]

Table 7.1.1-9: Wireless Telecommunications Coverage by Providers in Kansas

Wireless Telecommunications Providers	Coverage
AT&T Mobility Limited Liability Company (LLC)	99.68%
Verizon Wireless	99.24%
Sprint	25.96%
United Wireless	16.90%
T-Mobile	8.20%
Wheatland Broadband	7.33%
U.S. Cellular	5.89%
KanOkla Networks	5.57%
Other[a]	40.30%

Source: (NTIA 2014)

[a] Other: Provider with less than 5 percent coverage area. Providers include: Valnet; Sumner Comm.; Eagle Comm.; Pixius Comm.; SpeedNet; Nex-Tech.; Cricket Wireless; Mercury Wireless; SouthWest Kansas Online; NCKCN; S&T Comm.; Mutual Telecommunications; Kansas Broadband Internet; Blue Valley Telecommunications; BroadBand Wireless Internet; Nautilus Net; SCTelcom; FairPoint Comm.; Wave Wireless; WOW!; Golden Belt Telephone (GBT) Communications.; KASINET; Advantage Plus; Btsskynet; Rainbow Comm.; H&B Comm.; SwiftLink 4 State; Twin Valley Comm.; Giant Communications; Haviland Telephone; Midwest Mobile Radio Service.; Twinmounds; City of Coffeyville; Family Entertainment Network; Stouffer Comm.; Lawrence Freenet; Epic Touch Company; Rebeltec Comm.; Craw-Kan Telephone Coop; Diode Comm.

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

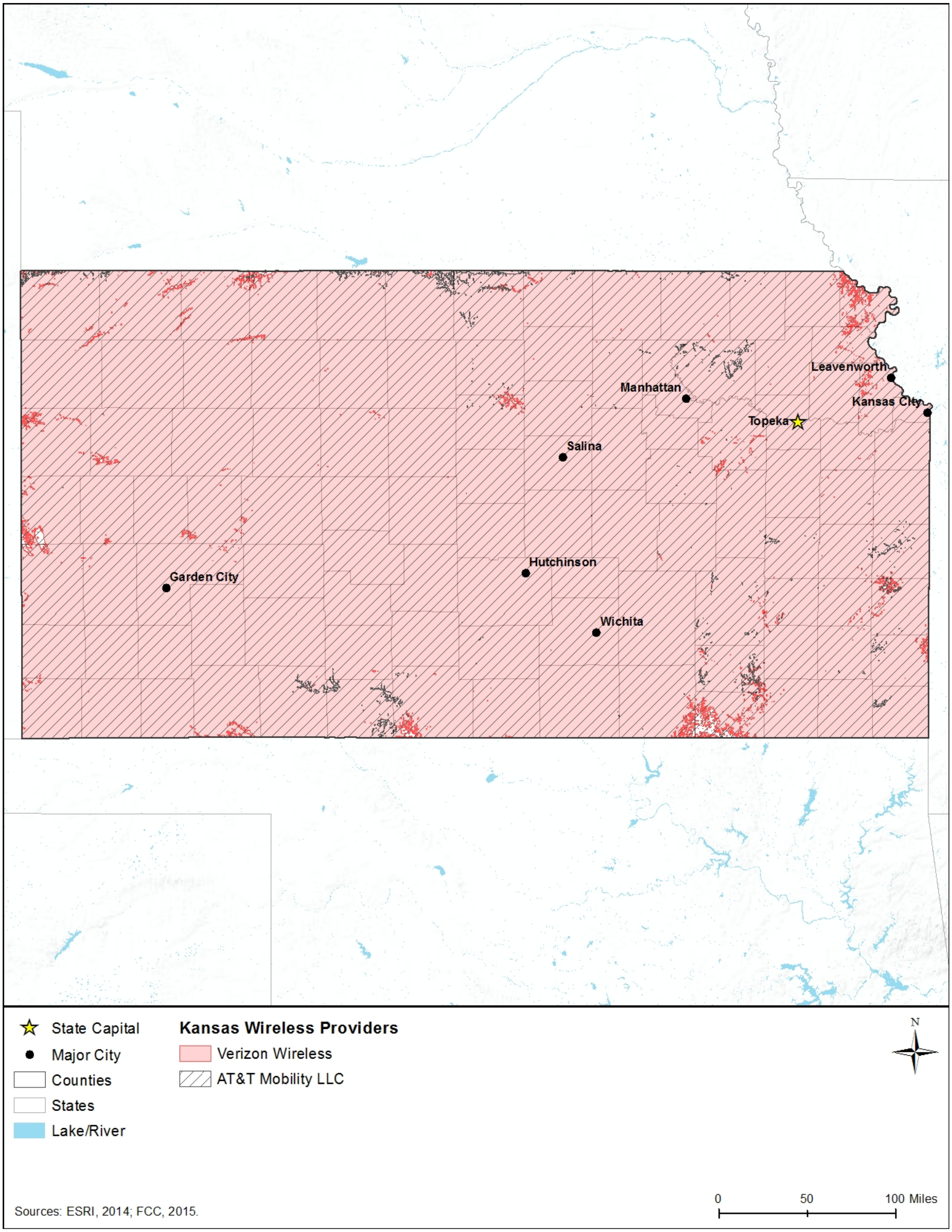


Figure 7.1.1-5: AT&T and Verizon Wireless Availability in Kansas

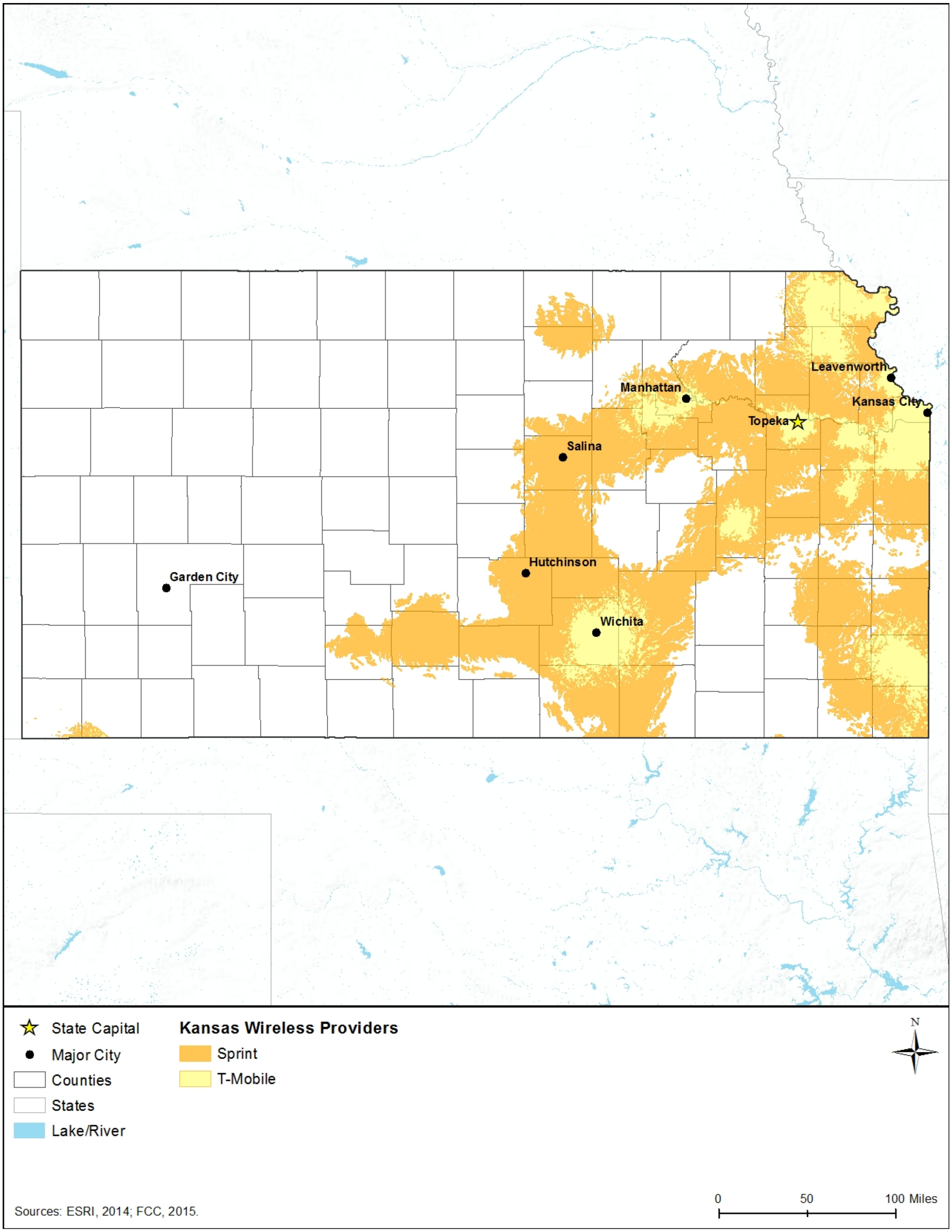


Figure 7.1.1-6: Sprint and T-Mobile Wireless Availability in Kansas

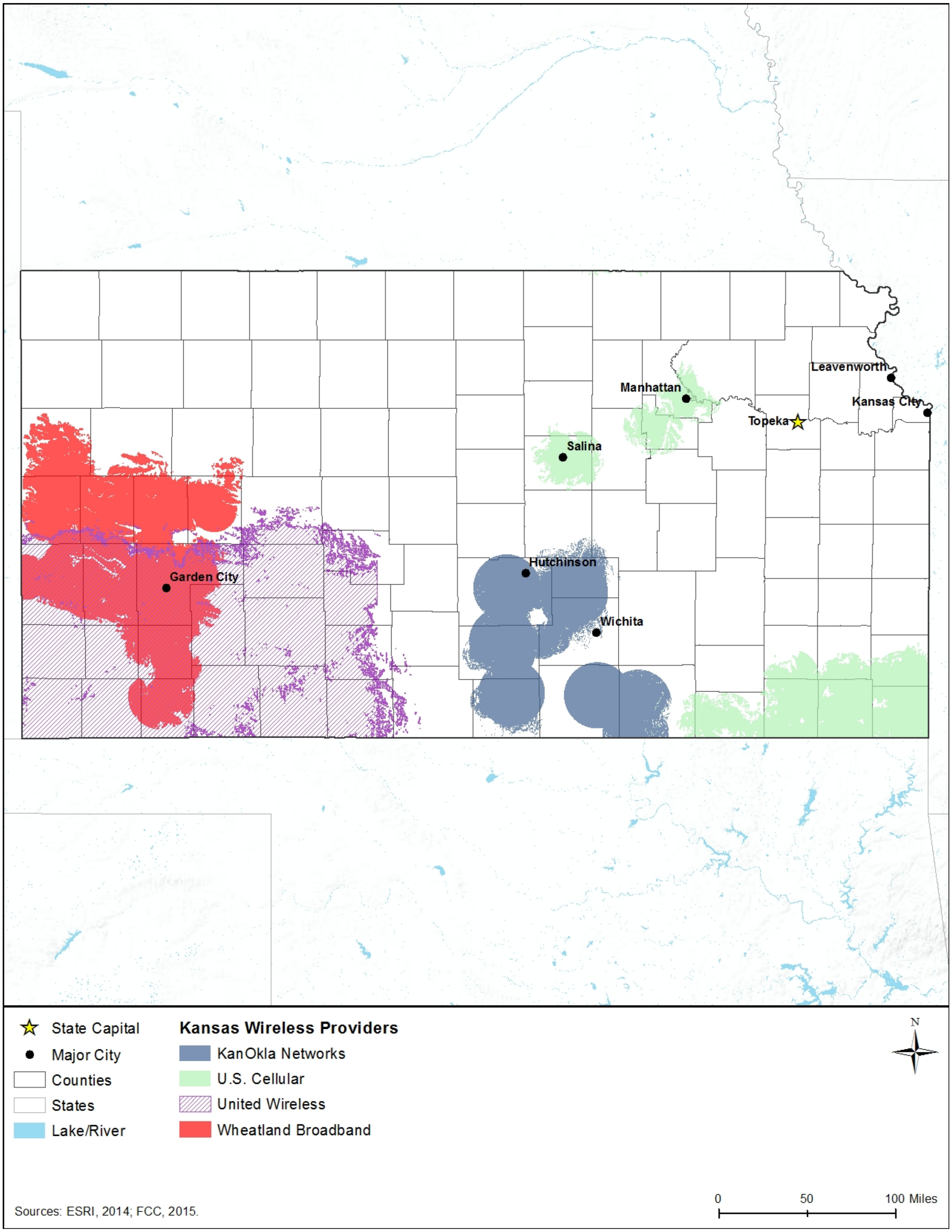


Figure 7.1.1-7: KanOkla Networks, U.S. Cellular, United Wireless, and Wheatland Broadband Wireless Availability in Kansas

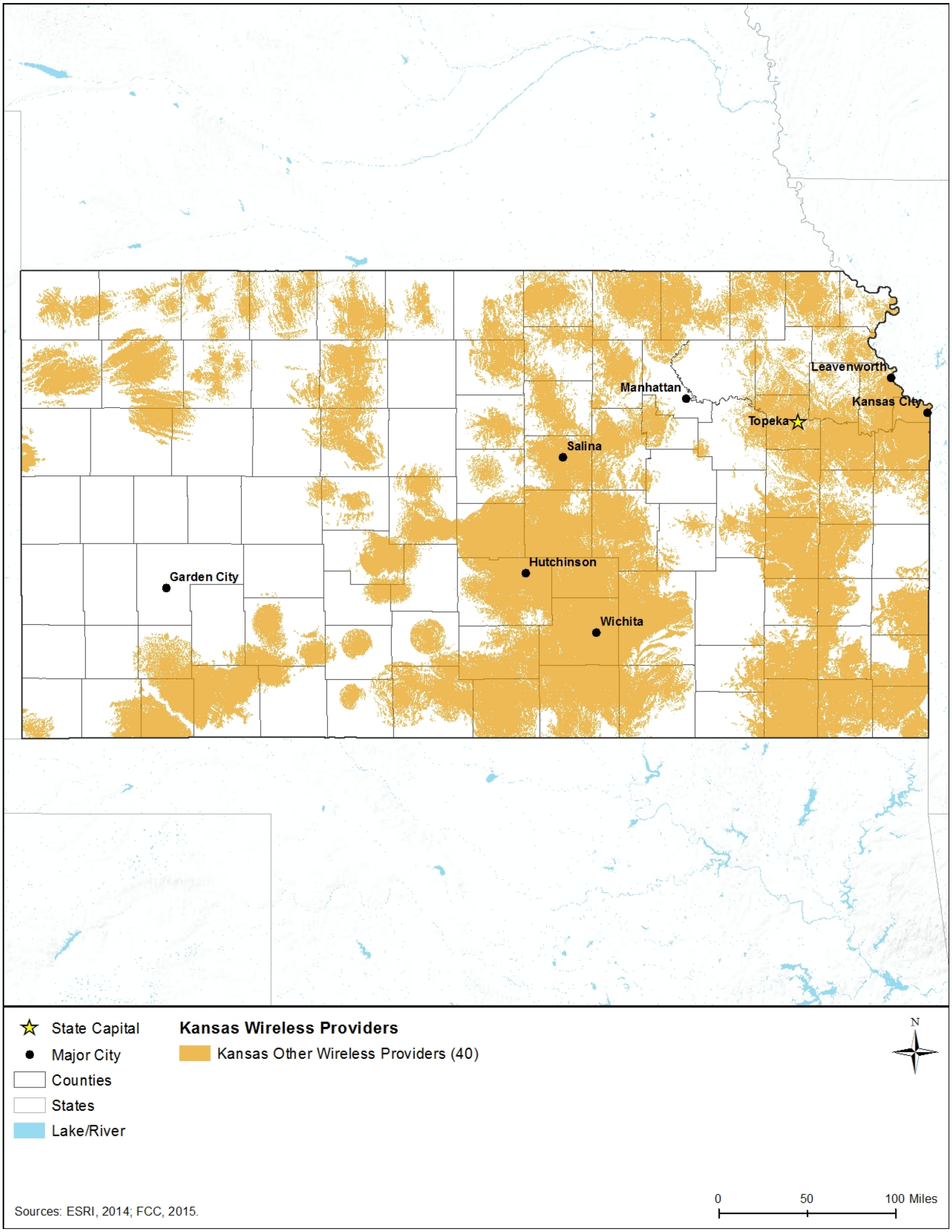


Figure 7.1.1-8: Other Provider's Wireless Availability in Kansas

Towers

There are many types of domestic towers employed today by the telecommunications industry, government agencies, and other owners. Towers are designed and used for a variety of purposes, and the height, location, and supporting structures and equipment are all designed, constructed, and operated according to the technical specifications of the spectrum used, the type of equipment mounted on the tower, geographic terrain, need for line-of-sight transmissions to other towers, radio frequency needs, and other technical specifications. There are three general categories of stand-alone towers: monopole, lattice, and guyed. Typically, monopole towers are the smallest, followed by lattice towers at a moderate height, and guyed towers at taller heights (with the guyed wires providing tension support for the taller heights) (CSC, 2007). In general, taller towers can provide communications coverage over larger geographic areas, but require more land for the actual tower site, whereas shorter towers provide less geographic coverage and require less land for the tower site (USFS 2009a). Figure 7.1.1-8 presents representative examples of each of these categories or types of towers.

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

Lattice
200 – 400 feet
Source: Personal Picture

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

Figure 7.1.1-9: Types of Towers

Telecommunications tower infrastructure proliferates throughout Kansas, although tower infrastructure is concentrated in the higher and more densely populated areas of Kansas. Owners of towers and some types of antennas are required to register those infrastructure assets with the FCC (FCC, 2016b).[9] Table 7.1.1-10 presents the number of towers (including broadcast towers) registered with the FCC in Kansas, by tower type, and Figure 7.1.1-10 presents the location of those structures, as of July 2016.

[9] An antenna structure must be registered with the FCC, if the antenna structure is taller than 200 feet above ground level or may interfere with the flight path of a nearby airport (FCC, 2016b).

Table 7.1.1-10: Number of Commercial Towers in Kansas by Type

Constructed[a] Towers[b]		Constructed Monopole Towers	
100ft and over	577	100ft and over	0
75ft – 100ft	626	75ft – 100ft	0
50ft – 75ft	351	50ft – 75ft	7
25ft – 50ft	193	25ft – 50ft	40
25ft and below	69	25ft and below	4
Subtotal	**1,816**	**Subtotal**	**51**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100ft and over	98	100ft and over	1
75ft – 100ft	82	75ft – 100ft	5
50ft – 75ft	21	50ft – 75ft	5
25ft – 50ft	9	25ft – 50ft	1
25ft and below	0	25ft and below	6
Subtotal	**210**	**Subtotal**	**18**
Constructed Lattice Towers		**Multiple Constructed Structures[c]**	
100ft and over	14	100ft and over	0
75ft – 100ft	52	75ft – 100ft	0
50ft – 75ft	29	50ft – 75ft	0
25ft – 50ft	16	25ft – 50ft	0
25ft and below	4	25ft and below	0
Subtotal	**115**	**Subtotal**	**0**
Constructed Tanks[d]			
Tanks	10		
Subtotal	**10**		
Total All Tower Structures		**2,220**	

Source: (FCC, 2015b)

[a] Planned construction or modification has been completed. Results will return only those antenna structures that the FCC has been notified are physically built or planned modifications/alterations to a structure have been completed (FCC, 2015b).
[b] Self standing or guyed (anchored) structure used for communication purposes (FCC 2012).
[c] Multiple constructed structures per antenna registration (FCC, 2016c).
[d] Any type of tank – water, gas, etc. with a constructed antenna (FCC, 2016c).

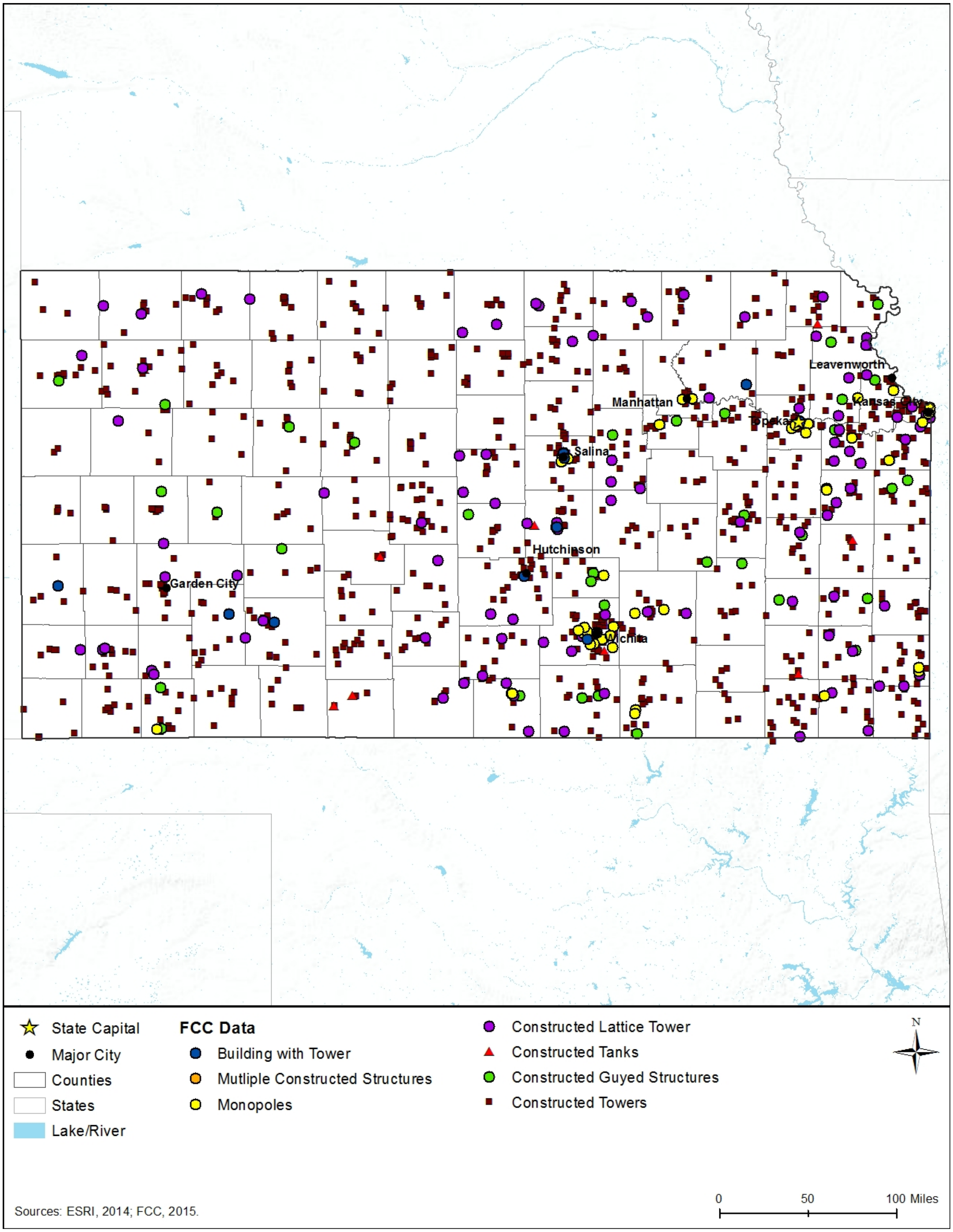
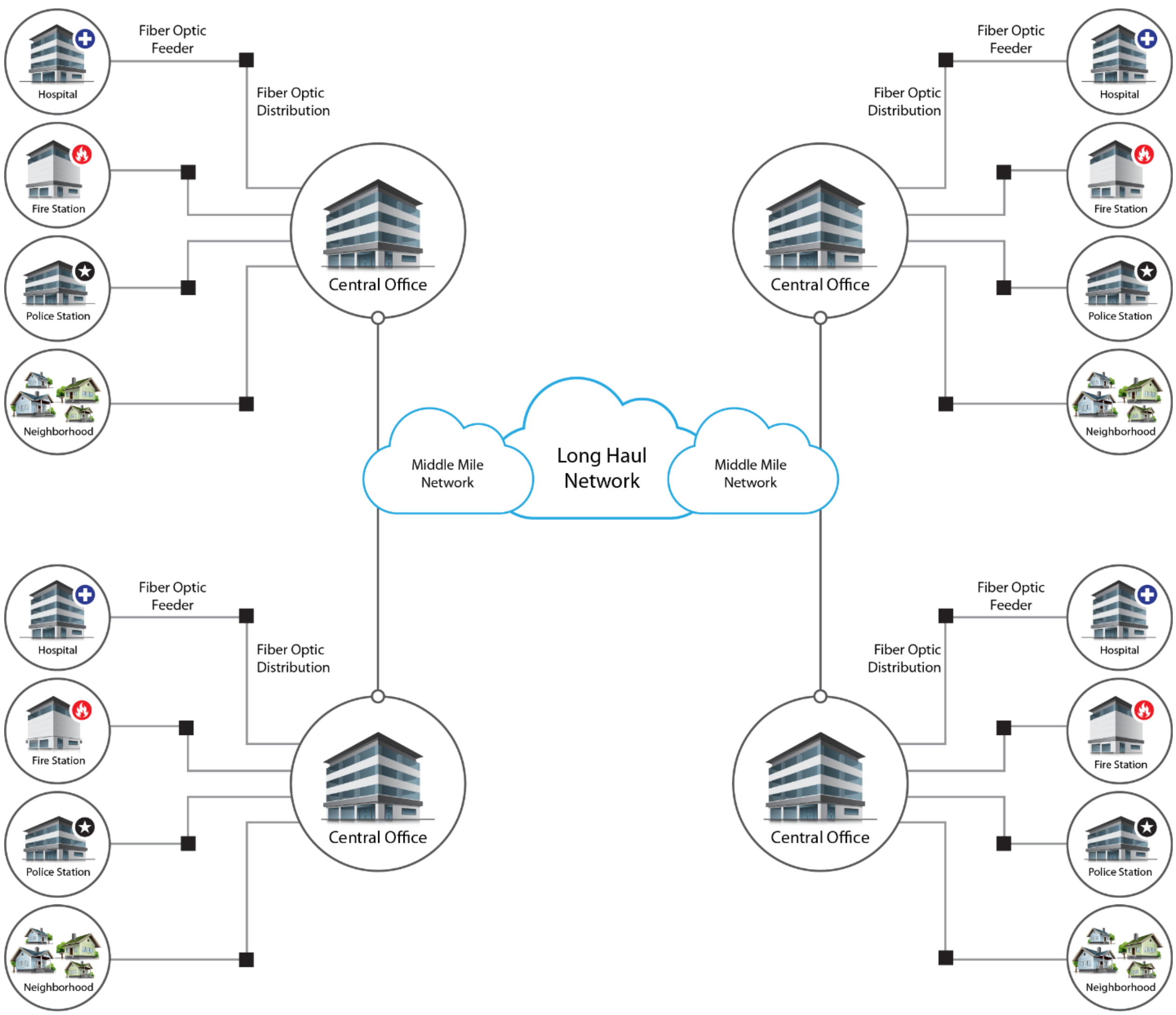


Figure 7.1.1-10: FCC Tower Structure Locations in Kansas

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 (ROWs). A fiber optic network includes an access network consisting of a central office, distribution and feeder plant (cables of various sizes directly leaving a central office and splitting to connect users to the network), and a user location, as shown in Figure 7.1.1-10. The network also may include a middle mile component (shorter distance cables linking the core network between central offices or network nodes across a region) and a long haul network component (longer distance cables linking central offices across regions) (FCC 2000).



Prepared by: Booz Allen Hamilton

Figure 7.1.1-11: Typical Fiber Optic Network in Kansas

Source: (ITU-T 2012)

Last Mile Fiber Assets

In Kansas, fiber access networks are concentrated in the highest population centers as shown in the figures below. In Kansas, there are 61 fiber providers that offer service in the state, as listed in Table 7.1.1-11. Figure 7.1.1-11 shows the coverage for Rural Telephone, CenturyLink, AT&T Southwest, and Pioneer Communication, and Figure 7.1.1-12 shows the coverage for providers with less than 5 percent coverage area, respectively.

Table 7.1.1-11: Fiber Provider Coverage in Kansas

Fiber Provider	Coverage
Rural Telephone	6.56%
CenturyLink	3.83%
AT&T Southwest	3.71%
Pioneer Communications	3.45%
Other[a]	30.71%

Source: (NTIA 2014)

[a]Other: Provider with less than 5 percent coverage area. Providers include: Cogent Communications, Inc.; Southeast Nebraska Telephone Company; Atwood Cable Systems, Inc.; Columbus Telephone Company; City of Baxter Springs; Zayo Group, LLC; ValuNet; Zito Media; Sumner Communications; City of Chanute; Giant Communications; Diller Telephone Company; Comcast; Level 3 Communications, LLC; Allegiance Cable Television; Google Fiber Kansas LLC; Cable ONE; Wildflower Internet; LaHarpe Telephone Company, Inc.; BWTelcom; MCC Missouri LLC; Suddenlink Communications; Epic Touch Company, Inc.; SureWest Kansas Operations, LLC; Peoples Telecommunications, LLC; Mutual Telecommunications; Townes Telecommunications Services Company; WOW!; S&A Telephone Company, Inc.; Madison Telephone LLC; Eagle Communications, Inc.; Gorham Telephone Company; Totah Communications, Inc.; Moundridge Telephone Company, Inc.; Wamego Telecommunications Company, Inc.; Time Warner Cable; MegaPath Corporation; Home Telephone Company, Inc.; Wheat State Telephone, Inc.; SCTelcom; Rainbow Communications; H&B Communications, Inc.; Cunningham Telephone & Cable; KanOkla Networks; Wilson Telephone Company, Inc.; Cox Communications; Southern Kansas Telephone Company, Inc.; Blue Valley Tele-Communications, Inc.; JBN Telephone Company, Inc.; Haviland Telephone Company, Inc.; The Tri-County Telephone Association; S&T Communications LLC; United Communications Association; FairPoint Communications; Craw-Kan Telephone Cooperative, Inc.; Twin Valley Communications, Inc.; GBT Communications

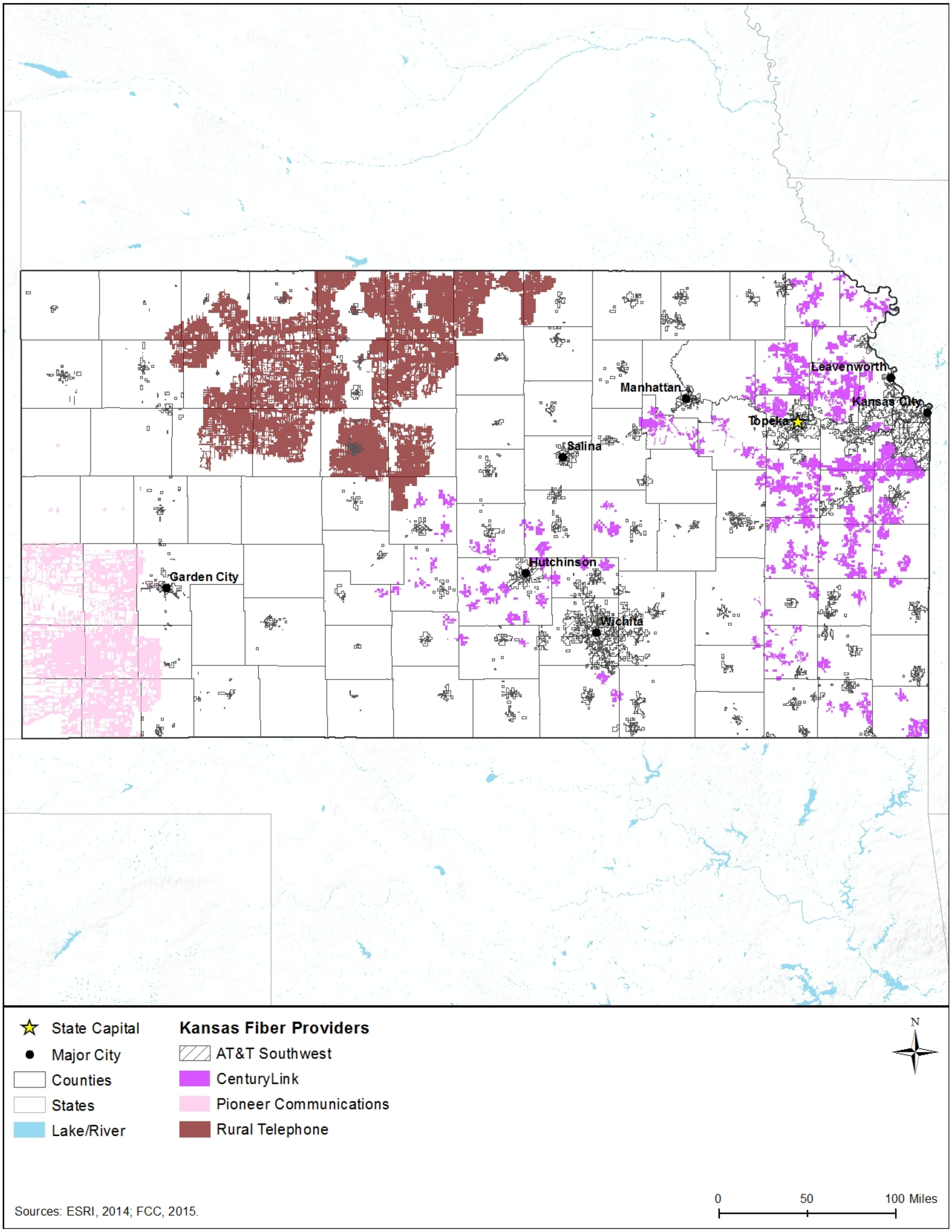


Figure 7.1.1-12: Fiber Availability in Kansas for AT&T Southwest, CenturyLink, Pioneer Communications, and Rural Telephone

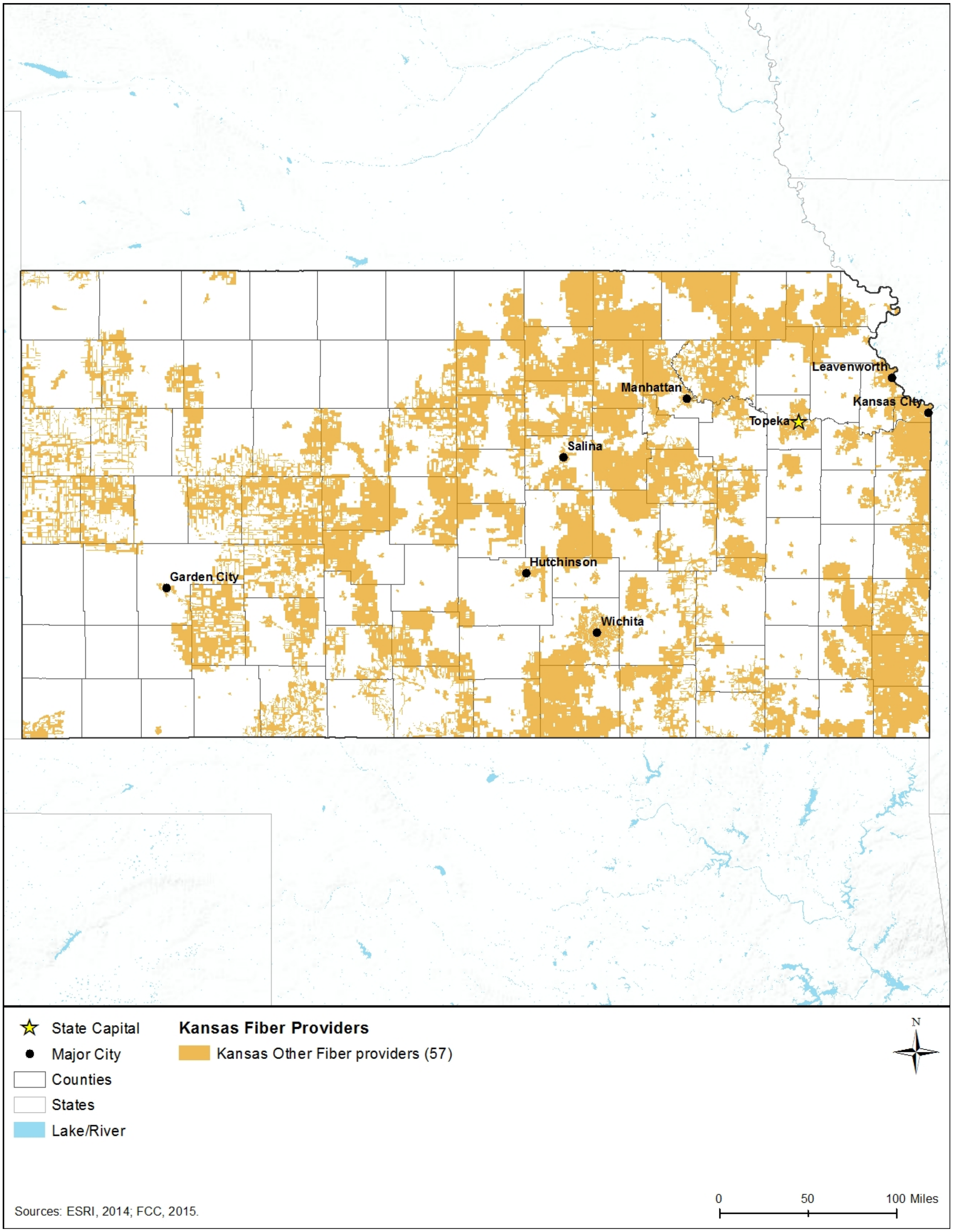


Figure 7.1.1-13: Other Provider's Fiber Availability in Kansas

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.

7.1.1.6. Utilities

Utilities are the essential systems that support daily operations in a community and cover a broad array of public services, such as electricity, water, wastewater, and solid waste. Section 7.1.4, Water Resources, describes the potable water sources in the state.

Electricity

Kansas' electric utilities are governed by the Kansas Corporation Commission (KCC), which has jurisdiction over the rates of public electricity utilities, though this does not extend to some electric cooperatives (KCC 2015a). The KCC lists four investor owned electric utilities as being subject to its jurisdiction (regarding the regulation of rates): the Empire District Electric Company, Kansas City Power and Light, Southern Pioneer and Westar Energy (KCC 2015b). In addition to these, the KCC acknowledges several other electric service companies that operate in the state; the Kansas Electric Power Cooperative, Inc. (KEPCo), Midwest Energy, Inc., and Sunflower Electric Power Company operate as cooperatives that perform transmission or generation services. Midwest Energy is regulated by the KCC while KEPCo and Sunflower are not. The Kansas City Board of Public Utilities is "a non-KCC jurisdictional municipal utility" that provides electricity to around 63,000 customers. The Kansas Municipal Power Agency (KMEA) "finances projects for the purchase, sale, generation, and transmission of electricity on behalf of its 77 member municipal electric utilities." Finally, the Kansas Power Pool "provides wholesale electric power, reserve sharing, collective resource planning and acquisition, network transmission service, and cost sharing of operations to its member municipal utilities," of which there are 34 (KCC 2015c).

A large portion of Kansas' electricity comes from coal-fueled electric generation plants, though wind and nuclear power contribute significant amounts as well. In 2014, coal-fueled plants accounted for 58 percent of the electricity generated in the state, or 28,752,282 megawatt-hours (MWh) of electricity[10] of the total 49,728,363 MWh generated (EIA 2015a). Wind power produced 10,844,861 MWh (22 percent) and nuclear power produced 8,558,384 MWh (17

[10] One megawatthour is defined as "one thousand kilowatt-hours or 1 million watt-hours." One watt-hour can be defined as "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).

percent). Natural gas accounted for about 3 percent, while biomass, petroleum liquids, and hydroelectric power all contributed negligible amounts (EIA 2015a). Kansas' industrial sector used 36.9 percent of the power generated, while the commercial sector used just 18.1 percent, the transportation used just 24.7 percent, and the residential sector used 20.3 percent (EIA 2015b).

Water

The Kansas Department of Health and Environment's (KDHE) Bureau of Water carries out provisions of the Safe Drinking Water Act (SDWA) (KDHE 2015a). Public water systems, defined as a "system for delivery to the public of piped water for human consumption that has at least 10 service connections or regularly serves at least 25 individuals daily at least 60 days out of the year," are overseen by the Public Water Supply Section of the Bureau (KDHE 2015b). This oversight includes permitting, data management and ensuring compliance with environmental regulations (KDHE 2015b). Permits must be issued by the Bureau for the construction of new facilities, as well as new construction on existing facilities and for the operation of these facilities (KDHE 2015c).

Programs dedicated to monitoring public water systems for contaminants such as coliform, lead, arsenic or radionuclides help to protect the state's populace (KDHE 2015d), and the regulations for acceptable levels of said contaminants are set by the Bureau. More than 1,000 Kansas public water systems must report annually on the levels of contaminants found. "In total, 99 systems, serving a population of 190,237, incurred at least one health based violation for a drinking water requirement during calendar year 2014." That year, "the overall health based compliance rate for all samples was 99.9 percent" (KDHE 2015d).

Wastewater

The operation of wastewater facilities is overseen by the KDHE through the use of permitting and certification. The operators of wastewater facilities must first receive a certification from KDHE and certifications (in addition to their requirements) differ based on the size and type of plant to be operated. While training information is offered by the University of California-Sacramento, it is not mandatory; however, operators are required to meet educational standards set forth by the KDHE and pass an examination (KDHE 2015e). The discharges from wastewater facilities are also regulated by KDHE, through the use of wastewater permits. The National Pollutant Discharge Elimination System (NPDES) permits are issued by KDHE under the authority of the U.S. Environmental Protection Agency (USEPA), and specify the types and quantities of pollutants that can be discharged into surface waters. Facilities that discharge into non-surface waters are also permitted through KDHE. Many facilities are issued general permits, which are used to "address particular categories of discharges with similar characteristics." Individual permits are issued for more specific circumstances (KDHE 2015f).

Solid Waste Management

Kansas' solid waste is also managed under the umbrella of the KDHE. The 2010 Solid Waste Management Plan lists 573 solid waste management facilities in the state. This number includes, but is not limited to, 147 composting facilities, 51 municipal solid waste landfills, 41 industrial landfills, 98 construction and demolition landfills, and 85 facilities dedicated to the disposal of waste tires. Of these, 249 are county-owned and 205 are privately-owned (KDHE 2010a). In 2010, one municipal landfill was slated for closure, but the state has enough landfill capacity to last through at least 2019. In 2009 (one year prior to the publication of the management plan), the state landfilled 5,580,000 tons of material, of which 3,014,000 tons was municipal waste, which accounted for 54 percent of the state's waste. Industrial waste contributed 1,120,000 tons, or 20 percent (KDHE 2010a).

A survey conducted by KDHE in 2013 on municipal recycling indicated a recycling rate of 31.6 percent across the state. This result did not include auto bodies or scrap tires. Of the recycled materials, paper accounted for 38.6 percent, metals accounted for 3.2 percent, ferrous metals accounted for 36 percent, and other materials (such as plastics, batteries, glass, textiles, wood, electronics, yard waste, or food waste) accounted for 22.2 percent of the materials recycled (KDHE 2013a).

7.1.2. Soils

7.1.2.1. Definition of the Resource

The Soil Science Society of America defines soil as:

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

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

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

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

7.1.2.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of 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 7.1.2-1 below.

Table 7.1.2-1: Relevant Kansas Soils Laws and Regulations

State Law / Regulation	Regulatory Agency	Applicability
Kansas National Pollutant Discharge Elimination System (NPDES) General Permit No. S-MCST-0312-1	KDHE	A Storm water Pollution Prevention Plan, as part of the required NPDES permit for construction disturbances greater than one acre, must include best management practices to control sediment discharge and erosion.

7.1.2.3. Environmental Setting

Kansas is composed of four Land Resource Region (LRR),[11] as defined by the National Resources Conservation Service (NRCS) (NRCS 2006):

- Central Feed Grains and Livestock Region
- Central Great Plains Winter Wheat and Range Region
- East and Central Farming and Forest Region
- Southwest Prairies Cotton and Forage Region

Within and among Kansas's four LRRs are 15 Major Land Resource Areas (MLRA),[12] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming. The locations and characteristics of Kansas's MLRAs are presented in Figure 7.1.2-1 and Table 7.1.2-2.

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[13] such as bacteria, fungi, biological crusts, vegetation, animals, and climatic variables such as precipitation and temperature. For example, expansive soils[14] with wet and dry seasons alternately swell and shrink, which presents integrity risks to structural foundations (Rogers, Olshansky and 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[15] (discussed further in the subsections below).

[11] Land Resource Region: "A geographical area made up of an aggregation of Major Land Resource Areas (MLRA) with similar characteristics" (NRCS 2006).
[12] 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).
[13] The flora and fauna of a region
[14] 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 and Rogers 2004).
[15] Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength (USFS 2009b).

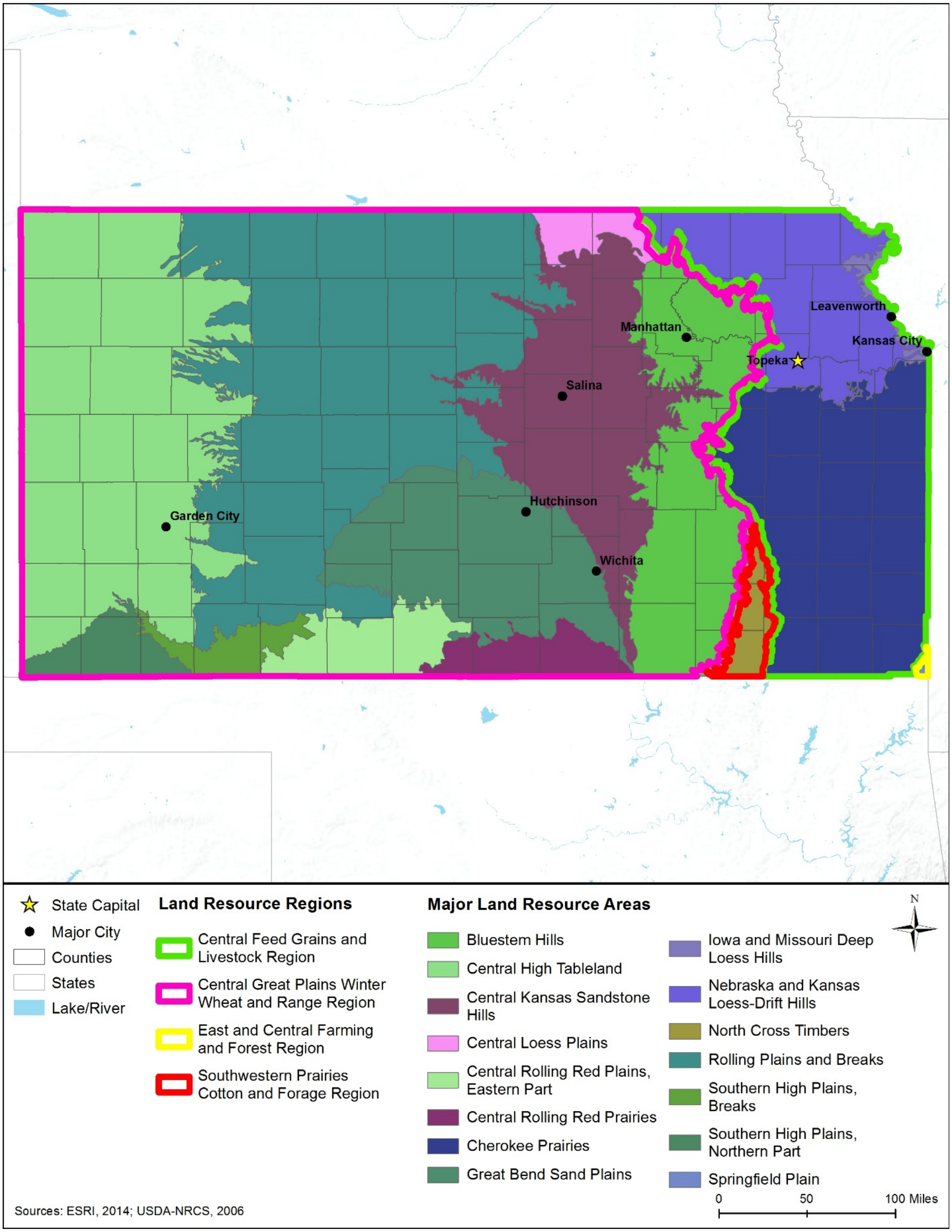


Figure 7.1.2-1: Locations of Major Land Resource Areas in Kansas

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

MLRA Name	Region of State	Soil Characteristics
Bluestem Hills	Eastern Kansas	Mollisols[a] is the dominant soil order. These loamy[b] or clayey soils range from moderately well drained to somewhat excessively drained, and from very shallow to very deep.
Central High Tableland	Western Kansas	Entisols[c] and Mollisols are the dominant soil orders. These sandy or loamy soils are typically moderately well drained to excessively drained, and are very deep.
Central Kansas Sandstone Hills	Central Kansas	Mollisols is the dominant soil order. These loamy or clayey soils range from moderately well drained to somewhat excessively drained, and from shallow to very deep.
Central Loess Plains	Northern Kansas	Mollisols is the dominant soil order. These loamy or clayey soils typically range from moderately well drained to somewhat poorly drained, and are moderately deep to very deep.
Central Rolling Red Plains, Eastern Part	Southern Kansas	Alfisols,[d] Inceptisols,[e] and Mollisols are the dominant soil orders. These moderately deep to very deep soils are clayey or loamy, and are moderately well drained to well drained.
Central Rolling Red Prairies	Southern Kansas	Mollisols is the dominant soil order. These well drained soils range from shallow to very deep, and are clayey or loamy.
Cherokee Prairies	Southeastern Kansas	Alfisols and Mollisols are the dominant soil orders, with Vertisols[f] less so. These moderately deep to very deep soils are clayey or loamy, and range from poorly drained to well drained.
Great Bend Sand Plains	South-central Kansas	Alfisols, Entisols, and Mollisols are the dominant soil orders. These loamy or sandy soils range from poorly drained to excessively drained, and are moderately deep to very deep.
Iowa and Missouri Deep Loess Hills	Northeastern Kansas	Mollisols is the dominant soil order, with Alfisols and Entisols less so. These loamy or silty soils are typically moderately well drained to well drained, and are very deep.
Nebraska and Kansas Loess-Drift Hills	Northeastern Kansas	Alfisols, Entisols, and Mollisols are the dominant soil orders.
North Cross Timbers	Southeastern Kansas	Alfisols, Entisols, Inceptisols, and Mollisols are the dominant soil orders. These clayey or loamy soils range from somewhat poorly drained to somewhat excessively drained, and from shallow to very deep.
Rolling Plains and Breaks	Western Kansas	Mollisols is the dominant soil order, with Entisols less so. These clayey or loamy soils are moderately well drained to excessively drained. They range from shallow to very deep.
Southern High Plains, Breaks	Southwestern Kansas	Alfisols, Inceptisols, and Mollisols are the dominant soil orders. These well drained soils range from shallow to very deep, and are sandy or loamy.
Southern High Plains, Northern Part	Southwestern Kansas	Alfisols and Mollisols are the dominant soil orders. These loamy soils are typically well drained and very deep.
Springfield Plain	Southeastern Kansas	Alfisols, Mollisols, and Ultisols[g] are the dominant soil orders. These soils are moderately well drained to well drained, and are moderately deep to very deep. They are medium to fine textured.

Source: (NRCS 2006)

[a] Mollisols: "Soils that have a dark colored surface horizon relatively high in content of organic matter. They are base rich throughout and quite fertile. Mollisols form under grass in climates that have a moderate to pronounced seasonal moisture deficit." (NRCS 2015b)
[b] Loamy Soil: "[A soil] that combines [sand, silt, and clay] in relatively equal amounts." (Purdue University Consumer Horticulture, 2006)

[c] 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 percent of the world's ice-free land surface." (NRCS 2015b)
[d] Alfisols: "Soils found in semiarid to moist areas that are formed from weathering processes that leach clay minerals and other constituents out of the surface layer and into the subsoil. They are productive for most crop, are primarily formed under forest or mixed vegetative cover, and make up nearly 10 percent of the world's ice-free land surface." (NRCS 2015b)
[e] 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 percent of the world's ice-free land surface." (NRCS 2015b)
[f] Vertisols: "Vertisols have a high content of expanding clay minerals. They undergo pronounced changes in volume with changes in moisture, and have cracks that open and close periodically, and that show evidence of soil movement. Vertisols transmit water very slowly, have undergone little leaching, and tend to be high in natural fertility. They make up about 2 percent 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 percent of the world's ice-free land surface." (NRCS 2015b)

7.1.2.4. Soil Suborders

Soil suborders are part of the soil taxonomy (a system of classification used to make and interpret soil surveys). Soil orders are the highest level in the taxonomy[16]; there are 12 soil orders in the world and they are characterized by both observed and inferred[17] 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 State Soil Geographic (STATSGO2)[18] soil database identifies 17 different soil suborders in Kansas (NRCS 2015d). Figure 7.1.2-2 depicts the distribution of the soil suborders, and Table 7.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

[16] A formal representation of relationships between items in a hierarchical structure (USEPA, 2016f).
[17] "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).
[18] STATSGO2 is the Digital General Soil Map of the U.S. that shows general soil association units across the landscape of the nation. Developed by the National Cooperative Soil Survey, STATSGO2 supersedes the State Soil Geographic (STATSGO) dataset.

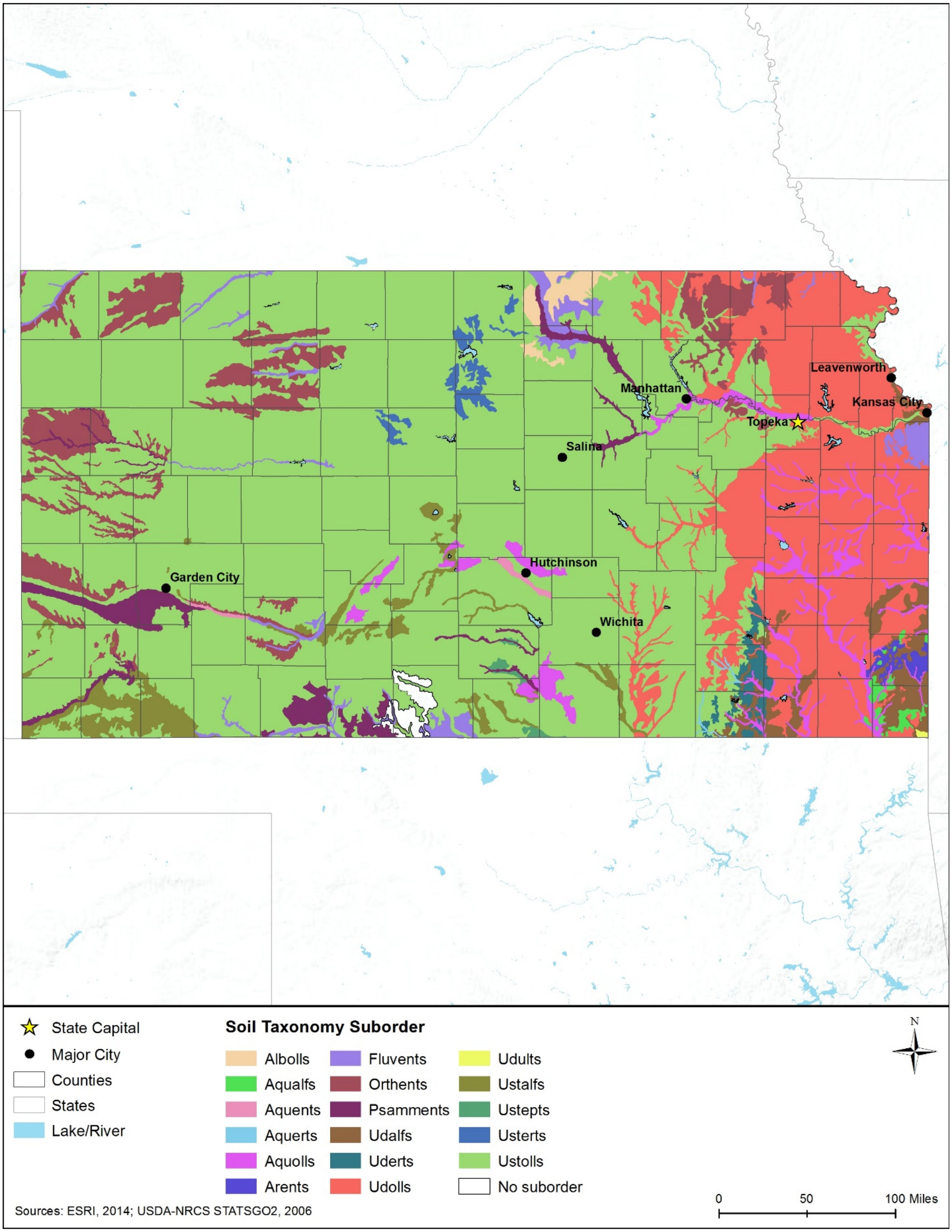


Figure 7.1.2-2: Kansas Soil Taxonomy Suborders

7.1.2.5. Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential.[19] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University 2015). Table 7.1.2-3 provides a summary of the runoff potential for each soil suborder in Kansas.

- **Group A Sand, loamy sand or sandy loam soils.** This group of soils has "low runoff potential and high infiltration rates[20] even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission" (Purdue University 2015). Fluvents, Orthents, Psamments, Ustalfs, and Ustolls fall into this category in Kansas.
- **Group B Silt loam or loam soils.** This group of soils has a "moderate infiltration rate when thoroughly wetted and consists chiefly or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures" (Purdue University 2015). This group has medium runoff potential. Aquents, Fluvents, Orthents, Udalfs, Udolls, Ustalfs, and Ustolls fall into this category in Kansas.
- **Group C Sandy clay loam soils.** This group of soils has "low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure" (Purdue University 2015). This group has medium runoff potential. Aquents, Aquolls, Arents, Fluvents, Udalfs, Uderts, Udolls, Udults, Ustepts, and Ustolls fall into this category in Kansas.
- **Group D Clay loam, silty clay loam, sandy clay, silty clay, or clay soils.** This group of soils "has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material" (Purdue University 2015). Albolls, Aqualfs, Aquerts, Aquolls, Orthents, Udalfs, Udolls, Ustalfs, Ustepts, Usterts, and Ustolls fall into this category in Kansas.

7.1.2.6. Soil Erosion

"Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity" (NRCS 2015g). Water-induced erosion can transport soil into streams, rivers, and lakes, degrading water quality and aquatic habitat. When topsoil is eroded, organic material is depleted, creating loss of nutrients available for plant growth. Soil particles displaced by wind can cause human health problems and reduced visibility, creating a public safety hazard (NRCS 1996a). Table 7.1.2-3 provides a summary of the erosion potential

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

Table 7.1.2-3: Major Characteristics of Soil Suborders[a] Found in Kansas, as depicted in Figure 7.1.2-2

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[b]	Hydrologic Group	Runoff Potential	Permeability[c]	Erosion Potential	Compaction and Rutting Potential
Mollisols	Albolls	Albolls have a fluctuating groundwater table, with gentle slopes. They supported grasses and shrubs, and are typically used as cropland.	Silt loam	0-1	Poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Alfisols	Aqualfs	Generally have warm and aquic (saturated with water long enough to cause oxygen depletion) conditions. Aqualfs are used as cropland for growing corn, soybeans, and rice, and most have some artificial drainage or other water control. Nearly all Aqualfs have likely supported forest vegetation in the past.	Silt loam	0-1	Somewhat poorly drained	No	D	High	Very Low	High	Low
Entisols	Aquents	Widely distributed, with some forming in sandy deposits, and most forming in recent sediments. Aquents support vegetation that tolerates either permanent or periodic wetness, and are mostly used for pasture, cropland, forest, or wildlife habitat.	Fine sand, Gravelly sand	0-3	Somewhat poorly drained	No	B, C	Medium	Moderate, Low	Medium	Low
Vertisols	Aquerts	Aquerts are wet soils, with prolonged moisture at or near the soil surface. Their natural vegetation includes savanna, grass, and forest. They are used as forest, rangeland, and cropland, although drainage for cropland can be difficult due to poor drainage.	Silty clay	0-1	Poorly drained	Yes	D	High	Very Low	High	High, due to hydric soil and poor drainage conditions
Mollisols	Aquolls	Aquolls support grass, sedge, and forb vegetation, as well as some forest vegetation. However, most have been artificially drained and utilized as cropland.	Clay loam, Sand, Sandy clay loam, Silt loam, Silty clay, Silty clay loam	0-3	Poorly drained to somewhat poorly drained	No, Yes	C, D	Medium, High	Low, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
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.	Very gravelly clay loam	5-50	Well drained	No	C	Medium	Low	Medium	Low
Entisols	Fluvents	Fluvents are mostly freely drained soils that form in recently-deposited sediments on flood plains, fans, and deltas located along rivers and small streams. Unless protected by dams or levees, these soils frequently flood. Fluvents are normally utilized as rangeland, forest, pasture, or wildlife habitat, with some also used for cropland.	Fine sand, Fine sandy loam, Loamy fine sand, Sandy loam, Silt loam, Stratified fine sand to clay loam, Stratified sand to loamy fine sand	0-9	Somewhat poorly drained to excessively drained	No	A, B, C	Low, Medium	High, Moderate, Low	Low to Medium, depending on slope	Low
Entisols	Orthents	Orthents are commonly found on recent erosional surfaces and are used primarily as rangeland, pasture, or wildlife habitat.	Clay loam, Fine sandy loam, Gravelly loam, Gravelly sandy loam, Loam, Sandy loam, Silt loam, Unweathered bedrock	0-30	Well drained to somewhat excessively drained	No	A, B, D	Low, Medium	High, Moderate, Low	Low to Medium, depending on slope	Low
Entisols	Psamments	Psamments are sandy in all layers. In some arid and semi-arid climates, they are among the most productive rangeland soils, and are primarily used as rangeland, pasture, or wildlife habitat. Those Psamments that are nearly bare are subject to wind erosion and drifting, and do provide good support for wheeled vehicles.	Fine sand, Loamy fine sand, Loamy sand	0-30	Somewhat poorly drained to excessively drained	No, Yes	A	Low	High	Low	High, due to hydric soil and poor drainage conditions

Soil Order	Soil Suborder	Ecological Site Description	Soil Texture	Slope (%)	Drainage Class	Hydric Soil[b]	Hydrologic Group	Runoff Potential	Permeability[c]	Erosion Potential	Compaction and Rutting Potential
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.	Loam, Silt loam, Very cobbly silty clay loam, Very gravelly clay, Very gravelly clay loam, Very gravelly silt loam	1-35	Somewhat poorly drained to well drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low
Vertisols	Uderts	Uderts are found in humid areas, and primarily used as cropland, forest, or pasture. They have low permeability, and water usually must be drained from the surface of cropland.	Silty clay	0-3	Moderately well drained	No	C	Medium	Low	Medium	Low
Mollisols	Udolls	Udolls are found in humid climates. They are more or less freely drained, and have historically supported tall grass prairie. They are used as pasture or rangeland, and as cropland in areas with little slope.	Clay, Clay loam, Flaggy silty clay, Loam, Silt loam, Silty clay, Silty clay loam, Unweathered bedrock, Very flaggy silt loam, Weathered bedrock	0-30	Somewhat poorly drained to somewhat excessively drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	Low
Ultisols	Udults	Udults are more or less freely drained, relatively humus poor, and have an udic moisture regime. Most of these soils currently support or formerly supported mixed forest vegetation, and many have been cleared and used as cropland (mostly with the use of soil amendments).	Extremely gravelly silt loam	1-8	Moderately well drained	No	C	Medium	Low	Medium	Low
Alfisols	Ustalfs	Ustalfs are primarily used for grazing or cropland, and they also support savanna and grassland vegetation. They are found in areas with a marked dry season.	Fine sandy loam, Loamy fine sand, Loamy sand, Sandy loam, Variable	0-15	Somewhat poorly drained to well drained	No	A, B, D	Low, Medium, High	High, Moderate, Very Low	Low to High, depending on slope	Low
Inceptisols	Ustepts	Ustepts are freely drained soils, typically used as pasture or cropland, although some support forest, rangeland, and wildlife habitat.	Loam, Weathered bedrock	1-20	Well drained	No	C, D	Medium, High	Low, Very Low	Medium to High, depending on slope	Low
Vertisols	Usterts	Usterts are soils with low permeability, and receive low rainfall amounts. They support grasses and forbs, and are mostly used for rangeland or cropland. However, but due to their low permeability, they typically need to be artificially drained if irrigated, to prevent standing water and a buildup of salinity.	Clay	3-15	Moderately well drained	No	D	High	Very Low	High	Low
Mollisols	Ustolls	Ustolls typically supported grass and forest vegetation, and are now primarily used as cropland or rangeland. They are generally freely drained, and found in subhumid to semiarid climates. Areas with drought are common, and blowing soil can be an issue.	Clay, Clay loam, Fine sand, Fine sandy loam, Loam, Loamy sand, Sandy clay loam, Sandy loam, Silt loam, Silty clay, Silty clay loam, Unweathered bedrock, Very channery loam, Very gravelly coarse sand, Weathered bedrock	0-40	Somewhat poorly drained to excessively drained	No, Yes	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	High, due to hydric soil and poor drainage conditions

Sources: (NRCS 2015d) (NRCS 1999)
[a] 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.
[b] Hydric Soil: “A soil that formed under conditions of saturation, flooding or ponding long enough during the growing season to develop anaerobic conditions in the upper part” (NRCS 2015f). Soil suborders constitute a broad range of soil types. Within each soil suborder, some specific soil types are hydric while others are not.
[c] Based on Runoff Potential, described in Section 7.1.2.5.

for each soil suborder in Kansas. Soils with medium to high erosion potential in Kansas include those in the Albolls, Aqualfs, Aquents, Aquerts, Aquolls, Arents, Fluvents, Orthents, Udalfs, Uderts, Udolls, Udults, Ustalfs, Ustepts, Usterts, and Ustolls suborders, which are found throughout the state (Figure 7.1.2-2).

7.1.2.7. Soil Compaction and Rutting

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

Loam, sandy loam, and sandy clay loam soils are most susceptible to compaction and rutting; silt, silty clay, silt loam, silty clay loam, and clay soils are more resistant to compaction and rutting (NRCS 1996b). Table 7.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in Kansas. Soils with the highest potential for compaction and rutting in Kansas include those in the Albolls, Aquerts, Aquolls, Psamments, and Ustolls suborders, which are found throughout the state, including along major rivers (Figure 7.1.2-2).

7.1.3. Geology

7.1.3.1. Definition of the Resource

The U.S. Geological Survey (USGS) is the primary government organization responsible for the nation's geological resources. USGS defines geology as an interdisciplinary science with a focus on the following aspects of earth sciences: geologic hazards and disasters, climate variability and change, energy and mineral resources, ecosystem and human health, and ground-water availability. Several of these elements are discussed in other sections of this Programmatic Environmental Impact Statement (PEIS), including Water Resources (Section 7.1.4), Human Health and Safety (Section 7.1.15), and Climate Change (Section 7.1.14).

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

- Section 7.1.3.3, Environmental Setting: Regions[21] and Provinces[22]
- Section 7.1.3.4, Surface Geology

[21] Physiographic regions: Areas of the United States that share commonalities based on topography, geography, and geology (Fenneman, N., 1916)
[22] Physiographic provinces: Subsets within physiographic regions (Fenneman, N., 1916).

- Section 7.1.3.5, Bedrock Geology[23]
- Section 7.1.3.6, Paleontological Resources[24]
- Section 7.1.3.7, Fossil Fuel and Mineral Resources
- Section 7.1.3.8, Geologic Hazards[25]

7.1.3.2. Specific Regulatory Considerations

The Proposed Action must meet the requirements of NEPA and other applicable laws and regulations. A list of applicable state laws and regulations is included in Table 7.1.3-1.

Table 7.1.3-1: Applicable Kansas Geology Laws and Regulations

State Law / Regulation	Agency	Applicability
Kansas Building Codes	Local Agencies	Check county, city, and other local agencies for seismic guidelines in building codes.

Sources: (Sedgwick County, Kansas 2015) (City of Lawrence 2015)

7.1.3.3. Environmental Setting: Physiographic Regions and Provinces

The concept of physiographic regions was created in 1916 by geologist Nevin Fenneman as a way to describe areas of the United States based on common landforms (i.e., not climate or vegetation). Physiographic regions are areas of distinctive topography, geography, and geology. Important physiographic differences between adjacent areas are generally 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, N., 1916).

Kansas has two major physiographic regions: Interior Highlands (Ozark Plateaus) and Interior Plains (Central Lowland and Great Plains). The locations of these regions are shown in Figure 7.1.3-1 and their general characteristics summarized in the following subsections.

[23] Bedrock: Solid rock beneath the soil and superficial rock (USGS, 2015e).
[24] Paleontology: "Study of life in past geologic time based on fossil plants and animals" (USGS, 2015f).
[25] Geologic Hazards: Any geological or hydrological process that poses a threat to people and/or their property, which includes but is not limited to volcanic eruptions, earthquakes, landslides, sinkholes, mudflows, flooding, and shoreline movements (NPS, 2013).

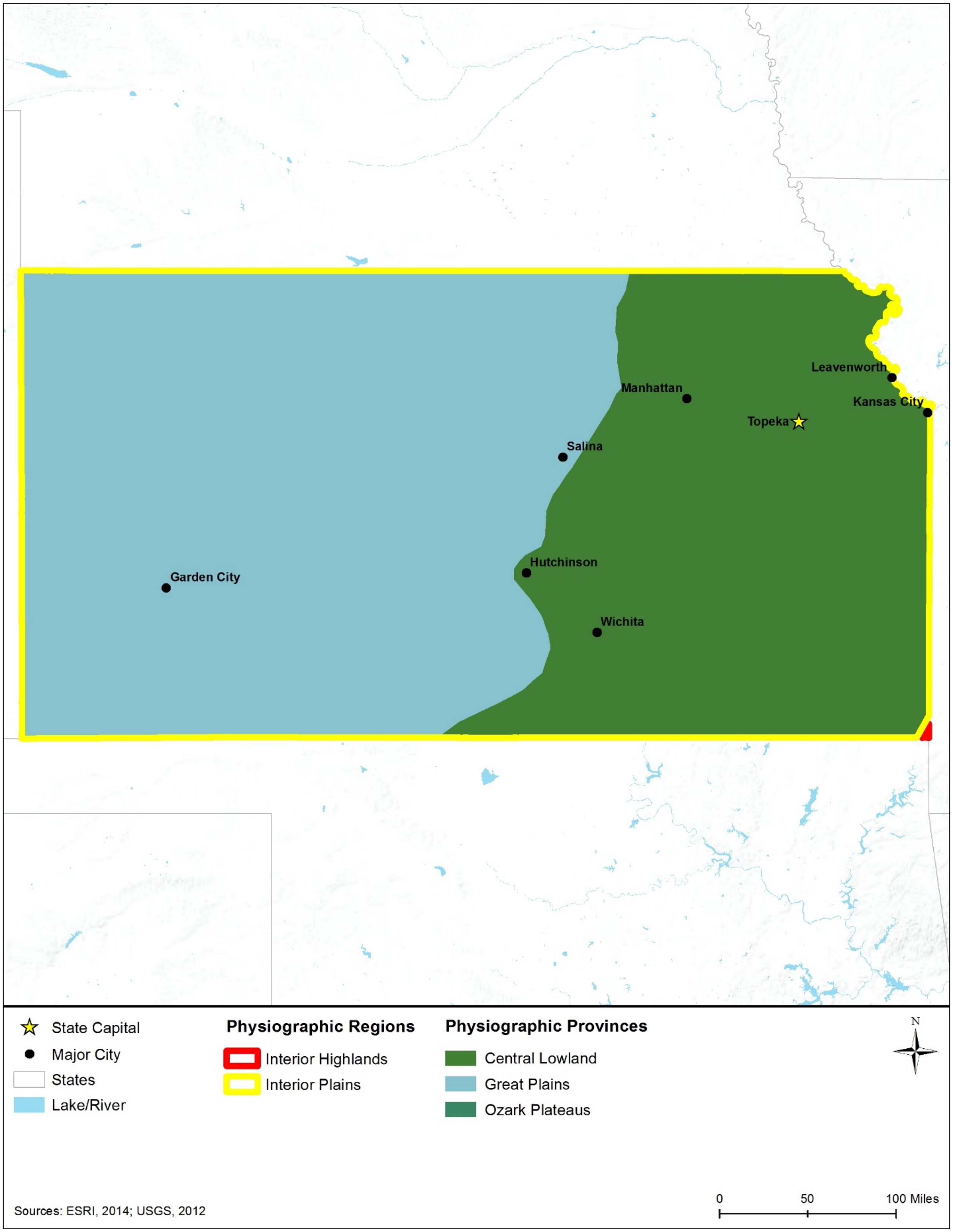


Figure 7.1.3-1: Physiographic Regions and Provinces of Kansas

Interior Highlands Region

The Interior Highlands Region includes the elevated portions of Illinois, Missouri, Arkansas, Kansas, 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 million years ago [MYA]) sedimentary rocks.[26] 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).

As reported above, the Interior Highlands Region within Kansas is composed of the Ozark Plateaus Province (USGS 2003b).

Ozark Plateaus Province – Within Kansas, the Ozark Plateau Province includes a small area within Cherokee County in the extreme southeastern portion of the state. This area is underlain by limestone[27] that dates to the Mississippian Period (359 to 318 MYA) and is characterized by hilly terrain. (Kansas Geological Survey 1997a)

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, N., 1916). Metamorphic[28] and igneous[29] rocks dating to the Precambrian Era (older than 542 million years ago [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[30] 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,[31] mudstone,[32] and clay (USGS, 2014b).

Central Lowland Province – The Central Lowland Province is comprised of the eastern third of Kansas, and is distinguished from the Great Plains Province to the west by its elevation. Whereas the Great Plains Province is generally at elevations greater than 2,000 feet above sea

[26] 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.
[27] 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, 2015g)
[28] 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, 2015g)
[29] Igneous Rocks: "Rock formed when molten rock (magma) that has cooled and solidified (crystallized)." (USGS, 2015g)
[30] Sedimentary Rock: "Rocks that formed from pre-existing rocks or pieces of once-living organisms. They form from deposits that accumulate on the Earth's surface. Sedimentary rocks often have distinctive layering or bedding" (USGS, 2014j).
[31] Sandstone: "Sedimentary rock made mostly of sand-sized grains." (USGS, 2015g)
[32] Mudstone: "A very fine-grained sedimentary rock formed from mud." (USGS, 2015g)

level (ASL), the Central Lowland Province is entirely below 2,000 feet ASL. The border between the two provinces is an eastward facing escarpment[33] (Fenneman, 1922).

Within Kansas, the southeastern portion of the Central Lowland Province is characterized by cuestas[34] that are underlain by "layers of sandstone, limestone, and shale.[35]" Rolling hills with gentle slopes also are found throughout this area (Kansas Geological Survey 1997b). The northeastern portion of the Central Lowland is noted for being the only portion of the state to have been impacted by glaciers. Quartzite[36] boulders and loess[37] are common throughout this part of the state (Kansas Geological Survey 1997c). The westernmost portion of the Kansas's Central Lowland Province contains rolling grasslands that are underlain by limestone interbedded with chert[38] (also referred to as flint). Chert is more resistant to erosion than limestone, resulting in the preservation of chert gravels throughout the landscape (Kansas Geological Survey 1997d).

Great Plains Province – The Great Plains include the western two-thirds of Kansas. "The Great Plains Physiographic Province is a vast east-tilted surface formed by deposition of sediment eroded from the ancestral Rocky Mountains, beginning about 65 [MYA]" (USGS, 2014c). Elevations throughout the state rise from east to west, culminating at the highest point in the state (Mount Sunflower) at 4,039 feet ASL in Wallace County. Kansas's Great Plains are characterized by broad flatlands, which are underlain by "layers of tightly packed, but uncemented, sand and gravel. This layer of sand, gravel, and porous rock is known as the Ogallala Formation," (Kansas Geological Survey 1997e) which is a key unit within the High Plains Aquifer (USGS, 2014c).

7.1.3.4. Surface Geology

Surficial geology is characterized by materials such as till,[39] 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,[40] subsidence,[41] and erosion (Thompson 2015).

[33] Escarpment: "A cliff formed by faulting, erosion, or landslides." (USGS, 2015g)
[34] Cuesta: "An asymmetric ridge capped by resistant rock layers of slight to moderate dip, commonly less than 10 degrees." (NRCS, 2015e)
[35] 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, 2015g)
[36] Quartzite: "Hard, somewhat glassy-looking rock made up almost entirely of quartz." (USGS, 2015g)
[37] Loess: "A wind-blown deposit of sediment made mostly of silt-sized grains." (USGS, 2015g)
[38] Chert: "A very fine-grained sedimentary rock made of quartz. Usually made of millions of globular siliceous skeletons of tiny marine plankton called radiolarians. Black chert is called flint." (USGS, 2015g)
[39] 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 2013b).
[40] 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)
[41] Subsidence: "Gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS 2000).

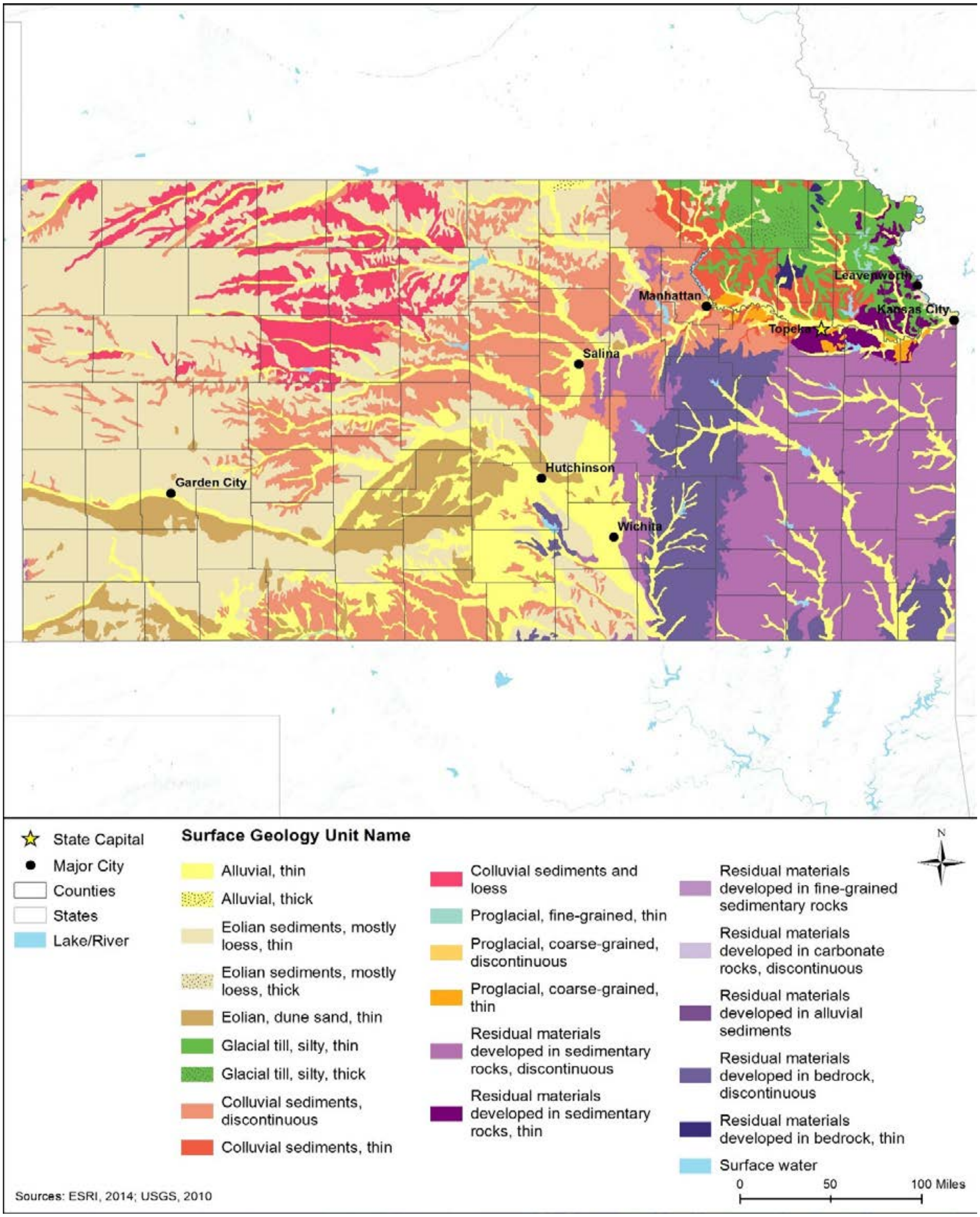


Figure 7.1.3-2: Generalized Surface Geology for Kansas

As noted in Section 7.1.3.3, northeastern Kansas is the only portion of the state that contains glacial deposits from the Pleistocene glaciations (within the last 2 MYA). Much of surficial material in northeastern Kansas dates to the Wisconsinan glaciation (85,000 to 11,000 years ago), which was the most recent stage of the Pleistocene glaciation. "Multiple advances and retreats (stades) during the Wisconsinan resulted in the deposition of alluvium in the valley areas and loess in the upland areas" (Kansas Geological Survey 1968).

Tertiary (66 to 2.6 MYA) surficial materials are found within the western portions of the Great Plains Province in Kansas. These deposits are generally derived from eroded "igneous rocks in the Rocky Mountain Region and the area of sedimentary rocks in eastern Colorado and extreme western Kansas." These surface deposits reach up to 350 feet in thickness. Western Kansas's Flint Hills are also a source for surface deposits in this area of the state. These materials generally include brownish-red clay and reach depths of roughly 20 feet below the ground surface. Quaternary (2.6 MYA to present) loess deposits are also common in western and northern Kansas. "Loess is the most widespread Quaternary deposit and forms the immediate surface material over approximately one-half the area of the State" (Kansas Geological Survey 1968). Figure 7.1.3-2 displays the general surface geology for Kansas.

7.1.3.5. Bedrock Geology

Bedrock geology analysis, and "[the study of] distribution, position, shape, and internal structure of rocks" (USGS, 2015a) reveals important information about a region's surface and subsurface characteristics (i.e., three-dimensional geometry), including dip (slope of the formation),[42] rock composition, and regional tectonism.[43] 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).

Eastern and central Kansas are primarily underlain by sedimentary rocks that date to the Pennsylvanian (318 to 299 MYA), Permian (299 to 251 MYA), and Cretaceous Periods (251 to 200 MYA) (USGS 1997). Pennsylvanian units cover much of the eastern part of the state, and include shale, limestone, sandstone, chert, and conglomerate,[44] which were deposited in a shallow marine environment. Further to the west, Permian sedimentary units are exposed and include "limestone, shale, and chert that form [the] Flint Hills in eastern Kansas, [while] shale, siltstone,[45] sandstone, dolomite,[46] and gypsum[47] [form] the Red Hills in south-central Kansas." Cretaceous sedimentary units extend throughout north-central Kansas and are composed of marine deposited sandstone and limestone. The western third of Kansas is made up of sands, gravels, and silts, which are discussed in greater detail in Section 7.1.3.4. Figure 7.1.3-3 shows the general bedrock geology for Kansas.

[42] 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).

[43] Tectonism: "Structure forces affecting the deformation, uplift, and movement of the earth's crust." (USGS, 2015g)

[44] Conglomerate: "A sedimentary rock made of rounded rock fragments, such as pebbles, cobbles, and boulders, in a finer-grained matrix. To call the rock a conglomerate, some of the constituent pebbles must be at least 2 mm (about 1/13th of an inch) across." (USGS, 2015g)

[45] Siltstone: "A sedimentary rock made mostly of silt-sized grains." (USGS, 2015g)

[46] Dolomite: "A magnesium-rich carbonate sedimentary rock. Also, a magnesium-rich carbonate mineral ($CaMgCO_3$)." (USGS, 2015g)

[47] Gypsum: "The mineral form of hydrated calcium sulfate, $CaSO_4 \cdot 2H_2O$." (USGS 2002)

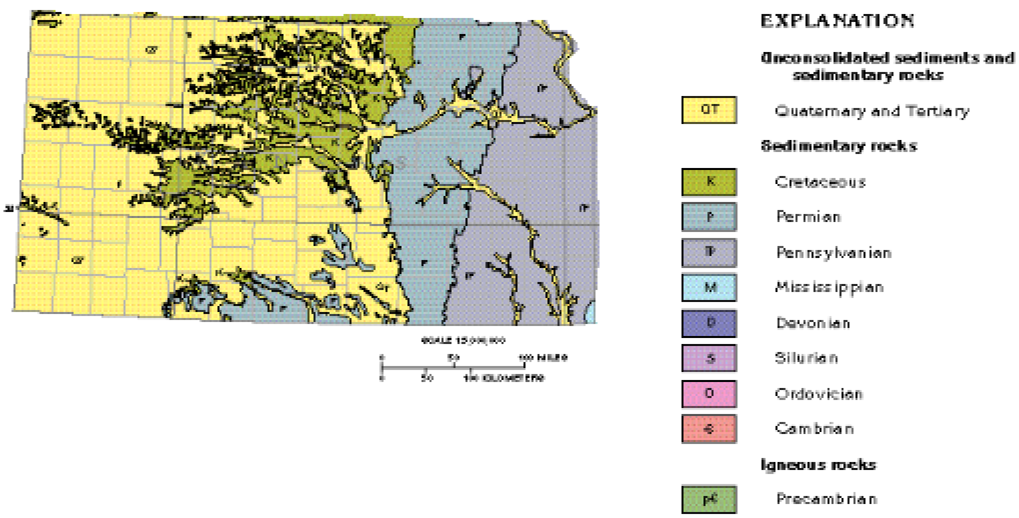
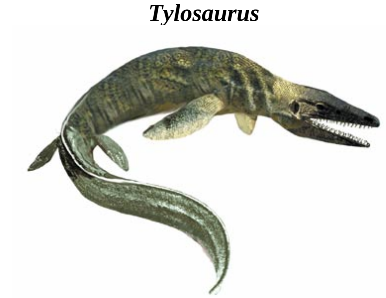


Figure 7.1.3-3: Generalized Bedrock Geology for Kansas

Source: (USGS 1997)

7.1.3.6. Paleontological Resources

Kansas State Fossil
Tylosaurus



Source: (Kansas Historical Society 2015)

During the Carboniferous Period (359 to 299 MYA), ocean levels fluctuated over Kansas, resulting in the formation of vast swamps in eastern Kansas. Carboniferous deposits have yielded fossils from amphibians, plants (e.g., scale trees and ferns), and marine invertebrates including brachiopods,[48] corals, trilobites,[49] bivalves,[50] and bryozoans.[51] During the Permian Period (299 to 251 MYA), sea levels dropped in Kansas, though some Permian marine fish, shark, and lungfish fossils have been recorded. By the Mesozoic Era (251 to 66 MYA), warm, shallow seas covered western Kansas, resulting in the preservation of both marine and plant fossils. Deep seas returned by the Cretaceous Period (146

[48] 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)

[49] 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)

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

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

to 66 MYA), as evidenced by the recovery of fish, turtle, shark, mosasaur, and plesiosaur fossils (The Paleontology Portal, 2015). The two Kansas state fossils, Tylosaurus and Pteranodon, lived during the Cretaceous Period. The Tylosaurus, Kansas's official state marine fossil, measured more than 40 feet in length and weighed more than seven tons. The Pteranodon is the official state flying fossil, and possessed a wingspan of more than 24 feet (Kansas Historical Society, 2015). During the Quaternary Period (2.6 MYA to present), glaciers advanced over northeast Kansas, with short grass prairies, grassland savannas, and coniferous forests spreading over the rest of the state. Quaternary fossils from saber-toothed cats, bison, elk, deer camels, mammoths, and mastodons have been recorded in shallow quarries and riverbeds (The Paleontology Portal, 2015).

7.1.3.7. Fossil Fuel and Mineral Resources

Oil and Gas

In 2013, Kansas produced more than 46.8 M barrels of oil with 27 rotary rigs in operation. This level of production accounted for nearly two percent of total nationwide oil production for that year. In July 2015, Kansas ranked 10th in the nation in crude oil production. "Oil fields span Kansas in a broad arc that includes all but a few counties in the north central part of the state" (EIA, 2015c). Paleozoic (542 to 251 MYA) units throughout Kansas, including the Sauk, Tippecanoe, Kaskaskia, and Absaroka Sequences are major sources of oil (Kansas Geological Survey, 2001).

Kansas has produced natural gas since 1882. In 2014, Kansas produced 286,080 million cubic feet of natural gas, which accounted for one percent of total nationwide natural gas production.[52] The Hugoton Field in Kansas is one of the largest natural gas fields in the country (EIA, 2015c).

Minerals

As of 2015, Kansas's total nonfuel mineral production was valued at $1.05 billion, which ranked 25th nationwide (in terms of dollar value). This level of production accounted for 1.34 percent of the total production value in the country. As of 2015, Kansas' leading nonfuel minerals were helium (Grade-A), Portland cement, salt, stone (crushed), and helium (crude) (USGS, 2016a).

Coal mining has occurred in Kansas since the 1850s. In 2013, Kansas produced 22,000 short tons of coal. This level of production ranked 25th nationwide and last among coal producing states (EIA, 2015c).

7.1.3.8. Geologic Hazards

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

[52] Kansas was ranked 14th in 2013 in natural gas production nationwide (EIA 2015c).

Earthquakes

Between 1973 and March 2012, there were four earthquakes of a magnitude 3.5 (on the Richter scale) or greater in Kansas (USGS, 2014d). Earthquakes are the result of large masses of rock moving against each other along fractures called faults. Earthquakes occur when landmasses on opposite sides of a fault suddenly slip past each other; the grinding motion of each landmass sends out shock waves. The vibrations travel through the Earth and, if they are strong enough, they can damage manmade structures on the surface. Earthquakes can produce secondary flooding impacts resulting from dam failure (USGS, 2012a).

The shaking due to earthquakes can be significant many miles from its point of origin depending on the type of earthquake and the type of rock and soils beneath a given location. Crustal earthquakes, the most common in Kansas, typically occur at depths of 6 to 12 miles; these earthquakes typically do not reach magnitudes higher than 6.0 on the Richter scale.[53] Subduction zone earthquakes occur where Earth's tectonic plates collide. When tectonic plates collide, one plate slides beneath the other, where it is reabsorbed into the mantle of the earth (USGS, 2014e). Convergence boundaries between two tectonic plates can result in earthquakes with magnitudes that exceed 8.0 on the Richter scale (Oregon Department of Geology, 2015). Kansas is far from any convergene boundaries.

Figure 7.1.3-4 depicts the seismic risk throughout Kansas; 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 two percent chance of being exceeded in a 50-year period. Units on the map are measured in terms of acceleration due to gravity (percent g). Most pre-1965 buildings are likely to experience damage with exceedances of 10 percent g. Post-1985 buildings (in California) have experienced only minor damage with shaking of 60 percent g. (USGS, 2010)

Earthquakes in eastern Kansas are often associated with the Humboldt fault zone of the Nemaha Ridge, which trends in a northeast-southwest direction and passes just east of Wichita and Manhattan (Kansas Geological Survey, 2014). The largest earthquake ever recorded in Kansas occurred in April 1867 just east of Manhattan, and likely measured 5.1 on the Richter scale (USGS, 2012b). This earthquake was associated with the Nemaha Ridge. "About 50 miles (80 km) west of the Nemaha Ridge is the Midcontinent rift, a zone of the earth's continental crust that was ripped apart and filled with oceanic-type crust (basaltic rocks) about 1.1 billion years ago. This zone of rifting extended from central Kansas near Salina, northeastward across Nebraska, Iowa, and Minnesota, and into the Lake Superior region." Microearthquakes have been recorded that are associated with this area (Kansas Geological Survey, 2014).

[53] 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, 2014f)

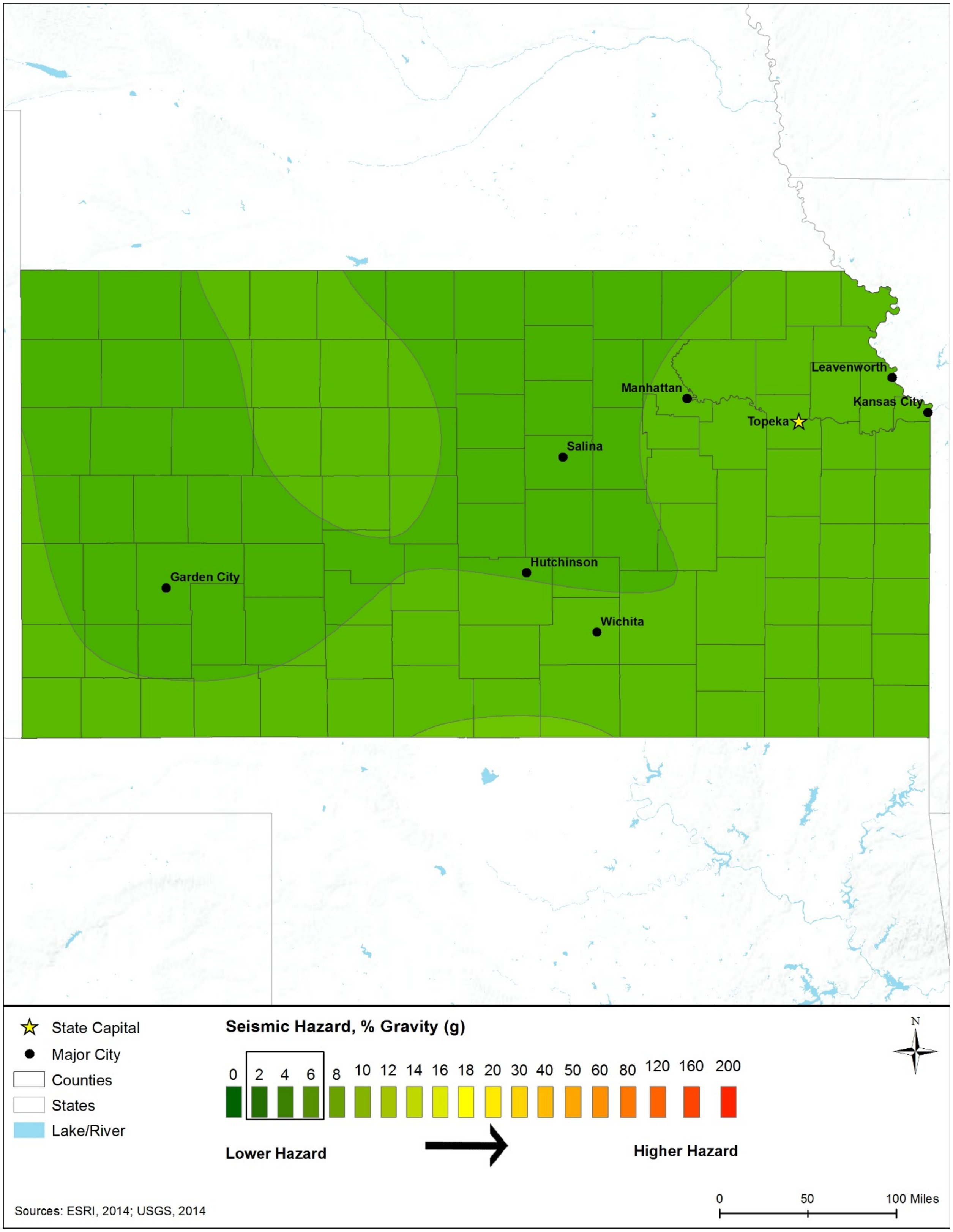


Figure 7.1.3-4: Kansas 2014 Seismic Hazard Map

Earthquakes were recorded in south-central Kansas near the Oklahoma border. In May 2015, a 4.0 earthquake was recorded 19 miles southwest of Pratt, Kansas (USGS, 2015c). In parts of Kansas, particularly Harper and Sumner Counties, many small earthquakes have been recorded that are possibly attributable to human activities associated with oil drilling. "USGS data shows that from 1981 through 2010, Kansas experienced 30 recorded earthquakes. In 2013, there were four recorded earthquakes in Kansas. That number increased to 127 in 2014. From January 1, 2015, to March 16, 2015, Kansas experienced 51 recorded earthquakes" (KCC, 2016).

Landslides

Despite its relatively flat topography, portions of Kansas are susceptible to landslide events (Kansas Geological Survey, 1999). "The term 'landslide' describes many types of downhill earth movements, ranging from rapidly moving catastrophic rock avalanches and debris flows in mountainous regions to more slowly moving earth slides and other ground failures" (USGS, 2003a). Geologists use the term "mass movement" to describe a variety of processes such as rock fall, creep, slump, mudflow, earth flow, debris flow, and debris avalanche regardless of the time scale (USGS, 2003a).

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

Photo of Damage Caused by the 1995 Overland Park Landslide

Source: (Kansas Geological Survey 1999)

On average, landslides have been recorded once every 2.4 years in Kansas (between 1990 and 2007). The Kansas Division of Emergency Management (KDEM) considers it "likely" that a landslide will occur in Kansas within any three-year period. Between 1990 and 2007, seven significant landslide events were documented in the state. (KDEM, 2010a)

Landslides most commonly occur in Kansas when hilly areas underlain by shale or loess becomes saturated with water (Radbruch-Hall, et al., 1982). Areas of Kansas at greatest risk to landslides are in northeastern and north-central Kansas, and include "the Kansas City metropolitan area (Johnson, Leavenworth, and Wyandotte counties); the Smoky Hills in northern and central Kansas; and northwestern Hamilton County." A 1995 landslide in Overland Park destroyed two homes and resulted in more than $1M in damage (KDEM, 2010a). Figure 7.1.3-5 shows landslide incidence and susceptibility throughout Kansas.

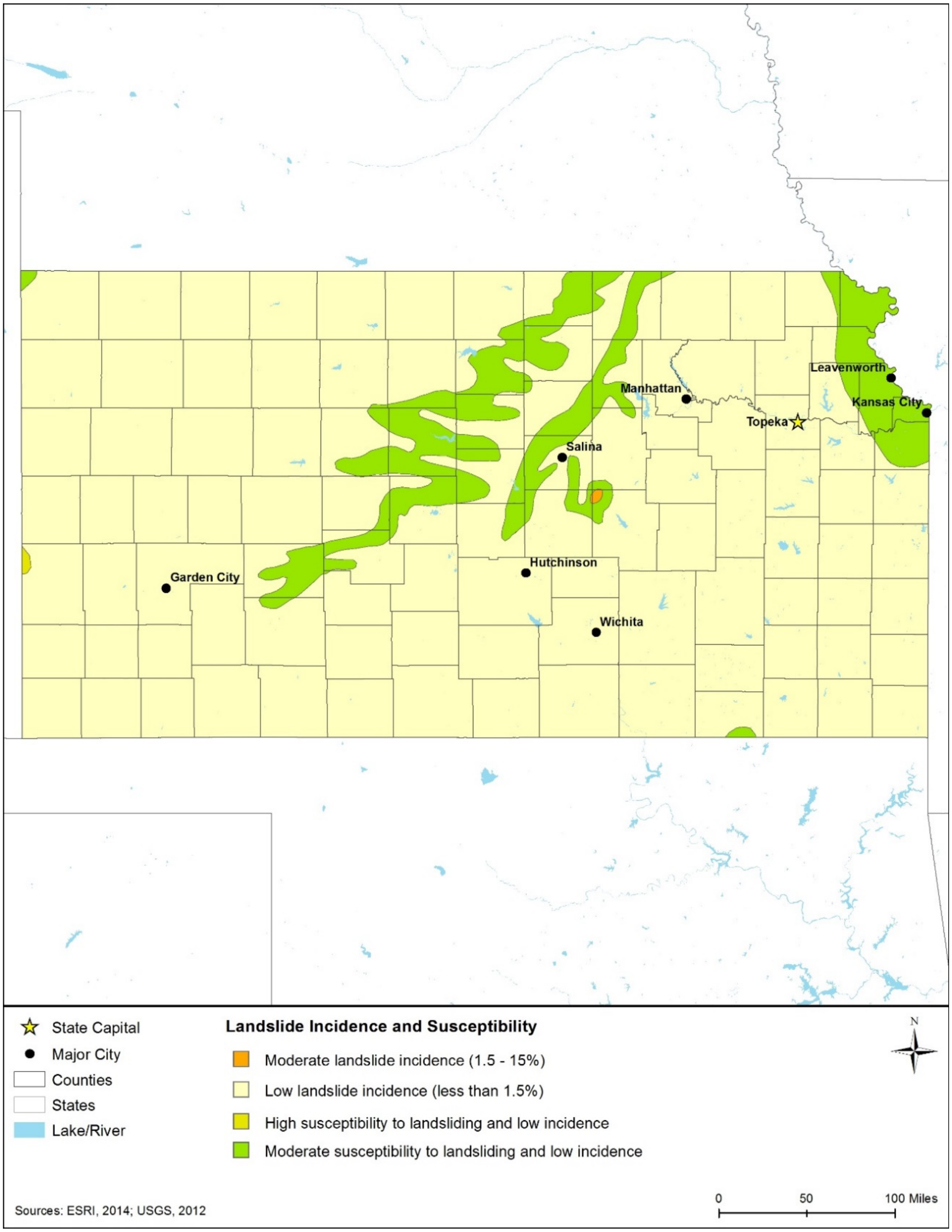


Figure 7.1.3-5: Kansas Landslide Incidence and Susceptibility Hazard Map[54]

[54] Susceptibility hazards not indicated in Figure 7.1.3-5 where same or lower than incidence. Susceptibility to landslides is defined as the probable degree of response of areal rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. High, moderate, and low susceptibility are delimited by the same percentages used in classifying the incidence of landslides. Some generalization was necessary at this scale, and several small areas of high incidence and susceptibility were slightly exaggerated. (USGS, 2014g)

Land Subsidence

Land subsidence is a "gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000). In Kansas, land subsidence is mostly attributable to mine subsidence, dissolution of underground salt deposits, and karst[55] topography (KDEM, 2010a). Nationwide, the primary causes of land subsidence are attributed to aquifer system compaction, drainage of organic soils, underground mining, sinkholes, and thawing permafrost. More than 80 percent of subsidence in the U.S. is a consequence of over-withdrawal of groundwater. In many aquifers, which are subsurface soil layers through which groundwater moves, water is pumped from pore spaces between sand and gravel grains. If an aquifer is confined by layers of silt or clay, which do not transport groundwater, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure compromises support for the clay and silt beds, causing them to collapse on one another. The effects of this compression are seen in the permanent lowering of the land surface elevation (USGS, 2000).

Land subsidence can result in altered stream elevations and slopes; detrimental effects to infrastructure and buildings; and collapse of wells due to compaction of aquifer sediments. Subsided areas can become more susceptible to inundation, both during storm events and non-events. Additionally, land subsidence can affect vegetation and land use (USGS, 2013a).

In Kansas, mine subsidence constitutes a significant hazard throughout the state. Subsidence risk due to mine collapse is "highest in the southeast corner of the state, where subsidence events are primarily due to coal, lead, and zinc mining… Overall, approximately 46,000 acres in 41 counties have been affected by coal mining in Kansas, including 1,142 acres of mining-related subsidence under towns and roads." (KDEM, 2010a)

Land subsidence attributable to salt dissolution has been observed in Sumner, Sedgwick, Reno, and McPherson Counties[56] (KDEM, 2010a). In 1879, a nearly 200-foot wide sinkhole that formed due to salt dissolution was discovered in Kansas (UNESCO, 1984). More recently, "two active sinkholes along a short stretch of I-70 in Russell County have been pulling down the driving lanes since the highway's construction in the mid-1960s. They are the result of dissolution of a salt bed below the surface. An improperly capped abandoned oil well allowed fresh water to pass through and dissolve the salt" (KDEM, 2010a). It is estimated that the dissolved salt beds were more than 1,300 feet below the ground surface (Croxton, 2000).

Another significant cause of land subsidence in Kansas is karst topography, which results in the formation of sinkholes, fissures,[57] tubes, and caves. Karst is particularly common throughout eastern Kansas in areas that are underlain by carbonate rocks.[58] Subsidence due to dissolution of

[55] 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, 2015g)
[56] Sedgwick, Reno and McPherson Counties are in south-central Kansas.
[57] Fissure: "Elongate, narrow fractures." (USGS, 2015g)
[58] Carbonate Rocks: "A sedimentary rock made mainly of calcium carbonate ($CaCO_3$). Limestone and dolomite are common carbonate sedimentary rocks." (USGS, 2015g)

gypsum[59] has been observed in southern Kansas (KDEM, 2010a). Figure 7.1.3-6 shows the location of areas in Kansas that are susceptible to land subsidence due to karst topography.

[59] Gypsum: "The mineral form of hydrated calcium sulfate, $CaSO_4 \cdot 2H_2O$." (USGS 2002)

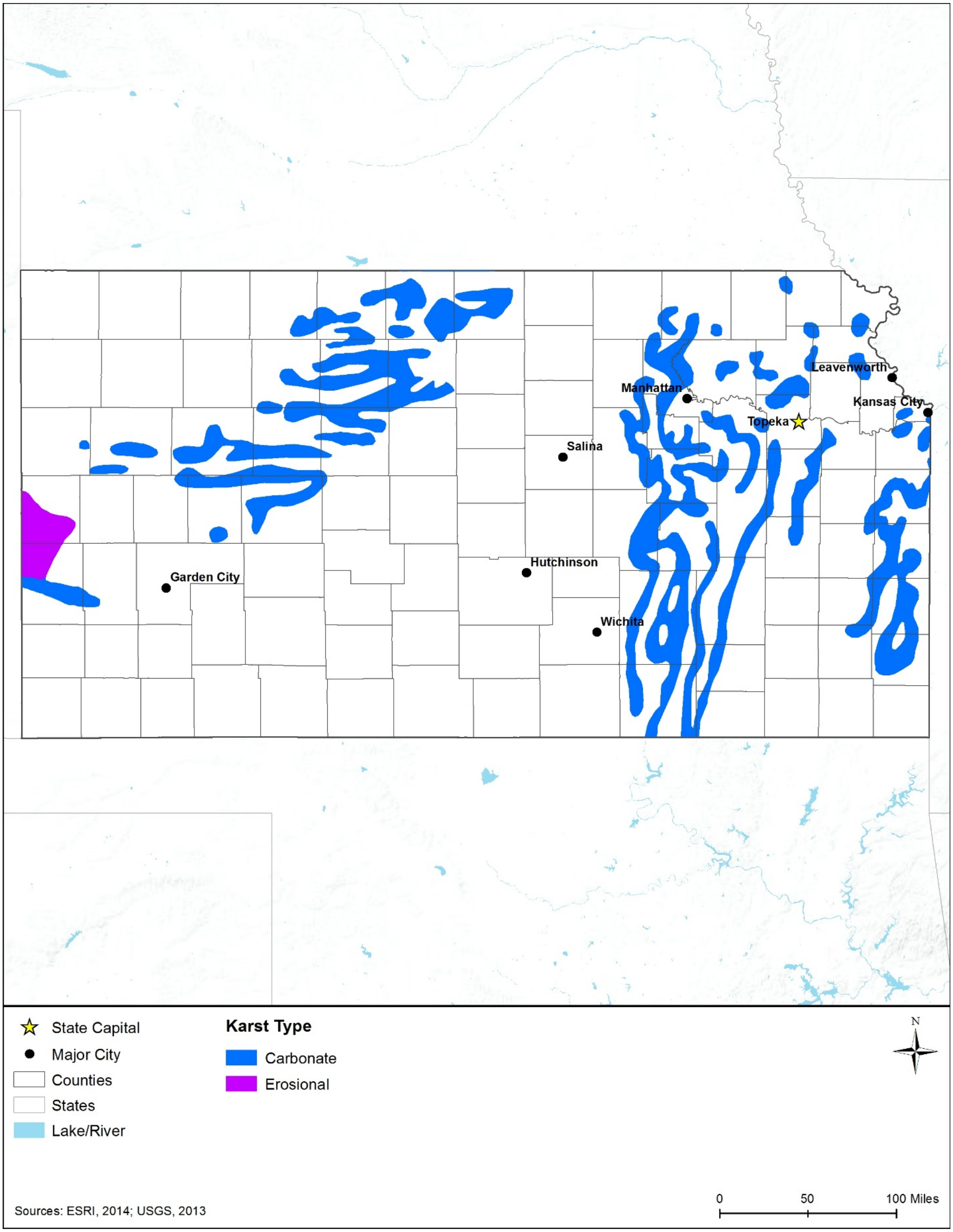


Figure 7.1.3-6: Areas Susceptible to Subsidence due to Karst Topography in Kansas

7.1.4. Water Resources

7.1.4.1. Definition of the Resource

Water resources are defined as all surface water bodies and groundwater systems including streams, rivers, lakes, canals, ditches, estuarine waters, floodplains, aquifers, and other aquatic habitats (Wetlands are discussed separately in Section 7.1.5). These resources can be grouped into watersheds which are defined as areas of land whose flowing water resources (including runoff from rainfall) drain to a common outlet such as a river or ocean. The value and use of water resources are influenced by the quantity and quality of water available for use and the demand for available water. Water resources are used for drinking, irrigation, industry, recreation, and as habitat for wildlife. Some water resources that are particularly pristine, sensitive, or of great economic value enjoy special protections under federal and state laws. An adequate supply of water is essential for human health, economic wellbeing, and ecological health (USGS, 2014h).

7.1.4.2. 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 7.1.4-1 identifies the relevant laws and regulations for water resources in Kansas.

Table 7.1.4-1: Relevant Kansas Water Laws and Regulations

State Law / Regulation	Regulatory Agency	Applicability
Kansas Water Appropriations Act	KDA, Division of Water Resources	All use or appropriation of water for non-domestic (e.g., water "used for the household, watering livestock on pasture, or watering up to two acres of lawn and gardens) purposes.
Kansas National Pollutant Discharge Elimination System	KDHE	All construction projects that disturb one or more acre of surface soil.
CWA Section 401 permit	KDHE	In accordance with Section 401 of the Clean Water Act (CWA), activities that may result in a discharge to waters of the U.S. require a Water Quality Certification from KDHE indicating that the proposed activity will not violate water quality standards.

7.1.4.3. Environmental Setting: Surface Water

Surface water resources are lakes, ponds, rivers, and streams. According to the KDHE, Kansas has approximately 30,278 miles of classified rivers and streams with 320 lakes, reservoir, and ponds covering approximately 191,451 acres (KDHE, 2014a). Surface water uses include agriculture, public water supply, industrial, and recreation (KDA, 2015a).

Watersheds

Watersheds, or drainage areas, consist of surface water and all underlying groundwater, and encompass an area of land that drains streams and rainfall to a common outlet (e.g., reservoir, bay). Waters in Kansas (lakes, rivers, and streams) are divided into 12 major watersheds, or drainage basins). Visit http://www.kdheks.gov/tmdl/planning_mgmt.htm for information and additional maps about Kansas watersheds (KDHE, 2015i).

The Upper Republican watershed is in the northwestern corner of Kansas and covers approximately 4,900 square miles (KWO, 2009a). East of this watershed is the Solomon watershed, which drains an area entirely within Kansas. The Smoky Hill-Saline watershed lies south of these watersheds and extends from the northwestern Kansas border to central Kansas. The Upper Arkansas and Cimarron watersheds drain the remaining southwest portion of the state. The Lower Arkansas watershed extends from central Kansas to the southcentral Kansas border. This watershed drains an area of 11,500 square miles (KWO, 2009b). The Walnut and Verdigris watersheds are east of the Lower Arkansas watershed. The Neosho River Watershed extends from east-central Kansas down to the far southeastern corner of the state. This watershed covers approximately 6,300 square miles and contains several major reservoirs, including Marion Lake and John Redmond Reservoir (KWO, 2009c). The Marais des Cygnes watershed is east of the Neosho watershed and extends along the Kansas eastern border. The Kansas-Lower Republican watershed covers a large area in northeastern Kansas, while the Missouri watershed occupies a small area of 1,600 square miles in the far northeastern corner of Kansas (KWO, 2009d).

Freshwater

As shown in Figure 7.1.4-1, there are nine major rivers in Kansas: Arkansas, Cimarron, Walnut, Verdigris, Marais Des Cygnes, Kansas, Big Blue, Republican, and Solomon. The Kansas River begins at the confluence of the Republican and Smoky Hill rivers in east-central Kansas and flows east to join the Missouri River on the Kansas-Missouri border. The Kansas River drains the majority of the northern half of Kansas. The Arkansas River originates in Colorado and flows through southwestern and central Kansas before turning south to join the Mississippi River in Arkansas. (KDWPT, 2015a) The Solomon River is formed at the confluence of its north and south forks in northwestern Kansas and flows east through the northcentral portion of the state. The Verdigris River is in southeastern Kansas and flows south into Oklahoma. The Walnut River is just west of the Verdigris River and drains approximately 167 square miles as it flows south to join the Arkansas River in Oklahoma (KWO, 2009e).

Kansas has few natural lakes but has constructed many reservoirs to control flooding and store water (Kansas University, 2000). Major lakes and reservoirs in Kansas include El Dorado Lake, Cheney Reservoir, Perry Lake, John Redmond Lake, Marion Lake, Wilson Lake, Waconda Lake, and Kirwan Reservoir (Figure 7.1.4-1). El Dorado Lake is approximately 8,000 acres along the Walnut River in southeastern Kansas. The lake was constructed from two smaller lakes, Bluestem Lake and Old El Dorado Lake, and offers many recreational opportunities such as fishing, swimming, and boating (USACE, 2015a) (USACE, 2015b). In northeast Kansas, the

Perry Lake covers approximately 11,500 acres and is maintained for flood control, water storage, and recreation (USACE, 2015c). Waconda Lake, also known as Glen Elder Reservoir, is in northcentral Kansas and is approximately 12,500 acres. The lake offers numerous recreational opportunities for the public and includes a variety of wildlife species (KDWPT, 2015b).

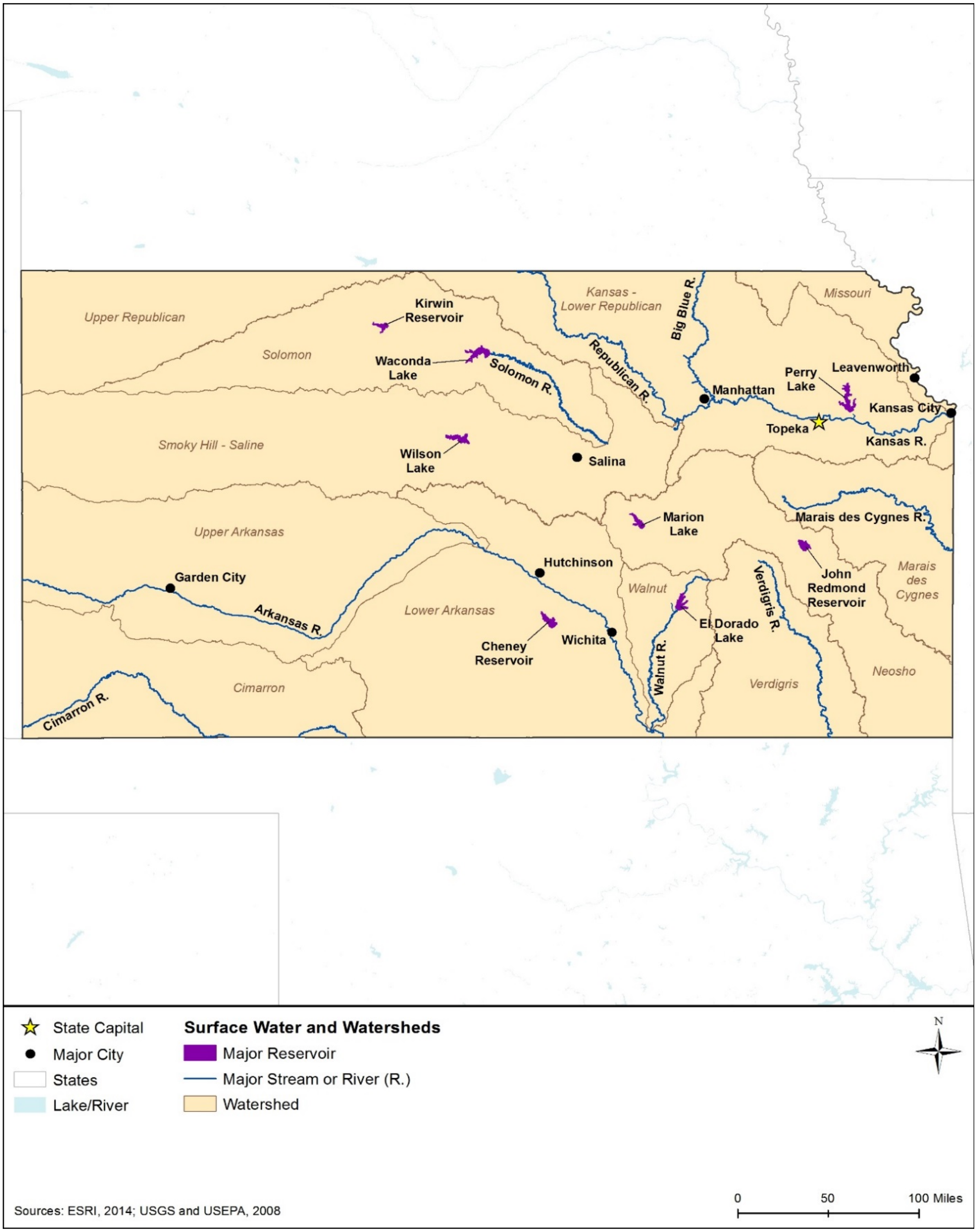


Figure 7.1.4-1: Major Kansas Watersheds and Surface Waterbodies

7.1.4.4. Sensitive or Protected Waterbodies

Special Resource Waters

Additionally, activities are regulated within Kansas Outstanding Resource Waters and Designated State Waters, including Exceptional State Waters and Special Aquatic Life Use Waters. A list of these surface waters can be viewed on the Kansas Surface Water Register at www.kdheks.gov/befs/download/Current_Kansas_Surface_Register.pdf (USACE, 2015d) (KDHE, 2013b).

7.1.4.5. Impaired Waterbodies

Several elements, including temperature, dissolved oxygen, suspended sediment, nutrients, metals, oils, observations of aquatic wildlife communities, and sampling of fish tissue, are used to evaluate water quality. Under Section 303(d) of the CWA, states are required to assess water quality and report a listing of impaired waters,[60] the causes of impairment, and probable sources. Table 7.1.4-2 summarizes the water quality of Kansas's assessed major waterbodies by category, percent impaired, designated use,[61] cause, and probable sources. Figure 7.1.4-2 shows the Section 303(d) waters in Kansas as of 2014.

As shown in Table 7.1.4-2, various sources affect Kansas's waterbodies, causing impairments. Statewide, the most widespread causes of impairment for rivers and streams include phosphorus, sulfates, sediment, and pathogens. The top designated use for impaired rivers and streams within Kansas includes aquatic life. In western and northeastern Kansas, years of irrigated crop production has altered and degraded aquatic ecosystems along rivers and streams. Further, urban growth and development has altered the ability of urban watersheds to remove pollutants from runoff water and mitigate effects of flooding. Therefore, physical habitats supporting aquatic life are negatively impacted by these alterations (KDHE, 2014a).

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

Table 7.1.4-2: Section 303(d) Impaired Waters of Kansas, 2014

Water Type[a]	Amount of Waters Assessed[b] (Percent)	Amount Impaired (Percent)	Designated Uses of Impaired Waters	Top Causes of Impairment	Top Probable Sources for Impairment
Rivers and Streams	21.8%	87.8%	aquatic life, domestic water supply, food procurement, and recreation	phosphorus, sulfates, sediment, pathogens[c]	no probable sources reported[d]
Lakes, Reservoirs, and Ponds	99.4%	97.9%	aquatic life, domestic water supply, food procurement, and recreation	nutrients, sediment, dissolved oxygen, high pH/acidity, sulfates and chloride	no probable sources reported

Source: (USEPA, 2015b)

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

KDHE works closely with federal and state agencies to implement programs to maintain and restore water quality across the state. One of the leading causes of impairment in Kansas's lakes, reservoirs, and ponds is nutrients. KDHE has made significant efforts in recent years to decrease nutrient loading to surface waters. For example, KDHE has initiated a program that requires new and upgraded wastewater treatment plants to construct and operate processes to reduce the amount of nitrogen and phosphorus in discharges. As of January 2014, more than half of the treatment plants that generate large amount of these pollutants are operating these reduction processes or are currently constructing them. For more information on Kansas's water quality, visit KDHE Division of Environment, Kansas Integrated Water Quality Assessment found at http://www.kdheks.gov/befs/download/Kansas_Integrated_Report_2014.pdf. (KDHE, 2014a)

7.1.4.6. 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

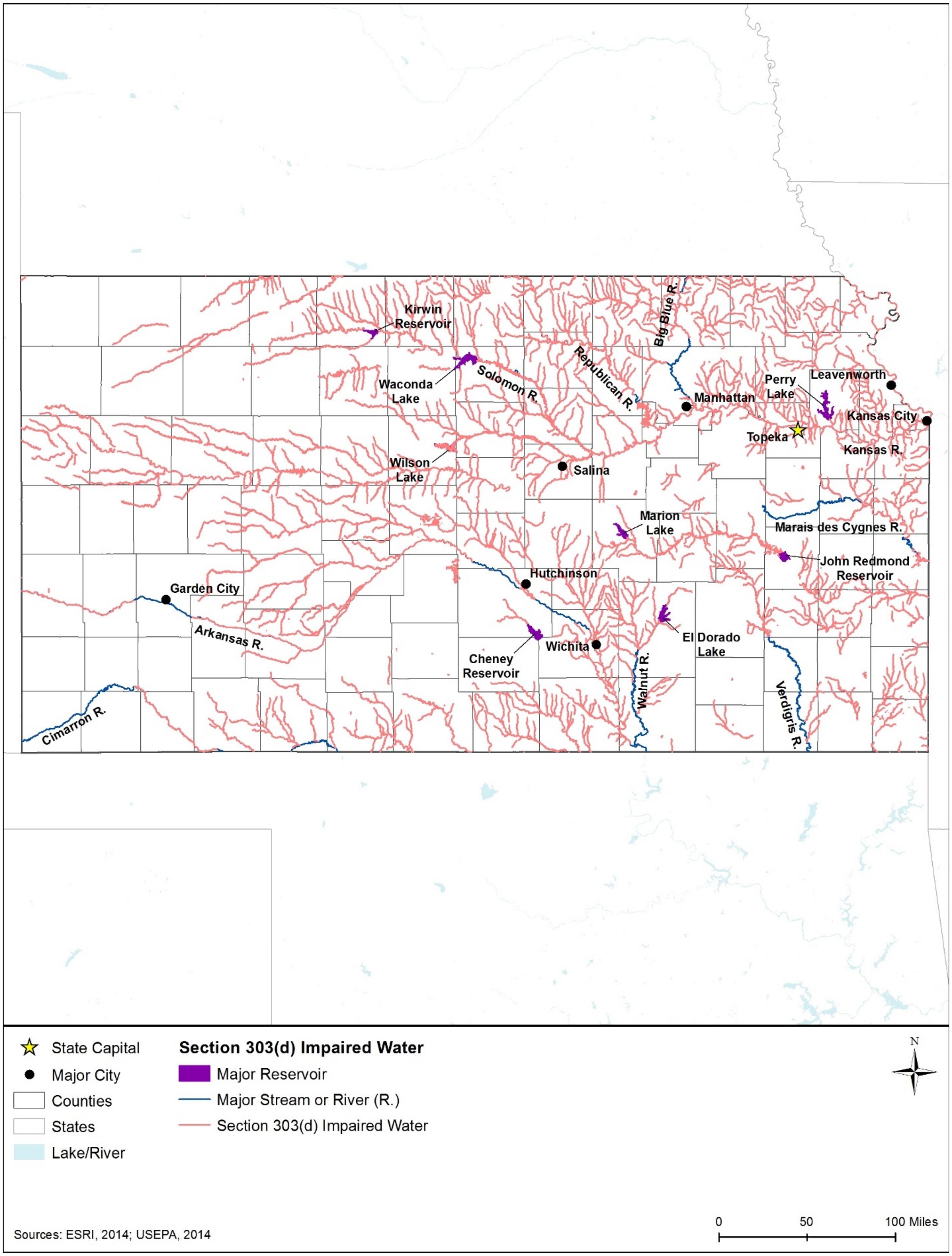


Figure 7.1.4-2: Section 303(d) Impaired Waters of Kansas, 2014

providing floodwater storage, erosion control, water quality maintenance, and groundwater recharge. Historically, floodplains have been favorable locations for agriculture, aquaculture, and forest production due to the relatively flat topography and nearby water supply. Floodplains can also offer recreational activities, such as boating, swimming, and fishing, as well as hiking and camping (FEMA, 2014a).

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

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 Kansas, often resulting in loss of life and damage to property, infrastructure, agriculture, and the environment. These include severe rain events, rapid snowmelt, storm-surge, ice jams, over-development/impervious[62] surfaces, and dam and level failture. (KDEM, 2010a) (KDEM, 2013).

Although some areas, such as floodplains, are more prone to flooding than others, no area in the state is exempt from flood hazards. Since 1957, there have been 34 Major Presidential Disaster Declarations and 1 Emergency Declaration that included flooding. Based on data from September 2006 to July 2012, flash flood events were most common within eastern counties of Kansas. Several counties along the eastern border of the state have experienced 20 or more flash floods during this period. Historical data shows that Kansas experiences an average of 190 flood events and $47.2M in flood losses each year (KDEM, 2013).

Local communities often have floodplain management or zoning ordinances that restrict development within the floodplain. FEMA provides floodplain management assistance, including mapping of 100-year floodplain limits, to approximately 452 communities in Kansas through the National Flood Insurance Program (NFIP) (FEMA, 2014c). Established to reduce the economic and social cost of flood damage by subsidizing insurance payments, the NFIP encourages communities "to adopt and enforce floodplain management regulations and to implement broader floodplain management programs" and allows property owners in participating communities to purchase insurance protection against losses from flooding (FEMA, 2015a). 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

[62] 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, 2015l).

management. As of May 2014, Kansas had 30 communities participating in the CRS (FEMA, 2014d).[63]

7.1.4.7. Groundwater

Groundwater systems are sources of water that result from precipitation infiltrating the ground surface, and includes underground water that occupies pore spaces between sand, clay, or rock particles. An aquifer is a permeable geological formation that stores or transmits water to wells and springs. Groundwater is contained in either confined (bound by clays or nonporous bedrock) or unconfined (no layer to restrict the vertical movement of groundwater) aquifers (USGS, 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.

Kansas's principal aquifers consist of carbonate-rock[64] and sandstone aquifers,[65] and sand and gravel aquifers of alluvial and glacial origin.[66] According to the Kansas Department of Agriculture (KDA), approximately 66 to 75 percent of total water diverted for use within Kansas is pumped from groundwater sources (KDA, 2015a). Generally, the water quality of Kansas's aquifers is suitable for drinking and daily water needs. Statewide, the most serious threats to groundwater quality include agricultural activities, storage and treatment facilities, disposal activities, industrial facilities, oil/gas activities, pipelines and sewer lines, and saltwater intrusion (saltwater moving into freshwater aquifers) (KDHE, 2014a).

Table 7.1.4-3 provides details on aquifer characteristics in the state; Figure 7.1.4-3 shows Kansas's principal aquifers. There are no sole source aquifers in Kansas.

[63] A list of the 30 CRS communities can be found in the most recent FEMA CRS report dated May 1, 2014 (FEMA 2014d) and additional program information is available from FEMA's NFIP CRS website (www.fema.gov/national-flood-insurance-program-community-rating-system)

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

[65] 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).

[66] 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, 2015h).

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

Aquifer Type and Name	Location in State	Groundwater Quality
Aquifers of Alluvial and Glacial Origin consists of unconsolidated sand and gravel	Northeastern corner of Kansas and along the courses of the Republican, the Kansas, the Missouri, the Solomon, the Saline, the Neosho, the Smoky Hill, the Marais des Cygnes, the Arkansas, and the Cimarron Rivers	Typically, the water is very hard. Water from these aquifers is used primarily for public supplies, self-supplied rural-domestic use, and industry.
High Plains aquifer consists of unconsolidated deposits of gravel, sand, silt, and clay	Throughout western part of the state stretching through south central Kansas	Water is hard to very hard. Most of the water pumped from the High Plains aquifer is used for irrigation, but the aquifer also supplies water for public supply and industrial use.
Lower Cretaceous aquifers consist of unconsolidated sand, gravel, and porous rocks	Central Kansas	Water is too salty for drinking so primarily used for irrigation, public, and rural-domestic supplies.
Ozark Plateaus aquifer system consists of limestone and dolomite but also include sandstone and chert	Small part of extreme southeastern Kansas	Water is very hard and variable in quality. Used for public supply, industrial, mining, and thermoelectric power uses

Sources: (Moody, Carr, Chase, & Paulson, 1986) (Miller, 1997)

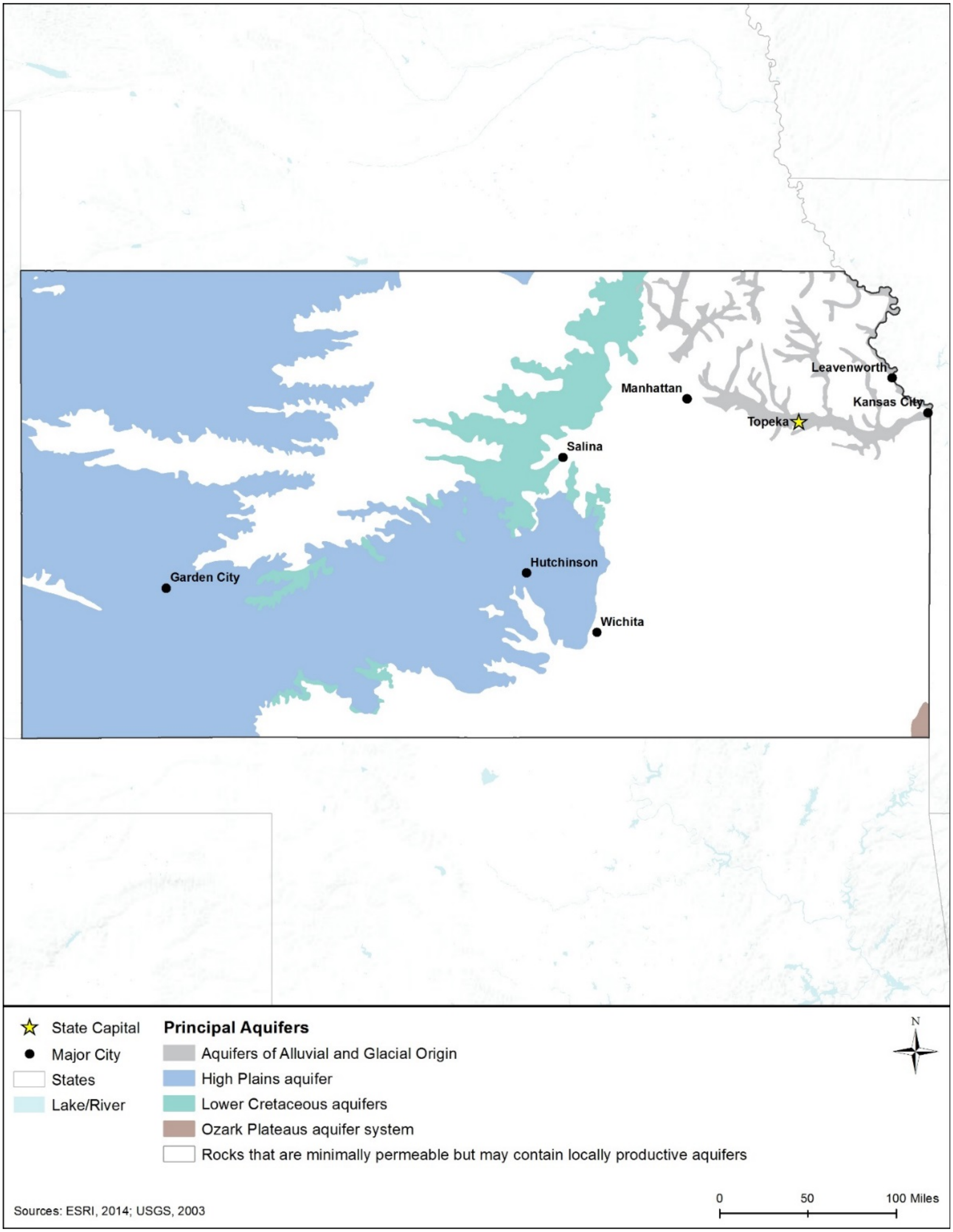


Figure 7.1.4-3: Principal Aquifers of Kansas

7.1.5. Wetlands

7.1.5.1. Definition of the Resource

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

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

7.1.5.2. Specific Regulatory Considerations

Appendix C, Environmental Laws and Regulations, describes the pertinent federal laws protecting wetlands in detail. Table 7.1.5-1 summarizes the major Kansas state laws and permitting requirements relevant to the state’s wetlands.

Table 7.1.5-1: Relevant Kansas Wetlands Laws and Regulations

State Law / Regulation	Regulatory Agency	Applicability
CWA Section 404 permit, Nationwide Permit (NWP)	U.S. Army Corps of Engineers (USACE), Kansas City District	Preconstruction notification is required for activities that cross the same stream multiple times or cross multiple parallel streams. The preconstruction notification must include a revegetation plan for any impacted wetlands. (USACE, 2015d)
CWA Section 401	KDHE	In accordance with Section 401 of the CWA, activities that may result in a discharge to waters of the U.S. require a Water Quality Certification from KDHE indicating that the proposed activity will not violate water quality standards (KDHE, 2015h).
Kansas National Pollutant Discharge Elimination System	KDHE	All construction projects that disturb one or more acre of surface soil (KDHE, 2015g).

7.1.5.3. 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 (as detailed in Table 7.1.5-2). The first four of these include both wetlands and deepwater habitats but the Palustrine includes only wetland habitats (USFWS, 2015a).

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

Three of these systems – Palustrine, Riverine, and Lacustrine – are present in Kansas, as detailed in Table 7.1.5-2. In Kansas, the main type of wetlands are palustrine (freshwater) wetlands found on river and lake floodplains across the state, as shown in Figure 7.1.5-1.[67] Riverine and lacustrine wetlands are found throughout the state. Table 7.1.5-2 uses 2014 NWI data to characterize and map Kansas 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. The map codes and colorings in Table 7.1.5-2 correspond to the wetland types in the figures.

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

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (acres)[b]
Palustrine forested wetland	PFO	PFO wetlands contain woody vegetation that are at least 20 feet tall. Floodplain forests and hardwood swamps are examples of PFO wetlands.	Forested lowlands within the state	76,438
Palustrine scrub-shrub wetland	PSS	Woody vegetation less than 20 feet tall dominates PSS wetlands. Thickets and shrub swamps are examples of PSS wetlands.	Throughout the state, often on river and lake floodplains	
Palustrine emergent wetlands	PEM	PEM 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, prairie potholes, and sloughs.	Eastern half of the state	214,385
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, concentrated in the western half	182,313
Palustrine aquatic bed	PAB	PAB wetlands include wetlands vegetated by plants growing mainly on or below the water surface line.		

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

Wetland Type	Map Code and Color	Description[a]	Occurrence	Amount (acres)[b]
Other Palustrine wetland	Misc. Types	Farmed wetland, saline seep[68], and other miscellaneous wetlands are included in this group.	Abandoned fields, depressions (seeps), along hillsides and highways	9,132
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	31,452
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 less than 8.2 feet deep.	Throughout the state	28,653
			Total	**542,373**

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

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

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

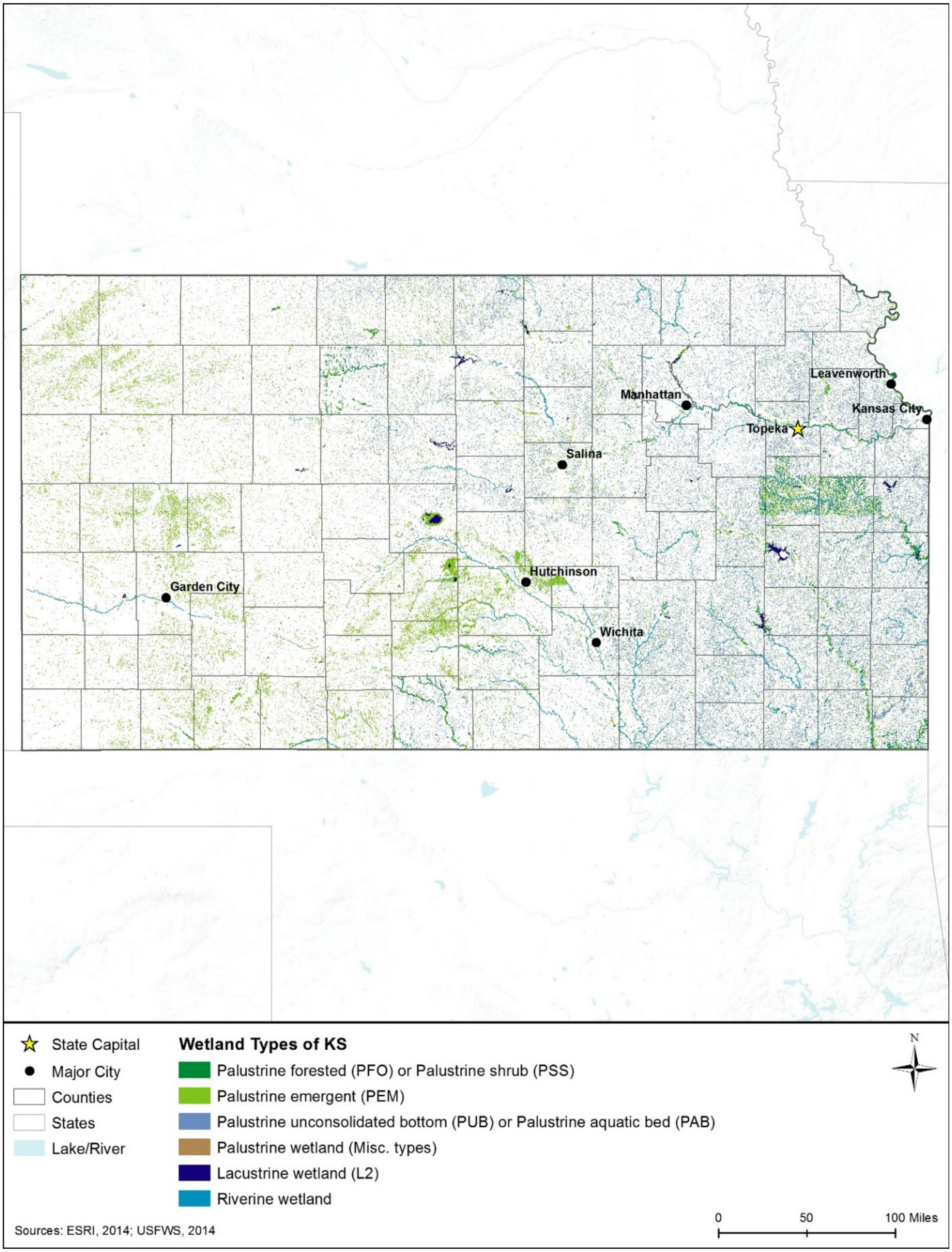


Figure 7.1.5-1: Wetlands by Type, in Kansas, 2014

Palustrine Wetlands

In Kansas, palustrine wetlands include the majority of vegetated freshwater wetlands (freshwater marshes, swamps, bogs, and ponds). There are few palustrine forested wetlands (PFO) in Kansas, occurring mostly along river floodplains. Common species include Eastern cottonwood *(Populus deltoides)*, hackberry *(Celtis occidentalis)*, American elm *(Ulmus Americana)*, and green ash *(Fraxinus pennsylvannica)*. Palustrine scrub-shrub wetlands (PSS) consist of willows (*Salix spp.*), dogwoods (*Cornus spp.*), arrowwoods (*Viburnum spp.*), buttonbush (*Cephalanthus occidentalis*), swamp rose (*Rosa palustris*), and saplings of trees such as red maple (*Acer rubrum*). PFO and PSS are the least common type of palustrine wetlands within Kansas. Palustrine emergent wetlands (PEM), or freshwater marsh, fen, and slough[69], in Kansas support diverse plant and animal populations, and are the most common type of wetlands in the state. Common PEM marsh plants in Kansas include cattails (*Typha spp.*), bulrushes *(Scirpus spp)*, ragweeds (*Ambrosia spp.)*, and sorrel (*Rumex spp*). Cheyenne Bottoms is an example of a large freshwater marsh in the state. (Wasson, Yasui, Brunson, Amend, & Ebert, 2005)

Palustrine aquatic (PAB/PUB) wetlands also include the shallow water zones of lakes, rivers, and ponds and aquatic beds formed by water lilies and other floating-leaved or free-floating plants. Cattails are often found growing in or around PAB/PUB wetlands in Kansas, and they offer important breeding grounds for waterfowl and other wildlife. These are the easiest wetlands to recognize and occur throughout the state. Common emergent and floating vegetation includes species of bulrush (*Cyperaceae*), cattail (*Typha latifola*), pondweed *(Potamogeton natans*), pond–lily (*Nuphar polysepalum)*, watermilfoil *(Myriophyllum spicatum)*, and reed canary grass (*Phalaris arundinacea L)*. (Wasson, Yasui, Brunson, Amend, & Ebert, 2005)

Another type of palustrine wetland in Kansas are playa lakes, which are the main palustrine wetlands of the Shortgrass Prairie Conservation Region in the western third of Kansas. Playa lakes are small circular depressions with a clay layer at the bottom that prevents water from soaking into the ground. These ephemeral (nonpermanent) wetlands are rainfed, formed by the wind, and are found throughout the western third of the state. Common species found in playa lakes include blue mudplantain (*Heteranthera limosa)*, foxtail barley *(Hordeum jubatum)*, woollyleaf bur ragweed *(Ambrosia grayi)*, pitseed goosefoot *(Chenopodium berlandieri))*. Agriculture activities (plowing, drainage, livestock, pesticide application) have altered many of the state's playa lakes. (Wasson, Yasui, Brunson, Amend, & Ebert, 2005)

Source: (USFWS, 2015z)

Figure 7.1.5-2: Rare Inland Salt Marsh at Quivira National Wildlife Refuge

In addition to freshwater marshes, Kansas has inland salt marshes, or saline wetlands, such as at Quivira

[69] Slough: "swamp or shallow lake system, usually a backwater to a larger body of water" (NOAA 2014).

National Wildlife Refuge (Figure 7.1.5-1). Inland salt marshes occur due to the high concentration of underground salt deposits that, as the groundwater flows through the salts in the bedrock the water becomes highly saline (salty). Salinity (or salt) levels in the water varies depending on rainfall, runoff from rainfall, and the depth of the water. Plants found in these wetlands include the Prairie cordgrass (*Spartina pectinate)*, spikerush (*Eleocharis spp.)*, and sedges *(Carex spp.)* Many areas have a high enough salinity to support salt-tolerant plant species such as inland salt grass *(Distichlis spicata)*, alkali sacaton *(Sporobolus airoides)*, and seepweed *(Suaeda caceoliformis)*. (Wasson, Yasui, Brunson, Amend, & Ebert, 2005)

Lacustrine Wetlands

Lacustrine wetlands are distributed throughout Kansas. In north Kansas, the wetlands are associated with both large lakes and with glaciated kettle lakes. There are approximately 28,653 acres of lacustrine wetlands in the state, or 5 percent of the total wetlands (USFWS, 2014a). Typical plant species include pondweeds, milfoils *(Myriophyllum spp.*), bladderworts *(Utricularia spp.*), coontails *(Ceratophyllum spp.*), muskgrass *(Chara spp.*), and other submergent (underwater) plants. (Wasson, Yasui, Brunson, Amend, & Ebert, 2005)

Riverine Wetlands

The wetlands occur in broad valleys and have fine textured sediments deposited by peak flows in the spring. Surface water in this region is temporary, due to the lowering of the water table, and surface and groundwater withdrawal, unless augmented by human activities. There are approximately 31,452 acres of riverine wetlands in the state, or 6 percent of the total wetlands (USFWS, 2014a). Dominant plant species include Eastern cottonwood, hackberry, American elm, and green ash. Wetlands occur along the Kansas, Neosho, Marais des Cygnes, and the Verdigris Rivers. (Wasson, Yasui, Brunson, Amend, & Ebert, 2005)

Status and Trends

Approximately 48 percent of wetlands within Kansas have been lost during the last 200 years (KDHE, 2010b). Main threats to wetlands in Kansas include agricultural conversion (draining, filling of wetlands) and urbanization (KDHE, 2010b). Based on the USFWS NWI 2014 analysis, PEM wetlands are the dominant wetland type (44 percent), followed by PUB/PAB (ponds) (38 percent), PFO/PSS (16 percent), and other palustrine wetlands (2 percent) (USFWS, 2014a). There are currently about 482,268 acres of palustrine (freshwater) wetlands in the state (USFWS, 2014a).

Important Wetland Sites in Kansas

- Kansas Wetland Education Center hosts two Ramsar[70] designated Wetlands of International Importance, Cheyenne Bottoms, the largest inland marsh in the United States, and Quivira National Wildlife Refuge, an inland salt marsh. Combined, the sites provide habitat for more

[70] 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)

than 90 percent of the world's population of sandpipers, as well as hundreds of thousands of geese and cranes. (Kansas Wetlands Education Center, 2016)

- National Natural Landmarks in Kansas range in size from 16 acres to over 1,700 acres and include undisturbed wetland prairie owned by Kansas Department of Wildlife and Parks, universities, counties, municipalities, and other conservation organizations and individuals (NPS, 2012a). Section 7.1.8, Visual Resources, describes Kansas's National Natural Landmarks.
- Other wetlands protected under easements or agreements through voluntary government programs and resource conservation groups are found across the state. These include Natural Resources Conservation Service (NRCS) Agricultural Conservation Easement Program and easements managed by natural resource conservation groups such as the Kansas Land Trust, The Nature Conservancy, Johnson County Park and Recreation District, and National Park Service. According to the National Conservation Easement Database, a national electronic repository of government and privately held conservation easements (http://conservationeasement.us/), NRCS holds more than 68,000 acres in conservation easements in Kansas. (NCED, 2015)

7.1.6. Biological Resources

7.1.6.1. Definition of the Resource

This chapter describes the biological resources of Kansas. Biological resources include terrestrial[71] vegetation, wildlife, fisheries and aquatic habitats,[72] threatened[73] and endangered[74] species as well as communities and species of conservation concern. Wildlife habitat and associated biological ecosystems are also important components of biological resources. Given Kansas's varied landscape, which includes flat to gently rolling plains, cuestas,[75] wetlands, lakes, and rivers and streams with their associated lowland valleys, Kansas supports a large number of habitats that supports a diversity of biological resources. Each of these topics is discussed in more detail below.

7.1.6.2. Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of biological resources in Kansas are summarized in Appendix C, Environmental Laws and Regulations. Table 7.1.6-1 summarizes the state laws relevant to the state's biological resources.

[71] Terrestrial: "Pertaining to the land" (USEPA 2015a).
[72] Habitat: "The environment in which an organism or population of plants or animals lives; the normal kind of location inhabited by a plant or animal" (USEPA 2015a).
[73] 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))
[74] 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))
[75] Cuesta: "Ridges with steep, clifflike faces on one side and gentle slopes on the other" (GeoKansas 2015).

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

State Law / Regulation	Regulatory Agency	Applicability
Kansas Noxious Weed Law (Kansas Statutes Annotated [KSA] § 2-1314 et seq.)	Kansas Department of Agriculture	Establishes a program for the control and monitoring of noxious weeds, establishment of noxious weed species list, public education, establishment of noxious weed control districts, and administration of noxious weed control laws at the county level.
Kansas Nongame and Endangered Species Conservation Act of 1975 (KSA § 32-957 to § 32-963, § 32-1009 to § 32-1012, §32-1033, and KSA § 32-960a and § 32-960b)	Kansas Department of Wildlife, Parks, and Tourism (KDWPT)	Provides protection against the taking, possessing, or transportation of wildlife or plants that are members of an endangered or threatened species, as established by the federal Endangered Species Act (ESA) as well as any species determined by the KDWPT to be threatened or endangered in the state. KDWPT is also directed to implement programs and studies for species conservation and management.

7.1.6.3. Terrestrial Vegetation

The distribution of flora[76] within Kansas 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 contained within a region. The boundaries of an ecoregion are not fixed; they depict a general area with similar ecosystem types, functions, and qualities (National Wildlife Federation, 2015) (USDA, 2015a) (World Wildlife Fund, 2015).

Ecoregion boundaries often coincide with physiographic[80] regions of a state. The ecoregions mapped by the USEPA are the most commonly referenced, although individual states and organizations have also developed ecoregions that may differ slightly from those designated by the USEPA. The USEPA divides North America into 15 broad Level I ecoregions. These Level I ecoregions are further divided into 50 Level II ecoregions. These Level II ecoregions are further divided into 182 smaller Level III ecoregions. This Section provides an overview of the terrestrial vegetation resources for Kansas at USEPA Level III. (USEPA, 2016a)

As shown in Figure 7.1.6-1, the USEPA divides Kansas into eight Level III ecoregions, which closely follow the various prairie grassland habitats, the Flint Hills, and other hills and

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[76] The plants of a particular region, habitat, or geological period.

[77] 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

[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 2015a).

[79] Ecoregion: “A relatively homogeneous ecological area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, or other ecologically relevant variables” (USEPA 2015a).

[80] Physiographic: “The natural, physical form of the landscape” (USEPA 2015a).

escarpments portions of the state. Plant communities are predominantly prairie grasslands throughout much of the state, generally exhibited as shortgrass prairie in western Kansas, mixed-grass prairie in central Kansas, and tallgrass prairie in eastern Kansas, as well as oak savanna and oak woodlands in eastern Kansas. Table 7.1.6-2 provides a summary of the general abiotic[81] characteristics, vegetative communities, and the typical vegetation found within each of Kansas's ecoregions. In addition to USEPA ecoregions, geographic regions have been included in Figure 7.1.6-1 and will be used in describing Kansas's biological resources in the following sections. Kansas can generally be divided into four geographic regions: Northeast (Kansas City/Topeka), Southeast, Central (including Wichita Metro), and Western Kansas.

[81] 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)

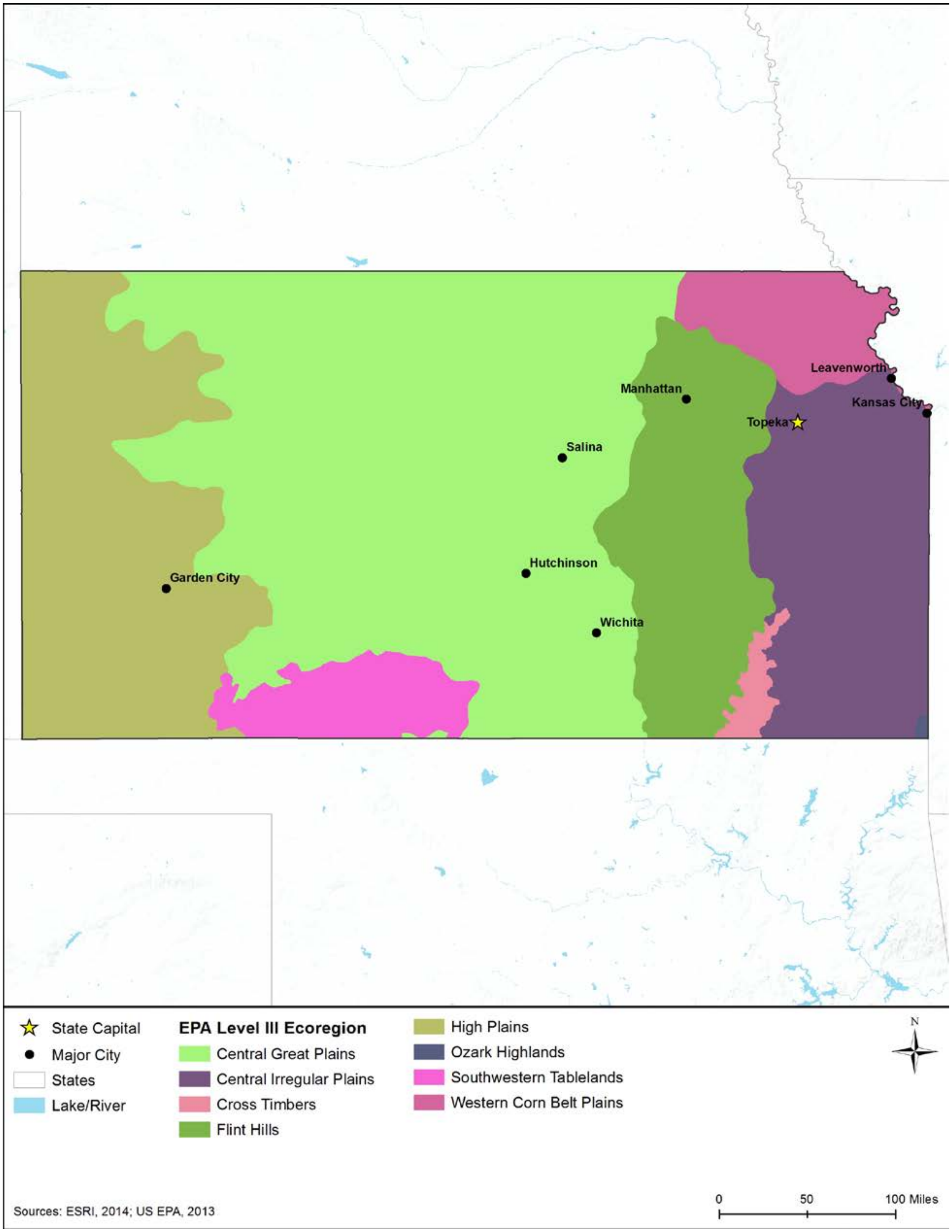

Figure 7.1.6-1: USEPA Level III Ecoregions of Kansas

Table 7.1.6-2: USEPA Level III Ecoregions in Kansas

Ecoregion Number	Ecoregion Name	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
Geographic Regions: Northeast Kansas (Kansas City/Topeka)				
47	Western Corn Belt Plains	This region is characterized by nearly level to gently rolling glaciated till plains and hilly loess plains. Climate consists of ample precipitation occurring mainly during the growing season, average annual precipitation ranges from 26 to 35 inches. Fertile, warm, moist soils have resulted in extensive agricultural activities, including one of the most highly productive areas globally for corn and soybeans.	Historically Tallgrass prairie, Oak-hickory forest, Floodplain forest/woodland; currently 90% of land is cropland agriculture	**Deciduous Trees –** Bur oak (*Quercus macrocarpa*), Basswood (*Tilia americana*), Black walnut (*Juglans nigra*), Willows (*Salix* spp.), Plains cottonwood (*Populus deltoides* ssp. *monilifera*), Green ash (*Fraxinus pennsylvanica*) **Forbs and Grasses** – Big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), Switch grass (*Panicum virgatum*), Little bluestem (*Schizachyrium scoparium*)
28	Flint Hills	This terrain of this region is characterized by rolling hills with rocky, coarse soils. The Flint Hills delineates the western edge of the tallgrass prairie ecosystem and is the largest remaining intact native tallgrass prairie in the Great Plains. Because of the rocky surface, this region has been less intensively used for cropland agriculture than surrounding prairie regions, and is used extensively for cattle grazing. Average annual precipitation ranges from 28 to 35 inches.	Tallgrass prairie	**Deciduous Trees –** Eastern cottonwood (*Populus deltoides*), Green ash (*Fraxinus pennsylvanica*), Hackberry (*Celtis occidentalis*), Pecan (*Carya illinoensis*), Black willow (*Salix nigra*) **Forbs and Grasses** – Big bluestem (*Andropogon gerardii*), Little bluestem (*Schizachyrium scoparium*), Switch grass (*Panicum virgatum*), Indian grass (*Sorghastrum nutans*), Hairy grama (*Bouteloua hirsuta*), Prairie cordgrass (*Spartina pectinata*), Western wheatgrass (*Pascopyrum smithii*), June grass (*Koeleria macrantha*)
40	Central Irregular Plains	This ecoregion exhibits gently undulating plains with steep ridges (cuestas). Glacial activity did not influence this region as heavily, resulting in thinner loess soils,	Tallgrass prairie, Oak-hickory woodland/forest	**Deciduous Trees –** Shagbark hickory (*Carya ovata*), Bitternut hickory (*Carya cordiformis*), Red oak (*Quercus rubra*), White Oak (*Quercus alba*), Black oak (*Quercus velutina*), Shumard oak (*Quercus shumardii*), Pin oak (*Quercus palustris*), Ohio buckeye (*Aesculus glabra*),

Ecoregion Number	Ecoregion Name	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
		leading to lower agricultural productivity. In addition to some cropland, this region supports oil and gas fields, coal mining, and the extraction of building stone, cement, and ceramic materials. Rainfall ranges from an average of 32 to 40 or more inches annually.		Pawpaw (*Asimina triloba*), Pecan (*Carya illinoinensis*), Persimmon (*Diospyros virginiana*) **Forbs and Grasses** – Little bluestem (*Schizachyrium scoparium*), Sideoats grama (*Bouteloua curtipendula*), Big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), Switchgrass (*Panicum virgatum*), Sideoats grama (*Bouteloua curtipendula*)
Geographic Regions: Southeast Kansas				
29	Cross Timbers	A hillier region that provides a transition between prairie vegetation to the west and forested regions to the south, this region is characterized by series of hills and uplands. This sandstone-eroded region has fewer, smaller hills than the nearby Flint Hills ecoregion. Soils are sandy, dry and precipitation ranges from 32 to 36 inches per year.	Oak savanna, Oak forest	**Deciduous Trees –** Post oak (*Quercus stellate*), Blackjack oak (*Quercus marilandica*), Hickory (*Carya* spp.) **Conifer Trees** – Eastern red-cedar (*Juniperus virginiana*) **Forbs and Grasses** – Big bluestem (*Andropogon gerardii*), Little bluestem (*Schizachyrium scoparium*), Sideoats grama (*Bouteloua curtipendula*), Blue grama (*Bouteloua gracilis*), Western wheatgrass (*Pascopyrum smithii*), Indian grass (*Sorghastrum nutans*), Needle and thread (*Hesperostipa comata*)
40	Central Irregular Plains	This ecoregion exhibits gently undulating plains with steep ridges (cuestas). Glacial activity did not influence this region as heavily, resulting in thinner loess soils, leading to lower agricultural productivity. In addition to some cropland, this region supports oil and gas fields, coal mining, and the extraction of building stone, cement, and ceramic materials. Rainfall ranges from an average of 32 to 40 or more inches annually.	Tallgrass prairie, Oak-hickory woodland/forest	**Deciduous Trees –** Shagbark hickory (*Carya ovata*), Bitternut hickory (*Carya cordiformis*), Red oak (*Quercus rubra*), White Oak (*Quercus alba*), Black oak (*Quercus velutina*), Shumard oak (*Quercus shumardii*), Pin oak (*Quercus palustris*), Ohio buckeye (*Aesculus glabra*), Pawpaw (*Asimina triloba*), Pecan (*Carya illinoinensis*), Persimmon (*Diospyros virginiana*) **Forbs and Grasses** – Little bluestem (*Schizachyrium scoparium*), Sideoats grama (*Bouteloua curtipendula*), Big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*), Switchgrass (*Panicum virgatum*), Sideoats grama (*Bouteloua curtipendula*)
28	Flint Hills	This terrain of this region is characterized by rolling hills with	Tallgrass prairie	**Deciduous Trees –** Eastern cottonwood (*Populus deltoides*), Green ash (*Fraxinus pennsylvanica*), Hackberry (*Celtis*

Ecoregion Number	Ecoregion Name	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
		rocky, coarse soils. The Flint Hills delineates the western edge of the tallgrass prairie ecosystem and is the largest remaining intact native tallgrass prairie in the Great Plains. Because of the rocky surface, this region has been less intensively used for cropland agriculture than surrounding prairie regions, and is used extensively for cattle grazing. Average annual precipitation ranges from 28 to 35 inches.		*occidentalis*), Pecan (*Carya illinoensis*), Black willow (*Salix nigra*) **Forbs and Grasses** – Big bluestem (*Andropogon gerardii*), Little bluestem (*Schizachyrium scoparium*), Switch grass (*Panicum virgatum*), Indian grass (*Sorghastrum nutans*), Hairy grama (*Bouteloua hirsuta*), Prairie cordgrass (*Spartina pectinata*), Western wheatgrass (*Pascopyrum smithii*), June grass (*Koeleria macrantha*)
39	Ozark Highlands	This ecoregion is characterized by smooth, rolling hills and forested terrain and is only present in a small portion of extreme southeast Kansas. Cherty limestone result in silty, moist, acidic soils that are some of the least fertile soils in Kansas. This region is not extensively used for agriculture but has been used for lead and zinc mining in the past. Average annual precipitation ranges from 40 to 42 inches per year.	Woodlands, Oak-hickory forest. Historically tallgrass prairie on uplands but most have been converted to agriculture.	**Deciduous Trees –** Pecan (*Carya illinoinensis*), Shumard oak (*Quercus shumardii*), Pin oak (*Quercus palustris*), White sassafras (*Sassafras albidum*), River birch (*Betula nigra*), Flowering dogwood (C*ornus florida*) **Forbs and Grasses** – Little bluestem (*Schizachyrium scoparium*), Sideoats grama (*Bouteloua curtipendula*), Big bluestem (*Andropogon gerardii*), Indian grass (*Sorghastrum nutans*)
Geographic Region: Central Kansas (including Wichita Metro)				
27	Central Great Plains	Characterized by somewhat irregular, flat to rolling loess-covered plains. Subsurface salt deposits and leaching contribute to the high salinity occurring in some streams.	Historically grassland with scattered low trees and shrubs; currently cropland, mixed-grass prairie, Tallgrass prairie, Lowland tallgrass prairie, Wetlands Floodplain forest	**Deciduous Trees –** Plains cottonwood (*Populus deltoides* ssp. *monilifera*), Green ash (*Fraxinus pennsylvanica*), Peachleaf willow (*Salix amygdaloides*), Silver maple (*Acer saccharinum*) **Conifers –** Eastern redcedar (*Juniperus virginiana*) **Shrubs –** Sandbar willow (*Salix exigua*), Roughleaf dogwood (*Cornus drummondii*), Red osier dogwood (*Cornus sericea*) **Forbs and Grasses –** Needle and thread (*Hesperostipa comata*), Little bluestem (*Schizachyrium scoparium*), Big bluestem (*Andropogon gerardii*), Blue grama (*Bouteloua*

Ecoregion Number	Ecoregion Name	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
				gracilis), Sideoats grama (*Bouteloua curtipendula*), Western wheatgrass (*Pascopyrum smithii*), Spike rushes (*Eleocharis* spp.), Slender bulrush (*Schoenoplectus heterochaetus*)
26	Southwestern Tablelands	This region is characterized by tablelands with red buttes and mesas that were formed by erosion of ancient brick-red shale, siltstone, sandstone, and gypsum deposits. The many spring-fed streams in this region tend to have sandy soils and mineralized waters. This region is semiarid, receiving less precipitation than nearby regions, with averages ranging from 20 to 28 inches per year.	Mixedgrass prairie, Sandsage prairie, Floodplain woodlands	**Deciduous Trees –** Plains cottonwood (*Populus deltoides* ssp. *monilifera*), Black willow (*Salix nigra*), Peachleaf willow (*Salix amygdaloides*), Common hackberry (*Celtis occidentalis*), Green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*) **Conifers –** Eastern redcedar (*Juniperus virginiana*) **Shrubs and Subshrubs** - Prairie sagebrush (*Artemisia frigida*) **Forbs and Grasses –** Big bluestem (*Andropogon gerardii*), Little bluestem (*Schizachyrium scoparium*), Sideoats grama (*Bouteloua curtipendula*), Blue grama (*Bouteloua gracilis*), , Hairy grama (*Bouteloua hirsuta*), Sand bluestem (*Adropogon hallii*), Prairie sandreed (*Calamovilfa longifolia*)
Geographic Region: Western Kansas				
25	High Plains	Characterized by a semi-arid to arid climate in the rain shadow of the Rocky Mountains. Terrain generally consists of smooth to slightly irregular plains, higher than the Central Great Plains to the east. Much of the area is used for dryland agriculture and rangeland with some irrigated cropland. Annual precipitation ranges from 14 to 21 inches on average. Natural gas deposits yield a majority of natural gas produced in the midwestern United States.	Sandsage prairie, Shortgrass prairie, Mixed grass prairie	**Shrubs and Subshrubs** – Prairie sagebrush (*Artemisia frigida*) **Forbs and Grasses –** Sand bluestem (*Andropogon hallii*), Prairie sandreed (*Calamovilfa longifolia*), Little bluestem (*Schizachyrium scoparium*), Blue grama (*Bouteloua gracilis*), Buffalograss (*Bouteloua dactyloides*), Sideoats grama (*Bouteloua curtipendula*), Needle and thread (*Hesperostipa comata*), Threadleaf sedge (*Carex filifolia*), Western wheatgrass (*Pascopyrum smithii*), Alkali sacaton (*Sporobolus airoides*), Inland saltgrass (*Distichlis spicata*)
27	Central Great Plains	Characterized by somewhat irregular, flat to rolling loess-covered plains. Subsurface salt deposits and leaching contribute to	Historically grassland with scattered low trees and shrubs;	**Deciduous Trees –** Plains cottonwood (*Populus deltoides* ssp. *monilifera*), Green ash (*Fraxinus pennsylvanica*), Peachleaf willow (*Salix amygdaloides*), Silver maple (*Acer saccharinum*)

Ecoregion Number	Ecoregion Name	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
		the high salinity occurring in some streams.	currently cropland, mixed grass prairie, Tallgrass prairie, Lowland tallgrass prairie, Wetlands Floodplain forest	**Conifers –** Eastern redcedar (*Juniperus virginiana*) **Shrubs –** Sandbar willow (*Salix exigua*), Roughleaf dogwood (*Cornus drummondii*), Red osier dogwood (*Cornus sericea*) **Forbs and Grasses –** Needle and thread (*Hesperostipa comata*), Little bluestem (*Schizachyrium scoparium*), Big bluestem (*Andropogon gerardii*), Blue grama (*Bouteloua gracilis*), Sideoats grama (*Bouteloua curtipendula*), Western wheatgrass (*Pascopyrum smithii*), Spike rushes (*Eleocharis* spp.), Slender bulrush (*Schoenoplectus heterochaetus*)

Sources: (Chapman, et al., 2001) (USEPA, 2015a)

Communities of Concern

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

The Kansas Natural Heritage Program (KNHP) maintains a statewide inventory of plant and wildlife resources, including lists of all types of natural communities known to occur, or that have historically occurred, in the state. Historical occurrences are important for assessing previously undocumented occurrences or re-occurrences of previously documented species. Each natural community is assigned a rank based on its rarity and vulnerability. As with most state heritage programs, the KNHP ranking system assesses rarity using a state rank (S1, S2, S3, S4, S5) that indicates its rarity within Kansas (University of Kansas, 2012). Communities ranked S1 by the KNHP are of the greatest concern. This rank is typically based on the number of known examples, total area occupied, population trends, and the degree of threat to the community.

The Kansas Natural Heritage Inventory maintains a list of natural terrestrial vegetation communities within the state, including wetland and upland types. Of those 68 terrestrial vegetation communities, one vegetative communities is ranked as an S1 community[82] in Kansas, the cottonwood floodplain woodland (University of Kansas, 2012). This S1 community of conservation concern in Kansas is found within floodplains of rivers and streams having water tables close to the surface or depressions of standing water.

Two threatened plant species are located in Kansas. Section 7.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

Nuisance and Invasive Plants

There are a large number of undesirable plant species that are considered nuisance and invasive[83] plants. Direct impacts to nuisance and invasive plants may be viewed as beneficial to the environment, but often such impacts result in the inadvertent and unintended spread and dispersal of these species. Construction sites in particular provide colonizing opportunities for nuisance and invasive species, and long-term maintenance activities can perpetuate a disturbance regime that facilitates a continued dispersal mechanism for the spread of these species.

Noxious weeds are 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

[82] S1: “Range has not declined, but overall is restricted in KS, and therefore species is vulnerable” (Kansas Department of Health and Environment 2005).

[83] Invasive: “These are species that are imported from their original ecosystem. They can out-compete native species as the invaders often do not have predators or other factors to keep them in check” (USEPA 2015a).

(Government Printing Office, 2011). The U.S. government has designated certain plant species as noxious weeds in accordance with the Plant Protection Act of 2000 (7 U.S.C. 7701 et seq.). As of September 2014, 112 federally recognized noxious weed species have been catalogued in the U.S. (88 of which are terrestrial, 19 aquatic, and 5 parasitic) (USDA, 2014a).

Noxious weeds are a threat to Kansas's agricultural lands, forests, prairies, waterways, and other natural areas. Noxious weeds can have adverse ecological and economic impacts to these resources by displacing and outcompeting plants in both natural ecosystems and managed lands. The Kansas Noxious Weed Law was first enacted in 1937 and continues to regulate the control and eradication of listed noxious weeds (KSA § 2-1314 et seq.). The KDA is responsible for maintaining the statewide prohibited noxious weed list and updates to that list, as necessary. By state statute, each county is responsible for enforcement of noxious weed control within their jurisdiction and must employ a county weed supervisor to supervise the control and destruction of all noxious weeds in the county. In addition, the KDA may establish up to five noxious weed control districts within the state to facilitate and supervise the control and eradication of noxious weeds within the district (KSA § 2-1314 et seq.).

A total of 12 state-listed noxious weeds are regulated in Kansas (KSA § 2-1314 et seq.). Per the Kansas Noxious Weed Law, every person who owns or controls land in Kansas must control the spread of and eradicate all declared noxious weeds. The following species are regulated in as noxious weeds in Kansas:

- Terrestrial Forbs, Grasses, and Grass-like Plants – Russian knapweed (*Acroptilon repens*), bur ragweed (*Ambrosia grayi*), hoary cress (*Cardaria draba*), musk thistle (*Carduus nutans*), Canada thistle (*Cirsium arvense*), field bindweed (*Convolvulus arvensis*), quackgrass (*Elymus repens*), leafy spurge (*Euphorbia esula*), pignut (*Hoffmannseggia glauca*), sericea lespedeza (*Sericea lespedeza*), kudzu (*Pueraria montana* var. *lobata*), and johnsongrass (*Sorghum halepense*).

Individual counties may declare two additional species to be a noxious weed within the boundaries of the county: multiflora rose (*Rosa multiflora*) and bull thistle (*Cirsium vulgare*). None of the Kansas noxious weed species are included on the federal noxious weed list. In addition to the Kansas Noxious Weed Law, Kansas regulates other plants considered aquatic nuisance species. These species are discussed further in Section 7.1.6.5, Fisheries and Aquatic Habitat – Invasive and Aquatic Species.

7.1.6.4. *Terrestrial Wildlife*

This section discusses the terrestrial wildlife species in Kansas, divided among mammals,[84] birds,[85] reptiles[86] and amphibians,[87] and invertebrates.[88] Terrestrial wildlife consist of those species of animals, and their habitats, that live predominantly on land. Terrestrial wildlife include common big game species, small game animals and furbearers,[89] nongame animals, and game birds and waterfowl, and migratory birds as well as their habitats within Kansas. 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. Current records indicate Kansas is home to 88 mammal species, 475 bird species, 99 reptile and amphibian species, more than 20,000 invertebrate species, and 144 fish species (Great Plains Nature Center, 2015a) (KDWPT, 2005a). A discussion of nonnative and/or invasive terrestrial wildlife species is also included within this section.

Kansas has identified 314 wildlife Species of Greatest Conservation Need (SGCN). The SGCN list 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. The Kansas SGCN list includes species considered threatened or endangered under state and federal laws, so those these species are legally protected. The remaining SGCN have been targeted for conservation but are not currently under legal protection. The at-risk lists are updated periodically and are used by Kansas to improve and focus their conservation efforts as well as a basis for implementing the state wildlife conservation plan (KDWPT, 2005a).

Mammals

Common and widespread mammalian species in Kansas include white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), coyote (*Canis latrans*), cottontail rabbit (*Sylvilagus floridanus*), deer mice, bats, and squirrels. Other species such as beaver (*Castor canadensis*), red fox (*Vulpes vulpes*), opossum (*Didelphis virginiana*), woodchuck (*Marmota monax*), wild turkey (*Meleagris gallopavo silvestris*), pheasant (*Phasianus colchicus*), badger (*Taxidea taxus*), striped skunk (*Mephitis mephitis*), and muskrat (*Ondatra zibethicus*) are also common but are less widespread. Most mammal species are widely distributed throughout the state; however, some species such as wild turkey, opossum, mink (*Neovison vison*), muskrat, and beaver may be more commonly encountered in or along larger drainages (rivers and streams) and associated forests. Porcupine (*Erithizon dorsatum*) inhabit wooded areas in central and southwestern Kansas. Mule deer (*Odocoileus hemionus*) and pronghorn (*Antilocapra americana*) may be limited to the

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

[85] Birds: "Warm-blooded vertebrates possessing feathers and belonging to the class Aves" (USEPA 2015a).

[86] Reptile: "Cold-blooded, air-breathing vertebrates belonging to the class Reptilia usually covered with external scales or bony plates." (USEPA, 2015c)

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

[88] Invertebrates: "Animals without backbones: e.g., insects, spiders, crayfish, worms, snails, mussels, clams, etc." (USEPA 2015a).

[89] Furbearer is the name given to mammals that traditionally have been hunted and trapped primarily for fur.

rolling hills and breaks in western Kansas. Flying squirrels (*Glaucomys volans*) are restricted to the oak-hickory forests in eastern Kansas (Great Plains Nature Center, 2015a). Kansas is home to 88 mammal species, 21 of which have been identified as SGCN (KDWPT, 2005a). Three threatened or endangered mammals, the black-footed ferret (*Mustela nigripes*), gray bat (*Myotis grisescens*), and northern long-eared bat (*Myotis septentionalis*) are known to occur in Kansas. Section 7.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, discusses these species in further detail.

In Kansas, white-tailed deer, mule deer, pronghorn, elk (*Cervus elaphas*) and wild turkey are considered big game species. Small game species include small mammals (e.g., cottontail rabbits, jackrabbits [*Lepus californicus*], and gray squirrel [*Sciurus carolinensis*]), furbearers, and upland and migratory bird species, including waterfowl. The following 12 species of furbearers may be legally hunted or trapped in Kansas: badger, beaver, bobcat (*Lynx rufus*), coyote, red fox, gray fox (*Urocyon cinereoargenteus*), swift fox (*Vulpes velox*), mink, muskrat, otter (*Lontra canadensis*), raccoon, and striped skunk (KDWPT, 2015c).

Birds

The number of native bird species documented in Kansas varies according to the timing of the data collection effort, changes in bird taxonomy,[90] and the reporting organization's method for categorizing occurrence and determining native versus non-native status. The diverse ecological communities (i.e., large rivers and lakes, western hills and break lands, wetlands, prairie grasslands, deciduous oak forests) found in Kansas support a variety of bird species.

Approximately 475 species of resident and migratory birds have been documented in Kansas. Among the 475 extant[91] species in Kansas, 100 SGCN have been identified (KDWPT, 2005a). Six threatened, endangered, or candidate bird species are known to occur in Kansas and are discussed in Section 7.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Kansas is within the Central Flyway, which spans the Rocky Mountains, Great Plains, arid Southwest, and western Gulf Coast. The Central Flyway extends from northern Canada and Arctic islands south to Central and South America (National Audubon Society, 2015a). Kansas is approximately halfway down the Central Flyway's eastern tier of states. Large numbers of migratory birds utilize these flyways and other migration corridors and pathways throughout the state each year during their annual migrations northward in the spring and southward in the fall. Cheyenne Bottoms, in central Kansas, is the largest interior marsh in the United States and has been designated a wetland of international importance (Kansas Travel, 2015a). Cheyenne Bottoms serves as an important stop for migratory birds along the Central Flyway, and approximately half of all North American shorebirds migrating east of the Rocky Mountains utilize this area, in addition to waterfowl (The Nature Conservancy, 2015). "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

[90] Taxonomy: "A formal representation of relationships between items in a hierarchical structure" (USEPA 2015a)
[91] Extant: "A species that is currently in existence (the opposite of extinct)" (USEPA 2015a).

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 generally occur as winter migrants at most of the large reservoirs and rivers in Kansas, and an increasing number of bald eagles have been recorded as nesting in Kansas (Great Plains Nature Center, 2015b). Golden eagles are generally found in a variety of habitats within their range, but in Kansas they generally nest in isolated trees in native grasslands or on steep slopes of deeply-eroded gullies. Golden eagles have been observed throughout the state, but are more commonly encountered in the open grasslands in western Kansas during the winter season (KDWPT, 2015o).

A number of Important Bird Areas (IBA) have also been identified in Kansas, as can be seen in Figure 7.1.6-2. The IBA program is an international bird conservation initiative with a goal of identifying the most important places for birds, and to conserve these areas. IBAs assist in achieving local conservation priorities to provide important habitat for native bird populations during breeding,[92] migratory stops, feeding, and over-wintering areas (National Audubon Society, 2015c). 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 bird-watchers. These IBAs link global and continental bird conservation priorities to local sites that provide critical habitat for native bird populations[93]. IBA priority areas are based on a number of specific criteria. Generally, global IBAs are sites determined important for globally rare species or support bird populations 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 that support local populations of birds.

According to the National Audubon Society, a total of ten IBAs have been identified in Kansas, including breeding[94], migratory stop-over, feeding areas, and a variety of habitats and wintering rounds (National Audubon Society, 2015a). These IBAs are widely distributed throughout the state and comprise over 5,800,000 acres of land. The largest concentration of IBAs are within the Red Hills and Flint Hills regions and along the Arkansas River in the southern and central portions of the state. The largest IBA in the state is Cheyenne Bottoms Preserve and Wildlife Area, which provides approximately 27,552 acres of habitat for a wide variety of migratory birds including waterfowl (National Audubon Society, 2015a).

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

[93]Population: "Aggregate of individuals of a biological species that are geographically isolated from other members of the species and are actually or potentially interbreeding." (USEPA 2015a).

[94] Breeding range: "The area utilized by an organism during the reproductive phase of its life cycle and during the time that young are reared" (USEPA 2015a).

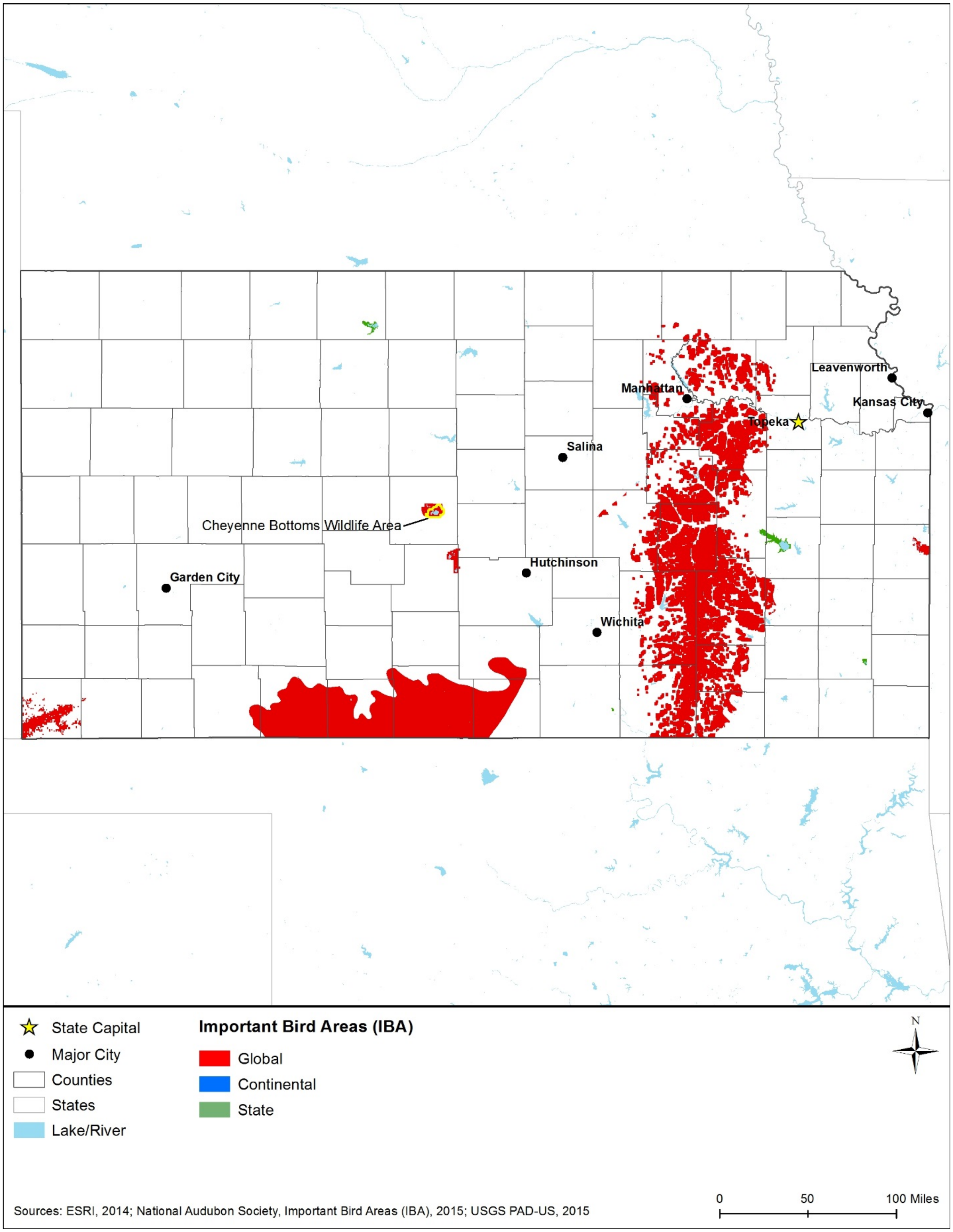


Figure 7.1.6-2: Important Birding Areas in Kansas

Reptiles and Amphibians

A total of 97 reptile and amphibian species are known to occur in Kansas. These species include 15 turtles, 15 lizards, 38 snakes, nine salamanders, and 20 frogs and toads (Great Plains Nature Center, 2015a). These species occur in a wide variety of habitats across the state, with some having widespread distribution and others being limited to a smaller region or locations in the state. Of the 97 reptile and amphibian species, 42 SGCN have been identified; however, no threatened or endangered reptile or amphibian species are known to occur in Kansas. (KDWPT, 2005a)

Kansas's reptile and amphibian species are classified as wildlife under the Game Law (KSA § 32-807). A hunting license is required to take certain amphibians and reptiles (Kansas Administrative Regulations [KAR] § 115-20-2); a fishing license is required to capture bullfrogs, snapping turtles, and softshell turtles (KAR § 115-7).

Invertebrates

The total number of invertebrate species occurring in Kansas is unknown but is believed to be greater than 20,000, including more than 15,000 insect species, such as dragonflies and damselflies, butterflies, grasshoppers, and a wide variety of beetles, moths, mayflies, ants, and bees (Great Plains Nature Center, 2015a). These invertebrates provide an abundant food source for birds, reptiles, amphibians, fish, mammals, and other invertebrates. In the United States, one third of all agricultural output depends on pollinators.[95] In natural systems, the size and health of the pollinator population is linked to ecosystem health, with a direct relationship between pollinator diversity[96] and plant diversity. Bees are pollinators of wild land plants and crops, especially peppers, tomatoes, eggplants, berry, fruit, and seed crops (Kock, Strange, & Williams, 2012). "As a group, native pollinators are threatened by habitat loss, pesticides, disease, and parasites" (NRCS, 2009). Detailed information on life history, distribution, and abundance is limited to a small number of Kansas's invertebrates. Given this lack of information on invertebrate species within the state, Kansas has chosen to focus on identification of at-risk species and species groups for which adequate information is available. This approach has resulted in a list of 31 invertebrate SGCN (KDWPT, 2005a). One endangered terrestrial invertebrate species, the American burying beetle (*Nicrophorus americanus*), is known to occur in Kansas and is discussed in Section 7.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Invasive Wildlife Species

The KDA addresses invasive species of all types, including noxious weeds, as previously mentioned. Aquatic invasive species are addressed in Section 7.1.6.5, Fisheries and Aquatic Habitat. Several invertebrate species are considered invasive in Kansas and present a threat to natural and cultivated plants and croplands. The invasive pest watch list kept by the Kansas Department of Agriculture includes the Asian longhorned beetle (*Anoplophora glabripennis*),

[95] Pollinators: "Animals or insects that transfer pollen from plant to plant" (USEPA 2015a).
[96] Diversity: "An ecological measure of the variety of organisms present in a habitat" (USEPA 2015a).

gypsy moth (*Lymantria dispar*), red imported fire ant (*Solenopsis invicta*), Japanese cedar longhorn beetle (*Callidiellum rufipenne*), Africanized honey bee (*Apis mellifera scutellata*), and spotted wing drosophila (*Drosophila suzukii*). Not all of the species on the pest watch list have been documented within Kansas; however, the Asian longhorned beetle and gypsy moth have been documented in the state, as well as three other invasive pest species: the emerald ash borer (*Agrilus planipennis*), hemlock woolly adelgid (*Adelges tsugae*), and pine pitch moth (*Dioryctria tumicolella*) (KDA, 2015b).

The link between nonnative forest insect and disease infestations and firewood as a major source of these infestations has been widely recognized. Kansas does not currently have comprehensive firewood restrictions. However, the KDA administers the Plant Pest and Agriculture Commodity Certification Act (KSA § 2-2112 et seq.); under this act, the state has authority to regulate plant pests and plant products and to suppress, control, prevent, or retard the spread of any plant pests. Under the provisions of this act, the KDA has implemented a quarantine on the transport of walnut trees and lumber products, including firewood, to prevent the spread of thousand cankers disease of walnut trees (KDA, 2014). Lumber products must be certified to be free of quarantined pests and diseases or be treated in an appropriate manner to destroy the pests. Emerald ash borer has been documented in Kansas and a federal quarantine has been established for this pest in northeastern Kansas (KDA, 2015b) (KDA, 2015c). This federal quarantine area for emerald ash borer continues to expand and currently includes three counties in northeastern Kansas and the nearby states of Iowa and Missouri, as well as many other states in the Midwest and eastern states (USDA, 2015b).

7.1.6.5. Fisheries and Aquatic Habitats

This section discusses the aquatic wildlife species in Kansas, including fish and invertebrates. A summary of non-native and invasive aquatic species is also presented in this section. Fish in Kansas are commonly split in two groups – coldwater species and coolwater/warmwater species, reflecting the general aquatic habitats in which fish occur. A distinctive feature of the Kansas landscape with regard to aquatic wildlife are the three major rivers (Kansas River, Arkansas River, and Missouri River), the lakes and reservoirs that occur throughout the state, and the smaller coldwater stream reaches in the eastern portion of the state. No Essential Fish Habitat (EFH) identified by the Magnuson-Stevens Fishery Conservation and Management Act exists in Kansas (NOAA, 2016).

Freshwater Fish

Kansas is home to 144 species of freshwater fish, ranging in size from small minnows to medium-sized species such as walleye (*Sander vitreus*), yellow perch (*Perca flavescens*), and striped bass (*Morone saxatilis*). These species are grouped into 16 families, as follows: bowfin, bullheads/catfishes, cods, drums, minnows, eels, gars, lampreys, perches, pikes, sculpins, silversides, sturgeons/paddlefishes, sunfish/bass trouts/smelts, and topminnows (Great Plains Nature Center, 2015a). Among these species are numerous recreational and game fish, such as yellow perch, walleye, catfish, sunfishes, bass, and trout. Of the 144 extant species in Kansas, 67 SGCN have been identified (KDWPT, 2005a). Two endangered fish species are known to occur in Kansas and are discussed in Section 7.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Fish communities in Kansas follow a roughly-defined distribution among two general habitat types: habitats adjacent to and including large rivers or deep lakes and reservoirs, and habitats including smaller streams or shallow lakes and ponds. Large rivers or deeper aquatic habitat fish species include largemouth bass (*Micropterus salmoides*), northern pike (*Esox lucius*), American eel (*Anguilla rostrate*), paddlefish (*Polyodon spathula*), and pallid sturgeon (*Scaphirhynchus albus*), among others. Small streams or shallow aquatic habitat fish species include chub and minnows, bluegill (*Lepomis macrochirus*), brook trout (*Salvelinus fontinalis*), yellow perch, brown trout (*Salmo trutta*), and rainbow trout (*Oncorhynchus mykiss*). Some fish species use both habitat types (e.g., yellow perch, walleye, carp), but many tend to occur in one of the two general habitat types. (Great Plains Nature Center, 2015a)

Freshwater fish and associated freshwater habitats are considered one of the most highly threatened ecosystems based on the vast decline in species population numbers. Approximately 40 percent of fish species in North America are considered at risk or vulnerable to extinction[97] (National Fish Habitat Board, 2010) (USFWS, 2015c). Major threats to freshwater fisheries include habitat modification and destruction (dams, culverts, weirs, urban development, and agricultural practices), overfishing, invasive species, and environmental pollution and impaired water quality. Among freshwater fish in Kansas and the southern Plains states in general, agriculture, urbanization, and irrigation diversion are the primary threats to aquatic habitat. Irrigation diversion projects on the Arkansas and other rivers have altered the water flow, influencing aquatic habitat, and in conjunction with habitat degradation and fragmentation have resulted in population declines of these and other species (National Fish Habitat Board, 2010).

Shellfish and Other Invertebrates

Multiple agencies and researchers have performed inventories of freshwater mollusks throughout Kansas over the years, but the number of crustaceans and other aquatic invertebrates remains unknown. Mollusks include mussels, of which 48 mussel species have been recorded as occurring in Kansas (Great Plains Nature Center, 2015a). Aside from a multitude of freshwater invertebrates whose adult forms are terrestrial insects (e.g., flies, beetles, etc.), other Kansas freshwater invertebrates that spend their lives in aquatic systems include crayfish, amphipods, and aquatic snails.

Kansas has identified 43 mollusks, 10 crustaceans, and 2 aquatic snails are considered SGCN in the state (KDWPT, 2005a). Three federally listed mussel species and critical habitat for two of these species are in Kansas and are discussed in Section 7.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

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

Invasive Aquatic Species

As previously discussed, Kansas has adopted regulations that prohibit the importation, movement, sale, possession, cultivation, and distribution of certain invasive plants and animals. Kansas does not have a single unifying law regarding aquatic nuisance species, rather KDWPT administers several policies relative to aquatic nuisance species (KDWPT, 2005b) (Goeckler, 2005). KDWPT maintains a list of prohibited aquatic species (KAR § 115-18-10), prohibits the release of all exotic wildlife into waters of the state (KAR § 115-20-3) and regulates the movement of baitfish (KAR § 115-8-6). The KDA has also enacted a quarantine for all federally listed noxious weeds, which currently includes 19 aquatic plants, as a measure to control aquatic nuisance plants in Kansas (KDWPT, 2005b).

The KDWPT has established a list of aquatic nuisance species and performs educational outreach to prevent the introduction or spread of these species into the state. The top three aquatic nuisance species include the zebra mussel (*Dreissena polymorpha*), Asian carp (which includes three species: silver carp [*Hypophthalmichthys molitrix*], bighead carp [*Hypophthalmichtys nobilis*], and black carp [*Mylopharyngodon piceus*]), and white perch (*Morone americana*). An additional 10 species are considered unwanted in the state and are included below (KDWPT, 2005b).

- Aquatic wildlife species – New Zealand mudsnail (*Potamopyrgus antipodarum*), round goby (*Neogobius melanostomus*), ruffe (*Gymnocephalus cernuus*), rudd (*Scardinius erythrophthalmus*), and rusty crayfish (*Orconectes rusticus*)
- Plant species – Eurasian watermilfoil (*Myriophyllum spicatum*), curly-leaf pondweed (*Potamogeton crispus*), purple loosestrife (*Lythrum salicaria*), hydrilla (*Hydrilla verticillata*), and salt cedar (*Tamarix spp*.)

7.1.6.6. Threatened and Endangered Species and Species of Conservation Concern

The USFWS is responsible for administering the Endangered Species Act (ESA) (16 U.S.C §1531 et seq.) in Kansas. The USFWS has identified nine federally endangered and nine federally threatened species known to occur in Kansas (USFWS, 2015d). Of these 18 federally listed species, 2 have designated critical habitat (USFWS, 2015e). One candidate species is identified by USFWS as occurring within the state (USFWS, 2015f). Candidate species are not afforded statutory protection under the ESA. However, the USFWS recommends taking these species into consideration during environmental planning because they could be listed in the future (USFWS, 2014b). The 18 federally listed species include 3 mammals, 5 birds, 4 fish, 4 invertebrates, and 2 plants, and are discussed in detail under the following sections (USFWS, 2015d). 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.

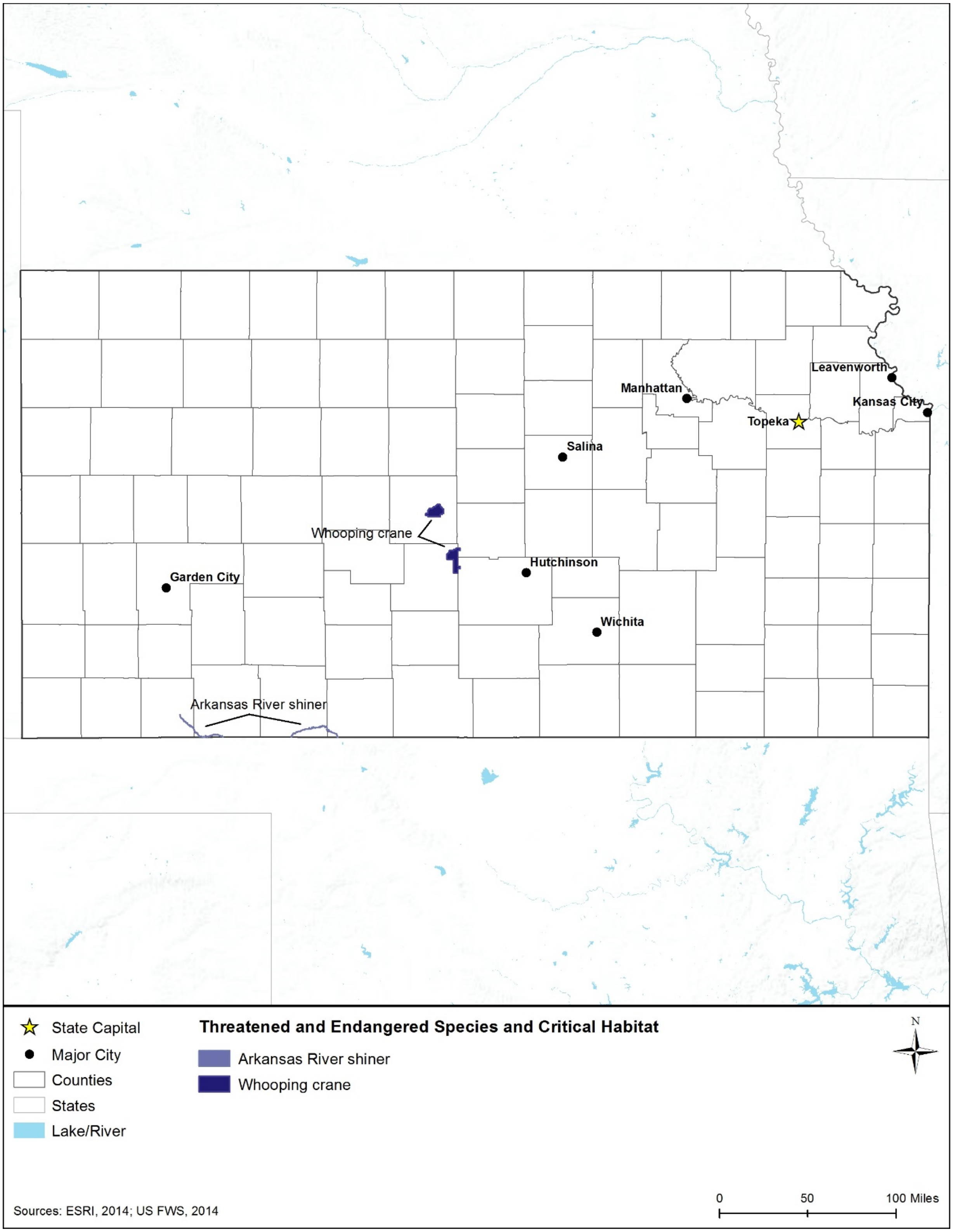


Figure 7.1.6-3: ESA Designated Critical Habitat in Kansas

Mammals

Two endangered and one threatened mammal species are federally listed for Kansas as summarized in Table 7.1.6-3. The black-footed ferret (*Mustela nigripes*) has been reintroduced in northwestern Kansas (USFWS, 2010). The gray bat (*Myotis grisescens*) is known to occur where limestone karst occurs in the southeastern portion of the state, and the Northern long-eared bat (*Myotis septentrionalis*) is found throughout eastern and central Kansas (USFWS, 2015g) (USFWS, 2015h). Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Kansas is provided below.

Table 7.1.6-3: Federally Listed Mammal Species of Kansas

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Kansas	Habitat Description
Black-footed Ferret	*Mustela nigripes*	E	No	Prairies and grasslands throughout Kansas.
Gray Bat	*Myotis grisescens*	E	No	Areas with significant limestone karst in southeastern Kansas.
Northern Long-eared Bat	*Myotis septentrionalis*	T	No	Grasslands and woodlands in eastern and central Kansas.

Source: (USFWS, 2015d)

[a] E = Endangered, T = Threatened

Black-footed Ferret. The endangered black-footed ferret is a member of the weasel family. It is has black feet, as its name suggests, a black face mask, black-tipped tail, and a slender body; it ranges from 19 to 24 inches in length and 1.4 to 2.5 pounds. A highly specialized predator, this ferret species depends on prairie dogs for survival. The ferret was first listed as endangered under early endangered species legislation in 1967 (32 Federal Register [FR] 4001, March 11, 1967) and was incorporated into the ESA as an endangered species (16 U.S.C. §1531 et seq.). The species was historically found throughout the Great Plains, mountain basins, and semi-arid grasslands of North America, wherever prairie dogs occurred. From the late 1800s to approximately 1960, the ferret population declined precipitously alongside prairie dog habitat destruction, poisoning, and disease. In 1986, only 18 individuals were known to exist within its range. The last remaining individuals in the wild were captured near Meeteetse, Wyoming, and were used to develop experimental populations in Arizona, Colorado, Montana, South Dakota, Utah, and Wyoming (USFWS, 2013b). In Kansas, the last known live black-footed ferret was recorded in 1957 near the town of Studley, Sheridan County (USFWS, 2012a). The species has been reintroduced into Logan County in northwestern Kansas since 2007. Based on 2010 USFWS population estimates, there were "more than 1,000 black-footed ferrets in the wild, and another 280 living in breeding facilities" (USFWS, 2010).

Black-footed ferret Photo credit: USFWS

Gray Bat. The gray bat is a medium-sized, insectivorous bat weighing approximately 7 to 16 grams and it is longer than any other *Myotis*. The gray bats have dark gray fur after molt in July or August and then the fur transitions to a chestnut brown. This species was federally listed as endangered in 1976 (41 FR 17736 17740, April 28, 1976). Regionally, this species is known to occur in limited geographic regions of limestone karst within southeastern states from Kansas and Oklahoma east to Virginia and North Carolina (USFWS, 1997) (USFWS, 2015g). In Kansas, the gray bat is known to occur in Crawford County in the southeastern region of the stat (USFWS, 2015g).

The gray bats live in caves all year. This species hibernates in deep vertical caves during the winter and inhabits caves along rivers the rest of the year. Most caves are in limestone karst regions and near rivers where these bats could feed on flying aquatic and terrestrial insects. Current threats to this species include human disturbance, habitat loss and degradation due to flooding, and commercialization of caves such as adding gates that alter the air flow, humidity, and temperature of caves (USFWS, 1997) (USFWS, 2015g)

Northern Long-eared Bat. The northern long-eared bat is a medium-sized (3 to 3.7 inches in length), brown furred, insectivorous bat with long ears, relative to other members of the genus *Myotis*. It was listed as threatened in 2015 (80 FR 17973 18033, April 2, 2015). In the U.S., its range includes most of the eastern and north central states. In Kansas, their range includes 69 counties in central and eastern regions of the state (USFWS, 2015h).

This species hibernates in caves and mines that exhibit constant temperatures, high humidity, and no air currents. In summer, they roost singly or in colonies beneath bark, or in crevices or cracks of both live and dead trees. Although mating occurs in the fall, fertilization occurs following hibernation. Pregnant females then migrate to summer areas where they roost in small colonies (USFWS, 2015i). White Nose Syndrome is the leading cause for the decline of this species. Other threats include temperature or air flow impacts to their hibernating habitat, forest management practices that are incompatible with this species' habitat needs, habitat fragmentation, and wind farm operations (USFWS, 2015h) (USFWS, 2015i).

Birds

Two endangered and three threatened bird species are federally listed in Kansas as summarized in Table 7.1.6-4. The least tern (*Sterna antillarum*), red knot (*Calidris canutus rufa*), and whooping crane (*Grus americana*) may be found in riverine and wetland habitats of the Arkansas, Cimarron, and Missouri Rivers in the Quivira National Wildlife Refuge and Cheyenne Bottoms Wildlife Area in central Kansas (USFWS, 1990a) (Great Plains Nature Center, 2015a) (USFWS, 2007). The piping plover (*Charadrius melodus*) may be found along the Kansas River and wetland environments in northeastern Kansas (KDWPT, 2000). The lesser prairie-chicken (*Tympanuchus pallidicinctus*) is in the prairie grasslands throughout much of western Kansas (USFWS, 2015j). Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Kansas is provided below.

Table 7.1.6-4: Federally Listed Bird Species of Kansas

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Kansas	Habitat Description
Least Tern	*Sterna antillarum*	E	No	Riverbanks of the Arkansas, Missouri, and Cimarron rivers and wetlands within Quivira and Cheyenne Bottoms wildlife areas.
Lesser Prairie-chicken	*Tympanuchus pallidicinctus*	T	No	Prairies and grasslands in western Kansas.
Piping Plover	*Charadrius melodus*	T	No	Vegetated wetlands, beaches, lakes, or rivers of the Great Plains in northeastern Kansas.
Red Knot	*Calidris canutus rufa*	T	No	Coastlines of the Arkansas River, wetlands, and salt marshes of the Quivira and Cheyenne Bottoms wildlife areas.
Whooping Crane	*Grus americana*	E	Yes	Marshes, wet meadows and prairies, riverine habitats, and agricultural fields throughout the Great Plains, specifically Quivira and Cheyenne Bottoms wildlife areas.

Source: (USFWS, 2015d)

[a] E = Endangered, T = Threatened

Least Tern. The least tern is a 9-inch long, grey and white gull with black markings on its head. The species was federally listed as endangered in 1985 (50 FR 21784 21792, May 28, 1985). The tern is a summer resident in Kansas and breeds along several major river systems in the US, including the Missouri, Mississippi, Ohio, Red, and Rio Grande Rivers. Specifically in Kansas, the Arkansas River has been known to host breeding populations. In Kansas, interior least terns nest on the Cimarron River in Meade, Comanche, and Clark Counties, and at the Quivira National Wildlife Refuge and Cheyenne Bottoms Wildlife Management Area (USFWS, 1990a). The least tern is known to occur in 17 counties throughout Kansas (USFWS, 2015aa).

Suitable habitat for least terns consists of relatively unvegetated sandbars near rivers, reservoirs and other open water habitat. The primary threat to this species is the destruction and degradation of habitat. Nest disturbance and predation can also be factors (USFWS, 2014c). The primary causes of habitat loss historically have been dam construction, recreational activities, and the alteration of flow regimes along major river systems (USFWS, 2013c).

Lesser Prairie-chicken. The lesser prairie-chicken is a medium-sized, grayish brown grouse of approximately 16 inches in length. The species is marked with alternating brown and white bands and have tufts of elongated feathers on each side of their neck. The lesser prairie-chicken was federally listed as threatened in 2014 (79 FR 19973 20071, April 10, 2014) although current legislation is challenging this listing (National Audubon Society, 2015b) (USFWS, 2015j). Historically the lesser prairie-chicken was found throughout the southern plains in the states of Texas, New Mexico, Oklahoma, Kansas, and Colorado. Today, the species occurs in less than 16 percent of these grasslands (USFWS, 2014e). Locally, the species is known to occur in 41 counties in western Kansas (USFWS, 2015j).

Primary threats to the species include habitat loss and fragmentation due to development, infrastructure, and land conversion, impacts from oil/gas and wind farms, transmission lines, and recent droughts which dropped the lesser prairie-chicken populations by more than half. Additional factors include impacts from invasive plants, predation, and that the species becomes less resilient with greater isolation (USDA, 2011).

Piping Plover. The piping plover is a small, pale-colored, migratory shorebird of approximately 7 inches in length, a wingspan of 19 inches, and weighing approximately 2 ounces. The species has a grey back, white underbelly, and black head markings and neck ring. In the northern plains region, the species was listed as threatened in 1985 (50 FR 50726 50734, December 11, 1985) and critical habitat was designated in 2002 (67 FR 57637, in September 11, 2002) (USFWS, 2015k). The piping plover may be found in the northern Great Plains, along the Atlantic Coast, and in the Great Lakes Area within the US for approximately three to four months during the summer breeding season. In Kansas, habitat occurs in the northeastern portion of the state, with nesting occurring on sandbars along the Kansas River (KDWPT, 2000).

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[98] in the Northern Great Plains. Threats to piping plovers include destruction and degradation of preferred habitat resulting from construction and development activities and water control structures, nest predation, and nest abandonment caused by human presence or disturbance (USFWS, 2003a).

Red Knot. The red knot is a medium-sized, ruddy brown shorebird with grey and white speckled wings of approximately 9 inches in length. The species was listed as threatened in 2014 (79 FR 73705 73748, December 11, 2014). The red knot migrates annually from its breeding grounds above the Arctic Circle to the tip of South America where it winters. During spring and fall migration, the red knot travels in "non-stop segments of 1,500 miles and more, ending at stop sites called staging areas" (USFWS, 2005a). In Kansas, the red knot is a rare spring and fall transient, occurring in Barton, Reno, Rice, and Stafford counties in the central region of the state. Specifically, stopover areas for the species include the Quivira National Wildlife Refuge and Cheyenne Bottoms State Wildlife Area (Great Plains Nature Center, 2015a)

Red knots eat mussels and other mollusks mostly all year (USFWS, 2005a). Threats to this species include impacts to the reduced availability for foraging at staging areas and reduction of arctic breeding habitat as a result of climate change (USFWS, 2014f).

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

Whooping crane Photo credit: USFWS

Whooping Crane. The whooping crane is large snowy white plumed bird with a black beak and feet. It is the tallest bird of North America, growing to a height of up to 5 feet. The species was listed as endangered in 1967 (32 FR 4001, March 11, 1967) and grandfathered into the ESA of 1973 (USFWS, 2015l). The whooping crane nests in Canada and in Florida and Wisconsin in the U.S. It migrates bi-annually between central Canada in summer and the Texas coast in the winter, crossing the Great Plains in the spring and fall. The migratory corridor runs nearly straight from the Canadian Prairie Provinces of Alberta and Saskatchewan through the Great Plains states of eastern Montana, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas (USFWS, 2015l). Specifically, stopover areas for the species include the Quivira National Wildlife Refuge and Cheyenne Bottoms State Wildlife Area in Kansas, which are also designated critical habitat for whooping cranes in Kansas (USFWS, 2007).

Suitable habitat for the whooping crane consists of marshes, wet meadows and prairies, riverine habitats, and agricultural fields. Historically, threats to the whooping crane included hunting, displacement by humans, and loss of habitat. Current reasons for this species' decline is their isolated populations, loss and degradation of migration stopover habitat, construction of additional power lines, degradation of coastal ecosystems, and threat of chemical spills (USFWS, 2007).

Fish

Two endangered and two threatened fish species are federally listed in Kansas as summarized in Table 7.1.6-5. One candidate species, the Arkansas darter (*Etheostoma cragini*), has been identified in the state. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Kansas is provided below.

Table 7.1.6-5: Federally Listed Fish Species of Kansas

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Kansas	Habitat Description
Arkansas River Shiner	*Notropis girardi*	T	Yes	Shallow, sandy-bottomed channels and pools in the Arkansas and Cimarron rivers in southern Kansas.
Neosho Madtom	*Noturus placidus*	T	No	Shallow, gravel-bottomed rivers with swift currents in the Neosho River drainage in eastern and southeastern Kansas.
Pallid Sturgeon	*Scaphirhynchus albus*	E	No	Large rivers with strong currents (e.g., Kansas, Missouri Rivers) in eastern Kansas.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Kansas	Habitat Description
Topeka Shiner	*Notropis topeka*	E	No	Small prairie streams and pools in east-central and western Kansas.

Source: (USFWS, 2015d)

[a] E = Endangered, T = Threatened

Arkansas River Shiner. The Arkansas River shiner (*Notropis girardi*) is a small minnow, measuring up to 2 inches in length. This species has a light tan back, silvery sides, and a white belly. Distinguishing features include a rounded snout and a dark mark at the base of the tail fin (USFWS, 2001). The Arkansas River shiner was federally listed as threatened in 1998 (63 FR 64772 64799, November 23, 1998). Regionally, this species is known to occur in Arkansas, Kansas, New Mexico, Oklahoma, and Texas. In Kansas, this species occurs within a few stream reaches within the Lower Arkansas, Salt Fork Arkansas, and Cimarron basins in the southern region of the state (KDWPT, 2015e) (USFWS, 2015m). Critical habitat has been designated for the Arkansas River shiner, consisting of portions of the Cimarron River in Kansas and Oklahoma and a section of the Canadian River in Oklahoma (70 FR 59808 59846, October 13, 2005).

The preferred habitat for the Arkansas River shiner is a shallow, braided channel with a primarily sandy bottom, where pools and riffles are also present. The primary threat to this species is stream modification and reduction caused by impoundments, water diversion, groundwater mining, channelization, and non-native species (USFWS, 2001).

Neosho Madtom. The Neosho madtom (*Noturus placidus*) is a small catfish, averaging less than 3 inches in length. It has a brownish stripe and mottled skin pigment, and a relatively deep body. The Neosho madtom was listed as threatened in 1990 (55 FR 21148 21153, May 22, 1990). The current distribution of the Neosho madtom occurs in the Neosho River drainage, including the Neosho River in Kansas and Oklahoma, the Cottonwood River in Kansas, and the Spring River in Missouri and Kansas. The species is found across 10 counties in southeastern Kansas (USFWS, 1990b) (USFWS, 2015n).

Habitat for mature Neosho madtom includes shallow, gravel-bottom rivers, with swift currents. Threats to this species includes habitat destruction and modification, principally due to impoundments, dredging activities, and increased water demands (USFWS, 1990b).

Pallid Sturgeon. The pallid sturgeon (*Scaphirhynchus albus*) is one of two species of sturgeon found east of the Continental Divide; it is the larger of the two species, and weighs up to 60 pounds. The pallid sturgeon has a flattened snout and the part of the body just before the tail (caudal peduncle) is armored with cartilage plates (USFWS, 2015o). This species was first federally listed as endangered in 1990 (55 FR 36641 36647, September 6, 1990). The pallid sturgeon is found in the Missouri River and ranges from Montana through the Missouri-Mississippi confluence and

Pallid sturgeon Photo credit: USFWS

down to New Orleans, Louisiana. In Kansas, pallid sturgeon are found in the lower Kansas River in northeast region of the state (USFWS, 2014g).

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

Topeka Shiner. The Topeka shiner is a silvery minnow with a dark stripe on its side growing to approximately 3 inches in length. The species was federally listed as endangered in 1998 (63 FR 69008 69021, December 15, 1998) and critical habitat was designated in 2004 (69 FR 44736 44770, July 27, 2004). The Topeka shiner is known to occur in portions of South Dakota, Minnesota, Kansas, Iowa, Missouri, and Nebraska (USFWS, 2015p). In Kansas, the shiner is known to occur mainly in the Flint Hills in east central Kansas and in Wallace County in the far western part of the state (KDWPT, 2015g).

The Topeka shiners occurs primarily along small prairie streams in pools containing clear, clean water, clean gravel, rock, or sand bottoms. Threats to the species include alterations to stream quality such as increases in sedimentation and nutrients from fertilizers, changes in stream flow volume or temperatures, and restricted access for species river movement and isolation of populations (USFWS, 2015p).

Invertebrates

Three endangered and one threatened invertebrates are federally listed in Kansas as summarized in Table 7.1.6-6. The American burying beetle (*Nicrophorus americanus*) has been identified in the dry upland areas in southeastern portion of the state, while Neosho mucket (*Lampsilis rafinesqueana*), rabbitsfoot (*Quadrula cylindrica cylindrica*), and spectaclecase mussel (*Cumberlandia monodonta*) occur along rivers in eastern and southeastern Kansas. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Kansas is provided below.

Table 7.1.6-6: Federally Listed Invertebrate Species of Kansas

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Kansas	Habitat Description
American Burying Beetle	*Nicrophorus americanus*	E	No	Flat, forested areas in southeast Kansas.
Neosho Mucket	*Lampsilis rafinesqueana*	E	Yes	Arkansas River drainage system in southern Kansas.
Rabbitsfoot	*Quadrula cylindrica cylindrica*	T	Yes	Neosho and Spring rivers in southeastern Kansas.
Spectaclecase Mussel	*Cumberlandia monodonta*	E	No	Sheltered banks along large rivers in eastern Kansas

Source: (USFWS, 2015d)

[a] E = Endangered, T = Threatened

American Burying Beetle. The American burying beetle is the largest carrion beetle in North America, measuring between 1 to 2 inches in length. It has a shiny black shell, smooth shiny black legs, pronounced orange markings on its body, and orange, club-shaped antennae. The beetle buries carcasses to provide a food source for larvae and for feeding while caring for its young. The species was listed as endangered in 1989 (54 FR 29652 29655, July 13, 1989) (USFWS, 1991). Historically, the species ranged in more than 150 counties in 35 states of the eastern and central US (USFWS, 1991), but today it is only found in 5 distinct populations across 10 states. In Kansas, the American burying beetle is found in five counties on the southeast region of the state (USFWS, 2015q).

The American burying beetle can be found in flat topography with forest litter and decomposing plant matter in the top layers of well-drained soil. Threats to the species include habitat loss, fragmentation, and an overall reduction of small vertebrates that the species relies on for forage (USFWS, 1991).

Neosho Mucket. The Neosho mucket is a medium-sized mussel, measuring up to 3.7 inches in length. The shell of this species is olive-yellow to brown with green rays that are usually discontinuous. Males have an elliptical shell, while females have an ovate shell (USFWS, 2015r). This species was listed as endangered in 2013 (78 FR 57076 57097, September 17, 2013). It is endemic to the Arkansas River system and is known to occur in Arkansas, Kansas, Missouri, and Oklahoma. In Kansas, this species is known to occur in 11 counties in the southeastern region of the state (USFWS, 2015r).

The Neosho mucket is commonly found in riffles and runs with fast currents and gravel bottoms. Occasionally, this species is found close to shore, out of the main current (USFWS, 2015r). Threats to this species include habitat loss and degradation due to development, agricultural operations, and treated wastewater releases (USFWS, 2015s).

Rabbitsfoot. The rabbitsfoot mussel is a medium- to large-sized 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, 2015t). The rabbitsfoot mussel was federally listed as threatened in 2013 (78 FR 57076 57097, September 17, 2013). Regionally, this species occurs from Kansas to Pennsylvania and from Oklahoma to Alabama. In Kansas, this species is known or believed to occur in 8 counties throughout southeastern region of the state (USFWS, 2015t).

The rabbitsfoot prefers shallow areas 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 stable and undisturbed habitats with a sufficient population of host fish (USFWS, 2015t). Current threats to the rabbitsfoot mussel include loss of habitat, isolation of populations, range restrictions, sedimentation, and presence of non-native species (USFWS, 2012b).

Spectaclecase Mussel. The spectaclecase mussel is a large mussel, measuring up to at least 9 inches in length. This species has an elongated shell that is brownish to black in color, with a somewhat curved appearance and moderate inflation (USFWS, 2012c). This species was listed as endangered in 2012 (77 FR 14914 14949, April 12, 2012). The spectaclecase mussel has experienced a 55 percent decrease in its historical range and occurs in only 20 of the 44 streams it once inhabited. Current populations are fragmented and limited to short reaches of streams in

12 states, including Alabama, Arkansas, Illinois, Iowa, Kansas, Kentucky, Minnesota, Missouri, Tennessee, Virginia, West Virginia, and Wisconsin . In Kansas, the species is found only in Linn County, along the eastern boundary of the state (USFWS, 2015u).

Suitable habitat for the spectaclecase mussel includes sheltered areas in large rivers. This species seeks out areas that are sheltered from the force of the river current such as beneath rock slabs, firm mud banks, and in-between tree roots. The current major threat to the survival of this species are dams. Dams alter the natural flow and temperature regime of rivers, and block fish passage, which is necessary to prevent fragmentation of populations. Sedimentation of rivers, pollution, channelization, and invasive zebra mussels also pose threats to this species (USFWS, 2012c).

Plants

Two threatened plants are federally listed in Kansas, Mead's milkweed (*Asclepias meadii*) and western prairie fringed orchid (*Platanthera praeclara*) (Table 7.1.6-7). Information on the habitat, distribution, and threats to the survival and recovery of each of these species in Kansas is provided below.

Table 7.1.6-7: Federally Listed Plant Species of Kansas

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in Kansas	Habitat Description
Mead's Milkweed	*Asclepias meadii*	T	No	Moist, disturbed tallgrass prairies and plains in northeastern Kansas.
Western Prairie Fringed Orchid	*Platanthera praeclara*	T	No	Moist, disturbed prairies and meadows in northeastern Kansas.

Source: (USFWS, 2015d)

[a] E = Endangered, T = Threatened

Mead's Milkweed. Mead's milkweed is a flowering plant characterized by a single stem, which grows up to 16 inches tall in tallgrass prairie habitats. The species has hairless leaves, a white wax coating, and a singular cluster of flowers at the top (USFWS, 2005b). Mead's milkweed was listed as threatened in 1988 (53 FR 33992 33996, September 1, 1988). Regionally, the species' range extends from eastern Kansas to southern Illinois to southern Wisconsin. Mead's milkweed occurs in 13 counties in northeastern Kansas in the unglaciated material of the Osage Plains Physiographic Region and in glaciated material of the Kansan Glaciated Physiographic Region (USFWS, 2015v) (USFWS, 2003b).

Habitat for the species includes tallgrass prairie that is moderately wet or dry and maintained by fire. Threats to the species include habitat loss from farming and commercial development, habitat fragmentation, and hay mowing, which occurs in agricultural areas and can eliminate the early stages of the species' life cycle (USFWS, 2005b).

Western Prairie Fringed Orchid. The Western prairie fringed orchid grows stalks up to 4 feet tall with 24 white flowers. The species was federally listed as threatened in 1989 (54 FR 39857 39863, September 28, 1989) and can be found along the edge of the plains from Minnesota south to Oklahoma. In Kansas, the western prairie fringed orchid can be found in four counties in the northeastern portion of the state (USFWS, 2015w).

The orchid is found in prairies and meadows and utilizes support from mycorrhizal fungi during seed germination and before plants are capable of photosynthesis. The western prairie fringed orchid requires measured periodic disturbance (i.e., fire, mowing, or grazing) and consistent soil moisture. Threats to the species include land conversion, impacts to the few species of sphinx moths which pollinate the orchid, and lowering of groundwater levels (USFWS, 2015w).

7.1.7. Land Use, Recreation, and Airspace

7.1.7.1. Definition of the Resource

The following summarizes major land uses, recreational venues, and airspace considerations in Kansas, 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, lakes, forests, beaches, recreational facilities, museums, historic sites, and other areas/facilities. Recreational resources are typically managed by federal, state, county, or local governments.

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

Airspace

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

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

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

7.1.7.2. Specific Regulatory Considerations

Appendix C, Environmental Laws and Regulations, summarizes numerous federal environmental laws and regulations that, to one degree or another, may affect land use in Kansas. However, local county, city, and village laws and regulations govern most site-specific land use controls and requirements. Furthermore, many land use controls and requirements are implemented and enforced under the umbrella of land use planning, often with the help and support of state authorities. The Kansas Statute (Chapter 12, Article 7) outlines the authority for local governments to create, develop, and implement comprehensive plans or master plans (Kansas State Legislature, 2015a).

Because federal laws govern the Nation's airspace, there are no specific Kansas state laws that would alter the existing conditions relating to airspace for this PEIS.

7.1.7.3. Land Use and Ownership

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

Land Use

Table 7.1.7-1 identifies the major land uses by coverage type in Kansas. Agricultural land comprises the largest portion of land use with 51 percent of Kansas's total land area occupied by this category (Table 7.1.7-1 and Figure 7.1.7-1). Shrub and grassland is the second largest area of land use with 34 percent of the total land area. Developed areas account for approximately 5 percent of the total land area and forest and woodland account for 4.6 percent. The remaining percentage of land incudes public lands, surface water, and other land covers, shown in Figure 7.1.7-1 (USGS, 2011)

Table 7.1.7-1: Major Land Use in Kansas by Coverage Type

Land Use	Square Miles[a]	Percent of Land
Forest and Woodland	3,761	4.6%
Shrub and Grassland	28,371	34.7%
Agricultural Land	41,943	51.3%
Developed Land	4,088	5.0%
Public Land, Surface Water, and other Land Covers	3,580	4.4%

[a] Square miles are rounded to the nearest whole number. The maps and tables are prepared from the analysis of GIS data and imagery; a margin of error may result in the use of imagery. The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data, and the amount of ground truth verification work conducted. Other federal or state data sources may have slightly different totals.

Source: (USGS, 2011)

Forest and Woodland

Forest and woodland areas account for approximately five percent of the land in Kansas. Most of these areas are in the eastern third of the state. In the rest of the state, forest and woodland areas are found in riparian areas adjacent to rivers and streams. The forests provide wildlife habitat, recreation opportunities, and hardwoods such black walnut and oak. Nearly all of forest and woodland areas throughout Kansas are privately owned (approximately 95 percent). (USFS, 2013) There are no state forests in Kansas. Section 7.1.6, Biological Resources, presents additional information about terrestrial vegetation.

<u>Private Forest and Woodland</u>

Nearly 101,000 family forest owners own approximately 95 percent of Kansas's total forestland, collectively. Private landowners own an average of 19 acres of forest and woodlands. Private forestlands indirectly provide some public benefit, including forest products, wildlife habitat, forest and woodland products, scenic beauty, and outdoor recreation opportunities. (USFS, 2013) For additional information regarding forest and woodland areas, see Section 7.1.6, Biological Resources and Section 7.1.8, Visual Resources.

Shrub and Grassland

Approximately 35 percent of the state's surface area is classified as shrub and grassland. Shrub and grassland areas occur throughout the state and are concentrated in central and western Kansas. Portions of these grasslands are within the Cimarron National Grassland managed by the U.S. Forest Service (USFS) in southwestern Kansas. These areas provide a variety of land uses such as wildlife habitat, recreation, hunting, and livestock grazing (USFS, 2015a). For additional information on shrub and grassland, see Section 7.1.6.3, Terrestrial Vegetation.

Agricultural Land

Agricultural land exists in every region of the state (Figure 7.1.7-1). About 51 percent of Kansas's total land area is classified as agricultural land. In 2012, there were 61,773 farms in Kansas and 86 percent were owned and operated by small, family businesses, with the average farm size of 747 acres (USDA, 2014b). Some of the state's largest agricultural uses include corn, wheat, soybeans, sorghum, and beef. Other agricultural uses include hay, sunflowers, and dairy products (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/Kansas/.

Developed Land

Developed land in Kansas tends to be concentrated within major metropolitan areas and surrounding cities, towns, and suburbs (Figure 7.1.7-1). Although only 5 percent of Kansas land is developed, these areas are highly utilized for residential, commercial, industrial, recreational, and government purposes. Table 7.1.7-2 lists the top five developed metropolitan areas within the state and their associated population estimates, and Figure 7.1.7-1 shows where these areas are within the developed land use category.

Table 7.1.7-2: Top Five Developed Metropolitan Areas (2014 estimate)

Metropolitan Area	Population Estimate
Kansas City (MO/KS)	149,636
Wichita	388,413
Topeka	127,215
Lawrence	92,763
Manhattan	56,078
Total Estimated Population of Metropolitan Areas	**814,105**
Total State Estimated Population	**2,904,021**

Sources: (U.S. Census Bureau, 2012a) (U.S. Census Bureau, 2015w)

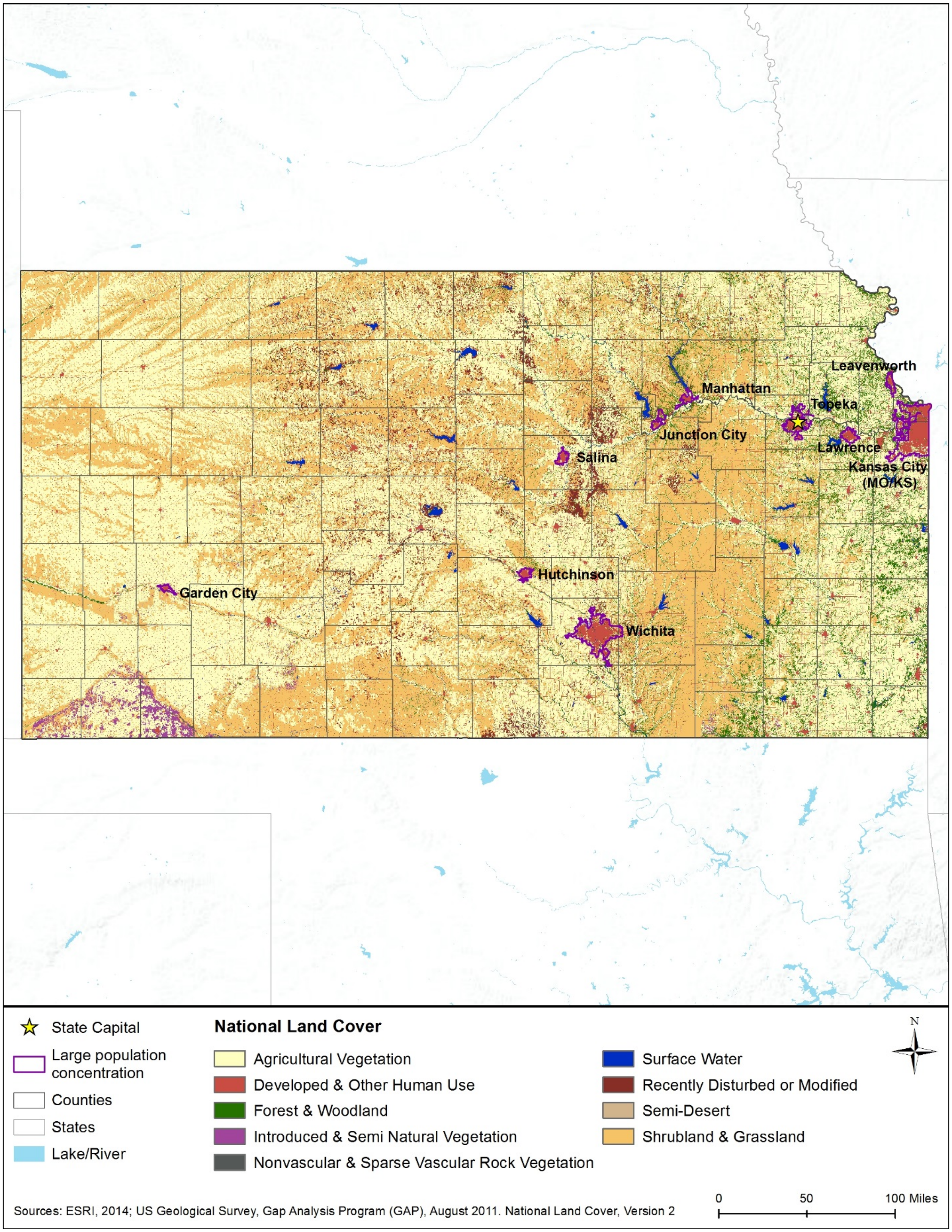


Figure 7.1.7-1: Major Land Use Distribution by Coverage Type

Land Ownership

Land ownership within Kansas has been classified into four main categories: private, federal, state, and tribal (Figure 7.1.7-2).[99]

Private Land

The majority of land in Kansas is privately owned, with most of this land falling under the land use categories of agricultural, shrub and grasslands, and developed (Figure 7.1.7-1). Highly developed, urban, metropolitan areas transition into suburban, agriculture, shrub, and woodland areas, which then transition into more wild and remote areas. Private land exists in all regions of the state.[100]

Federal Land

The federal government manages 887 square miles (one percent) of Kansas land with a variety of land types and uses, including military bases and facilities, a military range, National Wildlife Refuges, National Grassland, historic sites, national preserve, and Bureau of Reclamation projects and dams (USGS, 2012d) (USGS, 2014i). Five federal agencies manage the majority of federal lands throughout the state (Table 7.1.7-3 and Figure 7.1.7-2). 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 7.1.7-3: Federal Land in Kansas

Agency[1]	Square Miles	Representative Type
Department of Defense (DoD)	558	Military Bases, Facilities, Range
U.S. Fish and Wildlife Service	92	National Wildlife Refuges
USDA Forest Service	170	National Grassland
National Park Service[2]	18	National Historic Sites, National Preserve
Bureau of Reclamation	49	Projects, Dams
Total	**887**	**NA**

[1] Table identifies land wholly managed by the Agency; additional properties may be managed by or affiliated with the Agency
[2] Additional trails and corridors pass through Kansas that are part of the National Park System.

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

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

- The Department of Defense (DoD) owns and manages 558 square miles used for military bases, facilities, and a range (Department of Defense, 2014);
- The USFWS owns and manages approximately 92 square miles consisting of four NWRs in Kansas (USFWS, 2014d);
- The USDA Forest Service owns and manages 170 square miles set aside as the Cimarron National Grassland;

[99] 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.

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

- The NPS manages 18 square miles consisting of four National Historic Sites, the Tallgrass Prairie National Preserve, NPS units, and affiliated areas; and
- The Bureau of Reclamation manages 49 square miles consisting of nine projects and nine dams. (USGS, 2012d) (USGS, 2014i)

State Land[101]

The Kansas state government owns approximately 260 square miles of land or about 0.3 percent of the total land in the state. The KDWPT manages nearly all of these state administered lands. These lands are managed as State Parks, wildlife areas, state fishing lakes, reservoirs, and nature centers. These lands are managed for recreation, hunting and fishing opportunities, habitat management, and education opportunities. (KDWPT, 2015d)

Tribal Land

The Bureau of Indian Affairs, along with individual tribes, manages approximately 381 square miles, or 0.5 percent of the total land within Kansas.[102] These lands are composed of four Indian Reservations throughout the state (Table 7.1.7-4) (National Conference of State Legislators, 2015; U.S. Government Publishing Office, 2015) . For additional information regarding tribal land, see Section 7.1.11, Cultural Resources.

Table 7.1.7-4: Indian Reservations and Other Land Holdings in Kansas

Reservation Name	Square Miles
Iowa (KS-NE)	13.9
Kickapoo (KS)	237.1
Prairie Band of Potawatomi Nation	121.7
Sac and Fox Nation	8.0
Total	**381.0**

Sources: (National Conference of State Legislators, 2015) (U.S. Government Publishing Office, 2015)

[101] 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.
[102] Although the Bureau of Indian Affairs “manages” Native American lands, the Bureau of Indian Affairs is different than other land management agencies as the lands are held in trust and are sovereign nations.

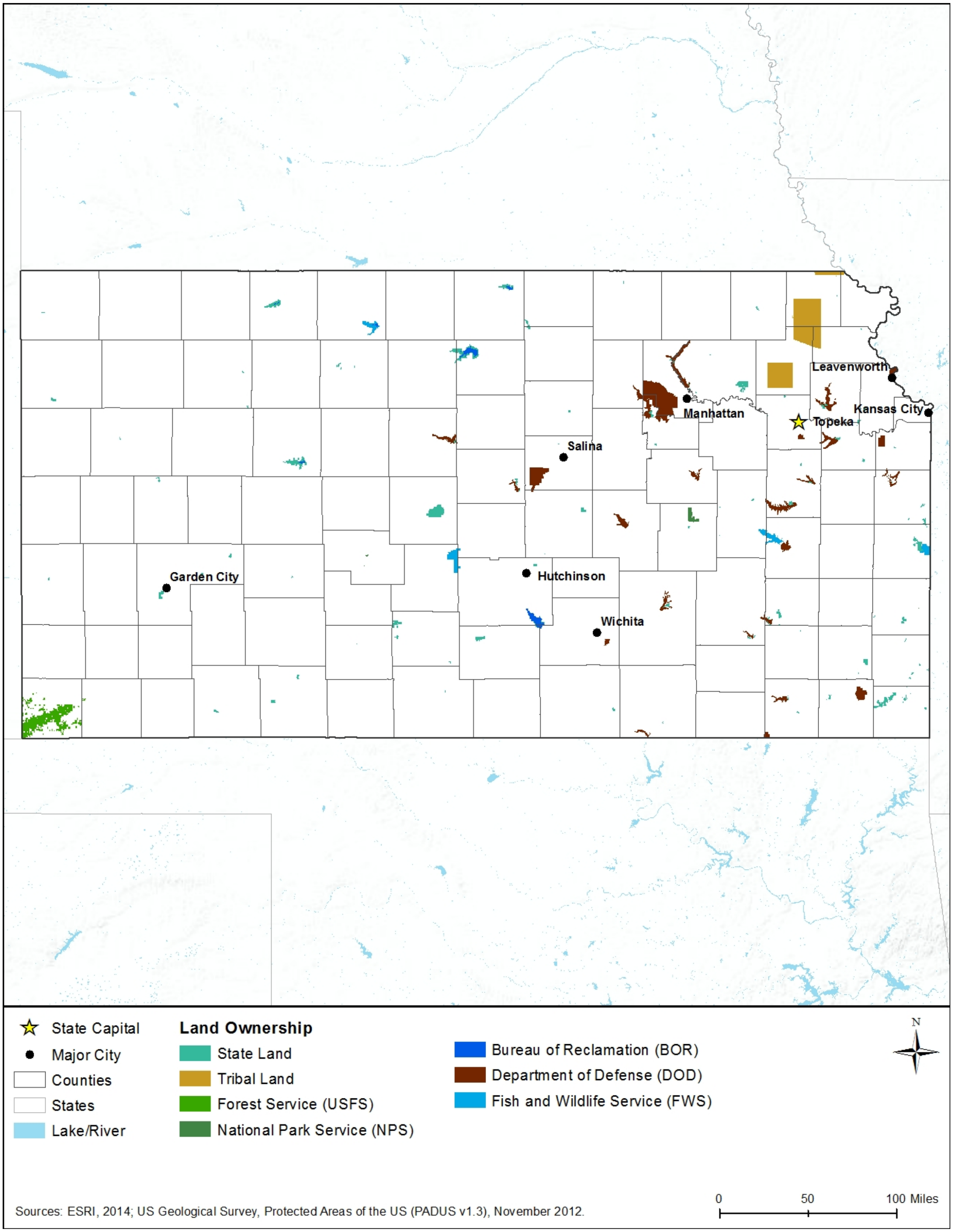


Figure 7.1.7-2: Land Ownership Distribution

7.1.7.4. Recreation

On the community level, cities and towns provide an assortment of indoor and outdoor recreational facilities including community and recreation centers, theaters, museums, athletic fields and courts, golf courses, multi-use trails, playgrounds, picnicking areas, theme/amusement parks, boat launches and marinas. Availability of community-level facilities is typically commensurate to the population's distribution and interests, and the natural resources prominent in the vicinity.

There are 26 State Parks with a combined total of more than 500-miles of trails within them (KDWPT, 2015h), and there are over 100 State Wildlife Areas (KDWPT, 2015i) (Figure 7.1.7-3).[103] Kansas has almost 133,956 river miles (National Wild and Scenic Rivers System, 2015) and many reservoirs and lakes that make water-based recreation very popular with residents and visitors. Fishing is especially popular.

There are 15 National Recreation Trails in the state, covering a combined total more than 120 miles (American Trails, 2015). Federally, the NPS, USFS, USFWS, and the USACE, manage areas in Kansas with substantial recreational attributes. Renowned as the geographical center of the U.S., Kansas was literally a thoroughfare for explorers, soldiers, settlers, Pony Express riders, and emigrants. The Lewis and Clark, California, Oregon, Santa Fe, and Pony Express Historic Trails and associated historic sites crisscross the state (NPS, 2014a). The Tallgrass Prairie National Preserve (managed cooperatively by the Nature Conservancy and the National Park Service) protects the majority of the last remaining tallgrass prairie ecosystem in North America (U.S. Department of the Interior, 2015a). There are no National Forests in Kansas, but there is the Cimarron National Grassland in the southwest corner of the state, adjacent to Colorado and Oklahoma state borders (USFS, 2015b).

This section discusses key recreational opportunities and activities representative of various regions of Kansas. The state can be categorized by three distinct recreational regions, each of which are presented in the following sub-sections. For information on visual resources such as National Scenic Byways and state-designated Byways, see Section 7.1.8, Visual Resources; and for information on culturally/historically significant resources (e.g., National Historic Sites, National Historic Landmarks, National Register of Historic Places listed sites, and Natural Heritage Areas), see Section 7.1.11, Cultural Resources.

Western Region

The Western Region is the most rural part of the state. Nebraska to the north, Colorado to the west, and Oklahoma to the south have similar topography and population densities in their bordering regions. Dodge City and Garden City situated adjacent to the Arkansas River are the

[103] 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.

largest cities in this region (Figure 7.1.7-3). Liberal, official hometown of Dorothy in the *Wizard of Oz*, has plenty of visitors wanting to walk its "Yellow Brick Road" and be entertained in the town's "Land of Oz". Saint Fidelis Catholic Church in Victoria (commonly known as "Cathedral of the Plains") is still in use today, and as one of the promoted "8 Wonders of Kansas," it is highly visited. Built in 1911 from native limestone and richly decorated with art from Germany, Austria, and Italy, it can seat 1,100 people (Kansas Travel, 2015b).

Cimarron National Grassland is the state's largest area of public land, and provides visitors with opportunities to picnic, bird watch, hike, bike, ride horses or all-terrain vehicles (ATV), camp, fish, and hunt (USFS, 2015b). Scott State Park's unique setting within a canyon on the vast prairie with a spring-fed lake, archaeological sites, and several historical sites including "El Cuartelejo" (KDWPT, 2015j). In Gove County, the towering chalk outcrop formations in Monument Rocks National Landmark (also known as the "Pyramids") and Castle Rock are popular stops for those exploring the geology of this region or seeking unique photography opportunities (Discover Oakley, 2015). Near Great Bend, the combined acreage of the Cheyenne Bottoms Wildlife Area, Preserve, and the nearby Quivira National Wildlife Refuge comprise what is considered the largest marsh in the U.S. interior. Bird watching, photography, and guided tours are available for those wanting to see the millions of migrating and wintering birds that stop there (Kansas Travel, 2015a).

Central Region

The Central Region lies roughly between the Great Plains west of Interstate 35 and the Flint Hills east of Topeka (Figure 7.1.7-3). Located on this major travel route from Oklahoma, Wichita provides urban leisure opportunities like museums, galleries, gardens, performing arts theaters, and sports venues to residents and visitors. Nearby Hutchinson's "Kansas Cosmosphere" has the largest collections of US and Russian space memorabilia (including several space vehicles) outside of Huntsville, Alabama and Russia (Kansas Travel, 2015c). The local Strataca Salt Mine offers tours of its caverns 650 feet below the earth's surface (Travel KS, 2015b). Abilene draws many visitors to the Ike Eisenhower Presidential Library, Museum, and his boyhood home.

Rock City Park, north of Salina, has over 200 freestanding sandstone boulders that attract curious visitors and geologists (Travel KS, 2015c). Wilson State Park is popular with mountain bikers for its 25.5-mile long "Switchgrass Bike Trail." Milford Reservoir and Waconda Lake are the largest lakes in Kansas. They are accompanied by Milford State Park and Glen Elder State Park, both very popular for camping, hiking, fishing, hunting, trapping, and bald eagle viewing. El Dorado Lake and State Park are best known for fishing, boating, and equestrian amenities (KDWPT, 2015k). Tallgrass Prairie National Preserve protects 11,000 acres of this rare remnant of land. There are over 40-miles of nature trails and several historic buildings from the 1880's to explore at this site (Travel KS, 2015d).

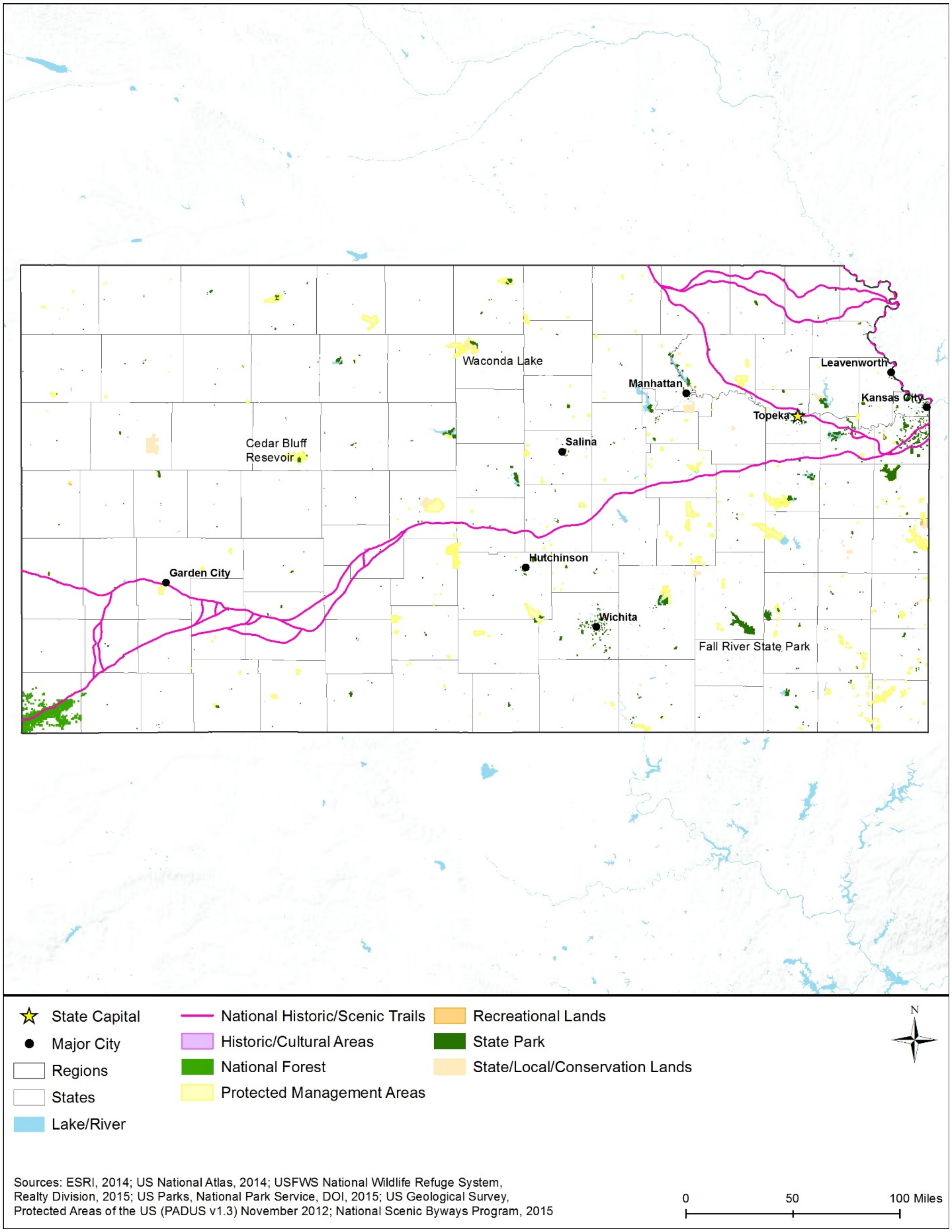


Figure 7.1.7-3: Kansas Recreation Resources

Eastern Region

The Eastern Region is the most heavily populated region of the state. The capital, Topeka, and the cities of Manhattan, Lawrence, and Leavenworth are located here; as well as the metro area of Kansas City-Overland Park (which shares the state line with Missouri's Kansas City-Independence-Raytown metropolis) (Figure 7.1.7-3). These cities provide typical urban opportunities for visiting museums, galleries, zoos, theaters, music, and sports venues. The Schlitterbahn Waterpark in Kansas City boasts of having the world's tallest waterslide, and longest tidal wave river (Travel KS, 2015e). The Kansas City Speedway is popular for National Association of Stock Car Auto Racing (NASCAR) fans. The Museum at Prairiefire is affiliated with the American Museum of Natural History in New York, and features exhibits on loan that attract many visitors. The Gary L. Haller National Recreation Trail is a scenic, multi-use trail heavily utilized by the residents of this large metropolitan area. Hillsdale Reservoir and State Park, just south of the Kansas City Metro Area, is well-known for its excellent hunting and fishing habitats. Birdwatching is also popular, as is horseback riding, swimming, and camping (KDWPT, 2015l). The 51-mile Prairie Spirit Rail Trail from Iola to Ottawa is a greenway and multi-use trail that follows an abandoned railway bed, and has eight pocket-parks incorporated (Travel KS, 2015f)

Clinton Lake and State Park near Lawrence (home of the University of Kansas) has developed areas for hosting large special events popular with students and visitors. Swim beaches, sand volleyball, disc golf and mountain bike skills courses are also available in additional to the typical park offerings of boating, fishing, water sports, camping, multi-use trails, and picnicking. (KDWPT, 2015m) To the north of Lawrence, the 30-mile Perry Lake Trail (that follows most of the Perry Lake shoreline) attracts about 1 million visitors a year (National Recreation Trails, 2015a). The Kaw River State Park provides access to the Kansas River for motorboats as well as smaller craft such as canoes and kayaks. In the southern portion of this region, canoeing on the Fall River (that feeds into the Fall River Reservoir) is a very popular activity. Nearby Elk City State Park has an assortment of impressive trails for hikers, mountain bikers, and wildlife watchers. Kansas state parks offer many opportunities for equestrians. Eisenhower State Park's equestrian campsites and its 20-mile Crooked Knee Horse Trail are typical of the excellent amenities provided at numerous park locations (KDWPT, 2015h).

7.1.7.5. Airspace

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

Airspace Categories

There are two categories of airspace or airspace areas:

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

Within each of these two categories, there are four types of airspace: controlled, uncontrolled, special use, and other airspace. The categories and types of airspace are dictated by the complexity or density of aircraft movements, the nature of the operations conducted within the airspace, the level of safety required, and the national and public interest. Figure 7.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[104] service is based on the airspace classification (FAA, 2008).

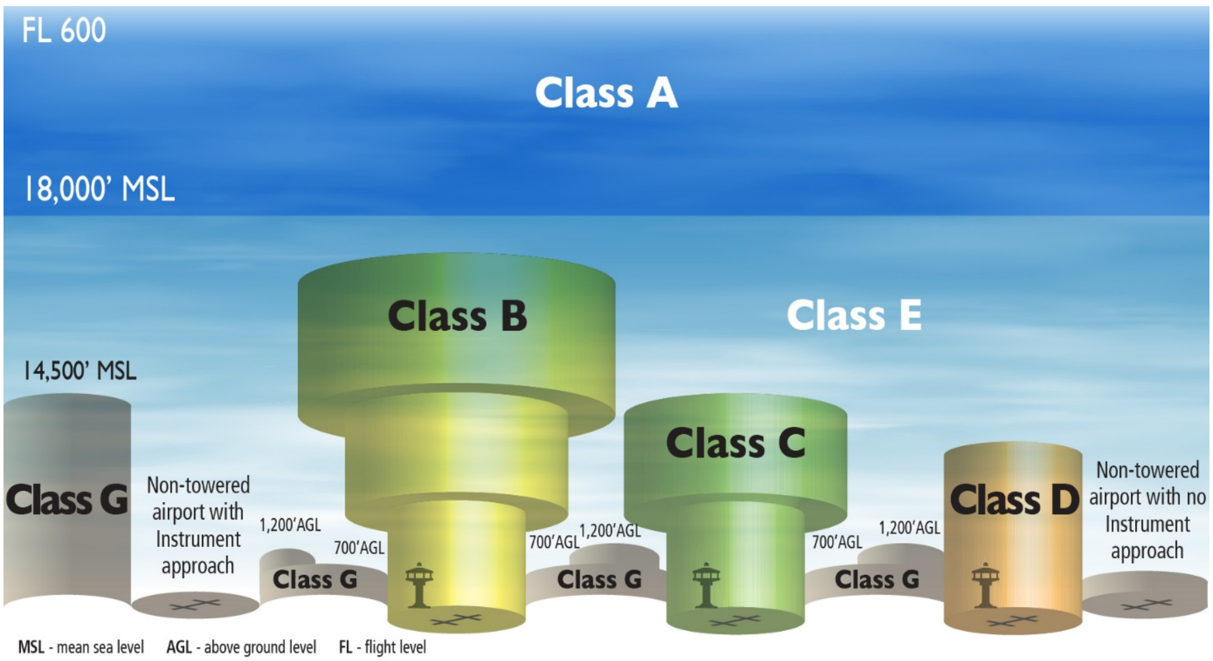


Figure 7.1.7-4: National Air Space Classification Profile

Source: Derived from (FAA, 2008)

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL)[105]. 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).[106]

[104] ATC – Approved authority service to provide safe, orderly and expeditious flow of air traffic operations (FAA 2015k).
[105] 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" (Sea Level 2015).
[106] IFR – Rules for the conduct of flights under instrument meteorological conditions (FAA 2015a).

- **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).

Uncontrolled Airspace

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

Special Use Airspace

SUA designates specific airspace that confines or imposes limitations on aircraft activities (See Table 7.1.7-5).

Table 7.1.7-5: SUA Designations

SUA Type	Definition
Prohibited Areas	"Airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. These areas are published in the Federal Register and are depicted on aeronautical charts."
Restricted Areas	"Airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of restricted areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. Restricted areas are published in the Federal Register and constitute 14 CFR Part 73."
Warning Areas	"Airspace of defined dimensions, extending from three NM from the U.S. coast, which contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn non-participating pilots of the potential danger. A warning area may be located over domestic or international waters or both."
MOAs	"Airspace of defined vertical and lateral limits established for separating certain military activities (e.g., air combat maneuvers, air intercepts, testing, etc.) from IFR traffic. Whenever an MOA is in use, non-participating IFR traffic may be cleared through a MOA if IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict nonparticipating IFR traffic."

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

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

Other Airspace Areas

Other airspace areas, explained in Table 7.1.7-6, include Airport Advisory, Military Training Routes (MTRs), Temporary Flight Restrictions (TFR), Parachute Jump Aircraft Operations, published Visual Flight Rules (VFR) and IFRs, and Terminal Radar Service Areas.

Table 7.1.7-6: Other Airspace Designations

Type	Definition
Airport Advisory	There are three types: • Local Airport Advisory – Operated within 10 statute miles of an airport where there is a Flight Service Station (FSS) located on an airport, but no operational control tower. The FSS advises the arriving and departing aircraft on particular conditions. • Remote Airport Advisory – Operated within 10 statute miles for specific high activity airports with no operational control tower. • Remote Airport Information Service – Used for short-term special events.
MTRs	MTRs are for use by the military for training, specifically low level combat tactics where low altitudes and high speed are needed.
TFRs	TFRs are established to: • Protect people and property from a hazard; • Provide safety for disaster relief aircraft during operations; • Avoid unsafe aircraft congestion associated with an incident or public interest event; • Protect the U.S. President, Vice President, and other public figures; • Provide safety for space operations; and • Protect in Hawaii declared national disasters for humanitarian reasons. Only those TFRs annotated with an ending date and time of "permanent" are included in this Draft PEIS, since it indicates a longer, standing condition of the airspace. Other TFRs are typically a shorter duration of for a one-time specific event.
Parachute Jump Aircraft Operations	Parachute jump area procedures are in 14 CFR Part 105, while the U.S. parachute jump areas are contained in the regional Airport/Facility Directory.

Type	Definition
Published VFRs and IRs	These are established routes for moving around and through complex airspace, like Class B airspace. VFRs are procedures used to conduct flights under visual conditions. IFRs are procedures used to conduct flights with instruments and meteorological conditions.
Terminal Radar Service Areas	Airspace areas that are not one of the established U.S. airspace classes. These areas provide additional radar services to pilots.

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

Aerial System Considerations

Unmanned Aerial Systems

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

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

Balloons

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

Obstructions to Airspace Considerations

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

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

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

Kansas Airspace

The Kansas Department of Transportation Aviation is responsible for overseeing the public-use airports in the state and relies on FAA Advisory Circulars and other FAA requirements for airspace (KDOT, 2015a). The one FAA FSDO in Kansas is located in Wichita (FAA, 2015d).

Kansas 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, and outlines key issues associated with their airports (National Association of State Aviation Officials, 2015). Figure 7.1.7-5 presents the different aviation airports/facilities residing in Kansas, while Figure 7.1.7-6 and Figure 7.1.7-7 present the breakout by public and private airports/facilities. There are approximately 368 airports within Kansas as presented in Table 7.1.7-7 and Figure 7.1.7-6 through Figure 7.1.7-7 (USDOT, 2015).

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

Type of Airport or Facility	Public	Private
Airport	138	195
Heliport	0	33
Seaplane	0	0
Ultralight	0	0
Balloonport	0	1
Gliderport	0	1
Total	**138**	**230**

Source: (USDOT, 2015)

There are Class C and Class D controlled airports in Kansas as follows:

- One Class C –
  - Wichita Mid-Continent
- Eleven Class D –
  - Fort Riley, Marshall Army Airfield
  - Garden City Regional
  - Hutchinson Municipal
  - Independence Municipal
  - Manhattan Municipal
  - Olathe, Johnson County Executive Airport
  - Olathe, New Century Aircenter
  - Salina Municipal
  - Topeka, Forbes Field Airport
  - Topeka, Philip Billard Municipal
  - Wichita McConnell Air Force Base (AFB) (FAA, 2015g)

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

- Brookville (Restricted)
  - R-3601A – Surface to, but not including, flight level (FL) 180
  - R-3601B – FL 180 to FL230
  - R-3602A – Surface to 29,000 feet MSL
  - R-3602B – Surface to 29,000 feet MSL (FAA, 2016)

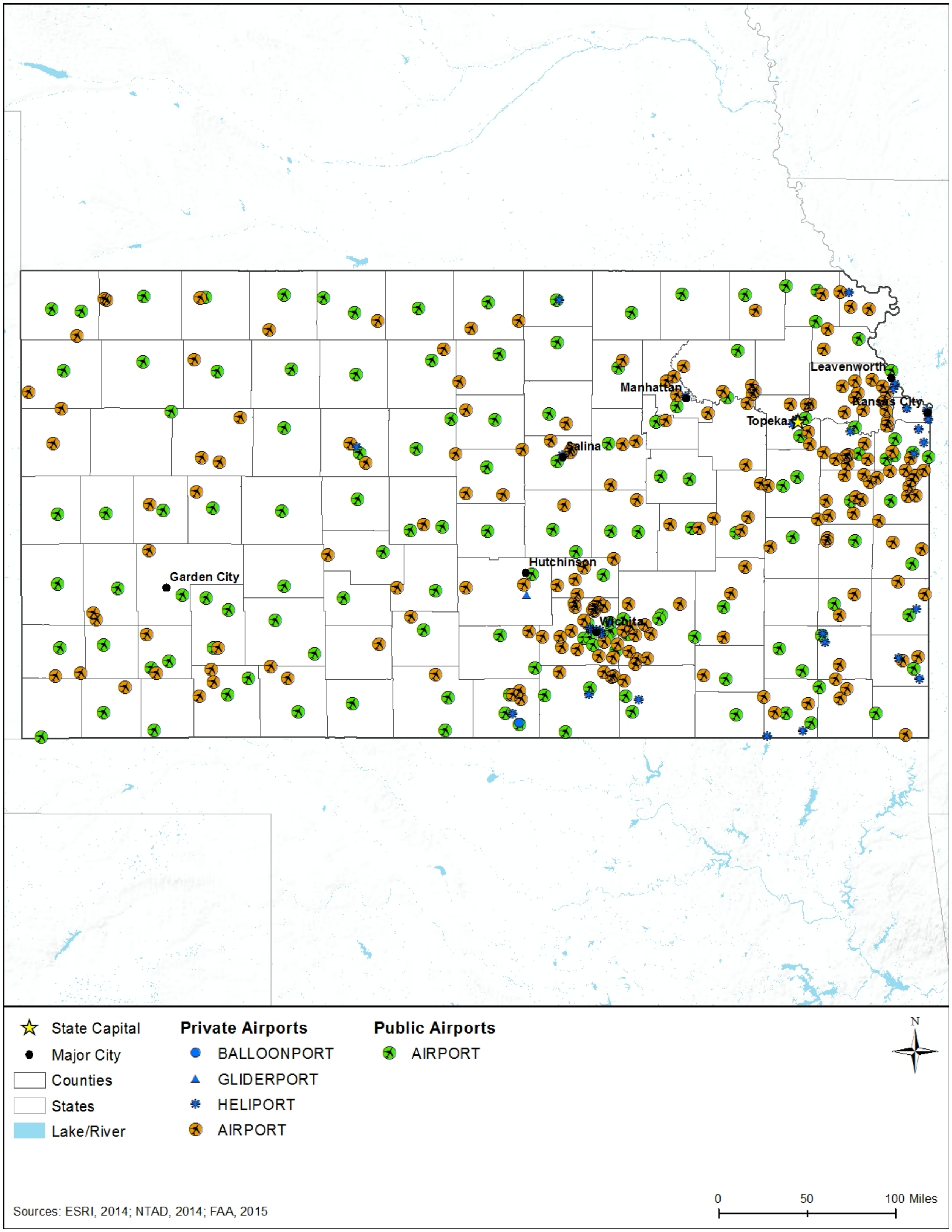


Figure 7.1.7-5: Composite of Kansas Airports/Facilities

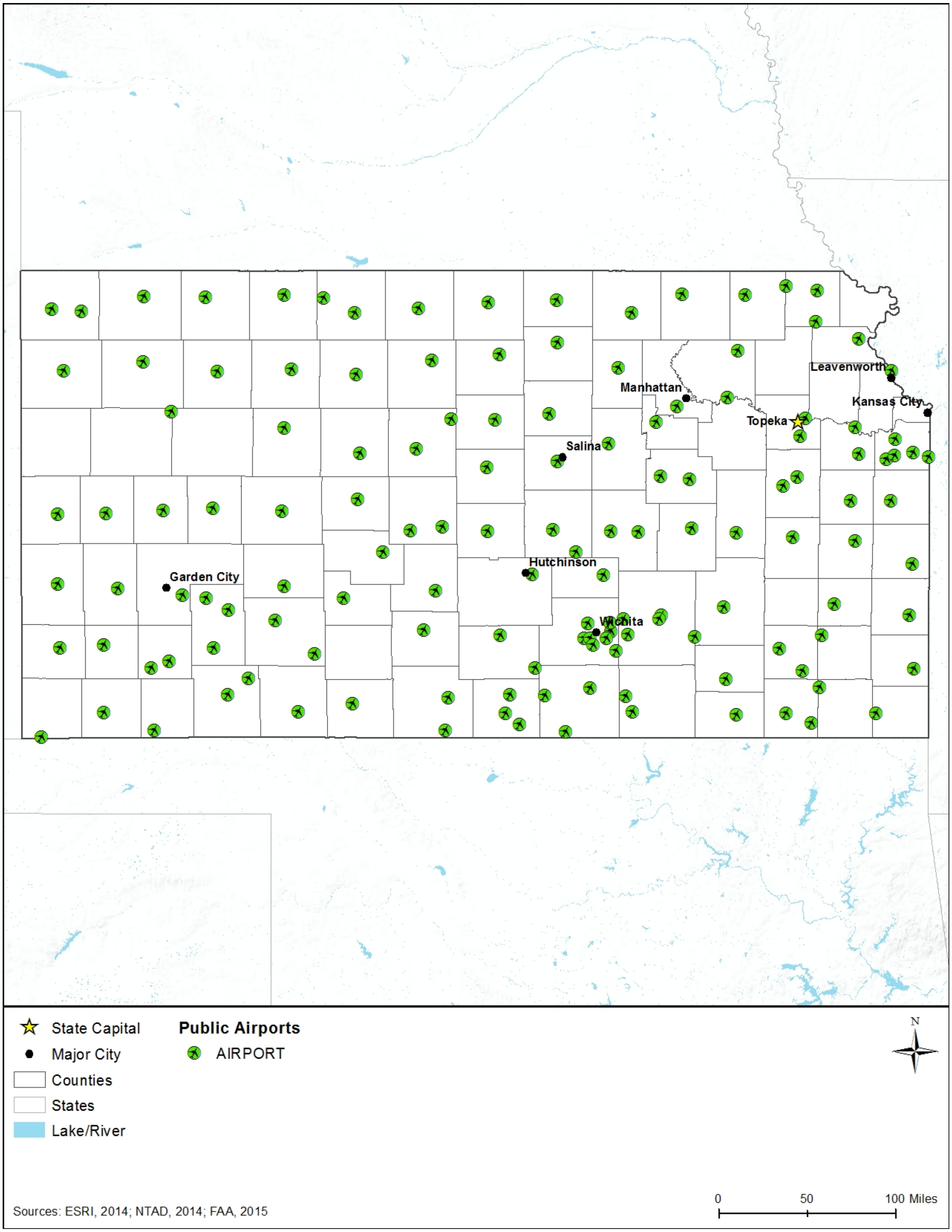


Figure 7.1.7-6: Public Kansas Airports/Facilities

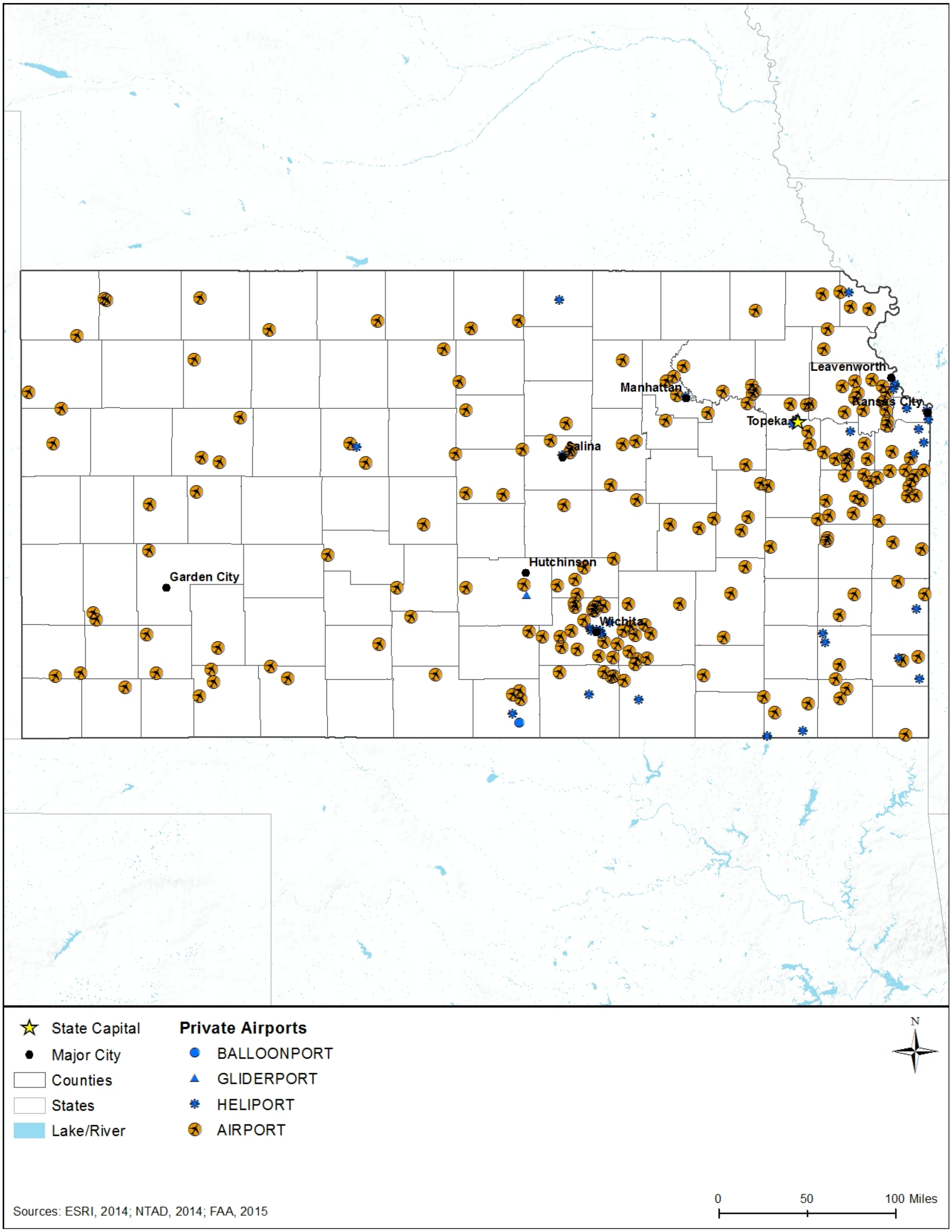


Figure 7.1.7-7: Private Kansas Airports/Facilities

The eight MOAs for Kansas are as follows:

- Ada –
  - East – 7,000 feet MSL to, but not including, FL 180
  - West – 7,000 to, but not including, FL 180
- Bison – 1,000 feet above ground level (AGL) to, but not including, FL 180; The airspace 1,500 AGL and below within a three NM radius of the Ellsworth Municipal Airport, KS is excluded from the MOA
- Eureka –
  - High – 6,000 feet MSL to, but not including, FL 180
  - Low – 2,500 feet to, but not including, 6,000 feet
- Riley – 7,000 feet MSL up to, but not including, FL 180
- Smoky – 500 feet AGL to, but not including, 5,000 feet MSL; The airspace 1,500 AGL and below within a three NM radius of the Ellsworth Municipal Airport, KS is excluded from the MOA.
  - High – 5,000 feet MSL to, but not including, FL 180 (FAA, 2016)

The MOA of Colorado (Cheyenne Low), associated with the 140th Tactical Fighter Wing, Buckley Air National Guard Base, extends into the western portion of the state; while the MOAs of Oklahoma (Vance B, C, D) extend into the southern portion of the state. (FAA, 2016) There is one Alert Area in the Wichita McConnell AFB area – A-683 (Surface to and including 4,500 feet MSL).

The SUAs for Kansas are presented in Figure 7.1.7-8. There are no TFRs (See Figure 7.1.7-8) (FAA, 2015h). MTRs in Kansas, presented in Figure 7.1.7-9, consist of 15 Visual Routes, 12 Instrument Routes, and 8 Slow Routes.

UAS Considerations

The NPS signed a policy memorandum on June 20, 2014 that “directs superintendents nationwide to prohibit launching, landing, or operating unmanned aircraft on lands or waters administered by the National Park Service” (NPS, 2014g). There are five National Parks, and affiliated areas, in Kansas that must comply with this agency directive (NPS, 2014a).

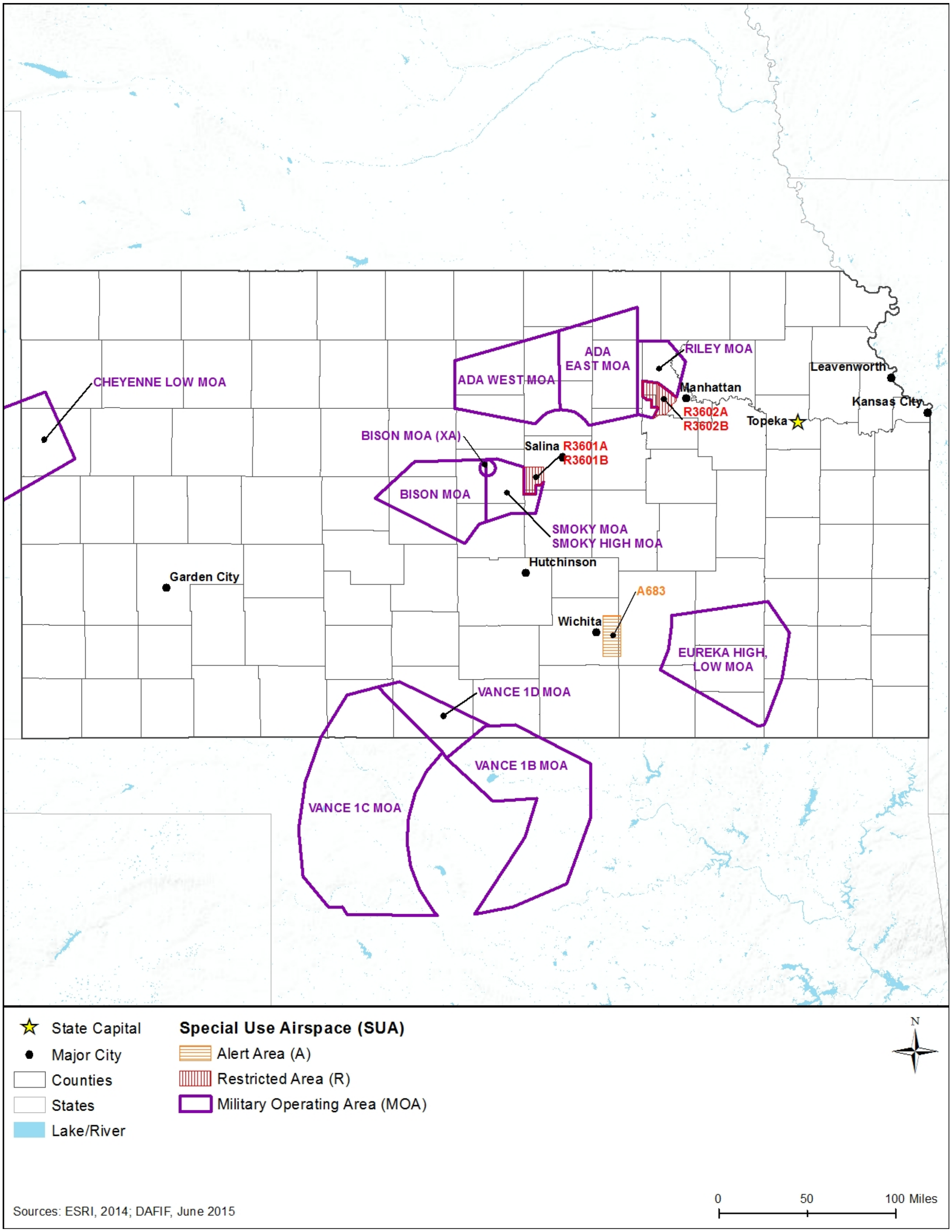


Figure 7.1.7-8: SUAs in Kansas

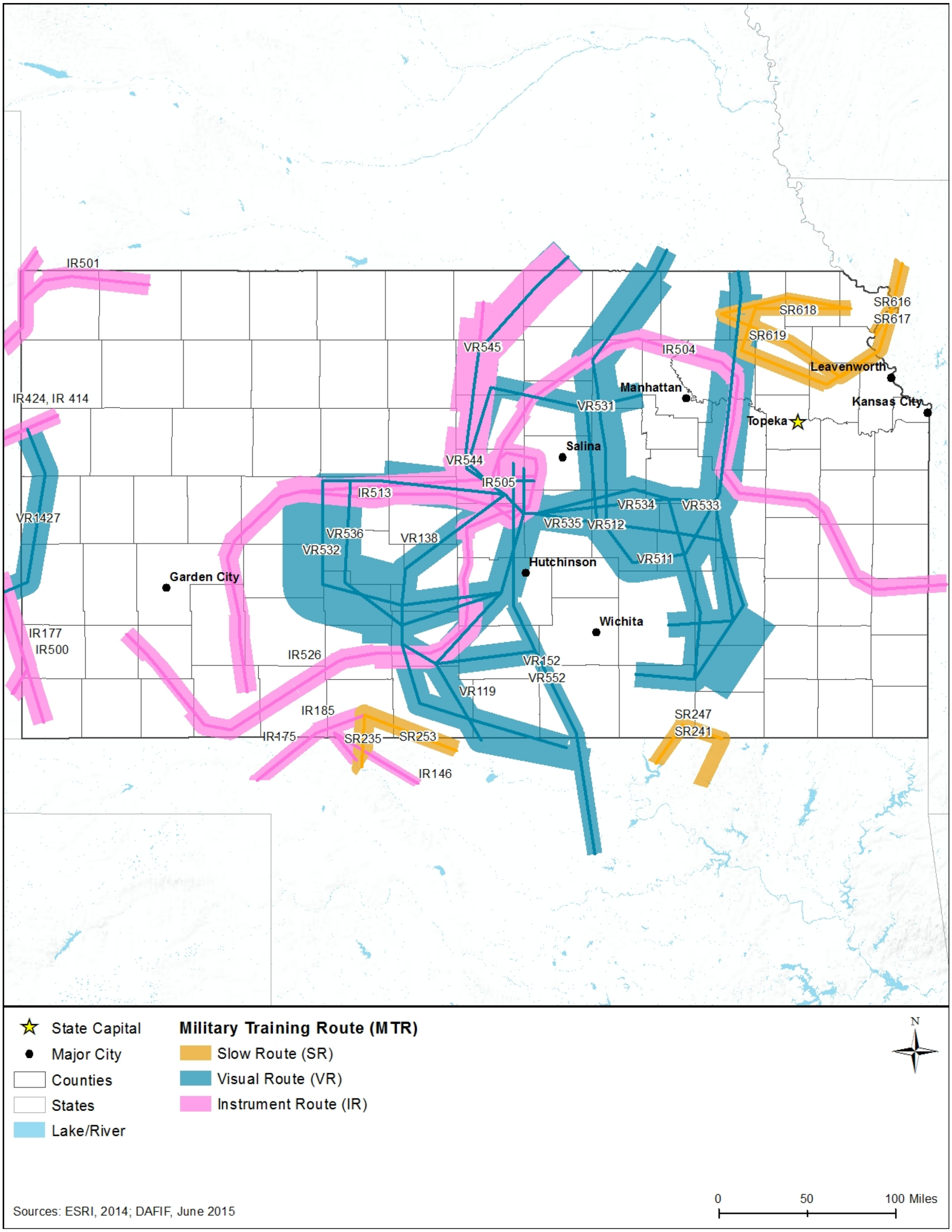


Figure 7.1.7-9: MTRs in Kansas

7.1.8. Visual Resources

7.1.8.1. Definition of the Resource

Visual resources influence the human experience of a landscape. Various aspects combine to create visual resources, such as color, contrast, texture, line, and form. Features (e.g., mountain ranges, city skylines, ocean views, unique geological formations, rivers) and constructed landmarks (e.g., bridges, memorials, cultural resources, or statues) are considered visual resources. For some, cityscapes are valued visual resources, whereas others prefer natural areas. While many aspects of visual resources are subjective, evaluating potential impacts on the character and continuity of the landscape is a consideration when evaluating proposed actions for NEPA and National Historic Preservation Act (NHPA) compliance. The federal government does not have a single 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).

7.1.8.2. Specific Regulatory Considerations

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

Table 7.1.8-1: Relevant Kansas Visual Resources Laws and Regulations

State Law / Regulation	Regulatory Agency	Applicability
75-2715. Historic preservation	State Historical Society	"…to engage in a comprehensive program of historic preservation and to foster and promote the conservation and use of historic property…" (Kansas State Legislature, 2012)

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.

7.1.8.3. Character and Visual Quality of the Existing Landscape

Kansas is in the geographic center of the U.S. within the Great Plains. The vast prairies and river valleys surround rich farmlands with wheat, corn, and livestock. The major rivers are the Kansas and Arkansas Rivers, with the Missouri River flowing along the eastern border of the state. Although it has been reported that Kansas is "flatter than a pancake," the state does have a variety of terrain and landscapes (Fonstad, Pugatch, & Vogt, 2003). Kansas has wide open vistas across the expansive grasslands, broad river valleys, rolling hills, buttes, mesas, forests, and the scenic skylines of Kansas City, Topeka, and Wichita (Kansas Native Plant Society, 2012).

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

Section 7.1.7 discusses land use and contains further descriptions of land cover within the state.

While some municipalities may have 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.

7.1.8.4. Visually Important Historic Properties and Cultural Resources

Visual and aesthetic qualities of historic properties can contribute to the overall importance of a particular site. Such qualities relate to the integrity of the appearance and setting of these properties or resources. Viewsheds (the natural and manmade environment visible from one or more viewing points) can also contribute to the significance of historic properties or cultural resources (NASA, 2013). Viewsheds containing historic properties and cultural resources may be considered important because of their presence in the landscape.

Figure 7.1.8-1 shows areas that are included in the National Register of Historic Places (NRHP) that may be considered visually sensitive. In Kansas, there are 1,408 NRHP listed sites, which include 1 National Heritage Area, 25 National Historic Landmarks, and 4 National Historic Sites (NPS, 2015a). Some State Historic Sites, State Heritage Areas, and State Historic Districts may also be included in the NRHP, whereas others are not designated at this time.

The *Secretary of the Interior's Standards for the Treatment of Historic Properties* addresses four aspects: preservation, rehabilitation, restoration, and reconstruction, whereas *The Guidelines for the Treatment of Cultural Landscapes*, both authored by the NPS, provides guidance for applying protections to all aspects of the historic and cultural landscape, such as forests, gardens, trails, structures, ponds, and farming areas, to meet the Standards (NPS, 1995). The Standards "require retention of the greatest amount of historic fabric, including the landscape's historic form, features, and details as they have evolved over time," which directly protects the historic properties and the visual resources therein (NPS, 1995).

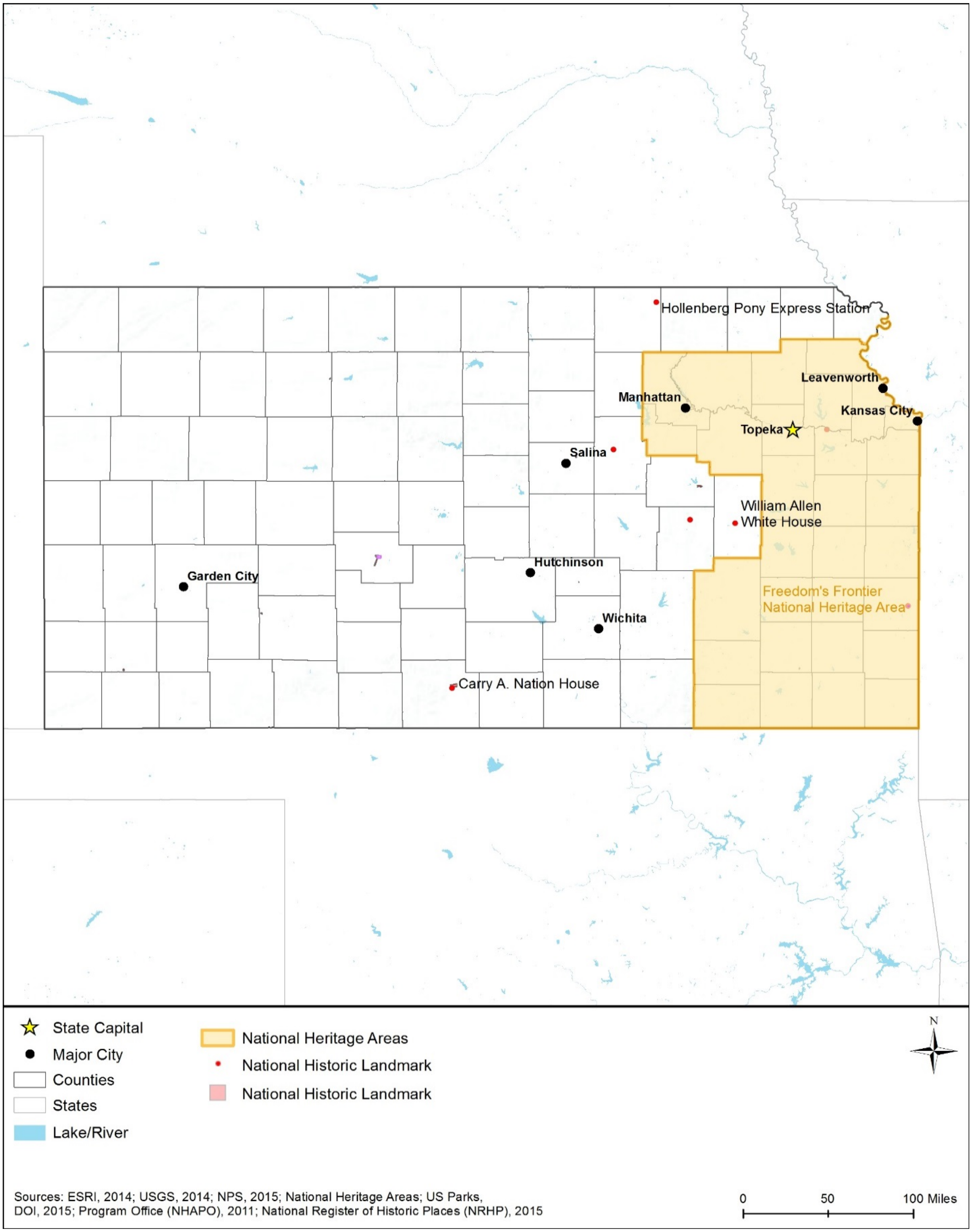


Figure 7.1.8-1: Representative Sample of Some Historic and Cultural Resources that May be Visually Sensitive

National Heritage Areas

National Heritage Areas (NHA) are "places where natural, cultural, and historic resources combine to form a cohesive, nationally important landscape" (NPS, 2011). These areas help tell the history of the United States. Based on this criteria, NHAs in Kansas may contain scenic or aesthetic areas considered visual resources or visually sensitive. There is one NHA in Kansas, the Freedom's Frontier National Heritage Area (Figure 7.1.8-1). This NHA is along the Kansas and Missouri border and denotes the Civil War battles between the two states. (Freedom's Frontier National Heritage Area, 2015)

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, 2015l).

NHLs may include "historic buildings, sites, structures, objects, and districts" (NPS, 2016a). Other types of historic properties include battlefields and canals. The importance of NHL-designated properties can be attributed to scenic or aesthetic qualities, among other attributes, that may be considered visual resources or visually sensitive at these sites. There are 25 NHLs in Kansas (NPS, 2015a).

The NHLs in Kansas are:

- Black Jack Battlefield (NPS, 2015a)
- Council Grove Historic District
- El Cuartelejo
- Fort Larned
- Fort Leavenworth
- Fort Scott
- Haskell Institute
- Hollenberg (Cottonwood) Pony Express Station
- Lecompton Constitution Hall
- Lower Cimarron Springs
- Marais Des Cygnes Massacre Site
- Medicine Lodge Peace Treaty Site
- Nation, Carry A., (House)
- Nicodemus Historic District
- Norman No. 1 Oil Well
- Parker Carousel
- Santa Fe Trail Remains
- Shawnee Mission
- Spring Hill Ranch
- Sumner Elementary School/Monroe Elementary School
- Tobias-Thompson Complex
- Warkentin Farm
- Western Branch, National Home For Disabled Volunteer Soldiers
- White, William Allen, House
- Whiteford, Price, (Site)

By comparison, there are over 2,500 NHLs in the United States (NPS, 2015b). Figure 7.1.8-1 provides a representative sample of some historic and cultural resources that may be visually sensitive.

National Historic Trails

Designated under Section 5 of the National Trails System Act (16 U.S.C. 1241-1251, as amended), National Historic Trails are defined as extended trails that "provide for maximum outdoor recreation potential and for the conservation and enjoyment of the nationally significant scenic, historic, natural, or cultural qualities of the areas though which they pass" (NPS, 2014c). As shown in Figure 7.1.8-2, there are five National Historic Trails in Kansas: California, Lewis and Clark, Oregon, Pony Express, and Santa Fe (NPS, 2014a).[107]

The California, Oregon, and Pony Express National Historic Trails cross the northeastern corner of Kansas following the historic routes westward toward California, Oregon, and the through the states in between. Historic structures, river views, riparian forest, and wide prairies are some of the scenic sites along the trails (NPS, 2014a).

The Lewis and Clark National Historic Trail follows the route that the expedition took following the Missouri River along the eastern border of Kansas. There are several state parks along the trail route in Kansas, and visual resources encompass riparian forests, plains and prairies, and the majestic Missouri River. (NPS, 2015g)

The Santa Fe National Historic Trail crosses through five states: Missouri, Kansas, Oklahoma, Colorado, and New Mexico. Historic ruts from wagons and livestock, stopovers, houses, and a range of landscapes comprise the visual resources of this historic trail. (NPS, 2015i)

National and State Historic Sites

There are four National Historic Sites in Kansas: Brown v. Board of Education, Fort Larned, Fort Scott, and Nicodemus. Brown v. Education is a 16-site historic tour of homes, schools, and other historic sites through Topeka (NPS, 2015c). Fort Larned is in the prairie of west-central Kansas, with scenic historic structures, woodlands, and the Pawnee Fork River (NPS, 2016b). Fort Scott is a Civil War historic site with historic structures, 5 acres of tallgrass prairie, bluffs, woodland, and overlooks of the Marmaton River and Mill Creek (NPS, 2015e). Nicodemus is a small historic town in the plains of northeastern Kansas. Five of the historic structures remain along with wide-open vistas of the prairie. (NPS, 2016c)

Kansas has 13 state historic sites:

- Constitution Hall
- Cottonwood Ranch
- First Territorial Capitol
- Fort Hays
- Goodnow House
- Grinter Place
- Hollenberg Pony Express Station
- John Brown Museum
- Kaw Mission
- Mine Creek Civil War Battlefield
- Pawnee Indian Museum
- Red Rocks
- Shawnee Indian Museum

[107] 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.

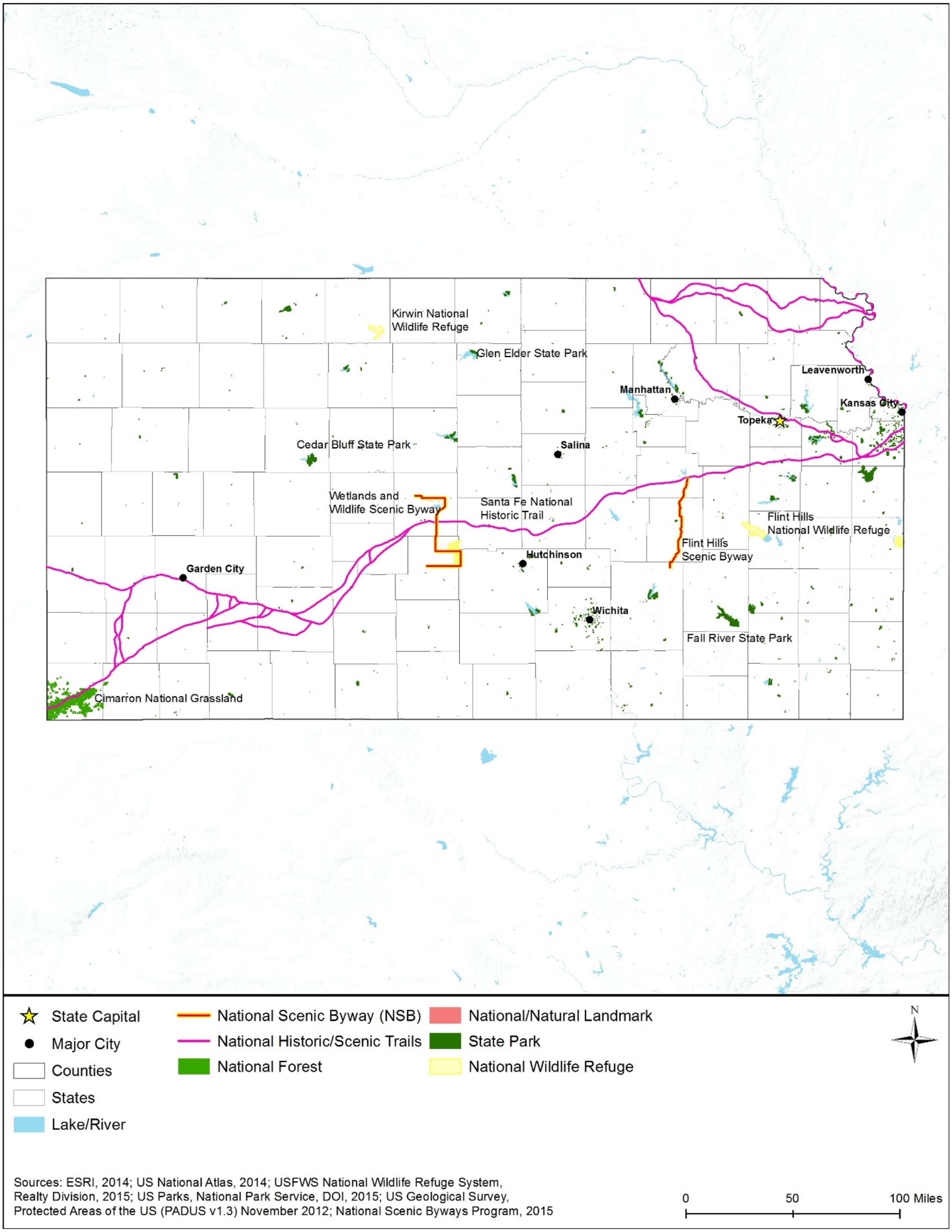


Figure 7.1.8-2: Natural Areas that May Be Visually Sensitive

These sites contain a variety of scenic resources such as historic homes and other structures, manicured gardens, woodlands, streams, rivers, and prairie. (Kansas Historical Society, 2016)

7.1.8.5. Parks and Recreation Areas

National Park Service

National Parks are managed by the National Park Service (NPS) and contain natural, historic, cultural, visual, ecological, and recreational resources of significance to the nation and are maintained for the public's use. In Kansas, there are five[108] officially designated National Parks in addition to other NPS affiliated areas, such as National Heritage Areas. There are four National Historic Sites, five National Historic Trails, and one National Preserve. Figure 7.1.8-2 displays natural areas that may be visually sensitive, including park and recreation areas. For additional information regarding parks and recreation areas, see Section 7.1.7, Land Use, Recreation, and Airspace.

Bureau of Reclamation

The Bureau of Reclamation manages seven reservoirs and recreation areas in Kansas, most often in partnership with state and federal agencies (Figure 7.1.8-2) (Recreation.gov, 2015). The areas are primarily for water storage and secondary recreation use. The managing agencies that consider visual resources in their planning processes may apply management to protect scenic resources within these areas (USACE, 2015e).

State Parks

State parks contain natural, historic, cultural, and/or recreational resources of significance to Kansas residents and visitors. There are 26 state parks throughout Kansas (Figure 7.1.8-2) which contain scenic landscapes such as lakes, rivers, forest, prairie, geologic features, canyons, bluffs, and historic sites. The following are the state parks within Kansas (KDWPT, 2015h):

- Cedar Bluff
- Cheney
- Clinton
- Crawford
- Cross Timbers
- Eisenhower
- El Dorado
- Elk City
- Fall River
- Glen Elder
- Hillsdale
- Kanopolis
- Kaw River
- Lovewell
- Meade
- Milford
- Mushroom Rock
- Perry
- Pomona
- Prairie Dog
- Prairie Spirit Trail
- Sand Hills
- Scott
- Tuttle Creek
- Webster
- Wilson

State and Federal Trails

There are 15 National Recreation Trails in Kansas (National Recreation Trails, 2015b). "National Recreation Trails may be designated by the Secretary of Interior or the Secretary of

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

Agriculture to recognize exemplary trails of local and regional significance in response to an application from the trail's managing agency or organization" (National Recreation Trails, 2015c). In Wyoming, several federal agencies or local governments manage the trails. The names, miles of trails and managing agency are listed in Table 7.1.8-2.

The Kansas River Water Trail is the second National Water Trail inducted into the system of National Water Trails (NPS, 2014b). Designation of the water trails is the same process as National Recreation Trails. The Kansas River Water Trail spans 173 through Kansas from Junction City to the confluence of the Missouri River (NPS, 2015j).

Table 7.1.8-2: National Recreation Trails

Name and Managing Agency	Miles
Buffalo Track Canyon Trail (State)	1.50
Burr Oak Nature Trail (USACE)	0.75
Dornwood Park Nature Trail (Topeka)	7.00
Elk River Hiking Trail (USACE)	15.00
Fort Leavenworth-Gateway (Fort Leavenworth Military Reservation)	30.00
Gary L. Haller Trail (Johnson County)	17.50
George O. Latham Jr. Trail (USACE)	4.30
International Forest of Friendship (Atchison)	0.60
Kaw River Trail (Lawrence)	14.0
Perry Lake Trail (USACE)	30.00
Pioneer Nature Trail (USACE)	1.25
Post Oak Nature Trail (Kansas)	0.70
Sand Creek Trail (Bethel College)	2.00
Table Mound Hiking Trail (Kansas)	2.80
Woodard Nature Trail (Dillon Nature Center)	3.00
Total	**140.10**

Source: (National Recreation Trails, 2015b)

7.1.8.6. Natural Areas

The abundance of natural areas varies by state depending on the amount of public or state lands managed within each state. Although many natural areas may not be managed specifically for visual resources, these areas are allowed protection for their natural resources and the resulting management protects these scenic resources. Figure 7.1.8-2 identifies natural areas that may have sensitive visual resources.

National Wildlife Refuges and State Wildlife Management Areas

National Wildlife Refuges (NWRs) are a network of lands and waters managed by the USFWS. These lands and waters are set aside "for the conservation, management, and where appropriate, restoration of fish, wildlife, and plant resources and their habitats" (USFWS, 2015x). There are four NWRs in Kansas covering over 27,000 acres (Table 7.1.8-3).

Table 7.1.8-3: Kansas National Wildlife Refuges

Refuge	Acres	Visual Resources
Flint Hills	18,464	Wetlands, riparian areas, grasslands
Kirwin	10,778	Lake, river, wetlands, riparian areas, rolling hills
Marais des Cygnes	7,500	River, riparian forest, prairie
Quivira	22,135	Wetlands, salt marsh, sand dunes, prairie

Source: (USFWS, 2015y)

National Preserve

The Tallgrass Prairie National Preserve protects much of the remaining four percent of the tallgrass prairie within the state (about 11,000 acres) (Figure 7.1.8-3). Rolling hills, grassland, and cultural resources are protected within this NPS unit co-managed by The Nature Conservancy. (NPS, 2015k)

Figure 7.1.8-3: Tallgrass Prairie National Preserve

National Natural Landmarks

There are five National Natural Landmarks (NNL) in Kansas. NNLs are sites designated by the U.S. Secretary of the Interior that "contain outstanding biological and/or geological resources, regardless of land ownership, and are selected for their outstanding condition, illustrative value, rarity, diversity, and value to science and education" (NPS, 2014d). These landmarks may be considered visual resources or visually sensitive. These five NNLs in Kansas cover over 2,800 acres and are owned by private and state agencies. Table 7.1.8-4 displays a list of NNLs, their size, and some of the scenic resources protected within these areas (NPS, 2012b).

Table 7.1.8-4: National Natural Landmarks with Scenic Resources

National Natural Landmarks	Acres	Visual Resources
Baker University Wetlands	548	Wetlands, riparian forest
Baldwin Woods	243	Deciduous forest,
Big Basin Preserve	1,704	Geological features, grassland
Monument Rocks Natural Area	331	Geologic features, prairie
Rock City	16	Geologic features, wide open vistas

Source: (NPS, 2012b)

National Grasslands

There is one USFS National Grassland in Kansas. The Cimarron National Grassland is 108,175 acres in the southwestern corner of the state. The scenic resources include miles of wide-open vistas, rocky outcrops, rolling hills, riparian forest, and grasslands (USFS, 2015a).

7.1.8.7. Additional Areas

State and National Scenic Byways

National Scenic Byways are resources designated specifically for scenic or aesthetic areas or qualities which would be considered visual resources or visually sensitive. Kansas has two designated National Scenic Byways: the Flint Hills Scenic Byway and the Wetlands and Wildlife Scenic Byway (Figure 7.1.8-2) (FHWA, 2015b).

Figure 7.1.8-4: Wetlands and Wildlife Scenic Byway, Cheyenne Bottoms Wildlife Area near Hoisington, KS.

Source: (FHWA, 2015c)

Similar to National Scenic Byways, Kansas Byways are transportation corridors that are of particular statewide interest. There are nine state byways in addition to the two National Scenic Byways (Figure 7.1.8-2). The names of the nine Kansas Byways are given in Section 7.1.1.3. These routes highlight some of the most scenic areas in the state, including rolling hills of wildflowers, geologic features, buttes, canyons, rivers, and prairies. (Kansas Byways, 2015)

7.1.9. Socioeconomics

7.1.9.1. Definition of the Resource

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

The choice of socioeconomic topics and depth of their treatment depends on the relevance of potential topics to the types of federal actions under consideration. FirstNet's mission is to provide public safety broadband and interoperable emergency communications coverage throughout the nation. Relevant socioeconomic topics include population density and growth, economic activity, housing, property values, and state and local taxes. The financial arrangements for deployment and operation of the FirstNet network may have socioeconomic implications. Section 1.1 frames some of the public expenditure and public revenue considerations specific to FirstNet; however this is not intended to be either descriptive or prescriptive of FirstNet's financial model or anticipated total expenditures and revenues associated with the deployment of the Nationwide Public Safety Broadband Network (NPSBN). This socioeconomics section provides some additional, broad context, including data and discussion of state and local government revenue sources that FirstNet may affect.

Environmental justice is a related topic that specifically addresses the presence of minority populations (defined by race and Hispanic ethnicity) and low-income populations, in order to give special attention to potential impacts on those populations, per Executive Order 12898 (see Section 1.8, Overview of Relevant Federal Laws and Executive Orders). This PEIS addresses Environmental Justice in a separate section (Section 7.1.10). This PEIS also addresses the following topics, sometimes included within Socioeconomics, in separate sections: Land Use, Recreation and Airspace (Section 7.1.7), Infrastructure (Section 7.1.1), and aesthetic considerations in Visual Resources (Section 7.1.8).

Wherever possible, this section draws on nationwide datasets from federal sources such as the U.S. Census Bureau (Census Bureau)[109] and U.S. Bureau of Labor Statistics (BLS). This ensures consistency of data and analyses across the states examined in this PEIS. In all cases, this section uses the most recent data available for each geography at the time of writing. At the county, state, region, and United States levels, the data are typically for 2013 or 2014. For smaller geographic areas, this section uses data from the Census Bureau's American Community Survey (ACS). The ACS is the Census Bureau's flagship demographic estimates program for years other than the decennial census years. This PEIS uses the 2009-2013 ACS, which is based on surveys (population samples) taken across that five-year period; thus, it is not appropriate to attribute its data values to a specific year. It is a valuable source because it provides the most accurate and consistent socioeconomic data across the nation at the sub-county level (U.S. Census Bureau, 2016).

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

7.1.9.2. Specific Regulatory Considerations

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

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

7.1.9.3. Communities and Populations

This section discusses the population and major communities of Kansas 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.

Statewide Population and Population Growth

Population growth is an important aspect for this PEIS given FirstNet's mission. Table 7.1.9-1 presents the 2014 estimated population and population density of Kansas in comparison to the Central region[110] and the nation. The estimated population of Kansas in 2014 was 2,911,641. The population density was 36 persons per square mile (sq. mi.), which is considerably lower than the population density of both the region (66 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, Kansas was the 34th largest state by estimated population among the 50 states and the District of Columbia, 13th largest by land area, and had the 42nd greatest population density (U.S. Census Bureau, 2015a; U.S. Census Bureau, 2015b).

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

Geography	Land Area (sq. mi.)	Estiamted Population 2014	Population Density 2014 (persons/sq. mi.)
Kansas	81,759	2,911,641	36
Central Region	1,178,973	77,651,608	66
United States	3,531,905	318,857,056	90

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

Estimated population growth is an important subject for this PEIS, given FirstNet's mission. Table 7.1.9-2 presents the population growth trends of Kansas from 2000 to 2014 in comparison to the Central region and the nation. The state's annual growth rate decreased, from 0.60 percent to 0.44 percent, in the 2010 to 2014 period compared to 2000 to 2010. The growth rate of Kansas nearly matched the rate of the region (0.45 percent) and was considerably lower than the nation's rate (0.81 percent).

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

Table 7.1.9-2: Recent Population Growth of Kansas

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
Kansas	2,688,418	2,853,118	2,904,021	164,700	50,903	0.60%	0.44%
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, 2015c; U.S. Census Bureau, 2015a)
AARC = Average Annual Rate of Change (compound growth rate)

Demographers prepare future estimated population projections using various population growth modeling methodologies. For this nationwide PEIS, it is important to use estimated population projections that apply the same methodology across the nation. It is also useful to consider projections that use different methodologies, since no methodology is a perfect predictor of the future. The Census Bureau does not prepare population projections for the states. Therefore, Table 7.1.9-3 presents projections of the 2030 population from two sources that are national in scope and use different methodologies: the University of Virginia's Weldon Cooper Center for Public Service and ProximityOne, a private sector demographic and economic data and analysis service. The table provides figures for numerical change, percentage change, and annual growth rate based on averaging the projections from the two sources. The average projection indicates Kansas's estimated population will increase by approximately 374,000 people, or 12.9 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 0.76 percent, which is considerably higher than the historical growth rate from 2010 to 2014 of 0.44 percent. The projected growth rate of the state is higher than that of the region (0.60 percent) and somewhat less than the projected growth rate of the nation (0.80 percent).

Table 7.1.9-3: Projected Estimated Population Growth of Kansas

Geography	Estimated Population 2014	Projected 2030 Estimated Population			Change Based on Average Projection		
		University of Virginia (UVA) Weldon Cooper Center Projection	Proximity One Projection	Average Projection	Numerical Change 2014 to 2030	Percent Change 2014 to 2030	Rate of Change (AARC) 2014 to 2030
Kansas	2,904,021	3,156,962	3,398,309	3,277,636	373,615	12.9%	0.76%
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, 2015a; ProximityOne, 2015; UVA Weldon Cooper Center, 2015)
AARC = Average Annual Rate of Change (compound growth rate)

Population Distribution and Communities

Figure 7.1.9-1 presents the distribution and relative density of the estimated population of Kansas. 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, 2015d).

This map also presents the 10 largest population concentrations in the state, outlined in purple. These population concentrations reflect contiguous, densely developed areas as defined by the Census Bureau based on the 2010 census (U.S. Census Bureau, 2012b; U.S. Census Bureau, 2015e). These population concentrations often include multiple incorporated areas as well as some unincorporated areas.

Other groupings of brown dots on the map represent additional, but smaller, population concentrations. Dispersed dots indicate dispersed population across the less densely settled areas of the state. The northwestern portion of the state, north of the Garden City area, is very sparsely populated area.

Table 7.1.9-4 provides the populations of the 10 largest population concentrations in Kansas, based on the 2010 census. It also shows the changes in population for these areas between the 2000 and 2010 censuses.[111] In 2010, the largest population concentration was the Kansas portion of the Kansas City area, which had 663,508 people. The state had no other population concentrations over 500,000. It had two areas (the Wichita and Topeka areas) with populations between 100,000 and 500,000. The smallest of these 10 population concentrations was the Garden City area, with a 2010 population of 29,942. The fastest growing area, by average annual rate of change from 2000 to 2010, was the Junction City area, with an annual growth rate of 2.28 percent. The Garden City area experienced a population decline during this period.

Table 7.1.9-4 also shows that the top 10 population concentrations in Kansas accounted for 57.3 percent of the state's population in 2010. Further, population growth in the 10 areas from 2000 to 2010 amounted to 111.4 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.

[111] Census Bureau boundaries for these areas are not fixed. Area changes from 2000 to 2010 may include accretion of newly developed areas into the population concentration, Census Bureau classification of a subarea as no longer qualifying as a concentrated population due to population losses, and reclassification by the Census Bureau of a subarea into a different population concentration. Thus, population change from 2000 to 2010 reflects change within the constant area and change as the overall area boundary changes. Differences in boundaries in some cases introduce anomalies in comparing the 2000 and 2010 populations and in calculation of the growth rate presented in the table.

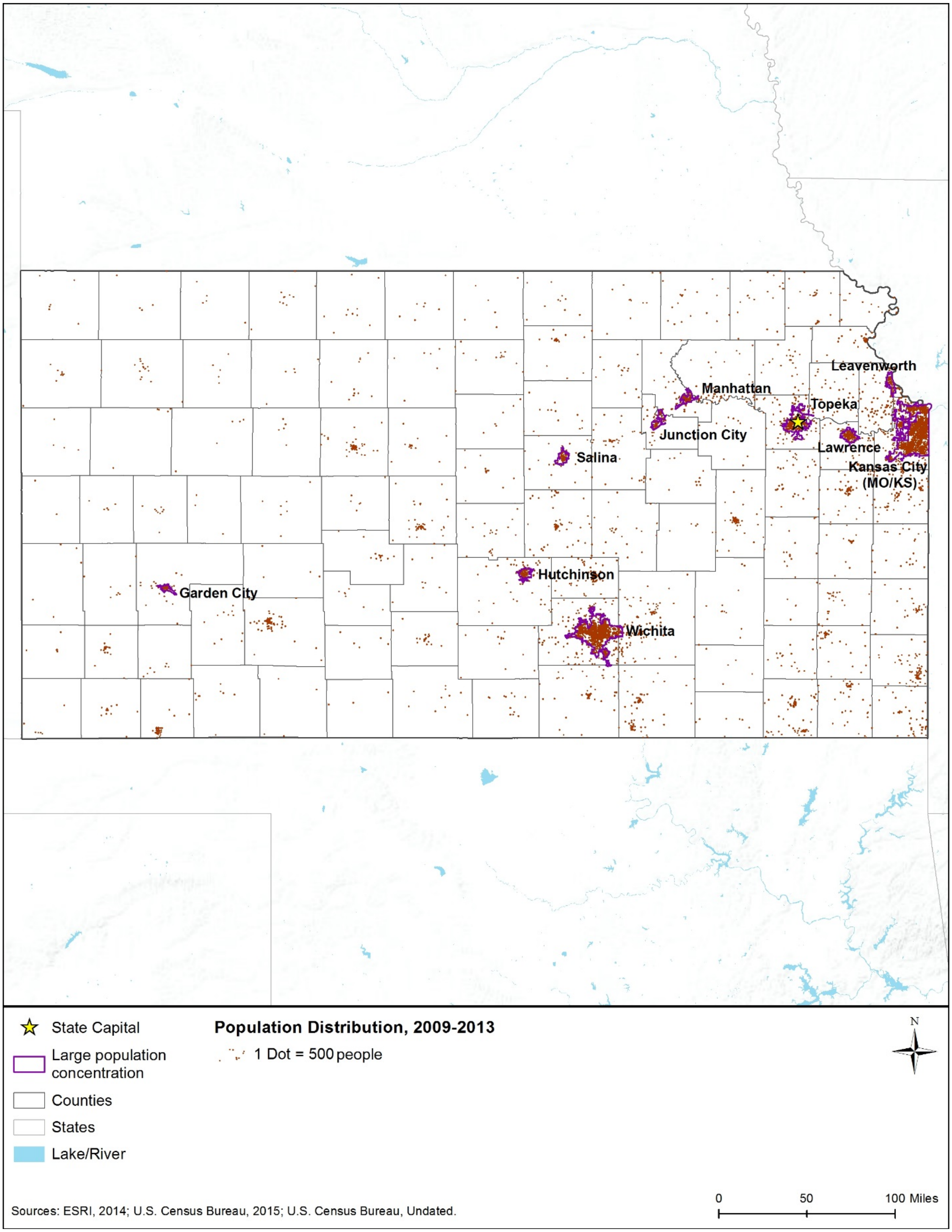


Figure 7.1.9-1: Estimated Population Distribution in Kansas, 2009–2013

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

Area	Population				Population Change 2000 to 2010	
	2000	2010	2009–2013	Rank in 2010	Numerical Change	Rate (AARC)
Garden City	33,142	29,942	29,692	10	(3,200)	-1.01%
Hutchinson	44,052	44,320	43,814	8	268	0.06%
Junction City	30,962	38,787	39,160	9	7,825	2.28%
Kansas City (MO/KS) (KS Portion)	562,451	663,508	671,855	1	101,057	1.67%
Lawrence	79,647	88,053	89,453	4	8,406	1.01%
Leavenworth	44,113	45,283	44,333	7	1,170	0.26%
Manhattan	46,671	54,622	56,267	5	7,951	1.59%
Salina	45,654	47,493	47,504	6	1,839	0.40%
Topeka	142,411	150,003	149,248	3	7,592	0.52%
Wichita	422,301	472,870	475,541	2	50,569	1.14%
Total for Top 10 Population Concentrations	**1,451,404**	**1,634,881**	**1,646,867**	**NA**	**183,477**	**1.20%**
Kansas (statewide)	**2,688,418**	**2,853,118**	**2,868,107**	**NA**	**164,700**	**0.60%**
Top 10 Total as Percentage of State	**54.0%**	**57.3%**	**57.4%**	**NA**	**111.4%**	**NA**

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

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

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

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

Social institutions – educational, family, political, public service, military, and religious – are present throughout the state. The institutions most relevant to FirstNet projects are public services such as medical and emergency medical services and facilities. This PEIS addresses public services in Section 7.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 7.1.9-5 compares several economic indicators for Kansas to the Central region and the nation. The table presents two indicators of income[112] – per capita and median household – as income is a good measure of general economic health of a region.

Per capita income is total income divided by the total population. As a mathematical average, the very high incomes of a relatively small number of people tend to bias per capita income figures upwards. Nonetheless, per capita income is useful as an indicator of the relative income level across two or more areas. As shown in Table 7.1.9-5, the per capita income in Kansas in 2013 ($27,175) was $353 lower than that of the region ($27,528), and $1,009 lower than that of the nation ($28,184).

Household income is a useful measure, and often used instead of family income, because in modern society there are many single-person households and households composed of non-related individuals. Median household income (MHI) is the income at which half of all households have higher income, and half have lower income. Table 7.1.9-5 shows that in 2013, the MHI in Kansas ($50,892) was $1,153 lower than that of the region ($52,045), and $1,358 lower than that of the nation ($52,250).

Employment status is a key socioeconomic parameter because employment is essential to the income of a large portion of the adult population. The federal government calculates the unemployment rate as the number of unemployed individuals who are looking for work divided by the total number of individuals in the labor force. Table 7.1.9-5 compares the unemployment rate in Kansas to the Central region and the nation. In 2014, Kansas's statewide unemployment rate of 4.5 percent was considerably lower than the rate for the region (5.7 percent) and the nation (6.2 percent).[113]

Table 7.1.9-5: Selected Economic Indicators for Kansas

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
Kansas	$27,175	$50,892	4.5%
Central Region	$27,528	$52,045	5.7%
United States	$28,184	$52,250	6.2%

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

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

[113] This timeframe for unemployment rates can change quarterly.

Figure 7.1.9-2 and Figure 7.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015i) and unemployment in 2014 (BLS, 2015b) varied by county across the state. These maps also incorporate the same population concentration data as Figure 7.1.9-1 (U.S. Census Bureau, 2012b; U.S. Census Bureau, 2015e). Following these two maps, Table 7.1.9-6 presents MHI and unemployment for the 10 largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to those on the maps. Nonetheless, both the maps and the table help portray differences in income and unemployment across Kansas.

Figure 7.1.9-2 shows that, in general, counties with a MHI above the national median were located in the northeastern portions of the state. Most of the remainder of the state had MHI levels below the national average. Table 7.1.9-6 shows that MHI in the Kansas portion of the Kansas City area and the Leavenworth area was above the state average ($51,332). MHI in all other population concentrations was below the state average. MHI was lowest in the Hutchinson area at $40,787, and highest in the Kansas City area (Kansas portion) at $64,902.

Figure 7.1.9-3 presents variations in the 2014 unemployment rate across the state, by county. It shows that the vast majority of counties in Kansas had unemployment rates below the national average (that is, better employment performance). When comparing unemployment in the population concentrations to the state average (Table 7.1.9-6), only the Garden City, Manhattan, and Salina areas had 2009–2013 unemployment rates that were lower than the state average (7.0 percent). Unemployment was lowest in the Garden City area (4.1 percent) and highest in the Junction City area (9.2 percent).

Detailed employment data provides useful insights into the nature of a local, state, or national economy. Table 7.1.9-7 provides figures on employment percentages by type of worker and by industry based on surveys conducted in 2013 by the Census Bureau. By class of worker (type of worker: private industry, government, self-employed, etc.), the percentage of private wage and salary workers was slightly lower in Kansas than in the Central region and the nation. The percentage of government workers was higher in the state than in the region and nation, while the percentage of self-employed workers in the state matched the nation's rate.

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

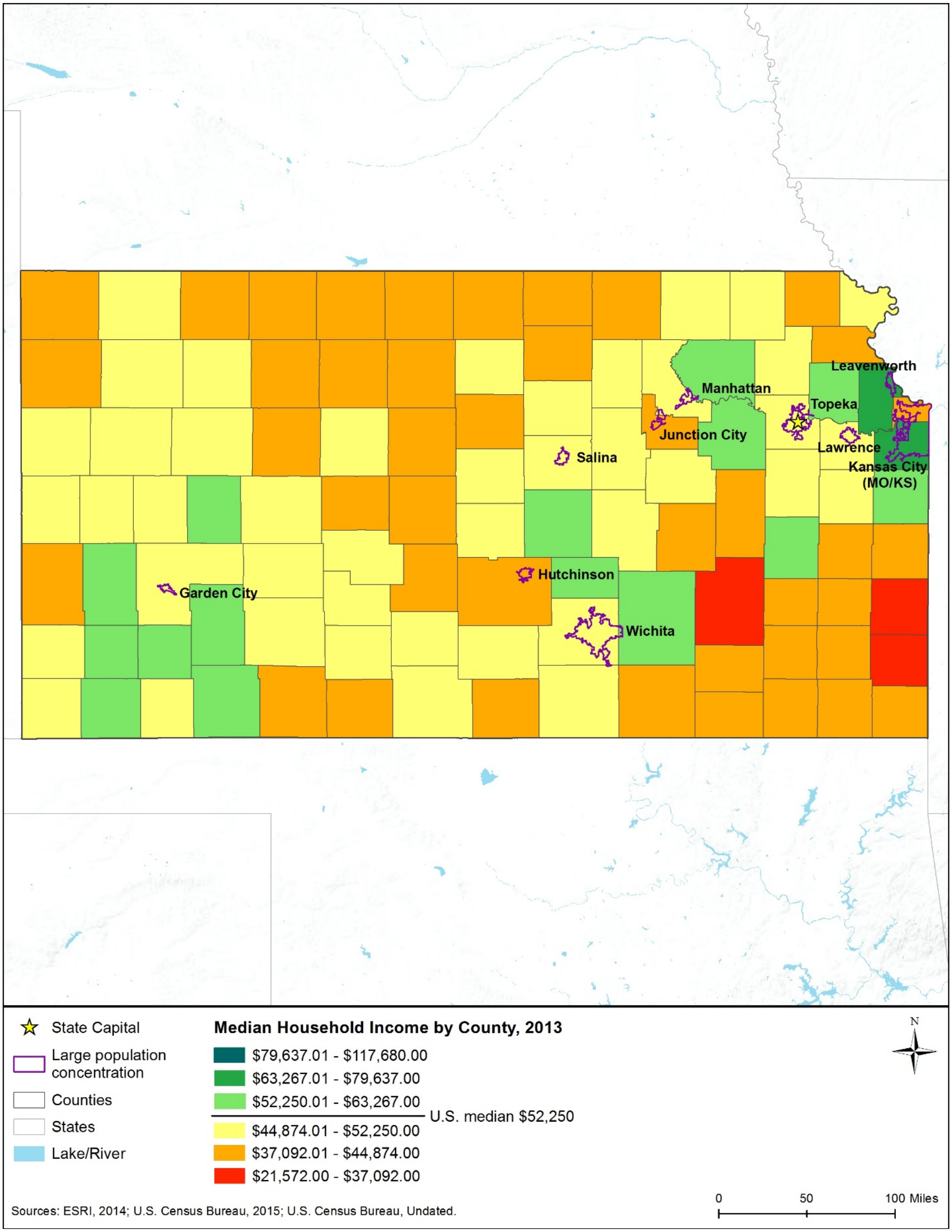


Figure 7.1.9-2: Median Household Income in Kansas, by County, 2013

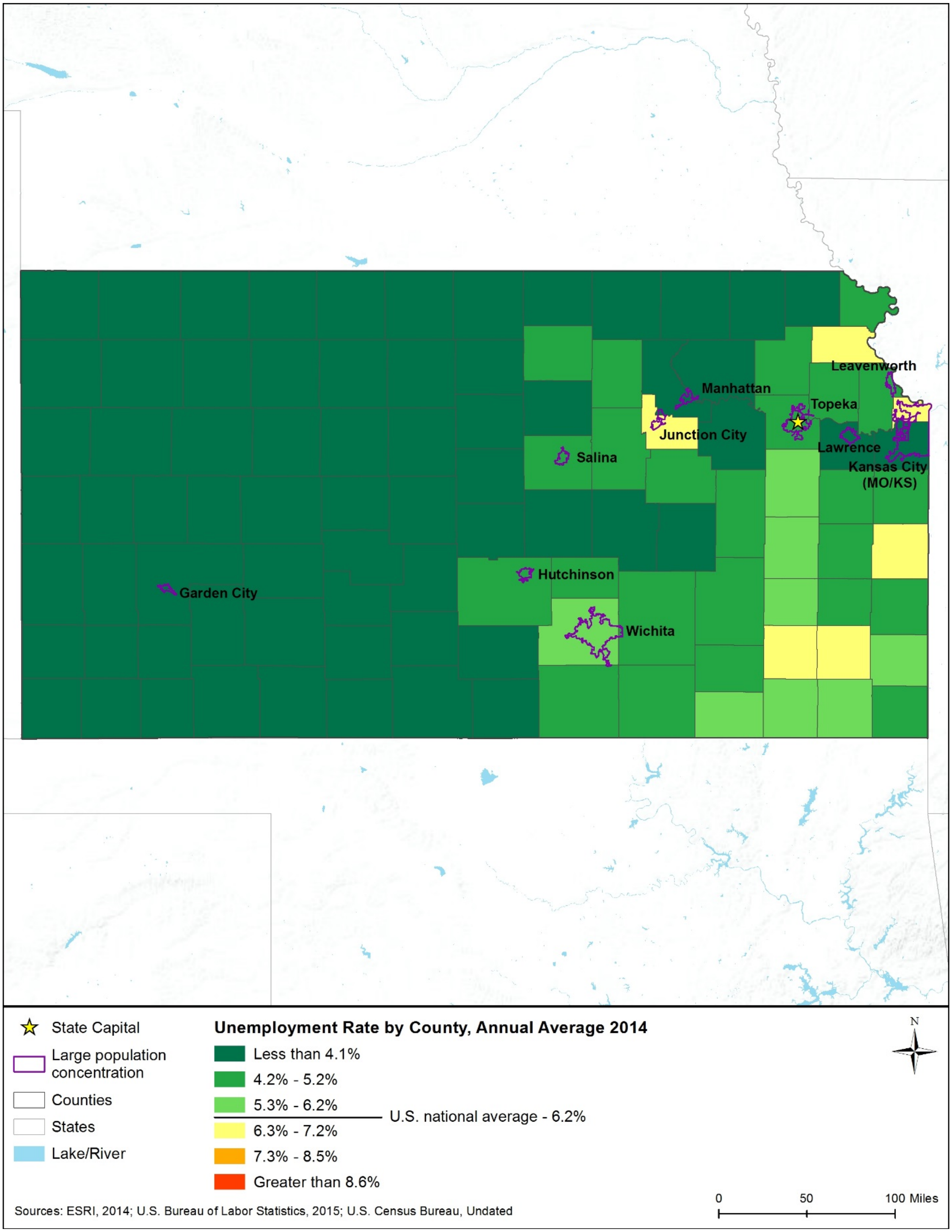


Figure 7.1.9-3: Unemployment Rates in Kansas, by County, 2014

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

Area	Median Household Income	Average Annual Unemployment Rate
Garden City	$45,168	4.1%
Hutchinson	$40,787	7.4%
Junction City	$44,349	9.2%
Kansas City (MO/KS) (KS Portion)	$64,902	7.0%
Lawrence	$45,525	7.2%
Leavenworth	$55,863	9.0%
Manhattan	$42,945	4.3%
Salina	$43,798	6.8%
Topeka	$44,674	8.5%
Wichita	$48,885	9.0%
Kansas (statewide)	$51,332	7.0%

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

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

Class of Worker and Industry	Kansas	Central Region	United States
Civilian Employed Population 16 Years and Over	1,399,578	36,789,905	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	78.3%	81.7%	79.7%
Government workers	15.6%	12.8%	14.1%
Self-employed in own not incorporated business workers	6.0%	5.3%	6.0%
Unpaid family workers	0.1%	0.2%	0.2%
Percentage by Industry			
Agriculture, forestry, fishing and hunting, and mining	3.6%	2.2%	2.0%
Construction	6.1%	5.6%	6.2%
Manufacturing	13.4%	14.0%	10.5%
Wholesale trade	2.7%	2.7%	2.7%
Retail trade	11.0%	11.5%	11.6%
Transportation and warehousing, and utilities	4.7%	4.9%	4.9%
Information	2.1%	1.9%	2.1%
Finance and insurance, and real estate and rental and leasing	5.9%	6.5%	6.6%
Professional, scientific, management, administrative, and waste management services	9.1%	9.7%	11.1%
Educational services, and health care and social assistance	24.5%	23.4%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	8.0%	9.1%	9.7%
Other services, except public administration	4.3%	4.6%	5.0%
Public administration	4.5%	3.9%	4.7%

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

Table 7.1.9-8 presents employment shares for selected industries for the 10 largest population concentrations in the state. The table reflects survey data taken by the Census Bureau from 2009 to 2013. Thus, its figures for the state are slightly different from those in Table 7.1.9-7 for 2013.

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

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Garden City	6.5%	5.8%	0.9%	4.8%
Hutchinson	7.4%	4.2%	2.2%	8.1%
Junction City	6.0%	3.6%	0.6%	8.8%
Kansas City (MO/KS) (KS Portion)	5.4%	4.5%	3.8%	14.4%
Lawrence	3.4%	2.1%	3.2%	9.6%
Leavenworth	4.0%	4.1%	1.3%	8.4%
Manhattan	5.4%	1.9%	1.4%	6.5%
Salina	4.9%	4.6%	1.2%	6.8%
Topeka	5.4%	4.7%	2.0%	8.9%
Wichita	6.2%	4.1%	1.7%	8.6%
Kansas (statewide)	6.3%	4.7%	2.3%	8.6%

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

Housing

The housing stock is an important socioeconomic component of communities. The type, availability, and cost of housing in an area reflect economic conditions and affect quality of life. Table 7.1.9-9 compares Kansas to the Central region and nation on several common housing indicators.

As shown in Table 7.1.9-9, in 2013, Kansas had a higher percentage of housing units that were occupied (89.8 percent) than the region (88.4 percent) or nation (87.6 percent). Of the occupied units, Kansas had a slightly lower percentage of owner-occupied units (66.1 percent) than the region (67.6 percent), and a higher percentage than the nation (63.5 percent). This is reflected in the higher percentage of detached single-unit housing (also known as single-family homes) in Kansas in 2013 (72.3 percent) compared to the region (67.7 percent) and nation (61.5 percent). The homeowner vacancy rate in Kansas (1.9 percent) was similar to the rate for the region (1.8 percent) and matched the rate for the nation (1.9 percent). This rate reflects "vacant units that are 'for sale only'" (U.S. Census Bureau, 2015h). The vacancy rate among rental units was slightly higher in Kansas (6.5 percent) than in the region (6.0 percent), and matched the nation's rate (6.5 percent).

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

Geography	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Kansas	1,239,755	89.8%	66.1%	1.9%	6.5%	72.3%
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, 2015n)

Table 7.1.9-10 provides housing indicators for the largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to the more recent data in the previous table. However, it does present variation in these indicators for population concentrations across the state and compared to the state average for the 2009 to 2013 period.

Table 7.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in Kansas, 2009–2013

Area	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
Garden City	10,626	94.9%	61.2%	0.9%	5.5%	65.4%
Hutchinson	19,667	91.7%	61.4%	1.3%	5.2%	74.6%
Junction City	14,562	85.6%	37.9%	5.0%	8.1%	44.4%
Kansas City (MO/KS) (KS Portion)	279,316	93.0%	67.1%	1.7%	6.3%	67.2%
Lawrence	37,552	92.3%	46.0%	2.8%	5.6%	48.4%
Leavenworth	16,780	89.8%	54.4%	3.6%	6.5%	66.1%
Manhattan	22,982	91.6%	40.2%	1.9%	7.9%	42.9%
Salina	20,663	92.0%	64.1%	0.6%	5.7%	71.3%
Topeka	67,584	91.1%	59.9%	2.2%	7.8%	66.8%
Wichita	202,948	90.6%	63.7%	2.2%	7.9%	69.8%
Kansas (statewide)	1,235,485	89.9%	67.5%	2.0%	7.0%	72.7%

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

Property Values

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

Table 7.1.9-11 provides indicators of residential property values for Kansas and compares these values to values for the Central region and nation. The figures on median value of owner-occupied units are from the Census Bureau's ACS, based on owner estimates of how much their property (housing unit and land) would sell for if it were for sale (U.S. Census Bureau, 2015h).

The table shows that the median value of owner-occupied units in Kansas in 2013 ($129,700) was lower than the corresponding values for the Central region ($151,200) and the nation ($173,900).

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

Geography	Median Value of Owner-Occupied Units
Kansas	$129,700
Central Region	$151,200
United States	$173,900

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

Table 7.1.9-12 presents residential property values for the largest population concentrations in the state. The table reflects survey data taken from 2009 to 2013. Thus, its figures are not directly comparable to the more recent data in the previous table. However, it does show variation in property values for population concentrations across the state and compared to the state average for the 2009 to 2013 period. The median property value for these 10 communities ranged from $189,200 in the Kansas portion of the Kansas City area to $89,100 in the Hutchinson area; the statewide value was $128,400. The lowest value was in the same area – Hutchinson – that had the lowest median household income (Table 7.1.9-6).

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

Area	Median Value of Owner-Occupied Units
Garden City	$103,900
Hutchinson	$89,100
Junction City	$128,900
Kansas City (MO/KS) (KS Portion)	$189,200
Lawrence	$179,000
Leavenworth	$131,700
Manhattan	$180,100
Salina	$113,600
Topeka	$107,500
Wichita	$122,100
Kansas (statewide)	$128,400

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

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 7.1.9-13 presents total and selected state and local government revenue sources as reported by the Census Bureau's 2012 Census of Governments. It provides both total dollar figures (in millions of dollars) and figures per capita (in dollars), based on total population for each geography. The per capita figures are particularly useful in comparing the importance of certain revenue sources in the state relative to other states in the region and the nation. State and local governments may obtain some additional revenues related to telecommunications infrastructure.

The state government in Kansas received less total revenue in 2012 on a per capita basis than its counterpart governments in the region and nation, while Kansas local governments obtained more total revenue per capita than counterparts in the region and less than counterparts in the nation. The Kansas state and local governments had lower levels per capita of intergovernmental revenues from the federal government[114] than counterpart governments. The state government in Kansas obtained lower levels of property taxes per capita than its counterparts in the region and nation. Local governments in Kansas obtained substantially higher levels of property taxes, per capita, than local governments in the region, and similar levels to local governments in the nation.

The Kansas state and local governments reported higher revenue from general sales taxes than their counterparts in the region and nation. The Kansas state government reported lower revenue from selective sales taxes on a per capita basis than its counterparts in the region, and nation. Local governments in Kansas reported higher levels of per capita selective sales taxes revenues compared to those reported by local governments in the region, and slightly lower levels compared to counterpart governments in the nation. The state government in Kansas reported no revenue from public utility taxes. Public utility taxes on a per capita basis were considerably higher for local governments in Kansas than for their counterparts in the region and nation. Revenue from individual income tax revenues, on a per capita basis, were higher for the Kansas state government than for state governments in the region and nation. Local governments in Kansas reported minimal levels of individual income tax revenues. The state government in Kansas reported slightly lower levels of corporate income tax revenues, on a per capita basis, than its counterparts in the region and nation. Local governments in Kansas did not report any corporate income tax revenues.

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

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

Type of Revenue		Kansas		Region		United States	
		State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue	**($M)**	$16,144	$13,864	$463,192	$231,980	$1,907,027	$1,615,194
	Per capita	$5,594	$4,804	$6,020	$3,015	$6,075	$5,145
Intergovernmental from Federal	($M)	$4,061	$271	$125,394	$9,383	$514,139	$70,360
	Per capita	$1,407	$94	$1,630	$122	$1,638	$224
Intergovernmental from State	($M)	$0	$3,810	$0	$76,288	$0	$469,147
	Per capita	$0	$1,320	$0	$992	$0	$1,495
Intergovernmental from Local	($M)	$38	$0	$2,721	$0	$19,518	$0
	Per capita	$13	$0	$35	$0	$62	$0
Property Taxes	($M)	$74	$3,851	$3,626	$61,015	$13,111	$432,989
	Per capita	$26	$1,335	$47	$793	$42	$1,379
General Sales Taxes	($M)	$2,826	$889	$58,236	$6,920	$245,446	$69,350
	Per capita	$979	$308	$757	$90	$782	$221
Selective Sales Taxes	($M)	$860	$244	$33,313	$2,191	$133,098	$28,553
	Per capita	$298	$85	$433	$28	$424	$91
Public Utilities Taxes	($M)	$0	$214	$3,627	$1,153	$14,564	$14,105
	Per capita	$0	$74	$47	$15	$46	$45
Individual Income Taxes	($M)	$2,892	$2	$72,545	$5,148	$280,693	$26,642
	Per capita	$1,002	$1	$943	$67	$894	$85
Corporate Income Taxes	($M)	$318	$0	$9,649	$310	$41,821	$7,210
	Per capita	$110	$0	$125	$4	$133	$23

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

7.1.10. Environmental Justice

7.1.10.1. Definition of the Resource

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

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

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).

7.1.10.2. Specific Regulatory Considerations

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

7.1.10.3. Environmental Setting: Minority and Low-Income Populations

Table 7.1.10-1 presents 2013 data on the composition of Kansas's estimated population by race and by Hispanic origin. The state's estimated population has lower percentages of individuals who identify as Black / African American (5.8 percent), Asian (2.5 percent), or Some Other Race (1.9 percent) than the estimated populations of the Central region and the nation. Those percentages are, for Black / African American, 9.3 percent for the Central region and 12.6 percent for the nation; for Asian, 2.8 percent and 5.1 percent respectively; and for Some Other Race, 2.4 percent and 4.7 percent respectively. The state's estimated population of persons identifying as White (85.6 percent) is larger than that of the Central region (82.2 percent) and the nation (73.7 percent).

The percentage of the estimated population in Kansas that identifies as Hispanic (11.1 percent) is larger than in the Central region (8.5 percent), and considerably smaller than in the nation (17.1 percent). Hispanic origin is a different category than race; persons of any race may identify as also being of Hispanic origin.

The category All Minorities consists of all persons who consider themselves Hispanic or of any race other than White. Kansas's All Minorities estimated population percentage (22.9 percent) is lower than that of the Central region (23.3 percent) and considerably lower than that of the nation (37.6 percent).

Table 7.1.10-2 presents the percentage of the estimated population living in poverty in 2013, for the state, region, and nation. The figure for Kansas (14.0 percent) is somewhat lower than those for the Central region (14.7 percent) and the nation (15.8 percent).

Table 7.1.10-1: 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		
Kansas	2,893,957	85.6%	5.8%	0.8%	2.5%	0.0%	1.9%	3.3%	11.1%	22.9%
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, 2015r)
"All Minorities" is defined as all persons who consider themselves Hispanic or of any race other than White. Because some Hispanics identify as both Hispanic and of a non-White race, "All Minorities" is less than the sum of Hispanics and non-White races.

Table 7.1.10-2: Percentage of Estimated Population (Individuals) in Poverty, 2013

Geography	Percent Below Poverty Level
Kansas	14.0%
Central Region	14.7%
United States	15.8%

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

7.1.10.4. Environmental Justice Screening Results

Analysis of environmental justice in a NEPA document typically begins by identifying potential environmental justice populations in the project area. Appendix D, Environmental Justice Methodology, presents the methodology 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 7.1.10-1 visually portrays the results of the environmental justice population screening analysis for Kansas. The analysis used block group data from the Census Bureau's American Community Survey 2009-2013 5-Year Estimates (U.S. Census Bureau, 2015d; U.S. Census

Bureau, 2015t; U.S. Census Bureau, 2015u; U.S. Census Bureau, 2015v) and Census Bureau urban classification data (U.S. Census Bureau, 2012b; U.S. Census Bureau, 2015e)

Figure 7.1.10-1 shows that Kansas has many areas with high potential for environmental justice populations. However, a smaller proportion of the state's land area is classified in this category compared to many other states. The distribution of these high potential areas is fairly even across the state, and occurs both within and outside of the 10 largest population concentrations. This includes some of the state's most sparsely populated areas, such as areas in the northwestern portions of the state, north of the Garden City area. The distribution of areas with moderate potential for environmental justice populations is also fairly even across the state.

It is important to understand how the data behind Figure 7.1.10-1 affect the visual impact of this map. Block groups have similar populations (hundreds to a few thousand individuals) regardless of population density. In sparsely populated areas, a single block group may cover tens or even hundreds of square miles, while in densely populated areas, block groups each cover much less than a single square mile. Thus, while large portions of the state outside the areas defined as large population concentrations show moderate or high potential for environmental justice populations, these low density areas reflect modest numbers of minority or low-income individuals compared to the potential environmental justice populations within densely populated areas. The overall effect of this relative density phenomenon is that the map visually shows large areas of the state having environmental justice potential, but this over-represents the presence of environmental justice populations.

It is also very important to note that Figure 7.1.10-1 does not definitively identify environmental justice populations. It indicates degrees of likelihood of the presence of populations of potential concern from an environmental justice perspective. Two caveats are important. First, environmental justice communities are often highly localized. Block group data may under- or over-represent the presence of these localized communities. For instance, in the large block groups in sparsely populated regions of the state, the data may represent dispersed individuals of minority or low-income status rather than discrete, place-based communities. Second, the definition of the moderate potential category draws a wide net for potential environmental justice populations. As discussed in Appendix D, the definition includes some commonly used thresholds for environmental justice screening that tend to over-identify environmental justice potential. 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 Chapter (Chapter 7.2) addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

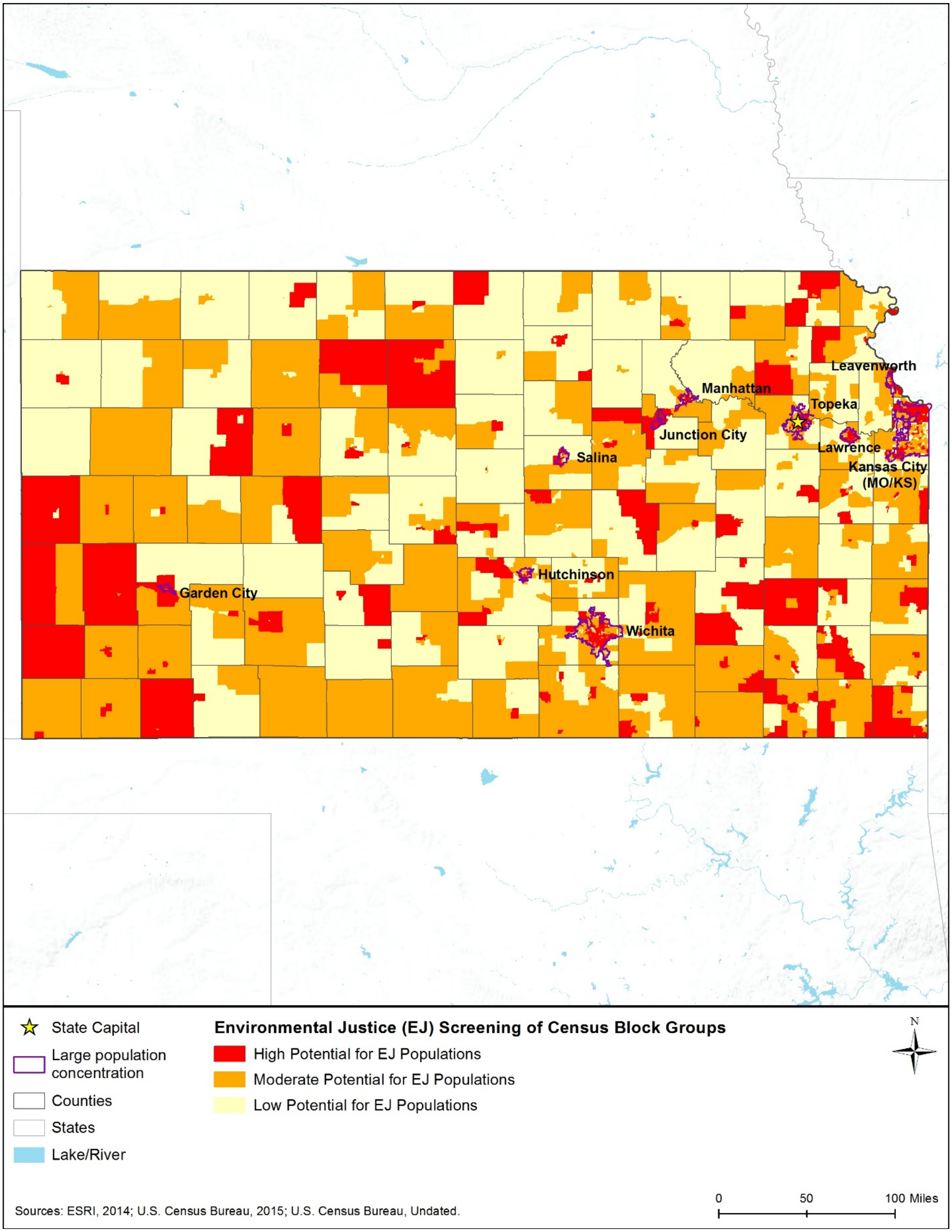


Figure 7.1.10-1: Potential for Environmental Justice Populations in Kansas, 2009–2013

7.1.11. Cultural Resources

7.1.11.1. Definition of Resource

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

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

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

- The statutory language and implementing regulations for Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA), formerly 16 U.S.C. 470a(d)(6)(A) (now 54 U.S.C. 306131(b)) and 36 CFR 800.16(l)(1);
- The 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);
- The 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, 2015d); and
- Advisory Council on Historic Preservation's (ACHP) guidance for protection and preservation of sites and artifacts with traditional religious and cultural importance to Indian tribes or Native Hawaiian organizations (Advisory Council on Historic Preservation, 2004).

7.1.11.2. Specific Regulatory Considerations

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, ARPA, and NAGPRA. Appendix C, Environmental Laws and Regulations, summarizes these pertinent federal laws.

Kansas does not have a state regulation that is similar to the NHPA or NEPA (refer to Table 7.1.11-1). While federal agencies may take into account compatible state laws and regulations, their actions that are subject to federal environmental review under NEPA and NHPA are not subject to compliance with such state laws and regulations. Table 7.1.11-1 presents state and local laws and regulations that relate to cultural resources.

Table 7.1.11-1: Relevant Kansas Cultural Resources Laws and Regulations

State Law / Regulation	Regulatory Agency	Applicability
75-2715. Historic Preservation	State Historical Society	Establishes the State Historical Society as the Kansas State Historic Preservation Office (SHPO).

7.1.11.3. Cultural and Natural Setting

Human beings have inhabited the Kansas area for at least 13,000 years (Kansas Historical Society, 2014). The majority of early human habitation evidence in Kansas 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 82 archaeological site listed on the NRHP: 18 are historic; 61 are prehistoric; and 3 have both historical and prehistoric provenience (NPS, 2014e).

Archaeologists typically divide large study areas into regions. Nearly all of Kansas is in the Interior Plains physiographic region (Figure 7.1.3-1). A small portion of the southeast corner of the state is part of the Interior Highlands physiographic region. The Interior Plains further divided into the Physiographic Province of the Central Lowland, Great Plains, and the Ozark Plateaus as shown in Section 7.1.3.3 of this document.

Evidence from most archeological sites in Kansas are in relatively shallow deposits either on the surface or within one to two feet of the surface. However, in some cases, natural factors have buried sites beneath multiple layers of sediment or organic materials, such as in floodplain deposits found along streams and rivers or peat deposits in wetlands. These alluvial deposits can range between one and ten feet below the current surface, with older sites in the deeper sediments. Disturbed ground, including urban areas, may contain archaeological resources in deeper or shallower strata than undisturbed areas (Grosser, 1973; Pauketat, 2012).

The following sections provide additional detail about Kansas' prehistoric periods of (approximately 11000 B.C. to A.D. 1500) and the historic period since European colonization in the 1600s. There is some overlap between the prehistoric period and the historic period, as American Indians continued to carry on their way of life in parts of Kansas after European contact. Section 7.1.11.4 presents an overview of the initial human habitation in Kansas and the cultural development that occurred before European contact. Section 7.1.11.5 discusses the federally recognized American Indian Tribes with a cultural affiliation to the state. Section 7.1.11.6 provides a current list of significant archaeological sites in Kansas and tools that the state has developed to ensure their preservation. Section 7.1.11.7 documents the historic context of the state since European contact, and Section 7.1.11.8 summarizes the architectural context of the state during the historic period.

7.1.11.4. Prehistoric Setting

Archaeologists divide Kansas' prehistoric past into four periods: The Paleoindian Period (11000 - 7000 B.C.), Archaic Period (7000 B.C. - A.D. 1), Woodland Period (A.D. 1 - 1000), and the Village Gardener Period (A.D. 1000 - 1500) (Kansas Historical Society, 2014). Figure 7.1.11-1 shows a timeline representing these periods of early human habitation of present day Kansas. The state is part of the Interior Plains archaeological culture of North America. 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 Kansas' 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).

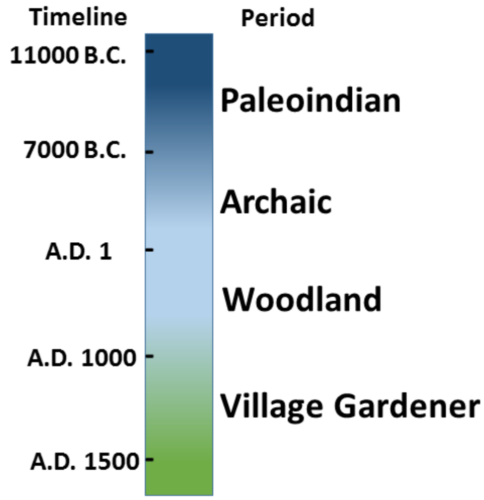


Figure 7.1.11-1: Timeline of Prehistoric Human Occupation

Sources: (Institute of Maritime History, 2015; Kansas Historical Society, 2014)

Paleoindian Period (11000 - 7000 B.C.)

The Paleoindian Period represents the earliest human habitation of Kansas. The earliest people to occupy the state were small groups of nomadic hunters and gatherers that used chipped-stone tools, including the "fluted javelin head" arrow and spear points, also referred to as the Clovis or Folsom fluted point. Studies show that that such technology was prevalent in northeastern Asia, the Arabian Peninsula, and Spain prior to human arrival into North America (Charpentier & Inizan, 2002).

During the Paleoindian period, large animals such as giant bison, mammoths, and other large mammals were hunted, although there was a major shift in the climate that lead to their eventual extinction. To supplement their diet, the people of the Paleoindian period foraged for wild plants such as berries, seeds, roots, small animals, or whatever edible substances they could consume (Morris & Blakeslee, 1987; Kansas Historical Society, 2014).

Most of the oldest known evidence of human settlement in Kansas comes from the discovery of Clovis and Folsom fluted spear points. The artifacts from the Paleoindian Period are unevenly distributed in Kansas; occurrences of artifact assemblages vary in accordance with geographic and topographic factors. Of the 11,257 projectile points found in the United States dating from the Paleoindian period, only 38 of them come from Kansas, but they have been found in all counties in the state (Anderson & Faught, 1998).

Archaic Period (7000 B.C. – A.D. 1)

Around 9,000 years ago, the climate of Kansas warmed considerably, which "greatly decreased the availability of big game animals" (Kansas Historical Society, 2014). As plants became more abundant during this period, there was as shift in the hunting and gathering practices. The people relied more heavily on edible wild plants as a main food source, supplementing their diet with whatever small game they could catch.

Also during the Archaic Period, there was a trend towards a less nomadic and more sedentary lifestyle by the inhabitants of the Kansas area, demonstrated by discovery of plant grinding implements at semi-permanent and permanent settlement sites. The manufacturing of ceramics in Kansas began about 5,500 years ago. Archaic Period tools found in Kansas include the atlatl or spear thrower (Kansas Historical Society, 2014).

Many of the Archaic Period archaeological sites in Kansas are buried beneath multiple layers of soil or rock. The Snyder site in Butler County, Kansas is rare because it represents four intact phases from the Archaic Period, occupied at various times over a 3,000-year period. Artifacts from the earliest dates of occupation are limited to burned limestone concentrations. Materials from later stages of occupation at this site include hunting and gathering tools, projectile or spear points, and tools associated with a more sedentary lifestyle, which are evidence of permanent settlement patterns. The site was also used as a seasonal hunting camp. Evidence of bow and arrow, and atlatl[115] technology are prevalent at the site (Grosser, 1973).

A Middle Archaic burial dated to approximately 5,000 years ago was found on the Plains-Prairie border in east-central Kansas. Artifacts collected at the site include deer bone, a drill, and a knife made of stone. It is significant to note that the tools were not used prior to placement in the grave (i.e., the tools were manufactured as funerary objects), indicating a specific form of ceremonialism practiced during this period of cultural development. Other burials from the same period in Kansas show similar mortuary practices (Hoard, Banks, Mandel, Finnegan, & Epperson, 2004).

A Late Archaic burial of an adult male was found in the High Plains of Sheridan County, Kansas along the bank of a dry tributary. Artifacts associated with this burial included a grinding stone and a bone tool. The grinding stone was well worn, and archaeologists are not sure of the use of the bone tool. According to archaeologists who analyzed the site, the grinding stone might have been used for the processing of wild plants such as hackberry fruits. This is an isolated burial, far from permanent settlements. (Hoard, Finnegan, Bozarth, & Rowlison, 2005)

Woodland Period (A.D. 1 - 1000)

"The Woodland Period [in Kansas] was marked by great changes in social systems, subsistence practices, and technology" (Kansas Historical Society, 2014). The manufacturing of pottery was widespread across the region. The bow and arrow became the preferred hunting method, as

[115] The atlatl javelin was a spear-throwing device with a stone weight. The weight was placed on a narrow board, which works like a lever, and the device projected out behind the throwing hand, permitting the javelin resting into its end to be hurled with greater force and precision (Bolton 1971, Ritchie 1969)

evidenced by the small size of the points (commonly referred to today as arrowheads). During the early part of the Woodland Period, people primarily lived in seasonal camps much like during the late Archaic, and the climate was much like the current conditions in Kansas. The hunting of deer, bison, and other animals was increasingly being augmented by gathering for wild plants to supplement their diet (Kansas Historical Society, 2014).

By the late Woodland Period, societies became sedentary and agriculture was being practiced as a substantial means for subsistence. Corn, beans, and other cultigens introduced from more tropical regions of North America were being exploited agriculturally (Bozarth, 1993).

Sophisticated societies were forming, based on refined artwork, complex mortuary practices, and trading networks documented in the archaeological record. The societal structure associated with the people of this period is referred to as the Hopewellian culture, which is noted by its sophisticated trading of exotic raw materials used for making toolmaking. Most Hopewellian settlements in Kansas were along the Missouri River. (Kansas Historical Society, 2014; Johnson, 1983; Johnson, 1987; Johnson, 1984).

Village Gardener Period (A.D. 1000 – 1500)

During the Village Gardener Period, people became more sedentary and populations increased across Kansas. Permanent sites from this period are well documented in Kansas, during which “most of the state’s inhabitants shifted to a dual economy, based on bison hunting and the cultivation of corn, squash, and beans, supplemented by small-scale hunting and gathering of wild foods.” Ceramic technology advanced, resulting in development of more durable and specialized pottery. Rectangular earthlodges were common in the northern part of the state, and thatched grass structures with plastered clay walls were common in the southern part of the state. There is evidence of trading with Puebloan Indians from the U.S. southwest (Kansas Historical Society, 2014).

7.1.11.5. Federally Recognized Tribes of Kansas

According to the Bureau of Indian Affairs and the National Conference of State Legislators, there are five federally recognized tribes in Kansas: the Delaware Tribe of Indians, Iowa Tribe, Kickapoo Tribe of Indians of the Kickapoo Reservation in Kansas, Prairie Band Potawatomi Nation, and the Sac and Fox Nation of Missouri (Kansas and Nebraska) (National Conference of State Legislators, 2015; U.S. Government Publishing Office, 2015). The locations of the federally recognized tribes in Kansas are shown in Figure 7.1.11-2. There are several other tribes depicted on the figure below that once lived in Kansas, but do not retain federal reservation or trust lands here any longer.

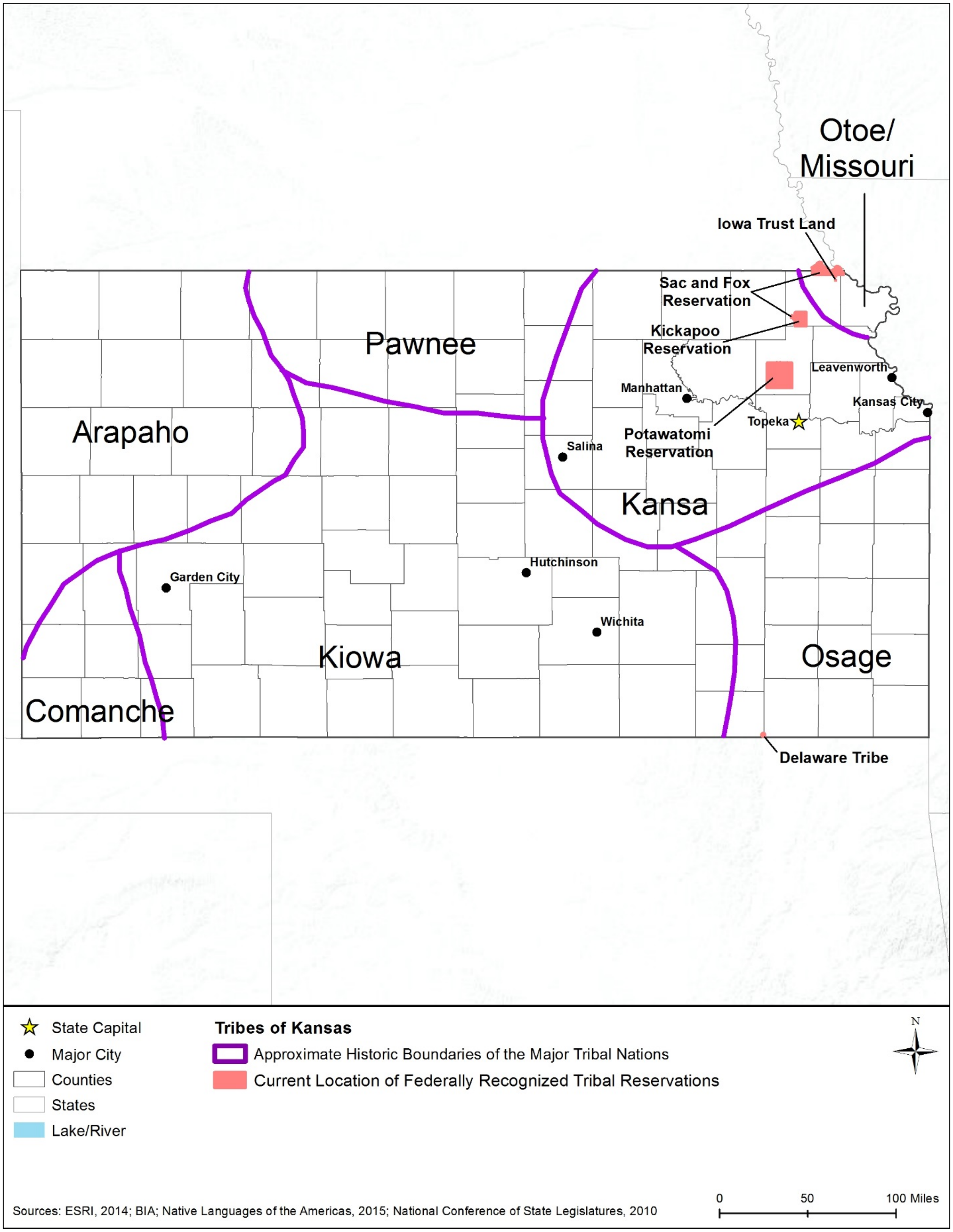


Figure 7.1.11-2: Approximate Historic Boundaries of Tribes in Kansas

7.1.11.6. Significant Archaeological Sites of Kansas

As previously mentioned in Section 7.1.11.3 there are 82 archaeological sites in Kansas listed on the NRHP. Table 7.1.11-2 lists the names of the sites, the city they are closest to, and type of site. The list includes both prehistoric and historic archaeological sites. The number of archaeological sites may increase with the discovery of new sites. A current list of NRHP sites are listed on the NPS NRHP website at http://www.nps.gov/nr/ (NPS, 2014e).

Kansas Cultural Resources Database and Tools

Kansas Historical Society (KSHS)

The Kansas Historical Society, which serves as the Kansas SHPO, maintains a collection of archaeological research material covering 10,000 years of human occupation of the state. The curated collection is accessible to qualified individuals for research; a list of research topics and materials is available by phone at 785-272-8681, ext. 240. More information on the archaeology collection is also available at the KSHS website (https://www.kshs.org/p/archeology-collections/14589).

Kansas Archaeological Society (KAS)

The Kansas Archaeological Society was founded in 1999, and it maintains a website with publically accessible information on the prehistory and archaeology of the state and the Central Plains (https://sites.google.com/site/kaskansasarchaeologicalsociety/home). Resources available from the KHS include artifact identification information, and links to websites with additional information on Kansas archaeological sites and artifacts.

Table 7.1.11-2: Archaeological Sites on the National Register of Historic Places in Kansas

Closest City	Site Name	Type of Site
Arkansas City	Arkansas City Country Club Site	Historic - Aboriginal, Prehistoric
Ashland	Bear Creek Redoubt	Historic, Military
Ashland	Cimarron Redoubt	Historic, Military
Bazine	Indian Village on Pawnee Fork	Military
Bremen	Oregon and California Trail--Pacha Ruts	Historic
Bunker Hill	Archeological Site Number 14RU315	Historic - Aboriginal
Caldwell	Buresh Archeological Site	Prehistoric
Carneiro	Archeological Site Number 14EW14	Historic - Aboriginal
Carneiro	Archeological Site Number 14EW33	Historic - Aboriginal
Carneiro	Archeological Site Number 14EW403	Historic - Aboriginal
Chetopa	Harmon Site	Prehistoric
Chetopa	Harmon Site No. 2 (14LT323)	Prehistoric
Clay Center	Mugler Lodge Site	Prehistoric
Coldwater	Archeological Site Number 14KW301	Historic - Aboriginal
Collyer	Walsh Archeological District	Prehistoric

Closest City	Site Name	Type of Site
Council Grove	Young, William, Archeological Site	Prehistoric
Dennis	Big Hill Archeological District	Prehistoric
Doniphan	Doniphan Archeological Site	Historic - Aboriginal
Dorrance	Archeological Site Number 14RU10	Historic - Aboriginal
Dorrance	Archeological Site Number 14RU316	Historic - Aboriginal
Elk City	Elk River Archeological District	Prehistoric
Ellsworth	Archeological Site Number 14EW17	Historic - Aboriginal
Ellsworth	Archeological Site Number 14EW303	Historic - Aboriginal
Ellsworth	Archeological Site Number 14EW401	Historic - Aboriginal
Ellsworth	Archeological Site Number 14EW404	Historic - Aboriginal
Ellsworth	Archeological Site Number 14EW406	Historic - Aboriginal
Falls River State Park	Archeological Site Number 14GR320	Historic - Aboriginal
Fanning	Fanning Archeological Site	Prehistoric
Geneseo	Archeological Site Number 14EW405	Historic - Aboriginal
Geneseo	Tobias-Thompson Complex	Historic - Aboriginal, Prehistoric
Great Bend	Walnut Creek Crossing	Historic, Historic - Aboriginal
Greensburg vicinity	Archeological Site Number 14KW302	Historic - Aboriginal
Hartford	Williamson Archeological Site	Prehistoric
Healy	Pottorff Site	Prehistoric
Independence	Archeological Site Number 14MY1320	Historic - Aboriginal
Independence	Archeological Site Number 14MY365	Historic - Aboriginal
Independence	Infinity Archeological Site	Prehistoric
Junction City	Bogan Archeological Site	Historic - Aboriginal
Junction City	Elliott Village Site	Prehistoric
Kansas City	Quindaro Townsite	Historic
Kansas City	Trowbridge Archeological Site	Prehistoric
Lansing	Lansing Man Archeological Site	Prehistoric
Larned	Lewis Site	Prehistoric
Larned	Pawnee Fork Crossing (Santa Fe Trail Dry Route) and Boyd’s Ranch Site	Historic
Leavenworth	Quarry Creek Archeological Site	Prehistoric
Leavenworth	Zacharias Site (14LV380)	Prehistoric
Lehigh	French Frank’s Santa Fe Trail Segment	Historic
Liberty	Archeological Site Number 14MY1385	Historic - Aboriginal
Lincoln	Archeological Site Number 14LC306	Historic - Aboriginal
Lindsborg	Paint Creek Archeological Site	Historic - Aboriginal
Lindsborg	Sharps Creek Archeological Site	Historic - Aboriginal
Little River	Archeological Site Number 14MY1	Historic - Aboriginal
Little River	Archeological Site Number 14RC10	Historic - Aboriginal
Little River	Archeological Site Number 14RC11	Historic - Aboriginal
Lyons	Malone Archeological Site	Prehistoric
Madison	Curry Archeological Site	Prehistoric

Closest City	Site Name	Type of Site
Madison	Lone Cone Site	Prehistoric
Marion	Marion Archeological District	Historic - Aboriginal, Prehistoric
Marquette	Indian Hill Site	Historic - Aboriginal, Prehistoric
Mayetta	Booth Site	Prehistoric
Melvern	Cow-Killer Archeological Site	Prehistoric
Minneapolis	Archeological Site Number 14OT4	Historic - Aboriginal
Minneapolis	Minneapolis Archeological Site	Prehistoric
Moline	Durbin Archeological Site	Prehistoric
Olsburg	Coffey Site	Prehistoric
Onaga	Dennis Quarry	Prehistoric
Onaga	Vermillion Creek Archeological District	Historic - Aboriginal, Prehistoric
Paola	Hillsdale Archeological District	Prehistoric
Paradise	Archeological Site Number 14RU314	Historic - Aboriginal
Penokee	Penokee Stone Figure	Historic - Aboriginal, Prehistoric
Pleasanton	Battle of Mine Creek Site	Military
Pratt	Pratt Archeological Site	Prehistoric
Republic	Pawnee Indian Village Site	Historic - Aboriginal
Russell	Archeological Site Number 14RU313	Historic - Aboriginal
Russell	Archeological Site Number 14RU324	Historic - Aboriginal
Russell	Archeological Site Number 14RU5	Historic - Aboriginal
Salina	Whiteford (Price) Archeological Site	Prehistoric
Saxman	Saxman Site	Historic - Aboriginal, Prehistoric
Scott City	El Cuartelejo	Historic - Aboriginal, Prehistoric
Severy	Two Duck Site	Prehistoric
Silver Lake	Hard Chief’s Village	Historic - Aboriginal
Soldier	Harris Site	Prehistoric
Stafford	Comanche Archeological Site	Prehistoric
Syracuse	Fort Aubrey Site	Historic, Military
Tonganoxie	Evans Site	Prehistoric
Tonganoxie	Paul Site	Prehistoric
Tonganoxie	Scott Site	Prehistoric
Tongonoxie	Caenen Site	Prehistoric
Ulysses	Santa Fe Trail--Grant County Segment 1	Historic - Aboriginal
Unknown	Archeological Site Number 14CM305	Historic - Aboriginal
Weskan	Goose Creek Tipi Ring Site	Historic - Aboriginal, Prehistoric
Westmoreland	Scott Spring	Prehistoric
Windom	Santa Fe Trail--Rice County Segment 3	Military

Source: (NPS, 2014e)

7.1.11.7. Historic Context

The first European known to have explored present day Kansas was the Spanish conquistador Francisco Vázquez de Coronado, who in 1541 led an expedition from Mexico into North

American in search of seven legendary cities of gold. During the 17th and 18th centuries, European fur traders, primarily from French Canada, who made alliances with the indigenous population, explored Kansas. In 1803, Kansas became part of the United States with the Louisiana Purchase, and the area was explored by Louis and Clark's Corps of Discovery expedition in 1804 to 1806; additional subsequent expeditions also occurred. European immigration in the region increased with the opening of the Santa Fe Trail in 1821, which linked Franklin, MO, to Santa Fe, NM, passing through Kansas. Fort Leavenworth, the first permanent non-indigenous settlement in Kansas, was established in 1827 (Washburn University, 2015).

In 1854, the Kansas-Nebraska Act established the Kansas Territory, and settlers began moving to the territory. Slavery in the region was hotly contested, particularly between Kansas and neighboring pro-slavery Missouri, and during the late 1850s, the Kansas Territory became known as "Bleeding Kansas" due to the widespread violence relating to this issue. On January 29, 1861, Kansas was admitted to the Union as the 34th state, just months before the outbreak of the Civil War. During the Civil War, Kansas sent troops to fight for the Union army. While no major battles occurred within the state, there were numerous raids by Confederate forces; Quantrill's Raid and Price's Raid are two notable examples (Washburn University, 2015).

Following the Civil War, railroad expansion occurred in the plains states, which included Kansas. The Homestead Act in 1862 encourage further occupation of the area by granting land to settlers who could farm and improve their tracts (Washburn University, 2015). This expansion of non-native settlement led to conflict with the Indians in the area, many of whom has already been relocated to the region after having been forced off their traditional lands east of the Mississippi River. This conflict was particularly violent in western Kansas and lasted for several years. During the latter part of the 19th century, immigration increased, including large numbers of European immigrants, as well as recently freed African Americans. There was also considerable expansion of government facilities during this time, as settlers required these public institutions in newly settled lands (Sachs & Ehrlich, 1996).

During the early 20th century, industry in Kansas grew, with Wichita becoming involved in the aviation field prior to World War I (WWI). Like much of the Midwest, Kansas suffered during the Great Depression, with the state's economy further impacted by a prolonged regional drought that further reduced farm production. New Deal programs provided direct assistance to struggling Kansas farmers, and expanded the states road network and other public works (Sachs & Ehrlich, 1996). During World War II (WWII), Kansas's mobilization for the war included sending troops overseas, increasing food production, and the development of new military bases in the state (Washburn University, 2015). Following WWII, internal improvements that had started prior to the war continued, such as road construction, which in turn facilitated transportation that helped to increase economic growth around the state's larger cities, such as Wichita, Kansas City, and Topeka (Sachs & Ehrlich, 1996).

Kansas has 1,408 National Register of Historic Places (NRHP) listed sites, as well as 25 National Historic Landmarks (NHL) (NPS, 2014a). Kansas contains a portion of one National Heritage

Area (NHA), the Freedom's Frontier National Heritage Area (NPS, 2015f). Figure 7.1.11-3 shows the location of NHA and NRHP sites within Kansas.[116]

7.1.11.8. Architectural Context

Early 19th century buildings in Kansas were constructed of local stone (including limestone) and wood where available, such as various hardwood trees that grow in the eastern portion of the state and Cottonwood trees that grow along rivers in western Kansas. Early structures were also built of earth and sod in areas where trees were not available.

The eastern portion of the state was settled first, due to both their proximity to navigable waterways and as the area first encountered by most settlers coming from the south and east. As a result, these areas still contain a large collection of the state's early architecture. Many of the first settlements were military outposts, such as Fort Leavenworth (1827), with non-military growth in that area occurring only after Kansas became a territory in 1854. Initial settlers were involved in agriculture, which was well-suited to fertile river valleys, particularly in the east. Several cultural resources remain relating to this history of settlement and homesteading in these areas (Sachs & Ehrlich, 1996).

Early structures were primarily of utilitarian designs, built primarily with the goal of providing residents with shelter and a means to sustain themselves economically. Pattern books featuring popular Romantic Era styles, such as Gothic Revival and later Italianate, were used to inform designs as settlements grew. Economic development and the arrival of railroads in the second half of the 19th century brought popular styles and building materials from eastern states. Dimensional lumber, modern cut nails, and cast iron structural members are examples of the types of materials that were imported via new rail lines; railroads led to the establishment of new towns as well. Clay deposits found throughout the state helped supply a great deal of the bricks needed within the state and there was a thriving brick manufacturing industry in the second half of the 19th century (Douglas, Richard L., 1910). Wichita is an example of a city that grew during the 1870s as a result of the railroad, and had grown into one of the largest cities in the state by the 1880s. Civic buildings, educational facilities, and banking buildings constructed during this time remain as indications of the growth that occurred in Kansas during the second half of the 19th century (Sachs & Ehrlich, 1996).

[116] See Section 7.1.7 for a more in-depth discussion of additional historic resources as they relate to recreational resources.

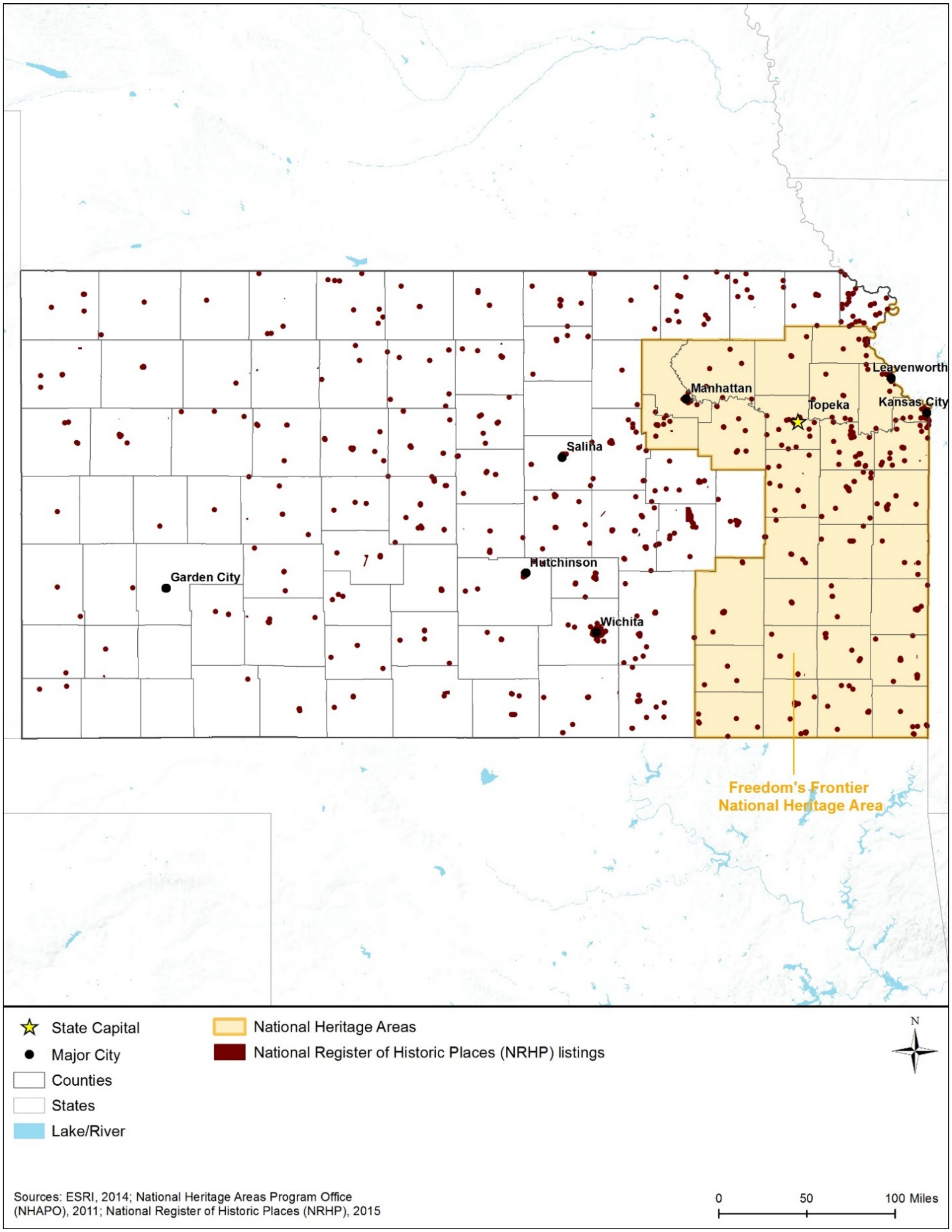


Figure 7.1.11-3: National Heritage Area (NHA) and National Register of Historic Places (NRHP) Sites in Kansas

During the latter part of the 19th century, Victorian Era architectural trends were popular, such as Queen Anne, Eastlake, and Shingle. Industry began to grow as well, which resulted in further urban development. Urban structures were built it popular revival styles, such as Colonial Revival and Neoclassical, with modern skyscrapers beginning to appear in the state's larger urban centers. The cities of Kansas City, Topeka, and Wichita were influenced by the City Beautiful movement, and benefited from construction of parks, public buildings, and boulevards. The Richardsonian Romanesque style was popular for public buildings, including banks, courthouses, and railroad stations. Despite growth slowing during WWI, new industries emerged, resulting in the construction of facilities relating to this growth (Sachs & Ehrlich, 1996).

Popular housing styles during the early 20th century reflect national trends, with Craftsman and Prairie styles homes being built during the 1910s up through the onset of WWII, minimal traditional houses during and after WWII, and ranch houses during the 1950s and 1960s. Kansas was the recipient of a considerable amount of federal money during the Great Depression, which resulted in the construction of improved roads, parks, post offices, and federal buildings. These were built in styles such as the Art Deco, Art Moderne, and International, which had finally replaced classically inspired styles of earlier years. Kansas lacked a substantially developed road system until after WWII, relying heavily on railroads. However, significant road improvement projects started during the New Deal programs during the Great Depression and was greatly enhanced with the creation of the Interstate Highway System in 1956, which was promoted by President Dwight D. Eisenhower, who had been raised in Kansas (Sachs & Ehrlich, 1996).

Figure 7.1.11-4: Representative Architectural Styles of Kansas

Top Left – Alexander G. Vanduvall House (Nicodemus, KS) – (Historic American Buildings Survey, 1933a)
Top Middle – Kandt-Domann Farmstead Barn (Hope, KS) – (Historic American Buildings Survey, 1933b)
Bottom Left – Fort Riley, Building Number 174 (Riley, KS) – (Historic American Buildings Survey, 1933c)
Bottom Middle – Fort Leavensworth (Leavensworth, KS) – (Historic American Buildings Survey, 1933d)
Right – Saint Catherine's Church (Catharine, KS) – (Historic American Buildings Survey, 1933e)

7.1.12. Air Quality

7.1.12.1. Definition of the Resource

Air quality in a geographic area is determined by the type and amount of pollutants emitted into the atmosphere, the size and topography[117] 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)[118] or micrograms per cubic meter (μg/m^3) determined over various periods of time (averaging time).[119] This section discusses the existing air quality in Kansas. USEPA designates areas within the United States as attainment,[120] nonattainment,[121] maintenance,[122] or unclassifiable[123] 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.

One local agency issues permits on behalf of the KDHE Bureau of Air (BOA). The Wyandotte County Department of Air Quality acts an agent of the state to issue permits under state authority and follows KDHE BOA rules and regulations.

7.1.12.2. Specific Regulatory Considerations

National and State Ambient Air Quality Standards

The Clean Air Act (CAA) establishes National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: Carbon monoxide (CO), lead, oxides of nitrogen (NO_X), particulate matter ($PM_{2.5}$ and PM_{10}), ozone (O_3), and oxides of sulfur (SO_X). The NAAQS establish various standards, either primary[124] or secondary,[125] 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. Kansas has not

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

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

[119] 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, 2015j).

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

[121] 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, 2015p).

[122] 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, 2015p).

[123] 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, 2015p).

[124] 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).

[125] 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).

established its own ambient air quality standards, and instead adopted the primary and secondary NAAQS (KDHE, 2014b).

In addition to the NAAQS, there are standards for hazardous air pollutants (HAP), which are those typically associated with specific industrial processes such as chromium electroplating (hexavalent chromium), dry cleaning (perchloroethylene), and solvent degreasing (halogenated solvents) (USEPA, 2016c). HAPs can have severe adverse impacts on human health and the environment, including increased risk of cancer, reproductive issues, or birth defects. HAPs are federally regulated under the CAA via the National Emission Standards for Hazardous Air Pollutants (NESHAPs). USEPA developed the NESHAPs for sources and source categories emitting HAPs that pose a risk to human health. Appendix E presents a list of federally regulated HAPs.

Title V Operating Permits/State Operating Permits

Kansas has authorization to issue CAA Title V operating permits on behalf of the USEPA, as outlined in 40 CFR 70. The Title V program refers to Title V of the CAA that governs permitting requirements for major industrial air pollution sources and consolidates all CAA requirements for the facility into one permit (USEPA, 2015d). The overall goal of the Title V program is to “reduce violations of air pollution laws and improve enforcement of those laws” (USEPA, 2015d). Kansas Air Quality Regulation (KAQR) 28-19-500 (Operating Permits; Applicability) describes the applicability of Title V operating permits. Kansas requires Title V operating permits for any major source if it emits or has the potential to emit pollutants in excess of the major source thresholds (see Table 7.1.12-1). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Table 7.1.12-1: Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Criteria Pollutant*	100
Single HAP	10
Total/Cumulative HAPs	25

Source: (USEPA, 2014b)

*Sources in nonattainment areas will have lower thresholds for some criteria pollutants depending on the classification of the nonattainment area.

Kansas has several types of operating and construction permits. A Class I permit is a “permit to operate an air contaminant emission stationary source,” and Class II and III operating permits are “an approval, rather than a permit, to operate an air contaminant emission stationary source” (KDHE, 2014b). Kansas also has general permits for categories of emissions units or stationary sources if there is sufficient number of sources.

Exempt Activities

As per 28-19-500 (Operating permit; applicability) a stationary source can avoid the need to obtain a Class I permit if it reduces its potential to emit (PTE) through either physical or operational limitations. Once the stationary source reduces its PTE, the facility can obtain a Class II or III permit. In addition, a stationary source, which is not a major source, is exempt from obtaining a Class I permit if they only require a permit because of emission limitations or standards under CAA Section 111 (Standards of performance for new stationary sources) and/or CAA Section 112 (hazardous air pollutants). (KDHE, 2014b)

Temporary Emissions Sources Permits

Under KAQR 28-19-512 (Class I operating permits; permit content) KDHE BOA issues Class I permits for portable sources[126] that are utilized by the same owner and operated at multiple facilities for the same purpose. The operations must be temporary and move at least once during the permit timeframe. (KDHE, 2014b)

State Preconstruction Permits

Under KAQR 28-19-300 (Construction permits and approvals; applicability) installation or modification of a stationary source or emissions unit must obtain a construction permit or approval prior to construction or modification of the source or emissions unit. Sources that are an affected source or a major source of hazardous air pollutants and sources that meet the potential to emit (PTE) in Table 7.1.12-2 must obtain a construction permit.

Table 7.1.12-2: Construction Permit Potential to Emit (PTE) Thresholds

Pollutant	Tons Per Year (TPY)
Particulate Matter*	25
PM_{10} [a]	15
CO	100
SO_x, VOC, and NO_x	40
Lead	0.6

Source: (KDHE, 2014b)

[a] Except for any agricultural-related activity, in which case the emissions level is 100 TPY of particulate matter, including but not limited to PM_{10}.

Sources that are not required to apply for a construction approval based on the PTE calculations in Table 7.1.12-2 and are not an affected source or major source of hazardous air pollutants must obtain an approval prior to construction if the PTE equal or exceed the levels in Table 7.1.12-3.

[126] Portable source are defined as "an emissions unit or stationary source that, due to the design of the emissions unit or stationary source, is capable of being moved from one location to another and that, except for storage purposes, remains at one location no longer than 180 days during any 365-day period, unless otherwise approved in writing by the department" (KDHE 2014b). An affected source must not be permitted as a portable source.

Table 7.1.12-3: Construction Permit Potential to Emit (PTE) Thresholds

Pollutant	Pounds Per Hour
Particulate Matter	5
PM_{10}[a]	2
CO, VOC[b], and NO_x	50 Pounds Per 24 Hours
SO_x	2 Pounds Per 24 Hours
Lead	0.1

Source: (KDHE, 2014b)

[a] Except for any agricultural-related activity, in which case the emissions level is 5 pounds per hour of particulate matter, including but not limited to PM10.
[b] Except when the stationary source or emissions unit is located in an area designated as a nonattainment area at 40 CFR 81.317 as in effect on July 1, 1989 in which case approval is required if the emission level exceeds either 15 pounds per 24 hour period or 3 pounds per hour.

The following installations and modifications are not considered a modification and are excluded from obtaining a construction permit or approval:

- “routine maintenance or parts replacement; or
- an increase or decrease in operating hours or production rates if:
- production rate increases do not exceed the originally approved design capacity of the stationary source or emissions unit; and
- the increased potential-to-emit resulting from the change in operating hours or production rates do not exceed any emission or operating limitations imposed as a condition to any permit issued under these regulations.” (KDHE, 2015j)

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, 2013). An action in designated nonattainment and maintenance areas would be evaluated for the emission of those particular pollutants under the General Conformity Rule through an applicability analysis. Pursuant to Title 40 CFR 93.153(d)(2) and (e), federal actions “in response to emergencies which are typically commenced on the order of hours or days after the emergency” and actions “which are part of part of a continuing response to emergency or disaster” that are taken up to 6 months after beginning response activities, will be exempt from any conformity determinations (U.S. Government Publishing Office, 2010).

The estimated pollutant emissions are compared to *de minimis*[127] levels. These values are the minimum thresholds for which a conformity determination must be performed (see Table 7.1.12-4). No Kansas counties lie in the Ozone Transport Region (OTR).

[127] 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)

Table 7.1.12-4: De Minimis Levels

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

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

If an action does not result in an emissions increase above the *de minimis* levels in Table 7.1.12-4, then a conformity determination is not required. If the applicability analysis shows that the total direct and indirect emissions are above the *de minimis* levels in Table 7.1.12-4, 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,[128] the agency would have to fulfill one or more of the following:

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

State Implementation Plan (SIP) Requirements

The Kansas SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. Kansas's SIP is a conglomeration of separate actions taken for each of the pollutants. All of Kansas's SIP actions are codified under 40 CFR

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

Part 52 Subpart R. A list of all SIP actions for all six criteria pollutants can be found on KDHE's website at http://www.kdheks.gov/bar/sip.html.

7.1.12.3. 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 7.1.12-1 and Table 7.1.12-5, below, present the current nonattainment areas in Kansas as of January 30, 2015. The year(s) listed in the table for each pollutant indicate when USEPA promulgated the standard for that pollutant; note that for $PM_{2.5}$, O_3, and SO_2, these standards are in effect. Table 7.1.12-5 contains a list of the counties and their respective current nonattainment status for each criteria pollutant. The year(s) listed in the table for each pollutant indicate when USEPA promulgated the Atomic Absorption Spectrophotometry for that pollutant. Unlike Table 7.1.12-5, Figure 7.1.12-1 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.

Table 7.1.12-5: Kansas 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
Saline (Part)			X-6								

Source: (USEPA, 2015g)

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 KDHE measures air pollutants at 18 sites across the state as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network. Annual Kansas State Ambient Air Quality Reports are prepared, containing pollutant data summarized by region. The KDHE BOA reports real-time pollution levels of PM and O_3 on the website AirNOW[129] to inform the public, found at https://www.airnow.gov/. (KDHE, 2014c)

[129] AirNow is a government website that posts daily Air Quality Index for more than 400 cities.

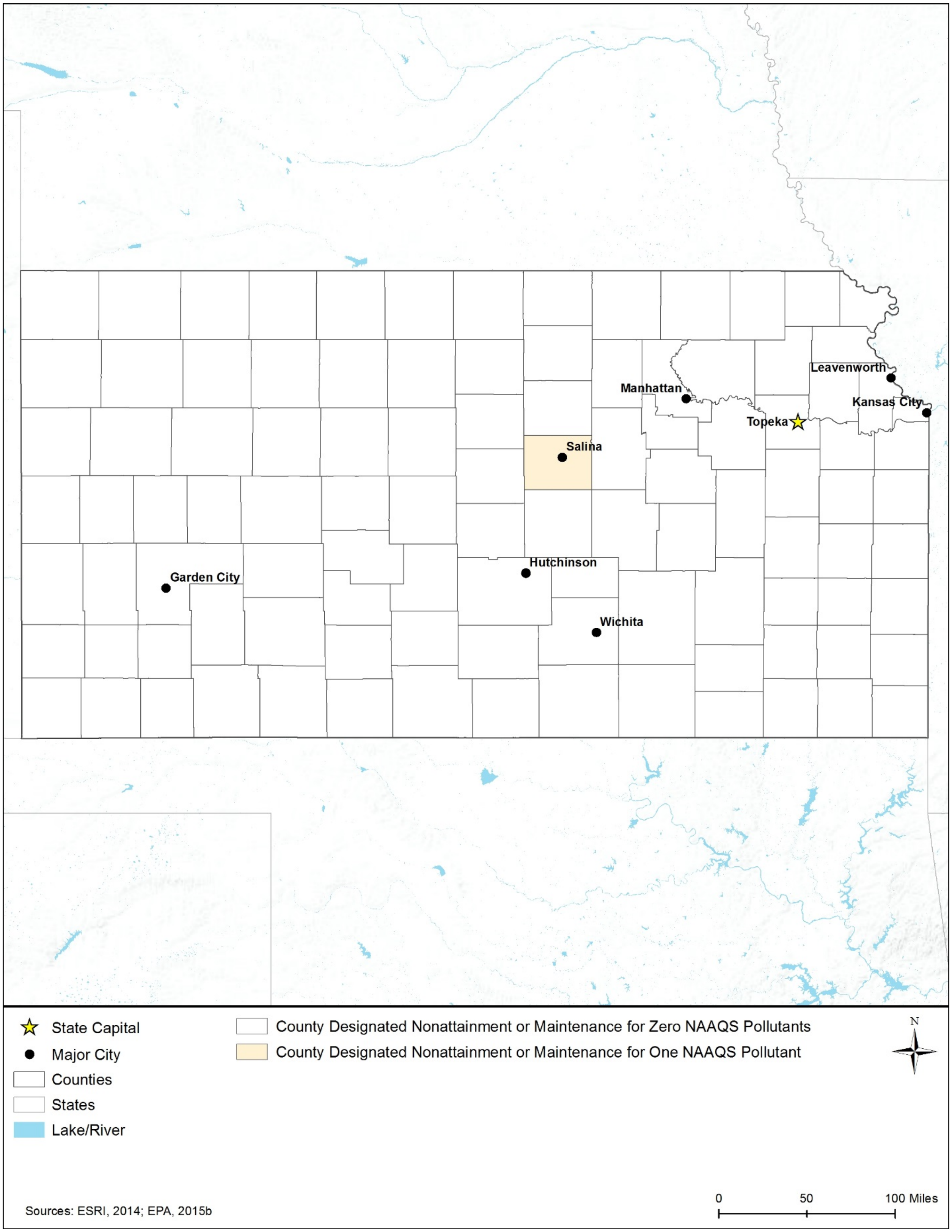


Figure 7.1.12-1: Nonattainment and Maintenance Counties in Kansas

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[130] 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[131] (the normal useful range of USEPA-approved Gaussian plume models" (USEPA, 1992).

Kansas 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 requirements, the air quality impact analysis need only to analyze the impacts to air quality within 100 kilometers from the source. Additionally, no other adjacent states have Class I areas within 100 kilometers of the Kansas border (USEPA, 1992). Therefore, notification to FLM will not be required for actions with Iowa or adjacent states.

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

7.1.13. Noise

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

7.1.13.1. Definition of the Resource

Noise is a form of sound caused by pressure variations that the human ear can detect and is often defined as unwanted sound (USEPA, 2012b). Noise is one of the most common environmental issues that interferes with normal human activities and otherwise diminishes the quality of the human environment. Typical sources of noise that result in this type of interference in urban and suburban surroundings includes interstate and local roadway traffic, rail traffic, industrial activities, aircraft, and neighborhood sources like lawn mowers, leaf blowers, etc.

The effects of noise can be classified into three categories:

- Noise events that result in annoyance and nuisance;
- Interference with speech, sleep, and learning; and,
- Physiological effects such as hearing loss and anxiety.

Fundamentals of Noise

For environmental noise analyses, a noise metric refers to the unit that quantitatively measures the effect of noise on the environment. The unit used to describe the intensity of sound is the decibel (dB). Audible sounds range from 0 dB ("threshold of hearing") to about 140 dB ("threshold of pain") (OSHA, 2016a). The vibration frequency characteristics of the sound, measured as sound wave cycles per second [Hertz (Hz)], determines the pitch of the sound (FTA, 2006). The normal audible frequency range is approximately 20 Hz to 20 kHz (FAA, 2015i). The A-weighted scale, denoted as dBA, approximates the range of human hearing by filtering out lower frequency noises, which are not as damaging as the higher frequencies. The dBA scale is used in most noise ordinances and standards (OSHA, 2016a).

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

- The total sound energy radiated by a source, usually reported as a sound power level.
- The actual air pressure changes experienced at a particular location, usually measured as a sound pressure level (SPL) (the frequency characteristics and SPL combine to determine the loudness of a sound at a particular location).
- The duration of a sound.
- The changes in frequency characteristics or pressure levels through time.

Figure 7.1.13-1 presents the sound levels of typical events that occur on a daily basis in the environment. For example, conversational speech is measured at about 55 to 60 dBA, whereas a band playing loud music may be as high as 120 dBA.

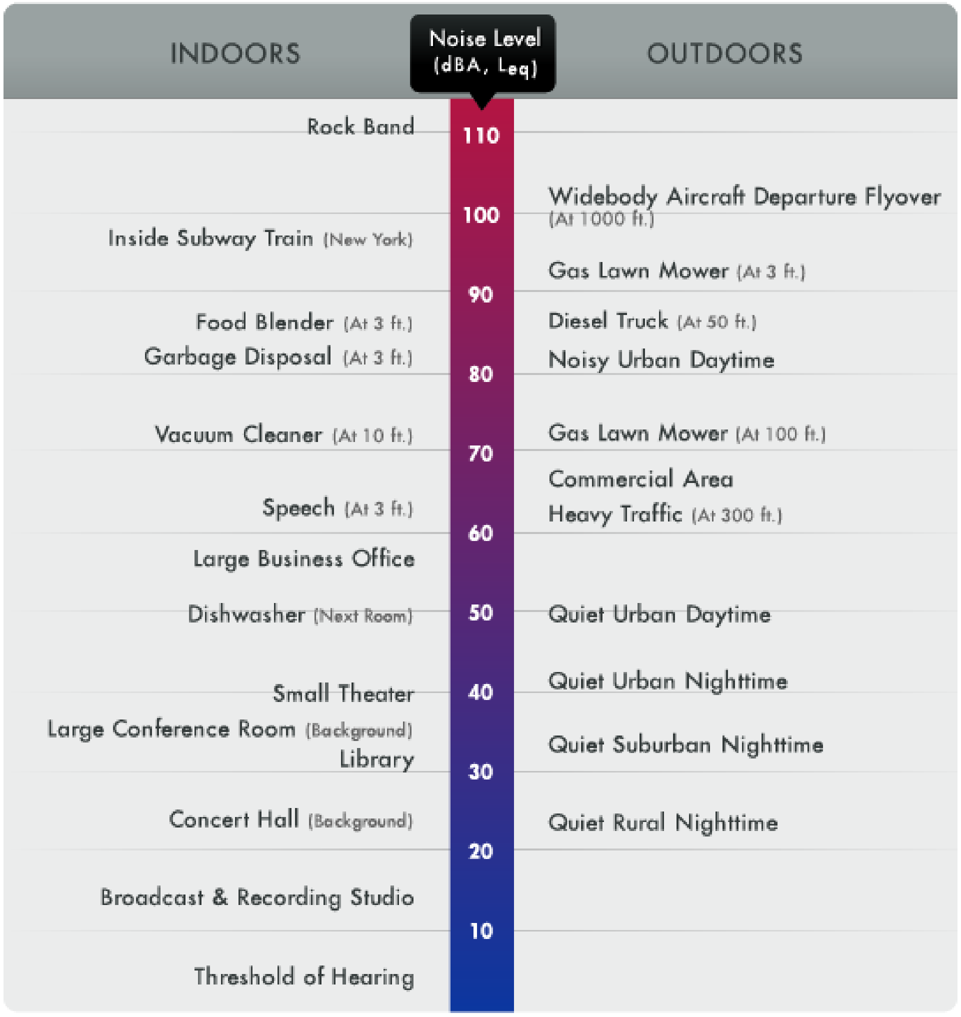


Figure 7.1.13-1: Sound Levels of Typical Sounds

Source: (Sacramento County Airport System, 2015)

Leq: Equivalent Continuous Sound Level
Prepared by: Booz Allen Hamilton

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

The changes in human response to changes in dB levels is categorized as follows (FTA, 2006):

- A 3-dB change in sound level is considered a barely noticeable difference;
- A 5-dB change in sound level will typically result in a noticeable community response; and
- A 10-dB change, which is generally considered a doubling of the sound level, almost certainly causes an adverse community response.

In general, ambient noise levels are higher during the day than at night and typically this difference is about 10 dB (USEPA, 1973). Ambient noise levels can differ considerably depending on whether the environment is urban, suburban, or rural.

7.1.13.2. 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.

Kansas has several statewide noise regulations, which are compiled under the Kansas Statutes. They mainly apply to motor vehicle functions such as engine running and horns. Table 7.1.13-1 provides a brief summary of these regulations.

Table 7.1.13-1: Relevant Kansas Noise Laws and Regulations

State Law/ Regulation	Regulatory Agency	Applicability
8-1738	Kansas State Legislature	Requires motor vehicles to be equipped with a horn or warning device.
8-1739	Kansas State Legislature	Requires motor vehicles to be equipped with a muffler or noise suppressing system.
32-1120	Kansas State Legislature	Regulates motorboat noise to a maximum level.

Source: (Kansas State Legislature, 2015b)

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. Larger cities and towns, such as Wichita and Kansas City, 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).

7.1.13.3. Environmental Setting: Ambient Noise

The range and level of ambient noise in Kansas varies widely based on the area and environment of the area. The population of Kansas can choose to live and interact in areas that are large cities, rural or suburban communities, small towns, and national and state parks. Figure 7.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of Kansas may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to Kansas. As such, this section describes the areas where the population of Kansas can potentially be exposed to higher than average noise levels.

- **Urban Environments:** Urban areas are likely to have higher noise levels on a daily basis due to highway traffic (70 to 90 dBA), construction noise (90 to 120 dBA), and outdoor conversations (e.g., small/large groups of people) (60 to 90 dBA) (U.S. Department of the Interior, 2008). The urban areas that are likely to have the highest ambient noise levels in the state are Wichita and Kansas City.
- **Airports:** Areas surrounding airports tend to have higher noise levels due to aircraft operations that occur throughout the day. A jet engine aircraft can produce between 130 to 160 dBA in its direct proximity (FAA, 2007). However, commercial aircraft are most likely to emit noise levels between 70 to 100 dBA depending of the type of aircraft and associated engine (FAA, 2012). This noise will be perceived differently based on the altitude of the aircraft and its distance to the point of measurement. Airport operations are primarily arrivals and departures of commercial aircraft but, based on the type of airport, can include touch-and-go operations that are typical of general aviation airports and military airfields. The location of most commercial airports is in proximity to urban communities resulting in noise exposures from aircraft operations (arrivals/departures) to 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 Kansas, Wichita Dwight D. Eisenhower National Airport (ICT) has operations of more than 128,000 flights annually (FAA, 2015j). These operations result in increased ambient noise levels in the surrounding communities. See Section 7.1.7, Land Use, Recreation, and Airspace, and Table Figure 7.1.7-5 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 (FHWA, 2014b). 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, 2014b). See Section 7.1.1, Public Safety Infrastructure, and Figure 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). Kansas is part of the Southwest Chief route, which connects Chicago, Kansas City, and Los Angeles. The Kansas section of this route stops in Topeka, Lawrence, Newton, Hutchinson, Dodge City, and Garden City (KDOT, 2015b). See Section 7.1.1, Public Safety Infrastructure, and Figure 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 to preserve these areas in

their natural environment. These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014f). Kansas has five national parks (NPS, 2015h). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 7.1.8, Visual Resources, and Figure 7.1.8-2 for more information about national and state parks for Kansas.

7.1.13.4. Sensitive Noise Receptors

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

7.1.14. Climate Change

7.1.14.1. Definition of the Resource

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

Accelerated rates of climate change are linked to an increase in atmospheric concentrations of greenhouse gas (GHG) caused by emissions from human activities such as burning fossil fuels to generate electricity (USEPA, 2012c). The IPCC is now 95 percent certain that humans are the main cause of current global warming (IPCC, 2013). Human activities result in emissions of four main GHGs: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and halocarbons (a group of gases containing fluorine, chlorine, or bromine) (IPCC, 2007). The common unit of measurement for GHGs is metric tons of CO_2-equivalent (MT CO_2e)[132], which equalizes for the different global warming potential of each type of GHG. Where this document references emissions of CO_2 only, the units are in million metric tons (MMT) CO_2. Where the document references emissions of multiple GHGs, the units are in MMT CO_2e.

The IPCC reports that "global concentrations of these four GHGs have increased significantly since 1750" with "Atmospheric concentrations of CO_2 increased from 280 parts per million (ppm) of carbon in 1750 to 379 ppm of carbon in 2005" (IPCC, 2007). The atmospheric concentration of CH_4 and N_2O have increased from pre-industrial values of about 715 and 270

[132] 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). Carbo dioxide equivalents are commonly expressed as million metric tons of carbon dioxide equivalents (MMT CO_{2e}). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP. MMT CO_{2e}= (million metric tons of a gas) * (GWP of the gas)" (USEPA 2015a).

parts per billion (ppb) to 1774 and 319 ppb, respectively, in 2005 (IPCC, 2007). In addition, the IPCC reports that human activities are causing an increase in various hydrocarbons from near-zero pre-industrial concentrations (IPCC, 2007).

Both the GHG emissions effects of the Proposed Action and Alternatives, and the relationships of climate change effects to the Proposed Action and Alternatives, are considered in this PEIS (see Section 7.2, Environmental Consequences). Existing climate conditions in the project area are described first by state and sub-region, where appropriate, and then by future projected climate scenarios. The discussion focuses on the following climate change impacts: 1) temperature; 2) precipitation and drought; and 3) severe weather events.

7.1.14.2. Applicable Statutes and Regulations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Appendix C, Environmental Laws and Regulations. Kansas has not established goals and regulations to reduce GHG emissions to combat climate change. However, Kansas is a member of the Climate Registry, which is a voluntary GHG registry.

7.1.14.3. Kansas Greenhouse Gas Emissions

Estimates of Kansas's total GHG emissions vary. The Department of Energy's (DOE) Energy Information Agency (EIA) collects and disseminates national-level emissions data on other GHGs such as CH_4 and nitrous oxide (NO_x), but not at the state level (EIA, 2015d). The USEPA also collects and disseminates national-level GHG emissions data, but by economic sector, not by state (USEPA, 2015h). 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, Kansas emitted a total of 72.8 MMT of CO_2 in 2013 from fossil fuels. Roughly 42 percent of CO_2 emissions came from coal used by the electric power sector. Petroleum productsaccounted for another 37 percent. Natural gas was the source of another 21 percent of emissions, mostly from the industrial sector (Table 7.1.14-1) (EIA, 2015e). Kansas's CO_2 emissions increased intermittently between 1980 and 2007 (a peak of 79.2 MMT), and then began to decline, mostly as a result of reductions in emissions from coal by the electric power sector, although they increased slightly (by 1.9 MMT) in 2013, with small increases in all sectors and fuels. Kansas ranked 27th in total CO_2 emissions among the 50 states and the District of Columbia in 2013, and ranked 13th in per capita emissions (EIA, 2015f).

Table 7.1.14-1: Kansas CO_2 Emissions from Fossil Fuels by Fuel Type and Source, 2013

Fuel Type (MMT)		Source (MMT)	
Coal	30.9	Residential	4.2
Petroleum Products	26.6	Commercial	2.0
Natural Gas	15.3	Industrial	15.8
		Transportation	18.8
		Electric Power	32.0
TOTAL	**72.8**	**TOTAL**	**72.8**

Source: (EIA, 2015f)

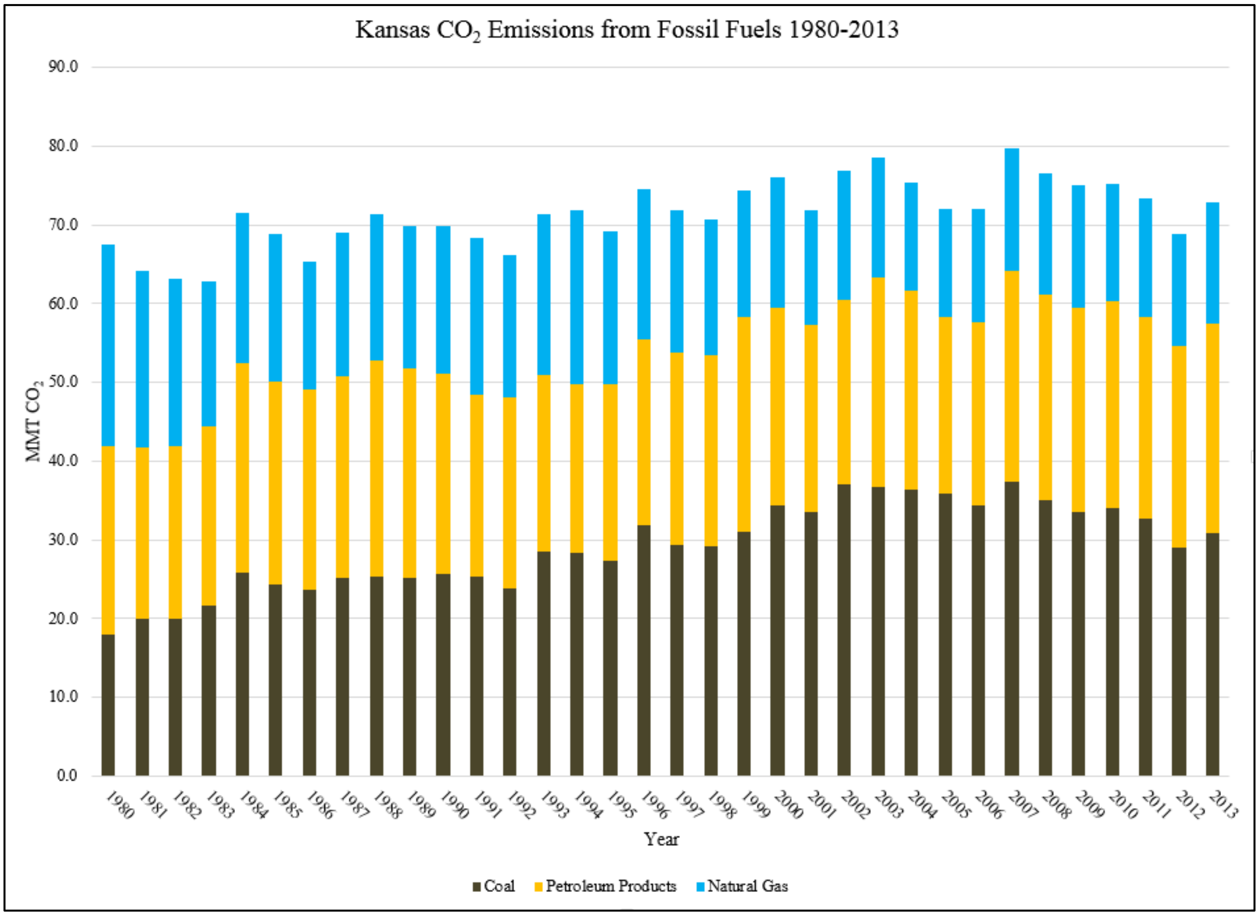


Figure 7.1.14-1: Kansas CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013

Source: (EIA, 2015f)

The KDHE commissioned the Center for Climate Strategies to prepare a draft of Kansas' GHG emissions inventory, which was last updated in May 2008 (KDHE, 2008). The majority of Kansas's GHG emissions are CO_2. These emissions are the result of fossil fuel combustion for the purpose of producing energy, mostly petroleum products from electric power generating facilities. Other major GHGs emitted in Kansas are CH_4 and NO_x, (KDHE, 2008).

Total U.S. GHG emissions were 6,673 million metric tons (14.7 trillion pounds) in 2013. In 2005, Kansas emitted 103 million metric tons of CO_2e (KDHE, 2008). Emissions came from energy related activities across all sectors such residential (20.3 percent) commercial (18.1 percent) industrial (36.9 percent) transportation (24.7 percent). Total GHG emissions increased an estimated eight percent between 1990 and 2005, and were projected to increase to 108.2 MMT CO_2e in 2010, 118.8 MMT CO_2e in 2020, and 126.5 MMT CO_2e in 2025. The largest increases are projected to come from energy generation, with small incremental increases in the other sectors (KDHE, 2008). Agriculture emissions in Kansas are much higher compared to other states because of the amount of farmland the state has. Emissions are predominantly from "enteric fermentation and agricultural soils." (KDHE, 2008) GHG emissions from agriculture are likely to increase by 5 percent by 2025 (KDHE, 2008).

Kansas is one of the largest oil producers in the nation with three refineries that produce diesel and motor gasoline oil. Kansas also uses a substantial amount of liquefied petroleum gas (LPG) which is primarily used for corn drying. Kansas is a significant natural gas producer and has 18 natural gas storage fields and one of the largest natural gas fields in the nation. There are nine pipelines that pass through the state from Oklahoma, Nebraska, and Colorado. "The Mid-Continent Center, a 194-mile pipeline system in south-central Kansas, is a key natural gas interconnect, merging production from several states in the region before piping it east toward major natural gas-consuming markets" (EIA, 2015g). Natural gas is the main resource for heating homes in Kansas, but overall the industrial sector consumes more than half of the state's natural gas supply and ships any remaining gas to Nebraska and Missouri (EIA, 2015g).

Kansas consumes a majority of its petroleum from the transportation sector. Between 1990 and 2005 emissions decreased annually by 0.1 percent. In the 2005, vehicles powered by gasoline were responsible for 62 percent of GHG emissions while diesel contributed 22 percent. The remaining emissions were a result of air travel, natural gas, and LPG vehicles. Between 1990 and 2005, emissions from diesel increased by 37 percent while emissions from rail and aviation decreased. The increase in diesel emissions is likely from growth in freight movement during that period (CCS, 2008).

7.1.14.4. Environmental Setting: Existing Climate

The National Weather Service (NWS) defines climate as the "reoccurring average weather found in any particular place" (NWS, 2016). 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, 2016). The first letter in each climate classification details the climate group. The Köppen-Geiger system further divides climates into smaller sub-categories based on precipitation and temperature patterns. The secondary level of classification details the seasonal precipitation, degree of aridity, and presence or absence of ice. The tertiary levels distinguish different monthly temperature characteristics (NWS, 2016).

Across the United States, the five most common climate groups are (A), (B), (C), (D), and (E). The majority of Kansas falls into climate group (C). Climates classified as (C) are generally warm, with humid summers and mild winters. During winter months, the mean climate feature is the mid-latitude cyclone (NWS, 2011a). In northern Kansas is a distinct band within the climate group (D). Climates classified as (D) are "moist continental mid-latitudinal climates," with "warm to cool summers and cold winters" (NWS, 2011a). In (D) climates, the "average temperature of the warmest month is greater than 50 degrees Fahrenheit (°F), while the coldest month is less than negative 22 °F" (NWS, 2011a). Winter months in (D) climate zones are cold and severe with "snowstorms, strong winds, and bitter cold from Continental Polar or Arctic air masses" (NWS, 2011a) (NWS, 2011b). Summer months in (D) climate zones are dominated by thunderstorms. Regions of northwestern, western, and southwestern Kansas fall into climate group (B). Climates classified as (B) are dry climates, "in large continental regions of the mid-latitudes often surrounded by mountains" (NWS, 2011a). "The most obvious climatic feature of this climate is that potential evaporation and transpiration exceed precipitation" (NWS, 2011a). Kansas has three sub-climate categories, which are described in the following paragraphs.

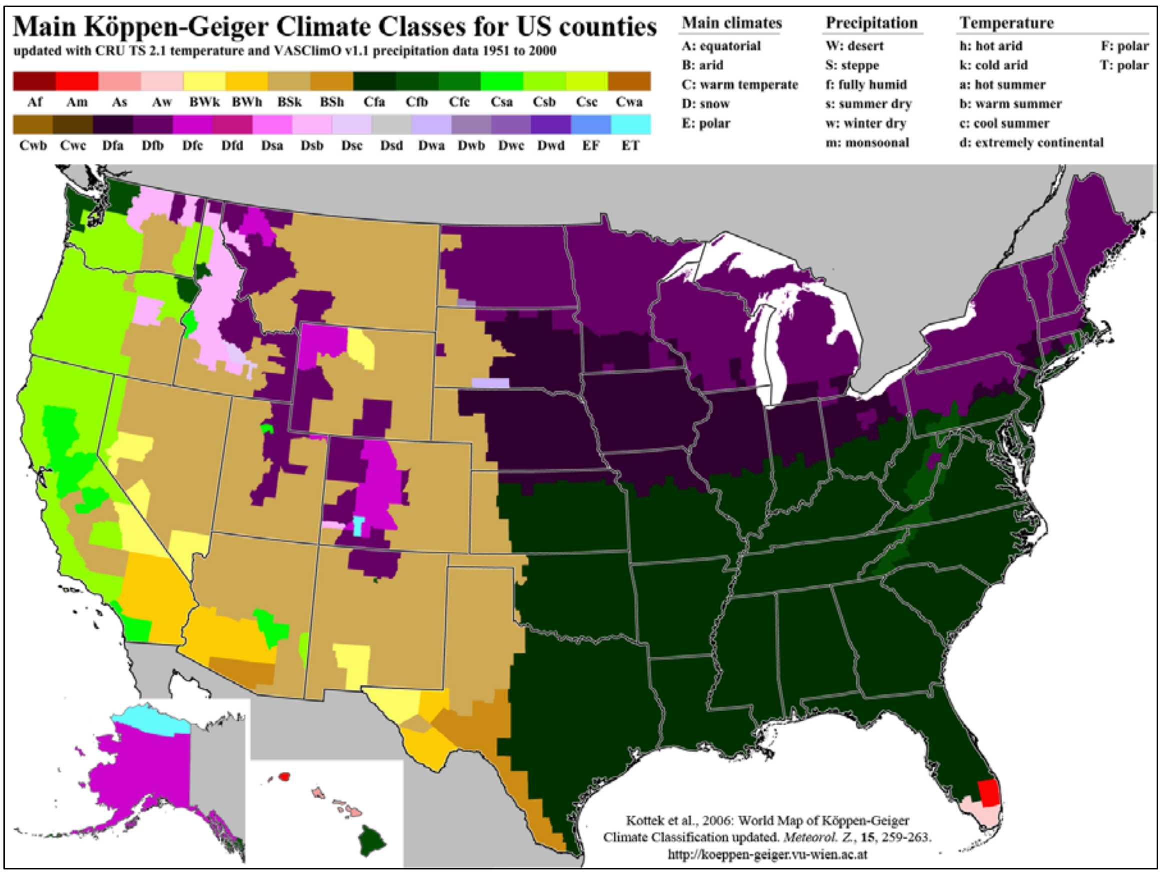


Figure 7.1.14-2: Köppen-Geiger Climate Classes for US Counties

Source: *(Kottek, 2006)*

BSk – The Köppen-Geiger climate classification system classifies northwestern, western, and southwestern regions such as Liberal, as BSk. Climates classified as BSk, are mid-latitude and dry. "Evaporation exceed precipitation on average but is less than potential evaporation" (NWS, 2011b). Average temperatures in BSk climate zones are less than 64 °F. (NWS, 2011a) (NWS, 2011b)

Cfa – The Köppen-Geiger climate classification system classifies the majority of Kansas, including the capital Topeka, 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, 2011a) (NWS, 2011b)

Dfa – The Köppen-Geiger climate classification system classifies a small northern band of Kansas, including Belleville, 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, 2011a) (NWS, 2011b)

This section discusses the current state of Kansas' climate with regard to air temperature, precipitation, and extreme weather events (e.g., severe thunderstorms, strong winds, flooding, and tornadoes) in the state's three climate regions, BSk, Cfa, and Dfa.

Air Temperature

The climate in Kansas is described as continental, "without the influence of any major bodies of water" (Knapp, 2015). Generally, summers are warm, "with the majority of the annual precipitation occurring during this period" (Knapp, 2015). Winters in Kansas are cold, with moderate amounts of snowfall. The highest temperature to occur in Kansas was on July 18, 1936 and July 24, 1936 with a record of 121 °F (SCEC, 2015). The lowest temperature to occur in Kansas was on February 13, 1905 with a record of negative 40 °F (SCEC, 2015).

The following paragraphs describe temperature variations as they occur within Kansas' various climate classification zones:

BSk – Liberal, in southwestern Kansas, is within the climate classification zone BSk. The average annual temperature in Liberal is approximately 56.2 °F; 35.2 °F during winter months; 77.2 °F during summer months; 54.9 °F during spring months; and 56.9 °F during autumn months (NOAA, 2015b).

Cfa – Topeka, the capital of Kansas, is within the climate classification zone Cfa. The average annual temperature in Topeka is approximately 55.1 °F; 32.0 °F during winter months; 76.9 °F during summer months; 55.0 °F during spring months; and 56.2 °F during autumn months (NOAA, 2015b).

Dfa – Belleville, in northern Kansas, is within the climate classification zone Dfa. The average annual temperature in Belleville is approximately 52.9 °F; 29.3 °F during winter months; 75.2 °F during summer months; 52.4 °F during spring months; and 54.1 °F during autumn months (NOAA, 2015b).

Precipitation

Annual average precipitation in Kansas ranges from approximately 45 inches in the southeast, to less than 20 inches in the west. Snowfall across the state ranges from 40 inches in the northwest to less than 15 inches in the southeast. The greatest 24-hour snowfall accumulation was on March 28, 2009 with a total of 30 inches in Pratt (SCEC, 2015).

The following paragraphs describe annual precipitation as it occurs in the various climate classification zones:

BSk – Liberal, in southwestern Kansas, is within the climate classification zone BSk. The average annual precipitation accumulation in Liberal is approximately 20.25 inches; 1.80 inches during winter months; 8.21 inches during summer months; 5.72 inches during spring months; and 4.52 inches during autumn months. (NOAA, 2015b)

Cfa – Topeka, the capital of Kansas, is within the climate classification zone Cfa. The average annual precipitation accumulation in Topeka is approximately 36.46 inches; 3.53 inches during winter months; 13.46 inches during summer months; 10.93 inches during spring months; and 8.54 inches during autumn months. (NOAA, 2015b)

Dfa – Belleville, in northern Kansas, is within the climate classification zone Dfa. The average annual precipitation accumulation in Belleville is approximately 30.60 inches; 2.43 inches during winter months; 12.02 inches during summer months; 9.34 inches during spring months; and 6.81 inches during autumn months. (NOAA, 2015b)

Severe Weather Events

Severe weather in Kansas is often generated "due to weather patterns that bring cold dry air into contact with warm moist air" (Knapp, 2015). Severe thunderstorms and tornadoes are common throughout the state, with an average of 111 tornadoes occurring on an annual basis. On average, between the years of 1950 and 2014, 60 tornadoes occur each year in Kansas. Between 2004 and 2014, this average increased to 100 tornadoes per year. The majority of tornadoes occur in May. Kansas's deadliest tornado occurred on May 25, 1955 in Kay County. Approximately half of the population in Udall was either killed or injured as a result of this tornado. In total, 75 people were killed and over 270 were injured. Monetary losses were also significant, with an estimated $2.2 million in damages. On April 26, 1991 another severe tornado struck, touching down in Harper, Sedgwick, and Butler Counties. This tornado reached an F-5 intensity, resulted in 13 fatalities, and over $272 million in damages (NWS, 1999).

Kansas is also subject to severe winds, with much of Kansas experiencing windier conditions than Chicago does. On average, annual wind speeds reach 10.4 miles per hour (mph), with wind speeds in Dodge City reaching an average of 14 mph. The largest hailstone recorded in Kansas was on September 2, 1970 with a total weight of 1.65 pounds and 17.6 inches in circumference. (SCEC, 2015) (Knapp, 2015).

Severe blizzards are also common to Kansas, with one of the most severe occurring in 1971. During this storm, approximately 10 to 13 inches of snow fell over southern Kansas, with winds that reached between 25 and 40 mph. The worst of the storm lasted for nearly eight hours, with residual snowfall lasting into the next day. When the storm ended on February 22, 1971 over 13 inches of snow was recorded at Wichita's airport, "making this one of the five worst snowstorms ever to hit Wichita, dating back to 1888." (NWS, 1999)

Flooding in Kansas is typically the result of severe thunderstorms, snowmelt, ice jams, or dam breaks and/or levee failures. In 1951, flooding affected the "Kansas, Marais des Cygnes, Neosho, and Verdigris River Basins in eastern Kansas." In total, 19 people were killed, approximately 1,100 people were injured, over 45,000 homes were either damaged or destroyed, two million farm acres were flooded, and damages totaled $5 billion (in 2000 dollars). More recently, widespread flooding across the Midwestern states, including Kansas, caused more than $400 million in damages.

7.1.15. Human Health and Safety

7.1.15.1. Definition of the Resource

The existing environment for health and safety is defined by occupational and environmental hazards likely to be encountered during the construction, 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 implementation 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 radiation or vehicle traffic.

7.1.15.2. Specific Regulatory Considerations

Federal organizations, such as Occupational Safety and Health Administration (OSHA), USEPA, the U.S. Department of Health and Human Services, and others protect human health and the environment. In Kansas, this resource area is regulated by the Kansas Department of Labor (KDOL), and the KDHE regulates waste and environmental pollution, as well as health and safety of the general public. Federal OSHA regulations apply to workers through either OSHA, or stricter state-specific plans that must be approved by OSHA. Kansas does not have an OSHA-approved "State Plan." Therefore, OSHA enforces public and private sector occupational safety and health programs in Kansas.

Federal laws relevant to protect occupational and public health and safety are summarized in Appendix C, Environmental Laws and Regulations. Table 7.1.15-1 below summarizes the major Kansas laws relevant to the state's occupational health and safety programs.

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

State Law / Regulation	Regulatory Agency	Applicability
Kansas Statutes: Chapter 44, Article 6	Kansas Department of Labor (KDOL)	Identifies occupational worker standards for investigations, worker safety, emergency control, industrial conditions, and mine inspections.
Kansas Statutes: Chapter 65, Article 57	KDHE	Helps to increase public access to information about chemicals at individual facilities, including uses and releases to the environment.
Kansas Statutes: Chapter 66, Article 17	KDOL	Requires proper occupational worker protection and notification prior to operating within 10 feet of overhead powerlines.

7.1.15.3. Environmental Setting: Existing Telecommunication Sites

There are many inherent health and safety hazards at telecommunication sites. Telecommunication site work is performed indoors, below ground level, on building roofs, over water bodies, and on communication towers. Tasks may also be performed at dangerous heights or 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, 2015a). In addition to tower climbing hazards, telecommunication workers have restricted workspace on rooftops or work from bucket trucks parked on uneven ground. Cumulatively, these conditions present fall and injury hazards to telecommunication workers, and the general public who may be observing the work or transiting the area (International Finance Corporation, 2007).

Trenches and confined spaces – In rare cases, FirstNet deployment, operation, and maintenance activities may involve work confined spaces. Installation and maintenance of underground utilities in urban areas or utility manholes[133] are examples of when trenching or confined space

[133] 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.

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. The general public can be at risk of or falling into uncovered confined spaces. (OSHA, 2016b)

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

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

Optical fiber safety – Optical fiber cable installation and repair presents additional risks to telecommunications workers, including potential eye or tissue damage, through ingestion, inhalation, or other contact with glass fiber shards. The shards are generated during termination and splicing activities, and can penetrate exposed skin (International Finance Corporation, 2007). Additionally, fusion splicing (to join optical fibers) in confined spaces or other environments with the potential for flammable gas accumulation 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 7.1.13, Noise) (OSHA, 2002). Fugitive noise may emanate beyond the telecommunication work site and impact the public living in the vicinity, observing the work, or transiting through the area (OSHA, 2016b).

Hazardous materials and hazardous waste – Work at telecommunication sites may require the storage and use of hazardous materials such as fuel sources for backup power generators and, compressed gases used for welding and metal cutting (new towers only). In some cases, telecommunication sites require use of potentially hazardous products (e.g., herbicides). Secondary hazardous materials (e.g., exhaust fumes) may present greater health risks than the primary hazardous material (e.g., diesel fuel). Furthermore, the use of hazardous materials creates down-stream potential to generate hazardous waste. While it is unlikely that any FirstNet activities would involve the generation or storage of hazardous waste, older existing telecommunication structures and sites could have hazardous materials present, such as lead-based paint on outdoor structures or asbestos tiles and insulation in equipment sheds. The general public, unless a telecommunication work site allows unrestricted access, are typically shielded from hazardous materials and hazardous wastes that are components of telecommunication site work. (OSHA, 2016b)

Aquatic environments – Installation of telecommunication lines may include laying, burying, or boring lines under wetlands and waterways, including lakes, rivers, ponds, and streams. Workers responsible for these activities operate heavy equipment from soft shorelines, boats, barges, and other unstable surfaces. There is potential for equipment and personnel falls, as well as drowning in waterbodies. Wet work conditions also increase risks of electric shock and hypothermia. (OSHA, 2016b)

Outdoor elements – Weather conditions have the potential to quickly and drastically reduce safety, and increase hazards at telecommunication work sites. Excessive heat and cold conditions impact judgement, motor skills, hydration, and in extreme cases may lead to hyper- or hypothermia. Precipitation, such as rain, ice, and snow, create slippery climbing conditions and wet or muddy ground conditions. Lightning strikes are risks to telecommunication workers climbing towers or working on top of buildings. (OSHA, 2016b)

Telecommunication Worker Occupational Health and Safety

The BLS uses established industry and occupational codes to classify telecommunications workers. For industry classifications, BLS uses the North American Industry Classification System (NAICS) codes, which identify the telecommunications industry (NAICS code 517XX) as being within the information industry (NAICS code 51). For occupational classifications, BLS uses the Standard Occupational Classification (SOC) system to identify workers as belonging to one of 840 occupations. Telecommunications occupations are identified as both telecommunication equipment installers and repairers, except line installers (SOC code 49-2022), 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 2,620 telecommunication equipment installers and repairers, and 2,060 telecommunication line installers and repairers (Figure 7.1.15-1) working in Kansas (BLS, 2015c). In 2011, the most recent year data are available, Kansas had 0.7 cases of nonfatal occupational injuries or illnesses in the telecommunications industry per 100 full-time workers (BLS, 2011). 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, 2014a).

Nationwide in 2013, there were 18 fatalities reported across the telecommunications industry (5 due to violence and other injuries by persons or animals; 3 due to transportation incidents; 7 due to slips, trips, or falls; and 3 due to unknown causes), with an hours-based fatal injury rate of 7.9 per 100,000 full-time equivalent workers (BLS, 2013). This represents 45 percent of the broader information industry fatalities (40 total), and less than 1 percent of total occupational fatalities (4,585 total). Kansas had one fatality within the telecommunication line installers and repairers occupation (SOC code 49-9052) in 2013. By comparison, within the broader installation, maintenance, and repair occupations (SOC code 49-0000), there were 59 fatalities in Kansas between 2003 and 2014, including six fatalities in 2014, with the highest being eight fatalities in 2005 (BLS, 2015d).

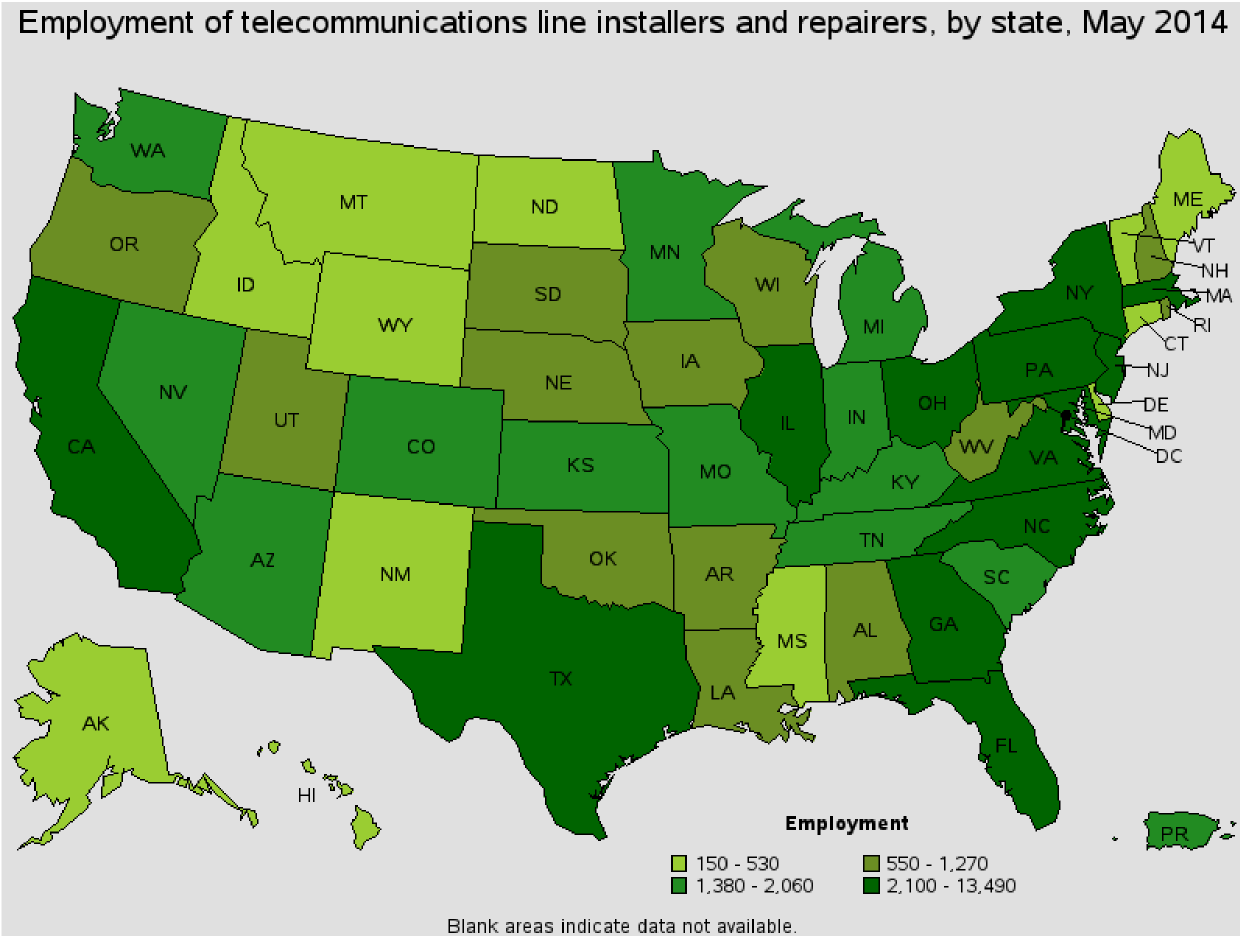


Figure 7.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014

Source: (BLS, 2015e)

Public Health and Safety

The general public is unlikely to encounter occupational hazards at telecommunication sites, due to limited access. KDHE collects injury surveillance and fatality data among the general public through the Kansas Environmental Public Health Tracking (EPHT) program (KDHE, 2015k). The same data are reported with more specificity at the federal level through the Center for Disease Control and Prevention Wide-ranging Online Data for Epidemiologic Research (WONDER). While the WONDER database cannot be searched for cases specific to telecommunication sites, many available injury categories are consistent with risks present at telecommunication sites. For example, between 1999 and 2013, there were 89 fatalities due to a fall from, out of, or through a building or structure; 25 fatalities due to exposure to electric transmission lines; and 59 fatalities due to being caught, crushed, jammed or pinched in or between objects (CDC, 2015). Among the general public, trespassers entering telecommunication sites would be at the greatest risk for exposure to health and safety hazards.

7.1.15.4. 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 at telecommunication sites, prior to the creation of environmental laws, could result in environmental contamination, affecting the quality of soil, sediments, groundwater, surface water, and air.

Contaminated property is typically classified by the federal environmental remediation or cleanup programs that govern them, such as sites administered through the Superfund Program[134] 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 Kansas, the KDHE provides oversight to USEPA superfund sites in the state through the Superfund Assistance Cooperative Agreement, funded by a USEPA grant (KDHE, 2015l). However, Kansas does not have a state-funded Superfund program. As of October 2015, Kansas had 40 RCRA Corrective Action sites[135], 605 brownfields, and 13 proposed or final Superfund/NPL sites (USEPA, 2015k). Based on a October 2015 search of USEPA's Cleanups in My Community (CIMC) database, there are three Superfund sites in Kansas where contamination has been detected at an unsafe level, or a reasonable human exposure risk exists (Cherokee County, near Galena, KS; United Zinc, near Iola, KS; and Plating Inc., near Great Bend, KS) (USEPA, 2015m).

Kansas's Brownfields Program and Voluntary Cleanup and Property Redevelopment Program offer incentives for the remediation and redevelopment of contaminated properties, which would otherwise hinder economic progress (KDHE, 2015m). One example of a brownfield site is the

[134] 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).

[135] Data gathered using the USEPA's Cleanups in My Community (CIMC) search on October 27, 2015, for all sites in Kansas, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active) (National Science Foundation 2015).

0.4-acre Chanute Movie Theater site (Chanute, KS), formerly developed as a filling station and parking lot. After sampling was conducted, a residential land use restriction was placed on the site due to petroleum contamination discovered in the soil. The site was then redeveloped into a movie theater in 2007 (KDHE, 2007).

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 TRI 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, Kansas had 309 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, Kansas released 21.2M pounds of toxic chemicals through onsite and offsite disposal, transfer, or other releases, largely from the electric utilities and chemicals industries. This accounted for 0.52 percent of nationwide TRI releases, ranking Kansas 44th in the nation based on total releases per square mile (USEPA, 2015c).

Another USEPA program is the National Pollutant Discharge Elimination System (NPDES), which regulates the quality of storm water 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 March 21, 2016, Kansas had 56 permitted major discharge facilities registered with the USEPA Integrated Compliance Information System (USEPA, 2015o).

The National Institute of Health, U.S. National Library of Medicine, provides an online mapping tool called TOXMAP, which allows users to “visually explore data from the USEPA’s TRI and Superfund Program” (National Institute of Health, 2015a). Figure 7.1.15-2 provides an overview of potentially hazardous sites in Kansas.

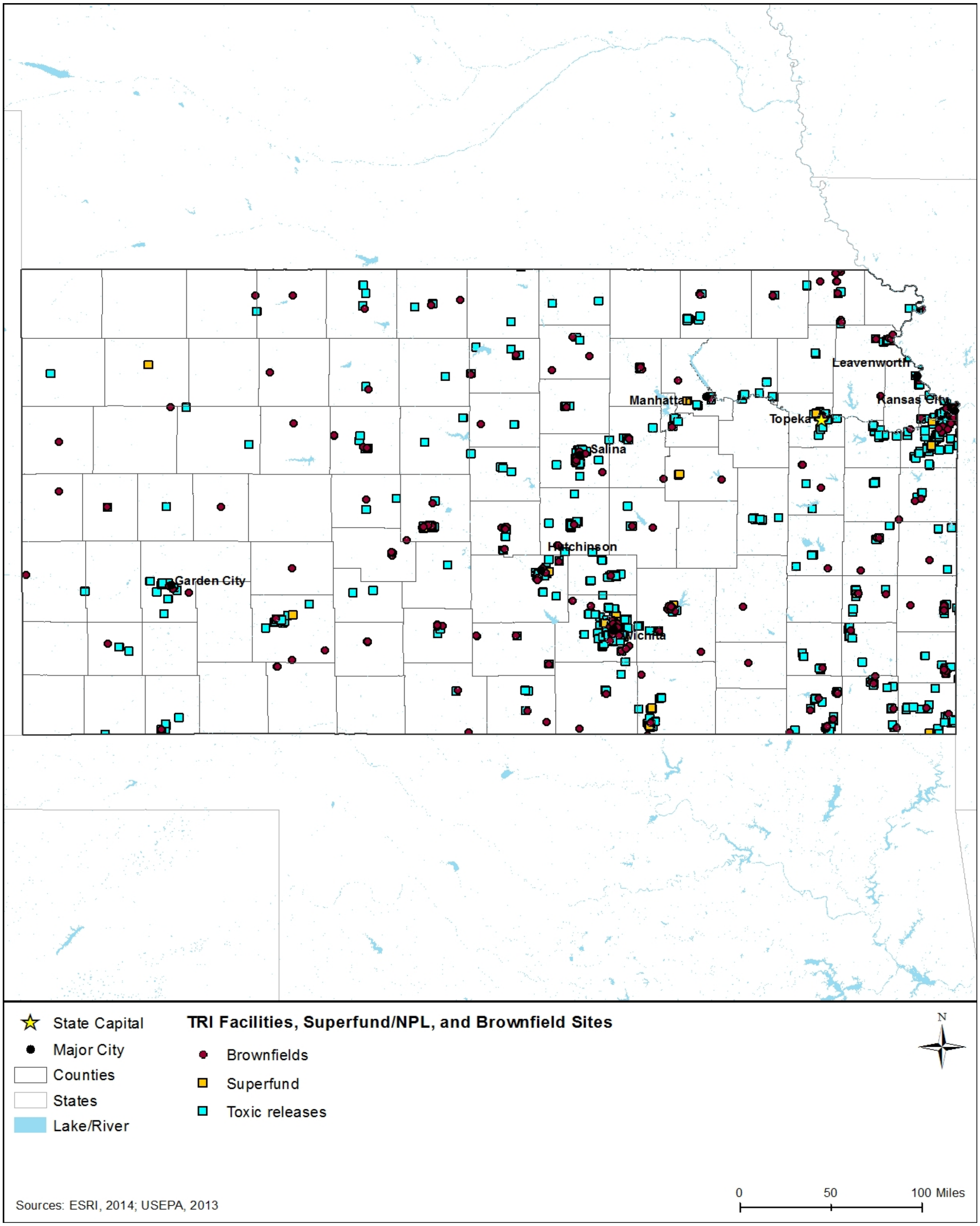


Figure 7.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in Kansas (2013)

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be on or near contaminated land, industrial discharge facilities, or sites presenting additional hazards. Occupational exposure to contaminated environmental media can occur during activities like soil excavating, trenching, other earthwork, and working over water bodies. Indoor air quality may 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 78 USEPA-regulated telecommunications sites in Kansas (USEPA, 2015e). These sites are regulated under one or more environmental programs including NPDES compliance, Superfund/NPL status, and TRI releases.

According to BLS data, Kansas had three occupational fatalities in 2004 within the installation, maintenance, and repair occupations (SOC code 49-0000) from exposure to "harmful substances or environments," although these were not specific to telecommunications (BLS, 2015d). The BLS reported three fatalities in 2011 and three fatalities[136] in 2014 nationwide within the telecommunications industry (NAICS code 517), due to exposure to harmful substances or environments. (BLS, 2015f). In 2014, BLS also reported four 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, 2014b).

Public Health and Safety

As described earlier, access to telecommunication sites is nearly always restricted to occupational workers. Although site access control is one of the major reasons telecommunication sites present an inherent low risk to non-occupational workers, the general public could be potentially exposed to contaminants and other hazards in a variety of ways. One example would be if occupational workers disturb contaminated soil while digging, causing hazardous chemicals to mix with an underlying groundwater drinking water sources. If a contaminant enters a drinking water source, the surrounding community could inadvertently ingest or absorb the contaminant when using that source of water for drinking, cooking, bathing, and swimming. By trespassing on a restricted property, a trespasser may come in contact with contaminated soil or surface water, or by inhaling harmful vapors. KDHE collects injury surveillance and fatality data among the general public through the Kansas EPHT program, although it does not report public health data resulting from exposure to environmental contamination (KDHE, 2015k).

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

Spotlight on Kansas Superfund Sites: United Zinc and Associated Smelters

Iola, Kansas, is home to several zinc and lead smelting plants, which have operated since the early 1900s, including the United Zinc and East Iola smelters on the east side of town and the Lanyon smelters on the west side of town. Smelting operations release lead into the atmosphere, which deposits to the soils in the surrounding area accumulates throughout the city. In 2006 and 2007, the USEPA conducted soil sampling in the community, and found high concentrations of lead deposits in residential soils, significant enough to constitute a public health risk. Emergency removal of lead-contaminated soils was conducted in 2006 and 2007 at 129 residential properties and a school yard. Contaminated soil was mechanically excavated and replaced with clean soil (Figure 7.1.15-3), then revegetated. (USEPA, 2015q). Lead concentrations of above 400 parts per million (ppm) are known to cause brain and kidney damage, and can be particularly dangerous for children younger than six years of age. As of 2015, the USEPA has sampled 2,500 residential properties for lead and found 1,050 properties with lead concentrations above 400 ppm that are scheduled for cleanup. (USEPA, 2015r)

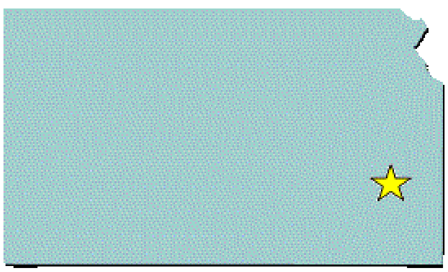


Figure 7.1.15-3: Removal of Contaminated Soil from a Schoolyard in Iola

Source: (KDHE 2006)

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

Another health and safety hazard in Kansas includes surface and subterranean mines. In 2014, the Kansas mining industry ranked 19th for non-fuel minerals (helium, portland cement, salt, crushed stone, and sand and gravel), generating a value of $1.15B (USGS, 2016a). In 2013, the most recent data available, Kansas had only one surface coalmining operation (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 (U.S. Department of the Interior, 2015b).

In Kansas, the KDHE, Surfacing Mining Section administers the AML Program, which oversees reclamation projects funded by grants from the Surface Mining Control and Reclamation Act. The AML section is responsible for managing AML health and safety hazards resulting from pre-1977 mining operations. The AML Emergency Program abates hazards that have an eminent impact on public health. The Surface Mining Section estimates there are approximately 350 abandoned coalmines in Kansas, projected to cost over $225M to reclaim (KDHE, 2015n).

Figure 7.1.15-4 shows the distribution of High Priority (Priority 1, 2 and adjacent Priority 3) AMLs in Kansas, 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, Kansas had 465 Priority 1 and 2 AMLs, with 349 unfunded problem areas (U.S. Department of the Interior, 2015c).

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be on or near AMLs or mine fires, presenting occupational exposure risks from fire, toxic gases, and subsidence during FirstNet deployment, operation, and maintenance activities. Because the locations of many abandoned mines are unknown or hidden, these mines pose a risk to telecommunications workers because they may be encountered during new construction operations.

Public Health and Safety

Subterranean mines present additional health and safety risks to the general public, by generating toxic combustible gases, which can penetrate the surface through ground fractures, potentially seeping into residential structures. Additionally, mine fires can consume enough sub-surface material, that risk of subsidence increases. As a result, AMLs and mine fires in particular, can result in evacuations of entire communities (U.S. Department of the Interior, 2015d). KDHE promotes a “Stay Out and Stay Alive” program, to educate the public of the dangers of abandoned mines (KDHE, 2015o).

Figure 7.1.15-4: High Priority Abandoned Mine Lands in Kansas (2015)

Source: (U.S. Department of the Interior, 2015e)

7.1.15.6. 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 general public. Telecommunications, including public safety communications, can be unavailable (temporarily or permanently) during disaster events. Examples of manmade disasters are train derailments, refinery fires, or other incident involving the release of hazardous constituents. A common example of a natural disaster is flooding. Floodwaters damage transportation infrastructure (roads, railways, etc.) and utility lines (sewer, water, electric power, broadband, natural gas lines, etc.). 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). High-risk targets for terror attacks include government centers, military bases, industrial facilities, and airfields, etc. As such, the District of Columbia presents an inherent risk for this type of disaster.

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 early responders 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, KDHE 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 177 NRC-reported incidents for Illinois in 2015 with known causes, four incidents were attributed to natural disaster (e.g., natural phenomenon), while 173 incidents were attributed to manmade disasters (e.g., derailment, dumping, equipment failure, operator error, over pressuring, transport accident, or trespasser) or other indeterminate causes (U.S. Coast Guard, 2015). For example, in May 2007, a tornado damaged an anhydrous ammonia pipeline between two large outdoor storage tanks at Southern Plains Co-Op in Greensburg, KS, releasing an unknown quantity of anhydrous ammonia. The owner of the tanks was unable to respond and clean up the release due to the severity of the tornado (U.S. Coast

Guard, 2012). Such incidents present unique, hazardous challenges to telecommunication workers during natural disasters.

Public Health and Safety

Hazards present during natural and manmade disasters are often far-reaching, affecting large geographic areas and affecting all populations living within the area. Similar to telecommunication workers, the public faces risks during these types of disasters, such as compromised transportation infrastructure and utilities, potential for exposure to unknown chemical and biologic hazards, and inadequate medical support. In 2014, Kansas had 1 weather-related fatality (due to heat) and 28 non-fatal injuries (NWS, 2015a). By comparison, during the tornado outbreak in 2007, Kansas had 17 weather-related fatalities and 96 non-fatal injuries (NWS, 2008).

Spotlight on Kansas Natural Disaster Sites: 2007 Tornado Outbreak

On May 4, 2007, a supercell thunderstorm developed near Greensburg, KS, generating 12 tornados that caused widespread devastation in Comanche County. One EF-5 tornado (over 200 mile per hour wind gusts) struck the town of Greensburg, KS, damaging a path 1.7 miles across and 5 to 6 blocks wide (Figure 7.1.15-5) (FEMA 2007). The tornado destroyed 95 percent of Greensburg and caused 11 fatalities despite adequate tornado warnings. Damaged infrastructure included 961 buildings destroyed, 216 buildings with major damage, and several ruptured petroleum storage tanks causing major environmental concerns. Debris remained strewn throughout the town as late as July 26, closing Highway 54 for over a month, which hindered emergency response operations for an extended time (NWS 2015b). Natural gas lines also ruptured, adding to the hazardous response conditions (U.S. Coast Guard, 2007).

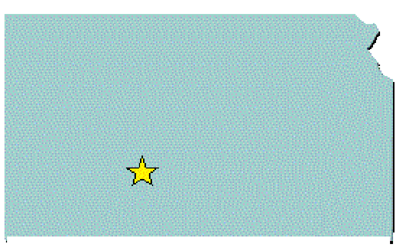


Figure 7.1.15-5: May 4, 2007 Tornado Damage (Greensburg, KS)

Source: (FEMA 2007)

7.2. ENVIRONMENTAL CONSEQUENCES

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

NEPA requires agencies to assess the potential direct and indirect impacts each alternative could have on the existing environment (as characterized earlier in this section). Direct impacts are those impacts that are caused by the Proposed Action and occur at the same time and place, such as soil disturbance. Indirect impacts are those impacts related to the Proposed Action but result from an intermediate step or process, such as changes in surface water quality because of soil erosion.

For each resource, the potential impact is assessed in terms of context of the action and the intensity of the potential impact, per CEQ regulations (40 CFR §1508.27). *Context* refers to the timing, duration, and where the impact could potentially occur (i.e., local vs. national; pristine vs. disturbed; common species vs. protected species). In terms of duration of potential impact, context is described as short or long term. *Intensity* refers to the magnitude or severity of the effect as either beneficial or adverse. Resource-specific significance rating criteria are provided at the beginning of each resource area section.

7.2.1. Infrastructure

7.2.1.1. Introduction

This section describes potential impacts to infrastructure in Kansas associated with construction, deployment, and operation of the Proposed Action and Alternatives. Chapter 19, Best Management Practices and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.1.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 7.2.1-1. As described in Section 7.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 7.2.1-1: Impact Significance Rating Criteria for Infrastructure

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

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

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

NA = Not Applicable

7.2.1.3. Description of Environmental Concerns

Transportation System Capacity and Safety

The primary concerns for transportation system capacity and safety related to FirstNet activities would primarily occur during the construction phases of deployment. Depending on the exact site locations and placement of new assets in the field, temporary impacts on traffic congestion, railway use, airport operations, or use of other transportation corridors could occur if site locations were near or adjacent to roadways and other transportation corridors, requiring temporary closures (lane closures on roadways, for example). Coordination would be necessary with the relevant transportation authority (i.e., departments of transportation, airport authorities, and railway companies to ensure proper coordination during deployment. KDOT has jurisdiction over freeways and major roads, airports, railroads, and mass transit in the state; local counties have jurisdiction for smaller streets and roads.

Based on the impact significance criteria presented in Table 7.2.1-1, such impacts would be less than significant due to the temporary nature of the deployment activities, even if such impacts would be realized at one or more isolated locations. Such impacts would be noticeable during the construction phase, but would be short-term, with no anticipated impacts continuing into the operational phase, unless any large-scale maintenance would become necessary during operations.

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

The capacity of local health, public safety, and emergency response services would experience less than significant impacts during deployment or operation phases. During deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. The only potential impact would be extremely rare – and that is if emergency response services were using transportation infrastructure to respond to an emergency at the exact time that deployment activities were taking place. This type of impact would be isolated at the local or neighborhood level, and the likelihood of such an impact would be extremely low. Once operational, the new network would provide beneficial impacts to the capacity of local health, public safety, and emergency response services through enhanced communications infrastructure, thereby increasing capacity for and enhancing the ability of first responders to communicate during emergency response situations. Based on the impact significance criteria presented in Table 3.2.1-1, 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 7.2.1-1, any potential impacts would be less than significant during deployment. As described above, during deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. Once operational, state and local public safety organizations would need to evaluate telecommunication practices and standard operating procedures (SOPs). FirstNet's mission is to 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

Commercial telecommunication systems, communications, or level of service would experience no impacts, as such commercial assets would be using a different spectrum for communications. Kansas's commercial telecommunications industry and infrastructure is robust with multiple service providers, offering products and services via the full spectrum of telecommunications technologies (FCC, 2014a) (FCC, 2014b). 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.[137] Such leases would then have less than significant positive impacts on commercial telecommunication systems, communications, or level of service, per the impact significance criteria presented in Table 7.2.1-1.

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

The activities proposed by FirstNet would have less than significant impacts on utilities, including electric power transmission facilities, and water and sewer facilities. Depending on the specific project contemplated, installation of new equipment could require connection with local electric sources, and use of site-specific local generators, on a temporary or permanent basis. Also, depending on the specific project contemplated, the draw or use of power from the 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.

[137] 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.

7.2.1.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to infrastructure resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes or disruption of transportation, telecommunications, or utility services.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would have no impacts to infrastructure resources because there would be no ground disturbance and no interference with existing utility, transportation, or communication systems.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the use of portable devices that use satellite technology would not impact infrastructure resources because there would be no change to the built or natural environment from the use of portable equipment. Installation of satellite-enabled equipment would not be expected to have any impacts to infrastructure resources, given that construction activities would occur on existing structures, would not be expected to interfere with existing equipment, and transportation capacity and safety, and access to emergency services would not be impacted.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN, however it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch

vehicle would be very unlikely to impact infrastructure resources, it is anticipated that this activity would have no impact on infrastructure resources.

Activities with the Potential to Have Impacts

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

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of points of presence (POPs), huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to infrastructure resources, depending on the specific assets connected on either end of the buried fiber. If a fiber optic plant is being used to tie into existing telecommunications assets, then localized impacts to telecommunications sites could occur during the deployment phase, however, it is anticipated that this tie-in would cause less than significant impacts as the activity would be temporary and minor.
  - New Build – Aerial Fiber Optic Plant: Installation of a new aerial fiber optic plant could impact new telecommunications infrastructure through the installation of new or replacement of existing telecommunications poles.
  - Collocation on Existing Aerial Fiber Optic Plant: Similar to new build activities (above), collocation on existing aerial fiber optic plant could include installation of new or replacement towers requiring ground disturbance.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact infrastructure resources because there would be no local infrastructure to impact, other than harbor operations. However, impacts to infrastructure resources could potentially occur as the result of the construction of landings and/or facilities on shores or the banks of waterbodies that accept the submarine cable, depending on the exact site location and proximity to existing infrastructure.
  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment such as small boxes or huts, or access roads, could potentially impact infrastructure. Impacts could include disruption of service in transportation corridors, disruption of service to telecommunications infrastructure, or other temporary impacts.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads might result in temporary or unintended impacts to current utility services during installation or

interconnection activities. Generally, however, these deployment activities would be independent and would not be expected to interfere with other existing towers and structures. In addition, installation activities would have beneficial impacts due to expansion of infrastructure at a local level. Such activities could enhance public safety infrastructure, and other telecommunications as the site could potentially be available for subsequent collocation.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would result in localized impacts to that tower and such as minor disruptions in services. As a result of collocation of equipment, the potential addition of power units, structural hardening, and physical security measures could potentially have beneficial impacts on existing infrastructure assets, depending on the site-specific plans.
- Deployable Technologies: Deployable technologies such as COWs, Cell on Light Trucks (COLT), and Site on Wheels (SOW) 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 (ROW) 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, although likely minor, impacts on utilities, if new infrastructure requires 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 ongoing phase of deployment, and minor. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Positive impacts to infrastructure resources may result from the expansion of public safety and commercial telecommunications capacity and an improvement in public safety telecommunications coverage, system resiliency, response times, and system redundancy.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to infrastructure associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if further construction related activities are required along public road and utility ROWs, increased traffic congestion, current telecommunication system interruption, and utility interruptions could occur. These potential impacts would be expected to be minor and temporary as explained above.

Numerous beneficial impacts would be associated with operation of the NPSBN. The new system is intended to result in substantial improvements in public safety response times and the ability to communicate effectively with and between public safety entities, and would 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 minimize disruptions and misinformation resulting from limited or disrupted service. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.1.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred

Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to infrastructure as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to infrastructure even if deployment requires expansion of infrastructure, such as paving of previously unpaved surfaces or other new infrastructure built to support deployment. This is primarily due to the small amount of paving or new infrastructure that might have to be constructed to accommodate the deployables. The site-specific location of deployment would need to be considered, and any local infrastructure assets (transportation, telecommunications, or utilities) would need to be considered, planned for, and managed accordingly to try to avoid any negative impacts to such resources. Beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events. 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 infrastructure resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment, as part of routine maintenance or inspection occurs off an established access roads or utility ROWs, or if additional maintenance-related construction activities occur within public road and utility ROWs, less than significant impacts would likely still occur to transportation systems or utility services due to the limited amount of new infrastructure needed to accommodate the deployables. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated deployment or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to infrastructure as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 7.1.1, Infrastructure. The state also would not realize positive, beneficial impacts to infrastructure resources described above.

7.2.2. Soils

7.2.2.1. Introduction

This section describes potential impacts to soil resources in Kansas associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.2.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 7.2.2-1. As described in Section 7.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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 impact.

Table 7.2.2-1: Impact Significance Rating Criteria for Soils

Type of Effect	Effect Characteristic	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Soil erosion	Magnitude or Intensity	Severe, widespread, and observable erosion in comparison to baseline, high likelihood of encountering erosion-prone soils.	Effect that is potentially significant, but with mitigation is less than significant.	Perceptible erosion in comparison to baseline conditions; low likelihood of encountering erosion-prone soil types.	No perceptible change in baseline conditions.
	Geographic Extent	State or territory.		Region or county.	NA
	Duration or Frequency	Chronic or long-term erosion not likely to be reversed over several years.		Isolated, temporary, or short-term erosion that that is reversed over few months or less.	NA
Topsoil mixing	Magnitude or Intensity	Clear and widespread mixing of the topsoil and subsoil layers.	Effect that is potentially significant, but with mitigation is less than significant.	Minimal mixing of the topsoil and subsoil layers has occurred.	No perceptible evidence that the topsoil and subsoil layers have been mixed.
	Geographic Extent	State or territory.		Region or county.	NA
	Duration or Frequency	NA		NA	NA
Soil compaction and rutting	Magnitude or Intensity	Severe and widespread, observable compaction and rutting in comparison to baseline.	Effect that is potentially significant, but with mitigation is less than significant.	Perceptible compaction and rutting in comparison to baseline conditions.	No perceptible change in baseline conditions.
	Geographic Extent	State or territory.		Region or county.	NA
	Duration or Frequency	Chronic or long-term compaction and rutting not likely to be reversed over several years.		Isolated, temporary, or short term compaction and rutting that is reversed over a few months or less.	No perceptible change in baseline conditions.

NA = Not Applicable

7.2.2.3. Description of Environmental Concerns

Soil Erosion

Soil erosion is an environmental concern of nearly every construction activity that involves ground disturbance. Construction erosion typically only occurs in a small area of land with the actual removal of vegetative cover from construction equipment or by wind and water erosion. Of concern in Kansas 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. Parts of Kansas contain soil types that occur on steep slopes and, therefore, have a medium to high potential for erosion. Those soil types include: Albolls, Aqualfs, Aquents, Aquerts, Aquolls, Arents, Fluvents, Orthents, Udalfs, Uderts, Udolls, Udults, Ustalfs, Ustepts, Usterts, and Ustolls suborders (see Section 7.1.2.4, Soil Suborders and Figure 7.1.2-2).

Based on the impact significance criteria presented in Table 7.2.1-1, building of some of FirstNet's network deployment sites could cause potentially significant erosion at locations with highly erodible soil and steep grades. Implementation of BMPs and mitigation measures (see Chapter 19) could further reduce potential impacts.

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, where practicable and feasible, to avoid or minimize impacts, and minimize the periods when exposed soil is open to precipitation and wind (see Chapter 19).

Topsoil Mixing

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

Based on impact significance criteria presented in Table 7.2.1-1, and due to the relatively small scale (less than 1 acre) of most FirstNet project sites, minimal topsoil mixing is anticipated. Implementation of BMPs and mitigation measures (Chapter 19) could further reduce potential impacts.

Soil Compaction and Rutting

Soil compaction and rutting at construction sites could involve heavy land clearing equipment such as bulldozers and backhoes, trenchers and directional drill rigs to install buried fiber, and cranes to install towers and aerial infrastructure. Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (see Section 7.1.2.4, Soil Suborders). Based on impact significance criteria presented in Table 7.2.1-1, 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.

7.2.2.4. *Potential Impacts of the Preferred Alternative*

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit through existing hand-holes, pulling vaults, junction boxes, huts, and POPs 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 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 POPs that require ground disturbance. Impacts from fiber optic plant installation and structure construction, as well as associated grading and restoration of the disturbed ground when construction is completed, could result in soil erosion, topsoil mixing, or soil compaction and rutting.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and replacement/upgrading of existing poles and structures could potentially impact soil resources resulting from ground disturbance for pole/structure installation (soil erosion and topsoil mixing), and heavy equipment use from bucket trucks operating on existing gravel, or dirt roads (soil compaction and rutting). Potential impacts to soils are anticipated to be small-scale and short-term.
  - Collocation on Existing Aerial Fiber Optic Plant: Topsoil removal, soil excavation, and excavated material placement during the replacement of poles and structural hardening could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in soil compaction and rutting.
  - New Build – Submarine Fiber Optic Plant: Installation of fiber optic plants in limited nearshore or inland bodies of water could potentially impact soil resources at and near the landings or facilities on shores or the banks of waterbodies that 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 or structural hardening are needed, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to soil resources could occur, including soil erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.
- Deployable Technologies: Implementation of deployable technologies could result in potential impacts to soil resources depending on the technology and location for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could result in soil compaction and rutting if deployed in unpaved areas. Where technologies such as COWs, COLTs, and SOWs are deployed on existing paved surfaces, there would be no impacts to soil resources because there would be no ground disturbance.

In general, the abovementioned activities could potentially involve land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to soil resources associated with deployment of this infrastructure could include soil erosion, topsoil mixing, or soil compaction and rutting. These impacts are expected to be less than significant as the activity would likely be short team, localized to the deployment locations, and would return to normal conditions as soon as revegetation occurs, often by the next growing season. It is expected that heavy equipment would utilize existing roadways and utility ROWs for deployment activities. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described earlier, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be no impacts to soil resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if the acceptable load of the surface is exceeded, soil compaction and rutting impacts could result as explained above. These impacts are expected to be less than significant due to the temporary nature and small scale of operations activities with the potential to create impacts. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.2.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to soil resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces, due to the small-scale nature of expected FirstNet activities in any particular location. In addition, impacts to soils could occur on paved surfaces if the acceptable load of the surface is exceeded. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could also result in soil compaction and rutting if deployed in unpaved areas. However, these potential impacts are expected to be less than significant due to the small scale and short-term nature of the deployment. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred

Alternative, it is anticipated that there would be no impacts to soil resources associated with routine inspections of 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 inspections occurs off of established access roads or corridors, or if the acceptable load of the surface is exceeded, less than significant soil compaction and rutting impacts could result as previously explained above. Finally, if deployable technologies are parked and operated with air conditioning for extended periods, the condensation water from the air conditioner could result in minimal soil erosion. However, it is anticipated that the potential soil erosion would result in less than significant impacts as described above. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to soil resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 7.1.2, Soils.

7.2.3. Geology

7.2.3.1. Introduction

This section describes potential impacts to Kansas geology resources associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.3.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 7.2.3-1. As described in Section 7.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 7.2.3-1: Impact Significance Rating Criteria for Geology

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Seismic Hazard	Magnitude or Intensity	High likelihood that a project activity could be located within a high-risk earthquake hazard zone or active fault.	Effect that is potentially significant, but with mitigation is less than significant.	Low likelihood that a project activity could be located within an earthquake hazard zone or active fault.	No likelihood of a project activity being located in an earthquake hazard zone or active fault.
	Geographic Extent	Hazard zones or active faults are highly prevalent within the state/territory.		Earthquake hazard zones or active faults occur within the state/territory, but may be avoidable.	Earthquake hazard zones or active faults do not occur within the state/territory.
	Duration or Frequency	NA		NA	NA
Volcanic Activity	Magnitude or Intensity	High likelihood that a project activity could be located near a volcano lava or mud flow area of influence.	Effect that is potentially significant, but with mitigation is less than significant.	Low likelihood that a project activity could be located near a volcanic ash area of influence.	No likelihood of a project activity located within a volcano hazard zone.
	Geographic Extent	Volcano lava flow areas of influence are highly prevalent within the state/territory.		Volcano ash areas of influence occur within the state/territory, but may be avoidable.	Volcano hazard zones do not occur within the state/territory.
	Duration or Frequency	NA		NA	NA
Landslide	Magnitude or Intensity	High likelihood that a project activity could be located within a landslide area.	Effect that is potentially significant, but with mitigation is less than significant.	Low likelihood that a project activity could be located within a landslide area.	No likelihood of a project activity located within a landslide hazard area.
	Geographic Extent	Landslide areas are highly prevalent within the state/territory.		Landslide areas occur within the state/territory, but may be avoidable.	Landslide hazard areas do not occur within the state/territory.

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

7.2.3.3. Description of Environmental Concerns

Environmental concerns regarding geology can be viewed as two distinct types, those that would potentially provide impacts to the project, such as seismic hazards and landslides, and those that would potentially cause, 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 7.1.3.8, the majority of Kansas is not at risk to significant earthquake events. As shown in Figure 7.1.3-4, Kansas is at a low risk to earthquakes throughout the state, as no earthquake over magnitude 6.0 on the Richter scale has ever occurred in the state. Based on the impact significance criteria presented in Table 7.2.3-1, seismic impacts would be less than significant even if FirstNet's deployment locations were within high-risk earthquake hazard zones or active fault zones, to the small scale and short-term nature of the deployment. Given the potential for minor to moderate earthquakes in parts of Kansas, some amount of infrastructure could be subject to earthquake hazards, in which case BMPs and mitigation measures (see Chapter 19) could help avoid or minimize the potential impacts.

Volcanic Activity

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

Landslides

Similar to seismic hazards, another concern would be placement of equipment in areas that are highly susceptible to landslides. 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.

As discussed in Section 7.1.3.8, despite its relatively flat topography, portions of Kansas are susceptible to landslide events (Kansas Geological Survey, 1999). The Kansas Division of Emergency Management considers it "likely" that a landslide will occur within Kansas within any three-year period. The areas of Kansas at greatest risk to landslides are in northeastern and north-central Kansas, and include "the Kansas City metropolitan area (Johnson, Leavenworth, and Wyandotte counties); the Smoky Hills in northern and central Kansas; and northwestern Hamilton County." Based on the impact significance presented in Table 7.2.3-1, potential impacts associated with landslides from deployment or operation of the Proposed Action would have less than significant impacts as it is likely that the project would attempt to avoid areas that are prone to landslides; however, landslide impacts to the Proposed Action could be potentially significant if FirstNet's deployment locations were within areas in which landslides are highly prevalent. Where infrastructure is subject to landslide hazards, BMPs and mitigation measures, as discussed in see Chapter 19, could help avoid or minimize the potential impacts.

Land Subsidence

As discussed in Section 7.1.3.8 and shown in Figure 7.1.3-6, portions of Kansas are vulnerable to land subsidence due to karst topography and mine collapse. Based on the impact significance criteria presented in Table 7.2.3-1, potential impacts to soil subsidence from deployment or operation of the Proposed Action would have less than significant impacts. However, subsidence impacts to the Proposed Action could be potentially significant to the Proposed Action if FirstNet's deployment locations were within areas at high risk to inundation from long-term land subsidence; however, where infrastructure is subject to land subsidence hazards, BMPs and mitigation measures, as discussed in Chapter 19, could help avoid or minimize the potential impacts.

Potential Mineral and Fossil Fuel Resource Impacts

Equipment deployment near mineral and fossil fuel resources are not likely to affect these resources. Rather the new construction is only likely to limit access to extraction of these resources. Based on the impact significance criteria presented in Table 7.2.3-1, impacts to mineral and fossil fuel resources are unlikely as the Proposed Action could only be potentially significant if FirstNet's deployment locations were to cause severe, widespread, observable impacts to mineral and/or fossil fuel resources. To the extent practicable and feasible, 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 7.2.3-1 impacts to paleontological resources could be potentially significant if FirstNet's buildout/deployment locations uncovered paleontological resources during construction activities. It is anticipated that potential impacts to specific areas known to contain paleontological resources would be avoided, minimized, or mitigated, and any potential impacts would be limited and localized. Potential impacts to fossil resources should be considered on a site-by-site basis. BMPs and mitigation measures (see Chapter 19) could further help avoid or minimize potential impacts.

Surface Geology, Bedrock, Topography, Physiography, and Geomorphology

Equipment installation and construction activities that degrade or alter surface geology, bedrock, or topography could cause measurable changes in physiographic characteristics of an area's geology, topography, physiography, or geomorphology. Based on the impact significance criteria presented in Table 7.2.3-1, impacts could be potentially significant if FirstNet's deployment were to cause substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes. Construction activities related to the Proposed Action and Alternatives are likely to be minor and less that significant as the proposed activities are not likely to require removal of significant volumes of terrain and any rock ripping would likely occur in discrete locations and woud be unlikely to result in large-scale changes to the geologic, topographic, or physiographic characteristics. When ground disturbance is required, BMPs and mitigation measures (see Chapter 19) could be implemented to help avoid or minimize the potential impacts.

7.2.3.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. In most cases, there would be no impacts to geologic resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to geologic resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact geologic resources, it is anticipated that this activity would have no impact on geologic resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to geologic resources, or resulting from geologic hazards due to implementation of the Preferred Alternative, would encompass a range of impacts that could occur as a result of ground disturbance activities, including loss of mineral and fuel resources and paleontological resources. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to geologic resources, or impacts from geologic hazards, include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to geologic resources due to associated ground disturbance, such as impacts to fuel and mineral resources or paleontological resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Aerial Fiber Optic Plant: Replacement of utility poles and structural hardening, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water is not expected to impact geologic resources. However, where landings and/or facilities for submarine cable are installed at locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require ground disturbance in locations that are susceptible to geologic hazards (e.g., land subsidence, landslides, or earthquakes), it is possible that they could be affected by that hazard.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result

in impacts to geologic resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in erosion or disturbance of geologic resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.

  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in ground disturbance. However, if the additional power units are needed, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to geologic resources could occur due to ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to geologic resources depending on the technology and location proposed for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. Where deployable technologies would be implemented on existing paved surfaces, there would be no impacts to/from geologic resources because there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: In most cases, the installation of permanent equipment on existing structures, adding equipment to satellites launched for other purposes, or the use of portable devices that use satellite technology would not impact geologic resources because those activities would not require ground disturbance. Where equipment is permanently installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that they could be affected by that hazard. The use of portable satellite-enabled devices would not impact geologic resources nor would it be affected by geologic hazards because there would be no ground disturbance nor any impact to the built or natural environment.

In general, the abovementioned activities could potentially involve ground disturbance resulting from land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to geological resources associated with deployment could include minimal removal of bedrock or mineral resources, or adverse impacts to installed equipment resulting from geologic hazards (e.g., seismic hazards, landslides, and land subsidence). Specific FirstNet are likely to be small scale; correspondingly, disturbance to geologic resources for those types of projects with the potential to impact geologic resources is also expected to be small scale. As a result, these potential impacts are expected to be less than significant. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to geological resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections.

The operation of the Preferred Alternative could be affected by to geologic hazards including seismic activity, volcanic activity, landslides, and land subsidence. However, potential impacts would be anticipated to be less than significant as it is anticipated that deployment locations would avoid, as practicable and feasible, locations that are more likely to be affected by potential seismic activity, landslides, or land subsidence. 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.

7.2.3.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

Implementation of deployable technologies on existing paved surfaces would not result in impacts to geologic resources (or from geologic hazards) as there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These impacts are expected to be less than significant due to the minor amount of paving or new infrastructure needed to accommodate the deployables. Chapter 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 as the deployment would be temporary and likely would attempt to avoid locations that are subject to increased seismic activity, landslides, and land subsidence. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to geologic resources (or from geologic hazards) from construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 7.2.3, Geology.

7.2.4. Water Resources

7.2.4.1. Introduction

This section describes potential impacts to water resources in Kansas associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.4.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 7.2.4-1. 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 7.2.4-1: Impact Significance Rating Criteria for Water Resources

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Water Quality (groundwater and surface water) - sedimentation, pollutants, nutrients, water temperature	Magnitude or Intensity	Groundwater contamination creating a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer; local construction sediment water quality violation, or otherwise substantially degrade water quality; water degradation poses a threat to the human environment, biodiversity, or ecological integrity. Violation of various regulations including: CWA, SDWA.	Effect that is potentially significant, but with mitigation is less than significant.	Potential impacts to water quality, but potential effects to water quality would be below regulatory limits and would naturally balance back to baseline conditions.	No changes to water quality; no change in sedimentation or water temperature, or the presence of water pollutants or nutrients.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Impact is temporary, lasting no more than six months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Floodplain degradation*	Magnitude or Intensity	The use of floodplain fill, substantial increases in impervious surfaces, or placement of structures within a 500-year flood area that will impede or redirect flood flows or impact floodplain hydrology. High likelihood of encountering a 500-year floodplain within a state or territory.	Effect that is potentially significant, but with mitigation is less than significant.	Activities occur inside the 500-year floodplain, but do not use fill, do not substantially increase impervious surfaces, or place structures that will impede or redirect flood flows or impact floodplain hydrology, and do not occur during flood events. Low likelihood of encountering a 500-year floodplain within a state or territory.	Activities occur outside of floodplains and therefore do not increase fill or impervious surfaces, nor do they impact flood flows or hydrology within a floodplain.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Impact is temporary, lasting no more than one season or water year, or occurring only during an emergency.	NA
Drainage pattern alteration	Magnitude or Intensity	Alteration of the course of a stream of a river, including stream geomorphological conditions, or a substantial and measurable increase in the rate or amount of surface water or changes to the hydrologic regime.	Effect that is potentially significant, but with mitigation is less than significant.	Any alterations to the drainage pattern are minor and mimic natural processes or variations.	Activities do not impact drainage patterns.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent.		Impact is temporary, lasting no more than six months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Flow alteration	Magnitude or Intensity	Consumptive use of surface water flows or diversion of surface water flows such that there is a measurable reduction in discharge.	Effect that is potentially significant, but with mitigation is less than significant.	Minor or no consumptive use with negligible impact on discharge.	Activities do not impact discharge or stage of waterbody (stream height).
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact occurs in perennial streams, and is ongoing and permanent.		Impact is temporary, not lasting more than six months.	NA
Changes in groundwater or aquifer characteristics	Magnitude or Intensity	Substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime.	Effect that is potentially significant, but with mitigation is less than significant.	Any potential impacts to groundwater or aquifers are temporary, lasting no more than a few days, with no residual impacts.	Activities do not impact groundwater or aquifers.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Impact is ongoing and permanent.		Impact is temporary, not lasting more than six months.	NA

* - Since public safety infrastructure is considered a critical facility, project activities should avoid the 500-year floodplain wherever practicable, per the Executive Orders on Floodplain Management (EO 11988 and EO 13690).
NA = Not Applicable

7.2.4.3. Description of Environmental Concerns

Potential Water Quality Impacts

Water quality impaired waterbodies are those waters that have been identified as not supporting their appropriate uses. Projects in watersheds of impaired waters may be subject to heightened permitting requirements. For example, the CWA requires states to assess and report on the quality of waters in their state. Section 703(d) of the CWA requires states to identify impaired waters. For these impaired waters, states must consider the deployment 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.

According to USEPA's 2014 statewide waters assessment, most of Kansas's assessed rivers and streams (87 percent) and most of the state's freshwater ponds and lakes (98 percent) are impaired with no probable sources reported (USEPA, 2015b) though one of the leading causes of impairment in Kansas's lakes, reservoirs, and ponds is nutrients. KDHE works closely with federal and state agencies to implement programs to maintain and restore water quality across the state.

Deployment activities could contribute to water quality impacts in a number of ways. Vegetation removal on site exposes soils to rain and wind that could increase erosion. Impacts to water quality may occur from post construction vegetation management, such as herbicides, that may leach into groundwater or move to surface waters through soil erosion or runoff, spray drift, or inadvertent direct overspray. Fuel, oil, and other lubricants from equipment could contaminate groundwater and surface waters if carried in runoff. Other water quality impacts could include changes in temperature, pH or dissolved oxygen levels, water odor, color, or taste, or addition of suspended solids.

Soil erosion or the introduction of suspended solids into waterways from implementation of the Preferred Alternative could contribute to degradation of water quality. If the Proposed Action and Alternatives would disturb more than 1 acre of soil, a Kansas or USEPA NPDES Construction General Permit (CGP) would be required. As part of the permit application for the CGP, a storm water pollution prevention plan (SWPPP) would need to be prepared containing BMPs that would be implemented to prevent, or minimize the potential for, sedimentation and erosion. Adherence to the CGP and the BMPs would help prevent sediment and suspended solids from entering the waterways and ensure that effects on water quality during construction would not be adverse.

Deployment activities associated with the Proposed Action have the potential to increase erosion and sedimentation around construction and staging areas. Grading activities associated with construction would potentially result in a temporary increase in the amount of suspended solids running off construction sites. If a storm event were to occur, construction site runoff could result in sheet erosion of exposed soil. If not adequately controlled, water runoff from these areas would have the potential to degrade surface water quality. Implementing BMPs and mitigation measures could help reduce potential impacts to surface water quality.

Expected deployment activities would not violate applicable state, federal (e.g., CWA, Safe Drinking Water Act), 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 7.2.4-1, water quality impacts would likely be less than significant, and could be further reduced if BMPs and mitigation measures were to be incorporated where practicable and feasible.

During implementation of the Proposed Action and Alternatives, there is the potential to encounter shallow groundwater due to clearing and grading activities, shallow excavation, or relocation of utility lines. This is unlikely, as trenching is not expected to exceed a 48-inch depth. However, groundwater contamination may exist in areas directly within or near the project area. If trenching[138] 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. Construction activities would need to comply with Kansas dewatering requirements. Any groundwater extracted 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.

Based on the impact significance criteria presented in Table 7.2.4-1, groundwater quality impacts could be potentially significant if the majority of FirstNet's deployment locations resulted in a drinking quality violation, or otherwise substantially and measurable degraded groundwater quality or aquifer characteristics. Due to of the permeability of most Kansas aquifers, there is potential for groundwater contamination within a watershed or multiple watersheds. Thus, based on the impact significance criteria presented in Table 7.2.4-1, there would likely be less than significant impacts on groundwater quality within most of the state. In areas where groundwater is close to the surface, then site-specific analysis, BMPs, and mitigation measures could be implemented to further reduce potential impacts.

Floodplain Degradation

Floodplains are low-lying lands next to rivers and streams. When left in a natural state, floodplain systems store and dissipate floods without adverse impacts on human beings, 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 projects may be outside of a floodplain, but still be in an area with known flooding history.

Based on the impact significance criteria presented in Table 7.2.4-1, floodplain degradation impacts would be potentially less than significant since the majority of FirstNet'sdeployment activities, on the watershed or subwatershed level, would likely occur inside the 500-year floodplain, use minimal fill, do not substantially increase impervious surfaces, do not impede or redirect flood flows or impact floodplain hydrology, and do not occur during flood events with

[138] 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).

the exception of deployable technologies, which may be deployed in response to an emergency. Additionally, any effects would be likely temporary, lasting no more than one season or water year, [139] 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 help reduce the risk of additional impacts to floodplain degradation (see Chapter 19).

Drainage Pattern Alteration

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

According to the significance criteria in Table 7.2.4-1, any temporary (lasting less than six months) alterations to drainage patterns that are minor and mimic natural processes or variations within the watershed or subwatershed level would be considered less than significant.

Example of projects that could have minor changes to the drainage patterns include:

- Land uses with pervious surfaces that create limited storm water runoff.
- Activities designed so that stormwater is contained on site and does not flow to or impact surface waterbodies offsite on other properties.
- Activities designed so that the amount of storm water generated before construction is the same as afterwards.
- Activities designed using low impact development techniques for storm water.

Since the proposed activities would not substantially alter drainage patterns in ways that alter the course of a stream or river; create a substantial and measurable increase in the rate and amount of surface water; or change the hydrologic regime; and any effects would be short-term; impacts to

[139] 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, 2016b)

drainage patterns would be less than significant. BMPs and mitigation measures could be implemented to further reduce any potentially significant impacts.

Flow Alteration

Flow alteration refers to the modification of flow characteristics, relative to natural conditions. Human activities may change the amount of water reaching a stream, divert flow through artificial channels, or alter the shape and location of streams. Surface water and groundwater withdrawals could alter flow by reducing water volumes in streams. Withdrawals may return to the surface/groundwater system at a point further downstream, be removed from the watershed through transpiration by crops, lawns or pastures, or be transferred to another watershed altogether (e.g., water transferred to a different watershed for drinking supply). Altered flow could increase flooding and introduce more erosion and potential for pollution. Alternatively, if water is diverted from its normal flow, the opposite may occur; wetlands and streams may not receive as much water as necessary to maintain the ecology and previous functions.

Activities that do not impact discharge or stage of waterbody (stream height) are not anticipated to have an impact on flow, according to Table 7.2.4-1. Projects that include minor consumptive use of surface water with less than significant impacts on discharge (do not direct large volumes of water into different locations) on a temporary (no more than six months) are likely to have less than significant impacts on flow alteration, on a watershed or subwatershed level. Examples of projects likely to have less than significant impacts include:

- Construction of any structure in a 100-year or 500-year floodplain that is built above base flood elevation pursuant to floodplain management regulations.
- Land uses that are maintaining or increasing pervious surfaces.
- Land uses that do not change the flow of water or drainage patterns off site or into surface water bodies that have not received that volume of storm water 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. BMP and mitigation measures could be implemented to further reduce any impacts.

Changes in Groundwater or Aquifer Characteristics

As described in Section 7.1.4.7, approximately 66 to 75 percent of total water diverted for use within Kansas is pumped from groundwater sources (KDA, 2015a). Groundwater is an important natural resource used by industrial, commercial, agricultural, and residential uses for manufacturing, irrigation, and drinking water purposes. Generally, the water quality of Kansas's aquifers is suitable for drinking and daily water needs. Once a groundwater supply is exhausted or contaminated, it is very expensive, and sometimes impossible, to replace. Water supply demand from the deployment activities is unlikely to exceed safe and sustainable withdrawal capacity rate of the local supply or aquifer.

Storage of generator fuel over groundwater or an aquifer would unlikely cause any impacts to water quality. Activities that may cause changes is groundwater or aquifer characteristics include:

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

Private and public water supplies often use groundwater as a water source. To maintain a sustainable system, the amount of water withdrawn from these groundwater sources must be balanced with the amount of water returned to the groundwater source (groundwater recharge).

Deployment activities will likely have less than significant impacts since they would not substantially deplete supplies of potable groundwater, as any construction dewatering would be short-term. The siting of deployment activities should, as practicable and feasible, be considered to avoid areas that would not extract groundwater from potable groundwater sources in the area.

7.2.4.4. 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, 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.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to water resources since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to water resources because there would be no ground disturbance.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact water resources because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact water resources, it is anticipated that this activity would have no impact on water resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to water resources because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including impaired water quality. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to water resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to water resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs and mitigation measures could reduce impact intensity.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would impact water resources from a short-term increase in suspended solids in the water. Site-specific impact assessment could be required to shoreline environments prior to installation to fully assess potential impacts to lake or river coastal environments.
  - New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Ground disturbance activities could cause impacts to water quality from increased suspended solids; groundwater impacts from trenching activities are not expected. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.

- Collocation on Existing Aerial Fiber Optic Plant: Replacement of poles or structural hardening could result in ground disturbance could cause impacts to water quality from increased suspended solids.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to water resources.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs and mitigation measures could further 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. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could further 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 would likely be less than significant due to the limited geographic scale of individual activities and would likely return to baseline conditions once revegetation of disturbed areas is complete. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities, and are expected to have no impacts as there would be no ground disturbing activity and it is likely routine mainentance activities would be conducted along existing roads and utility ROWs. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. Impacts to surface and groundwater quality from routine operations and maintenance, such as herbicide application to control vegetation, are not expected. 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.

7.2.4.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to water resources if the deployment occured on paved surfaces. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving, however, these activities would be isolated and short term, and would likely return to baseline conditions once revegtation was complete. Additionally, project activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites and from fuels leaking into surface or groundwater. However, spills from vehicles or machinery used during deployment tend to be associated with re-fueling operations, and as such, would likely be a few gallons or less in volume and would likely be contained or cleaned up. The amount of potential 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). Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The water resources impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource’s current use (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. 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 adjacent to waterbodies, however, due to the limited and temporary nature of deployable activities, it is anticipated that these potential impacts would be less than significant. Site maintenance, including mowing or herbicides, may result in less than significant effects to water quality, due to the small scale of expected FirstNet activities in any particular location. In addition, the presence of new access roads could increase the overall amount of impervious surface in the area, and increase runoff effects on water resources, as explained above. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to water resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 7.1.4, Water Resources.

7.2.5. Wetlands

7.2.5.1. Introduction

This section describes potential impacts to wetlands in Kansas associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.5.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 7.2.5-1. 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 7.2.5-1: Impact Significance Rating Criteria for Wetlands

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Direct wetland loss (fill or conversion to non-wetland)	Magnitude or Intensity	Substantial loss of high-quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.); violations of Section 704 of the CWA.	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity).	No direct loss of wetlands.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA
Other direct effects: vegetation clearing; ground disturbance; direct hydrologic changes (flooding or draining); direct soil changes; water quality degradation (spills or sedimentation)	Magnitude or Intensity	Substantial and measurable changes to hydrological regime of the wetland impacting salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands.	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands affecting the hydrological regime including salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands.	No direct impacts to wetlands affecting vegetation, hydrology, soils, or water quality.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	Long-term or permanent alteration that is not restored within 2 growing seasons, or ever.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA
Indirect Effects: [2] Change in Function(s)[3] Change in Wetland Type	Magnitude or Intensity	Changes to the functions or type of high quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.).	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity).	No changes in wetland function or type.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Long-term or permanent.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA

[1] "Magnitude" is defined based on the type of wetland impacted, using USACE wetland categories (USACE 2014). Category 1 are the highest quality, highest functioning wetlands

[2] Indirect effects are those resulting from direct effects, but they occur elsewhere in space and/or time. Includes indirect hydrologic effects (wetting or drying) that in turn alters wetland function or type

[3] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, threatened and endangered species habitat, biodiversity, recreational/social value.

NA – Not Applicable

7.2.5.3. Description of Environmental Concerns

Potential Direct Wetland Loss (Fill or Conversion to Non-Wetland)

Construction-related impacts from several of the deployment activities have the potential for direct wetland impacts such as filling, draining, or conversion to a non-wetland. Examples include placement of fill in a wetland to construct a new tower, trenching through a wetland or directly connected waterway to install a cable, and placement of a structure (tower, building) within the wetland.

Wetlands regulate the quality and quantity of surface and groundwater supplies, reduce flood hazards by serving as retention basins for surface runoff, and maintain water supplies after floodwaters subside. If wetlands were filled, the entire area may be at risk for increased flooding. There could be a loss of open space to be enjoyed by the community, and decreased wildlife populations may be observed due to displacement and increased noise, light, and other human disturbance. To the extent practicable or feasible, FirstNet and/or their partners would avoid filling wetlands or altering the hydrologic regime so that wetlands would not be lost or converted to non-wetlands. Loss of high and low-quality wetlands would be less than significant 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, 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).

There are more than 500,000 acres of palustrine, riverine, and lacustrine wetlands throughout Kansas (Table 7.1.5-2) (USFWS, 2014a). Palustrine (freshwater) wetlands are found on river and lake floodplains across the state, riverine wetlands include rivers, creeks and streams, and lacustirne (tidal) wetlands are lakes or shallow reservoir basins, as shown in Section 7.1.5-3.

Based on the impact significance criteria presented in Table 7.2.5-1, the deployment activities would most likely have less than significant direct impacts on wetlands. Additionally, the deployment activities would not violate applicable federal, state, and local regulations as FirstNet would obtain any necessary permits and adhere to the conditions of the permits. In Kansas, as discussed in Section 7.1.5.4, Wetlands, there are no regulated high quality wetlands.

In Kansas, as discussed in Wetlands, Section 7.1.5.4, approximately 48 percent of wetlands within Kansas have been lost during the last 200 years (KDHE, 2010b). Palustrine wetlands make up the majority of wetlands in the state, providing habitat for a number of species and support diverse plant and animal populations. Rare salt marshes are present in Kansas's palustrine wetlands and provide habitat for more than 90 percent of the world's population of sandpipers (Kansas Office of the Governor, 2016). Two Ramsar designated Wetlands of International Importance are found in Kansas: Cheyenne Bottoms and Quivira NWR (Kansas Office of the Governor, 2016).

If any of the proposed deployment activities were to occur in Kansas' rare salt marshes or designated Wetlands of International Importance, potentially significant impacts could occur.

Wetlands occur throughout the state, and are not always included on state maps; therefore, site-specific analysis would be helpful in identifying these locations. Implementation of BMPs and mitigation measures could help to reduce 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 storm water discharges; or water withdrawals that alter the functions of the wetlands.

Based on the impact significance criteria presented in Table 7.2.5-1, construction-related deployment activities that result in long-term or permanent, substantial, and measurable changes to hydrological regime of the wetland (i.e., changes in salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality) 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 Kansas 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 parameter.

- 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:[140] Changes in Function(s)[141] or Change in Wetland Type

The construction of curb and gutter systems diverts surface runoff and could cause flooding or wetlands to dry out, depending on the direction of diversion. Indirect effects to both high- and low-quality wetlands would be less than significant given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities and the application of federal, state, and local wetlands regulations. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures (see Chapter 19).

Examples of functions related to wetlands in Kansas that could potentially be impacted from construction-related deployment activities include:

- Flood Attenuation: Wetlands provide flood protection by holding excess runoff after storms, before slowly releasing it to surface waters. While wetlands may not prevent flooding, they could lower flood peaks by providing detention of storm flows. Correspondingly, 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

[140] 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

[141] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, threatened and endangered species habitat, biodiversity, recreational/social value.

communities because of hydrologic changes could have impacts on the preferred food supply and animal cover.

- Recreational Value: Wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography.
- Groundwater Recharge: Wetlands retain water, allowing time for surface waters to infiltrate into soils and replenish groundwater.

According to the significance criteria defined in Table 7.2.5-1, impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity), would be considered potentially less than significant. Since the majority of wetlands in Kansas are not considered high quality, deployment activities would likely 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 wetlands.

7.2.5.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. To determine the magnitude of potential impacts of site-specific activities, wetland delineations could be required to determine the exact location of all wetlands, including high quality wetlands, as well as a functional assessment by an experienced wetland delineator.

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to wetlands since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.

    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to wetlands because there would be no ground disturbance.

- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, adding equipment to satellites being launched for other purposes, and the use of portable devices that use satellite technology is not likely to impact wetlands since there would be no ground disturbance.
    - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN, however it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wetlands, it is anticipated that this activity would have no impact on wetlands.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wetlands because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct effects, other direct effects, and indirect effects on wetlands. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to wetlands include the following:

- Wired Projects
    - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wetlands. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to wetlands. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and/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 could be similar to Buried Fiber Optic Plant. Any ground disturbance could cause direct and indirect impacts to wetlands, depending on the proximity to wetlands and type of wetlands that could be affected.
    - 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 (see Chapter 19) could help 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 (see Chapter 19) 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 are needed, structural hardening, and physical security measures may require ground disturbance, such as grading, or excavation activities, and impacts to wetlands could occur. 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. 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 aircraft could have other direct impacts on wetlands if fuels spill or other chemicals seep into nearby waterbodies or wetlands. Implementing BMPs and mitigation measures (see Chapter 19) could reduce impact intensity.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Depending on the deployment activity for this infrastructure, potential impacts to wetlands may occur. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. These impacts are expected to be less than significant due to the small amount of land disturbance (generally less than one acre) and the short timeframe of deployment activities. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there could be ongoing other potential direct impacts to wetlands if heavy equipment is used for routine operations and maintenance application of herbicides occurs to control vegetation along all ROWs and near structures, depending on the proximity to wetlands. The intensity of the impact depends on the amount of herbicides used, frequency, and location of nearby sensitive wetlands. These impacts are expected to be less than significant due to the limited nature of deployment activities. It is also anticipatd that routine maintenance activities would be conducted on existing roads and utility ROWs. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.5.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to wetlands. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and/or indirect impacts to wetlands from a temporary increase in the amount of suspended solids running off construction sites to nearby surface waters. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type; however, impacts are expected to be less than significant due to the small scale and temporary duration of expected FirstNet deployment activities in any one location. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance could result in impacts similar to the abovementioned deployment impacts. The wetlands impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the wetland’s quality and function.

It is anticipated that there would be less than significant impacts to wetlands associated with routine inspections of the Deployable Technologies Alternative as it is likely existing roads and utility ROWs would be utilized for maintenance and inspection activities. Site maintenance, including mowing or herbicides, is anticipated to result in less than significant effects to wetlands due to the limited nature of site maintenance activities, including mowing and application of herbicides. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to wetlands from construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 7.1.5, Wetlands.

7.2.6. Biological Resources

7.2.6.1. Introduction

This section describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in Kansas associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.6.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on terrestrial vegetation, wildlife, fisheries, and aquatic habitats were evaluated using the significance criteria presented in Table 7.2.6-1. As described in Section 7.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

Given the nature of this programmatic evaluation, and because the Proposed Action could potentially cover a wide variety of actions that would take place in various landscapes, the potential impacts to terrestrial vegetation, wildlife, and fisheries and aquatic habitat addressed in Sections 7.2.6.3, 7.2.6.4, and 7.2.6.5, respectively, are presented as a range of possible impacts. Refer to Section 7.2.6.6 for impact assessment methodology and significance criterial associated with threatened and endangered species in Kansas.

Table 7.2.6-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, Fisheries, and Aquatic Habitats

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Direct Injury/Mortality	Magnitude or Intensity	Population-level or sub-population injury /mortality effects observed for at least one species depending on the distribution and the management of said species. Events that may impact endemics, or concentrations during breeding or migratory periods. Violation of various regulations including: Marine Mammal Protection Act (MMPA), Magnuson Stevens Fishery Conservation And Management Act (MSFCMA), 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 Kansas 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: MMPA, MSFCMA, 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 Kansas for at least one species. Anthropogenic disturbances that lead to the loss or alteration of nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Indirect Injury/Mortality	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Exclusion from resources necessary for the survival of one or more species and one or more life stages. Anthropogenic disturbances that lead to mortality, disorientation, the avoidance or exclusion from nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season. Violation of various regulations including: MMPA, MSFCMA, 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 Kansas for at least one species. Behavioral reactions to anthropogenic disturbances depend on the context, the time of year age, previous experience, and activity. Anthropogenic disturbances that lead to startle responses of large groupings of individuals during haulouts, resulting in injury or mortality.		Effects realized at one location.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years	NA
Effects to Migration or Migratory Patterns	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Temporary or long-term loss of migratory pattern/path or rest stops due to anthropogenic activities. Violation of various regulations including: MMPA, MSFCMA, 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 Kansas 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: MMPA, MSFCMA, 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 Kansas 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

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	Chronic and long-term effects not likely to be reversed over several breeding/spawning seasons for at least one species.		Temporary, isolated, or short-term effects that are reversed within one breeding season.	NA
Invasive Species Effects	Magnitude or Intensity	Extensive increase in invasive species populations over several seasons.	Effect that is potentially significant, but with 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 Kansas.		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, 2016d)

NA = Not Applicable

7.2.6.3. Terrestrial Vegetation

Impacts to terrestrial vegetation occurring in Kansas are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are permanent or temporary loss or disturbance of individual plants. Based on the impact significance criteria presented in Table 7.2.6-1, 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. This includes large-scale mortality or injury events that may impact sensitive endemic species. 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, mitigation measures, and avoidance measures would help to minimize or altogether avoid potential impacts to plant population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical disturbances that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the loss or breaking down of continuous and connected habitat.

Construction of new infrastructure and long-term facility maintenance would result in the alteration of the type of vegetative communities in these localized areas, and in some instances the permanent loss of vegetation. Further, some limited amount of infrastructure may be built in sensitive or rare regional vegetative communities, in which case BMPs and mitigation measures could be implemented to help minimize or avoid potential impacts.

Indirect Injury/Mortality

"Indirect effects" are effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8[b]). Indirect injury/mortality could include stress related to disturbance. The alteration of soils or hydrology within a localized area could result in stress or mortality of plants. Construction activities that remove large quantities of soil in the immediate vicinity of trees could cause undue stress to trees from root exposure, although this is unlikely to occur due to 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.

When non-native species are introduced into an ecosystem in which they did not evolve, their populations sometimes increase rapidly. Natural or native community species evolve together into an ecosystem with many checks and balances that limit the population growth of any one species. These checks and balances include such things as: predators, herbivores, diseases, parasites, and other organisms competing for the same resources and limiting environmental factors. However, when an organism is introduced into an ecosystem in which it did not evolve naturally, those limits may not exist and its numbers can sometimes dramatically increase. The unnaturally large population numbers 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. Even if natives are not completely eliminated, the ecosystem often becomes much less diverse.

The potential to introduce invasive plants within construction zones and during long-term site maintenance 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 would help to minimize or avoid the potential for introducing invasive plant species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to terrestrial vegetation resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range impacts, from no impacts to less than significant impacts, depending on the deployment scenario or site-specific conditions. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology[142], 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 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:

[142] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds.

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to terrestrial vegetation. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Implementation of BMPs and mitigation measures could help to avoid or minimize potential implacts.
  - 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 shores or the banks of waterbodies that accept submarine cables 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 of expected deployment activities. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would no impacts to terrestrial vegetation associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or herbicides, may result in less than significant effects due to the small scale of expected activities. These potential impacts could result from accidental spills from maintenance equipment or release of herbicides and because these areas would not be allowed to revert to a more natural state. If usage of heavy equipment or land clearing activities occurs off established roads or corridors as part of routine maintenance or inspections, direct or indirect injury/mortality to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species could occur to terrestrial vegetation, however impacts are expected to be less than significant due to the small scale of expected activities. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts from land/vegetation clearing, excavation, and paving activities. These activities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts. However, impacts are expected to remain less than significant due to the relatively small scale of FirstNet activities at individual locations. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred

Alternative, it is anticipated that there would be less than significant impacts to terrestrial vegetation associated with routine operations and maintenance due to the relatively small scale of likely FirstNet project sites. The impacts could vary greatly among species, vegetative community, and geographic region but are expected to remain less than significant due to the small-scale nature of expected FirstNet activities in any particular location.

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. There would be no impacts to terrestrial vegetation as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 7.1.6.3, Terrestrial Vegetation.

7.2.6.4. Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates occurring in Kansas are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle or vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 7.2.6-1, less than significant impacts would be anticipated given the 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 Kansas. 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. 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 “poor” fliers (e.g., ducks), night-migrating birds, heavy birds (e.g., swans and cranes), and birds that fly in flocks; while species susceptible to electrocution are birds of prey, ravens, and thermal soarers, typically having large wing spans (Gehring, Kerlinger, & 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 nesting or shelter from predators and inclement weather, or as nest trees for rearing young. The scale of this impact would be associated with the amount of tree removal and the abundance of forest-dwelling birds roosting/nesting in the area. These impacts could be particularly pronounced in IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, D. et al., 1997). Direct injury/mortality are not anticipated to be widespread or affect bird populations due to the small scale of likely FirstNet actions.

Direct mortality and injury to birds of Kansas 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, 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 in consultation with USFWS.

Reptiles and Amphibians

In Kansas, reptiles and amphibians occur in a wide variety of habitats across the state, with some having widespread distribution and others being limited to a smaller region or locations in the state (Great Plains Nature Center, 2015a). 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 Kansas 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.

Additionally, habitat loss can occur through exclusion, directly or indirectly, preventing an animal from accessing an optimal habitat (e.g., breeding, forage, or refuge), either by physically preventing use of a habitat or by causing an animal to avoid a habitat, either temporarily or long-term. It is expected that activities associated with the Proposed Action would cause exclusion effects only in very special circumstances, as in most cases an animal could fly, swim, or walk to a nearby area that would provide refuge.

Potential effects of vegetation and habitat loss, alteration, or fragmentation are described for Kansas's wildlife species below.

Terrestrial Mammals

Mammals occupy a wide range of habitats throughout Kansas; however, some species may be more commonly encountered in or along larger drainages (rivers and streams) and associated forests. Removal or loss of vegetation may impact large mammals (e.g., black bear, moose) 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., bats, fisher, American marten) 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 is prohibited under the MBTA. The USFWS and the KDWPT 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, D. et al., 1997).

The degree to which habitat exclusion affects birds depends on many factors. The impact to passerine[143] species from disturbance or displacement from construction activities is likely to be short-term with minor effects from exclusion. Exclusion from resources concentrated in a small migratory stop area during peak migration could have major impacts to species that migrate in large flocks and concentrate at stop overs (e.g., shorebirds). BMPs and mitigation measures, including nest avoidance during construction-related activities, would help to avoid or minimize the potential impacts to birds from exclusion of resources, as appropriate.

Reptiles and Amphibians

Important habitats for Kansas' amphibians and reptiles typically consist of wetlands and the surrounding upland forest. Impacts are expected to be less than significant due to the small-scale nature and limited geographic scope of individual activities. 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 7.2.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed Action may also have effects on Kansas's amphibian and reptile populations, though BMPs and mitigation measures could help to avoid or minimize the potential impacts.[144]

Terrestrial Invertebrates

Habitat loss and degradation are the most common causes of invertebrate species' declines; however, habitat for many common terrestrial invertebrates is generally assumed to be abundant and widely distributed across the state, therefore no significant effects to terrestrial invertebrates are expected. Impacts to sensitive invertebrate species are discussed below in Section 7.2.6.6, Threatened and Endangered Species and Species of Concern.

Indirect Injury/Mortality

Indirect injury/mortality impacts vary depending on the species, time of year and duration of deployment, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.

Terrestrial Mammals

Stress from repeated disturbances during critical time periods (e.g., roosting and mating) 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

[143]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.
[144] See Section 7.2.6, Wetlands, for a discussion of BMPs for wetlands.

occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Birds

Repeated disturbance, especially during the breeding and nesting season, could cause stress to individuals lowering fitness and productivity. These impacts could be particularly pronounced in IBAs within the state if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, D. et al., 1997). The majority of FirstNet deployment activities would be short-term in nature, therefore repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Reptiles and Amphibians

Changes in water quality and quantity, especially during the breeding seasons, could cause stress resulting in lower productivity. The majority of FirstNet deployment activities would be short-term in nature; therefore repeated disturbances would be unlikely to occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Terrestrial Invertebrates

Terrestrial invertebrates could experience chronic stress, either by changes in habitat composition or competition for resources, resulting in lower productivity. Due to the large number of invertebrates distributed throughout the state, and given the short-term nature of most of the deployment activities, this impact would likely be less than significant.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. Potential effects to migration patterns of Kansas's amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates are described below.

Terrestrial Mammals

Some large mammals (e.g., bobcats) will perform short seasonal migrations between foraging/breeding habitats and denning habitats. Some small mammals (e.g., bats) also have migratory routes that include spring and fall roosting areas between their summer maternity roosts and hibernacula.[145] 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 given

[145] A location chosen by an animal for hibernation

the short-term nature and limited geographic scope for individual activities. 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 Kansas undertake some of the longest-distance migrations of all animals. Kansas is within the Central Flyway, which spans the Rocky Mountains, Great Plains, arid Southwest, and western Gulf Coast. The Central Flyway extends from northern Canada and Arctic islands south to Central and South America (National Audubon Society, 2015a). Kansas has 10 IBAs that are widely distributed throughout the state and comprise over 5,800,000 acres of land. 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 given the short-term nature and limited geographic scope for individual activities. BMPs and mitigation measures could help to further avoid or minimize effects to migratory pathways.

Reptiles and Amphibians

Several species of salamanders and frogs are known to seasonally migrate. For example, gray treefrogs (*Hyla versicolor*) inhabit forested areas in the eastern region of Kansas. During breeding season this species migrates to temporary ponds to lay its eggs (Fort Hays State University, 2015).

Species that use streams as dispersal or migratory corridors may be impacted if these waterways are restricted or altered, but any impacts are expected to be less than significant given the short-term nature and limited geographic scope for individual activities. BMPs and mitigation measures could help to further avoid or minimize the potential impacts.

Terrestrial Invertebrates

The proposed deployment activities would be expected to be short-term or temporary in nature. No effects to migratory patterns of Kansas's terrestrial invertebrates are expected as a result of the Proposed Action.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce an animal's ability to produce offspring or reduce the rates of growth, maturation, and survival of offspring, which could affect the overall population of individuals.

Terrestrial Mammals

Restricted access to important winter hibernacula or summer maternity roosts for bats and calving grounds for large mammals, such as the moose, has the potential to negatively affect body condition and reproductive success of mammals in Kansas. Disturbance could also result in the abandonment of offspring leading to reduced survival. Reproductive effects as a result of displacement and disturbance could be minimized through the use of BMPs and mitigation measures.

Birds

Impacts due to Proposed Action deployment and operations could include abandonment of the area and nests due to disturbance. Disturbance (visual and noise) may displace birds into less suitable habitat and thus reduce survival and reproduction. These impacts could be particularly pronounced in IBAs within the state if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, D. et al., 1997).

These impacts are expected to be less than significant and if realized, would likely impact individual specimens as the majority of FirstNet deployment or operation activities are likely to be temporary and small scale in nature. FirstNet would try to avoid IBAs and other sensitive bird habitat where practicable and feasible. Additionally, 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 reptiles and amphibians may occur through direct loss or disturbance of nests. For example, the spiny softshell turtle (*Apalone spinifera*) will lay its eggs in exposed soil in late spring or summer and direct loss or disturbance of nesting sites could disrupt such cycles (USGS, 2015d).

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 impacts are expected to be less than significant because deployable activities are expected to be temporary and likely affecting only a small number of wildlife. BMPs and mitigation measures could help to further 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. The invasive pest watch list kept by the KDA includes the Asian longhorned beetle (*Anoplophora glabripennis*), gypsy moth (*Lymantria dispar*), red imported fire ant (*Solenopsis invicta*), Japanese cedar longhorn beetle (*Callidiellum rufipenne*), Africanized honey bee (*Apis mellifera scutellata*), and spotted wing drosophila (*Drosophila suzukii*). Not all of the species on the pest watch list have been documented within Kansas;

however, the Asian longhorned beetle and gypsy moth have been documented in the state, as well as three other invasive pest species: the emerald ash borer (*Agrilus planipennis*), hemlock woolly adelgid (*Adelges tsugae*), and pine pitch moth (*Dioryctria tumicolella*) (KDA, 2015b).

FirstNet deployment or operation 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 to project sites as part of the deployment activities from machinery or construction workers.

Potential invasive species effects to Kansas's wildlife are described below.

Terrestrial Mammals

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. FirstNet deployment activities could result in short-term or temporary changes to specific project sites although these sites are expected to return to their natural state in a year or two. Invasive bird species are not expected to be introduced at project sites as part of the deployment activities.

Reptiles and Amphibians

Invasive plants and other pest species could adversely alter or degrade native habitats (e.g., wetlands) used by reptiles and amphibians. Although FirstNet deployment activities could result in short-term or temporary changes to specific project sites, these sites are expected to return to their natural state in a year or two. Invasive reptile or amphibian species are not expected to be introduced at project sites from machinery or laborers during deployment operations.

Terrestrial Invertebrates

Terrestrial invertebrate populations are susceptible to invasive plant species that may change or alter the community composition of specific plants on which they depend. Effects from invasive plant species to terrestrial invertebrates would be similar to those described for habitat loss and degradation.

Invasive insects pose a large threat to Kansas' forest and agricultural resources (USFS, 2015c). Species such as the gypsy moth and Asian longhorn beetle are known to cause irreversible damage to native forests (KDA, 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. Impacts are expected to be less than significant due to the limited amount of construction activities envisioned. Invasive species effects related to terrestrial invertebrates could be minimized with the implementation of BMPs and mitigation measures.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wildlife resources and others would not. In addition, and as described in this section, infrastructure developed under the Preferred Alternative could result in a range of impacts, from no impacts to less than significant impacts, depending on the deployment scenario or site-specific conditions. The wildlife that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

<u>Activities Likely to Have No Impacts</u>

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and unlikely to produce measurable changes in wildlife behavior. It is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to wildlife resources because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellites launched for other purposes, and the use of portable devices that use satellite technology would not impact wildlife because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN, however it may include equipment on satellites that are

already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wildlife resources, it is anticipated that this activity would have no impact on wildlife resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wildlife resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure deployment 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 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 the shore or banks of water bodies to accept submarine cables could potentially impact wildlife (see Section 12.2.4, 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 RF 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 additional power units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of RF 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. 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 still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of terrestrial wildlife, particularly during migrations between winter and summer ranges or in calving areas.

In addition, the presence of new access roads and transmission line ROWs may increase human use of the surrounding areas, which could increase disturbance to wildlife resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. Wildlife may also be impacted if increased access leads to an increase in the legal or illegal take of biota. As stated above, these impacts would likely be limited to individual wildlife species and unlikely to cause population-level impacts, and therefore would likely be less than significant given the short-term nature and limited geographic scope for individual 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.

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts from direct and indirect injury or mortality events, changes in migratory patterns, disturbance, or displacement. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain less than significant because deployment activities are expected to be temporary, likely affecting only a small number of wildlife. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts because deployable activities are expected to be temporary and likely affecting only a small number of wildlife. The impacts could vary greatly among species and geographic region. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the 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 7.1.6.4, Terrestrial Wildlife.

7.2.6.5. Fisheries and Aquatic Habitats

Impacts to fisheries and aquatic habitats occurring in and near Kansas waters are discussed in this section.

Description of Environmental Concerns

Direct Injury/Mortality

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events (USEPA, 2012d).

Based on the impact significance criteria presented in Table 7.2.6-1, less than significant impacts would be anticipated given the size and nature of the majority of proposed deployment activities. Although anthropogenic disturbances may be measurable (but minimal) for some FirstNet projects, individual behavior of fish species would be short-term and direct injury or mortality impacts at the population-level or sub-population effects would not likely be observed. BMPs and mitigation measures could help to avoid or minimize potential impacts to fisheries and aquatic invertebrate population survival.

Vegetation and Habitat Loss, Alteration, or Fragmentation

Habitat impacts are primarily physical disturbances that result in alterations in the amount or quality of a habitat. As with all of the effects categories, the magnitude of the impact depends on the duration, location, and spatial scale of the system and associated activities. Habitat fragmentation is the breaking down of continuous and connected habitat, and impeding access to resources and mates.

Depending on the location, construction of new infrastructure and long-term facility maintenance could result in the shoreline habitat alteration in localized areas; in some instances, the permanent loss of riparian vegetation could occur, which could lead to water quality impacts and in turn aquatic habitat alteration. Habitat loss is not likely to be widespread or affect populations of species as a whole; fish species would be expected to swim to a nearby location, depending on the nature of the deployment activity. Therefore, impacts are expected to be less than significant due to the small-scale and short term nature of deployment activities in any one particular location.

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 expected FirstNet activities in any particular location. BMPs and mitigation measures to projected water resources (see Section 7.2.4, Water Resources) could help to minimize or avoid potential impacts.

Effects to Migration or Migratory Patterns

Migration is the regular movement of animals from one region to another and back again. Migratory patterns vary by species and sometimes within the same species. 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 given the small-scale nature of expected FirstNet activities in any particular location. BMPs and mitigation measures, as feasible and appropriate, could help to further avoid or minimize the potential impacts.

Invasive Species Effects

The potential to introduce invasive aquatic plants within construction zones could occur from vehicles and equipment being transported from one region to another, or when conducting revegetation of a site after deployment activities are complete. FirstNet deployment activities could result in short-term or temporary changes to specific project sites and these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers, therefore impacts are expected to be less than significant. BMPs and mitigation measures could help to avoid or minimize the potential for introducing invasive aquatic plant and animal species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that effects to fisheries would be temporary and would not result in any perceptible change.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to fisheries and aquatic habitats because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact fisheries and aquatic habitats because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact fisheries, it is anticipated that this activity would have no impact on the aquatic environment.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to fisheries and aquatic habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to fisheries and aquatic habitats include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to fisheries and aquatic habitats. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities, particularly if they occur adjacent to water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects. Implementations ofBMPs 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, if conducted near water resources that support fish, could result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water and construction of landings and/or facilities on the shore or banks or water bodies to accept submarine cables could result in direct injury/mortalities of fisheries and aquatic invertebrates that are not mobile enough to avoid construction activities (e.g., mussels), that utilize burrows (e.g., crayfish), or that are defending nest sites (some fish). Disturbance, including noise, associated with the above activities could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, particularly near water resources that support fish, such disturbance

could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to fisheries and aquatic habitats, if such actions were deployed near water resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads, particularly if they occur near waterbodies, could result in habitat loss or indirect injury/mortality, and invasive species effects, although highly unlikely. Refer to Section 2.4, Radio Frequency Emissions, for more information on RF emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower which would not result in impacts to fisheries and aquatic habitats. However, if new power units are needed, or replacement towers, structural hardening, or physical security measures require ground disturbance, impacts would be similar to new wireless construction. For a discussion of RF emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects if new access roads or other ground disturbing activities are necessary that generate erosion, sedimentation, or water quality impacts. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Deployment of drones, balloons, blimps, or piloted aircraft could potentially impact fisheries and aquatic habitat if deployment occurs within or adjacent to water resources. The magnitude of these effects depends on the timing and frequency of deployments, and could result in result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to fisheries and aquatic habitats associated with deployment of this infrastructure could include direct injury/mortality, habitat loss, indirect injury/mortality, effects to migration, reproductive effects, and effects of invasive species depending on the ecoregion, the species’ phenology, and the nature and extent of the habitats affected. These impacts are anticipated to be less than significant due to the small scale of deployment activities and the limited number of aquatic species expected to be impacted. 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 habitats could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of fish passage. In addition, the presence of new access roads and transmission line ROWs near water resources that support fish may increase human use of the surrounding areas, which could increase disturbance to fisheries and aquatic habitats resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. Fisheries and aquatic habitat may also be impacted if increased access leads to an increase in the legal or illegal take of biota. However, impacts are expected to be less than significant due to the small scale of expected activities with the potential to affect fisheries and aquatic habitat. As a result of the small scale, only a limited number of individuals are anticipated to be impacted, furthermore, habitat impacts would also be minimal in scale. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred

Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to fisheries and aquatic habitats as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts from habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain less than significant due to the limited nature of expected deployment activities. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

Operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts to fisheries and aquatic habitats associated with routine operations and maintenance due to the limited nature of expected deployment activities. The impacts could vary greatly among species and geographic region but they are still expected to remain less than significant due to the small scale of expected FirstNet activities in any particular location. 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 7.1.6.5, Fisheries and Aquatic Habitats.

7.2.6.6. Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species in Kansas' environment associated with deployment and operation of the Proposed Action and Alternatives. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on threatened and endangered species and their habitat were evaluated using the significance criteria presented in Table 7.2.6-2. The categories of impacts for threatened and endangered species and their habitats are defined as may affect, likely to adversely affect; may affect, not likely to adversely affect; and no effect. Characteristics of each effect type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 7.2.6-2: Impact Significance Rating Criteria for Threatened and Endangered Species

Type of Effect	Effect Characteristics	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
Injury/Mortality of a Listed Species	Magnitude or Intensity	As per the ESA, this impact threshold applies at the individual level so applies to any mortality of a listed species and any impact that has more than a negligible potential to result in unpermitted take of an individual of a listed species. Excludes permitted take.	Does not apply in the case of mortality (any mortality unless related to authorized take falls under likely to adversely affect category). Applies to a negligible injury that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Includes permitted take.	No measurable effects on listed species.
	Geographic Extent	Any geographic extent of mortality or any extent of injury that could result in take of a listed species.	Any geographic extent that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Any duration or frequency that does not meet the threshold of take due to its low level of effect and/or ability to fully mitigate the effect. Typically applies to infrequent, temporary, and short-term effects.	
Reproductive Effects	Magnitude or Intensity	Any reduction in breeding success of a listed species.	Changes in breeding behavior (e.g., minor change in breeding timing or location) that are not expected to result in reduced reproductive success.	No measurable effects on listed species.
	Geographic Extent	Reduced breeding success of a listed species at any geographic extent.	Changes in breeding behavior at any geographic extent that are not expected to result in reduced reproductive success of listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in reduced breeding success of a listed species.	Infrequent, temporary, or short-term changes in breeding behavior that do not reduce breeding success of a listed species within a breeding season.	

Type of Effect	Effect Characteristics	Impact Level		
		May Affect, Likely to Adversely Affect	**May Affect, Not Likely to Adversely Affect**	**No Effect**
Behavioral Changes	Magnitude or Intensity	Disruption of normal behavior patterns (e.g., breeding, feeding, or sheltering) that could result in take of a listed species.	Minor behavioral changes that would not result in take of a listed species.	No measurable effects on listed species.
	Geographic Extent	Any geographic extent that could result in take of a listed species.	Changes in behavior at any geographic scale that are not expected to result in take of a listed species. Typically applies to one or very few locations.	
	Duration or Frequency	Any duration or frequency that could result in take of a listed species.	Infrequent, temporary, or short-term changes that are not expected to result in take of a listed species.	
Loss or Degradation of Designated Critical Habitat	Magnitude or Intensity	Effects to any of the essential features of designated critical habitat that would diminish the value of the habitat for the survival and recovery of the listed species for which the habitat was designated.	Effects to designated critical habitat that would not diminish the functions or values of the habitat for the species for which the habitat was designated.	No measurable effects on designated critical habitat.
	Geographic Extent	Effects to designated critical habitat at any geographic extent that would diminish the value of the habitat for listed species. Note that the likely to adversely affect threshold for geographic extent depends on the nature of the effect. Some effects could occur at a large-scale but still not appreciably diminish the habitat function or value for a listed species. Other effects could occur at a very small geographic scale but have a large adverse effect on habitat value for a listed species.	Effects realized at any geographic extent that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to one or few locations within a designated critical habitat.	
	Duration or Frequency	Any duration or frequency that could result in reduction in critical habitat function or value for a listed species.	Any duration or frequency that would not diminish the functions and values of the habitat for which the habitat was designated. Typically applies to Infrequent, temporary, or short-term changes.	

Description of Environmental Concerns

Injury/Mortality of a Listed Species

Direct injury/mortality effects are physical injuries, extreme physiological stress, or death of an individual organism from interactions associated with the Proposed Action. The most common direct injuries are entanglement, vehicle strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events.

Based on the impact significance criteria presented in Table 7.2.6-2, any direct injury or mortality of a listed species at the individual-level could be potentially significant as well as any impact that has more than a negligible potential to result in unpermitted take of an individual species at any geographic extent, duration, or frequency. Direct injury/mortality environmental concerns pertaining to federally listed terrestrial mammals, birds, fish, invertebrates, and plants with known occurrence in Kansas are described below.

<u>Terrestrial Mammals</u>

Two endangered and one threatened mammal species are federally listed and known to occur in Kansas; they include the black-footed ferret (*Mustela nigripes*), gray bat (*Myotis grisescens*), and northern long-eared bat (*Myotis septentrionalis*) (USFWS, 2015d). Direct mortality or injury to the federally listed northern long-eared bat could occur if tree clearing activities occurred at roosting sites while bats were present (USFWS, 2015h). Direct mortality or injury to the federally listed gray bat could occur if caves were flooded or blocked off while bats were present (USFWS, 1997). While projects would not likely directly affect winter hibernacula (e.g., caves), human disturbance in and around these sites 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 (USFWS, 1997).

Direct mortality to the federally listed black-footed ferret could occur if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by one of these species. Entanglement in fences or other barriers could also be a source of mortality or injury to this species. Impacts would likely be isolated, individual events.

BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

<u>Birds</u>

Two endangered and three threatened bird species are federally listed and known to occur in Kansas; they include the least tern (*Sterna antillarum*), lesser prairie-chicken (*Tympanuchus pallidicinctus*), piping plover (*Charadrius melodus*), and whooping crane (*Grus americana*). USFWS recommends conservation measures be applied for these species. 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. 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, may be implemented as appropriate to further minimize potential impacts.

Fish

Deployment activities in or near Kansas rivers and streams could impact protected fish species. Two endangered and two threatened fish species are federally listed and known to occur in Kansas; they include the Arkansas river shiner (*Notropis girardi*), Neosho madtom (*Noturus placidus*), pallid sturgeon (*Scaphirhynchus albus*), and Topeka shiner (*Notropis topeka*). The most likely impact would be soil or sediment disturbance in or near waterways, which causes erosion and sedimentation that temporarily degrades the habitat of the listed fish species. However, the majority of FirstNet deployment projects would not occur in an aquatic environment. Direct mortality or injury to this species are unlikely but could occur from entanglements resulting from the Proposed Action. 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, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

No federally listed amphibians or reptiles occur in Kansas. Therefore, no injury or mortality effects to federally threatened and endangered reptiles and amphibians are expected as a result of the Proposed Action.

Invertebrates

Three endangered and one threatened invertebrate species are federally listed and known to occur in Kansas; they include the American burying beetle (*Nicrophorus americanus*), Neosho mucket (*Lampsilis rafinesqueana*), rabbitsfoot (*Quadrula cylindrica cylindrica*), and spectaclecase mussel (*Cumberlandia monodonta*). The federally listed American burying beetle (*Nicrophorus americanus*) is a terrestrial invertebrate. Direct mortality or injury to the American burying beetle could occur if land clearing or excavation activities associated with the Proposed Action occur in an area inhabited by this species.

The Neosho mucket, rabbitsfoot, and spectaclecase mussel are mollusk species. The majority of FirstNet deployment projects would not occur in an aquatic environment. Direct mortality or injury to this species are unlikely but could occur from entanglements resulting from the Proposed Action.

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, may be implemented as appropriate to further minimize potential impacts.

Plants

Two threatened plant species are known to occur in Kansas; they include the Mead's milkweed (*Asclepias meadii*) and western prairie fringed orchid (*Platanthera praeclara*). 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. 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, 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, fish, invertebrates, and plants with known occurrence in Kansas 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, may be implemented as appropriate to further minimize potential impacts.

Birds

Impacts to listed bird habitat due to land clearing or excavation activities could directly affect nesting if deployment activities occur during the breeding/nesting season. In addition, habitat loss or degradation could lead to indirect affects to nesting due to birds having to find new nesting sites. In addition, noise, light, or human disturbance within nesting areas could cause federally listed birds to 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, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

No federally listed reptiles or amphibians are known to occur in Kansas. Therefore, no reproductive effects to federally threatened and endangered reptiles or amphibians are expected as a result of the Proposed Action.

Fish

Deployment activities 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 7.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects to federally listed fish species in Kansas 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, may be implemented as appropriate to further minimize potential impacts.

Changes in water quality from ground disturbing activities could degrade habitat, resulting in lower productivity for these federally listed fish. In addition, introduction of invasive fish and aquatic plants could indirectly affect fish populations, by changing habitat, increasing predation, or reducing the reproductive success of the listed species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, BMPs and Mitigation Measures, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Changes in water quality from ground disturbing activities could cause stress resulting in lower productivity for federally listed mollusks known to occur in Kansas. In addition, introduction of invasive aquatic species could indirectly affect mollusks as a result of fish populations that they rely on for their reproductive cycle being altered (USFWS, 1997). Impacts to food sources utilized by the federally listed terrestrial invertebrates could lead to potential adverse effects on these species (USFWS, 2014c). 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, 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 Kansas are described below.

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, 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 piping plover use sites throughout Kansas as stopover habitat during their migration from the Northern Great Plains and Great Lakes Area to the coastal habitats in the south. Stopover sites consist of shorelines that occur throughout the state along reservoirs, lakes, ponds, rivers, and wetlands. Disturbance in stopover locations, 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, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

No federally listed reptiles or amphibians are known to occur in Kansas. Therefore, no behavioral effects to federally threatened and endangered reptiles or amphibians are expected as a result of the Proposed Action.

Fish

Changes in water quality as a result of ground disturbing activities could impact food sources for federally listed or candidate species in Kansas: the Arkansas darter (*Etheostoma cragini*), Arkansas river shiner (*Notropis girardi*), Neosho madtom (*Noturus placidus*), pallid sturgeon (*Scaphirhynchus albus*), and Topeka shiner (*Notropis topeka*). Further, increased human disturbance, noise, and vessel traffic could cause stress to these species 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, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Loss or alternation of habitat uatic invasive species could impact these federally listed insects, resulting in behavior changes, lower productivity, and population loss. Disturbances to food sources utilized by the federally listed terrestrial species, especially during the breeding season, could impact survival. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented, as necessary. Additional BMPs and mitigation measures, as defined in Chapter 19, 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, large-scale impacts could diminish the functions and values of the habitat, while in other cases small-scale changes could lead to potentially significant 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 birds and fish with designated critical habitat in Kansas environment are described below.

Terrestrial Mammals

No designated critical habitat occurs for terrestrial mammals in Kansas. 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

One of the federally listed bird species in Kansas has federally designated critical habitat. Critical habitat for the whooping crane was designated in Quivira National Wildlife Refuge and Cheyenne Bottoms State Waterfowl Management Area. Land clearing, excavation activities, and other ground disturbing activities in this region of Kansas could lead to habitat loss or degradation, which could lead to adverse effects to the these birds 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, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other federally listed bird species in Kansas; therefore, no effect to these species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Reptiles and Amphibians

No federally listed reptiles or amphibians are known to occur in Kansas. There is no designated critical habitat for reptiles or amphibians in Kansas. 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

One of the federally listed fish species in Kansas has federally designated critical habitat. Critical habitat for the Arkansas River shiner was designated as portions of the Cimarron River (USFWS, 2005c). Potential impacts to these threatened and endangered species could occur from the loss or degradation of designated critical habitat as a result of the Proposed Action. 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, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

None of the federally listed invertebrate species in Kansas have federally designated critical habitat. Therefore, no effect to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Plants

No designated critical habitat occurs for plants in Kansas. Therefore, no effect to threatened and endangered species from the loss or degradation of designated critical habitat is expected as a result of the Proposed Action.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to threatened and endangered species and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no 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 to threatened and endangered species or their habitat under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to

entry and exit points of the existing conduit in previously disturbed areas. Although threatened and endangered species and their habitat could be impacted, it is anticipated that effects to threatened and endangered species would be temporary, infrequent, and likely not conducted in locations designated as vital or critical for any period.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to threatened and endangered species or their habitat because there would be no ground disturbance and very limited human activity.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact threatened 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 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 protected species, it is anticipated that this activity would have no impact on protected species.

Activities with the Potential to Affect Listed Species

Potential deployment-related effects to threatened and endangered species and their habitats as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential effects to threatened and endangered species include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential 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., mollusks, small mammals, and young), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (e.g., ground-nesting birds). Disturbance, including noise, associated with the above activities could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat if BMPs and mitigation measure are not implemented.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house

outside plant equipment could result in potential impacts to threatened and endangered species and their habitat. Impacts may vary depending on the number or individual poles installed, but could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat.

- Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat to threatened and endangered species. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in reproductive effects or behavior changes.
- New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water and construction of landings and/or facilities on the shore or banks or water bodies to accept submarine cables could potentially affect threatened and endangered species and their habitat, particularly aquatic species (see Section 12.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. If activities occurred during critical time periods, reproductive effects and behavioral changes could occur.
- 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 RF 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 RF 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 RF 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 above-mentioned 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 anticipated to not likely adversely affect protected species. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The threatened and endangered species that would be affected would depend on the species' phenology and the nature and extent of the habitats affected.

It is anticipated that operational impacts may affect, but are not likely to adversely affect threatened and endangered species due to routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Site maintenance, including mowing or application of herbicides, may affect, but are not likely to adversely affect threatened and endangered species, as they would be conducted infrequently and in compliance with BMPs and mitigation measures developed through consultation with the appropriate resource agency.

During operations, direct injury/mortality of threatened and endangered species could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. Listed species may be affected, but are not likely to be adversely affected. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

Threatened and endangered species may be affected, but are not likely to be adversely affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of some species, particularly during migrations between winter and summer ranges. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies may affect, but is not likely to adversely affect, threatened and endangered species through direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further minimize potential impacts.

Operational Impacts

As explained above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that activities may affect, but are not likely to adversely affect, threatened and endangered species and their habitats as a result of routine operations, management, and monitoring. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 19, may be implemented as appropriate to further 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 effect on threatened and endangered species as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 7.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

7.2.7. Land Use, Recreation, and Airspace

7.2.7.1. Introduction

This section describes potential impacts to land use, recreation, and airspace resources in Kansas associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.7.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on land use, recreation, and airspace resources were evaluated using the significance criteria presented in Table 7.2.7-1. As described in Section 7.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 7.2.7-1: Impact Significance Rating Criteria for Land Use, Recreation, and Airspace

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Direct land use change	Magnitude or Intensity	Change in designated/permitted land use that conflicts with existing permitted uses, and/or would require a change in zoning. Conversion of prime or unique agricultural lands.	Effect that is potentially significant, but with mitigation is less than significant.	Minimal changes in existing land use, or change that is permitted by-right, through variance, or through special exception.	No changes to existing development, land use, land use plans, or policies. No conversion of prime or unique agricultural lands.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Land use altered indefinitely.		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase.	NA
Indirect land use change	Magnitude or Intensity	New land use directly conflicts with surrounding land use pattern, and/or causes substantial restriction of land use options for surrounding land uses.	Effect that is potentially significant, but with mitigation is less than significant.	New land use differs from, but is not inconsistent with, surrounding land use pattern; minimal restriction of land use options for surrounding land uses.	No conflicts with adjacent existing or planned land uses.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Land use altered indefinitely.		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Loss of access to public or private recreation land or activities	Magnitude or Intensity	Total loss of access to recreation land or activities.	Effect that is potentially significant, but with mitigation is less than significant.	Restricted access to recreation land or activities.	No disruption or loss of access to recreational lands or activities.
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance.		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Loss of enjoyment of public or private recreation land (due to visual, noise, or other impacts that make recreational activity less desirable)	Magnitude or Intensity	Total loss of enjoyment of recreational activities; substantial reduction in the factors that contribute to the value of the recreational resource, resulting in avoidance of activity at one or more sites.	Effect that is potentially significant, but with mitigation is less than significant.	Small reductions in visitation or duration of recreational activity.	No loss of enjoyment of recreational activities or areas; no change to factors that contribute to the value of the resource.
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance.		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory.	NA
	Duration or Frequency	Persists during or beyond the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Use of airspace	Magnitude or Intensity	Measurable, substantial change in flight patterns and/or use of airspace.	Effect that is potentially significant, but with mitigation is less than significant.	Alteration to airspace usage is minimal.	No alterations in airspace usage or flight patterns.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Airspace altered indefinitely.		Short-Term: Airspace altered for as long as the entire construction phase or a portion of the operations phase.	NA

NA = Not Applicable

7.2.7.3. Description of Environmental Concerns

Direct Land Use Change

Changes in land use could be influenced by the deployment, operation, and maintenance of facilities or other infrastructure, and the acquisition of ROWs or easements. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with exiting development or land use. The installation of poles, towers, structures, or other above-ground facilities or assets could have short- or long-term effects to existing development or land use based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of ROWs or easements and the construction of roads to access facilities and locations could influence changes in land use. The effects from these actions would depend on the geographic location; compatibility with existing land uses; and characteristics of the ROW, easement, or access road. These characteristics, such as the length, width, and location could change the existing land use to another category or result in the short- or long-term loss of the existing land use.

Based on the impact significance criteria presented in Table 7.2.7-1, less than significant impacts would be anticipated given the size and nature of the majority of the proposed deployment activities. Direct land use changes would be minimized and isolated at specific locations and all required permits would be obtained; only short-term impacts during the construction phase would be expected.

Indirect Land Use Change

Changes in surrounding land use patterns and options for surrounding land uses could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with surrounding land use patterns and options for surrounding land uses. The installation of poles, towers, structures, or other aboveground facilities or assets could have short- or long-term effects to surrounding land use patterns or options for surrounding land uses based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of ROWs or easements and the construction of roads to access facilities and locations could influence changes in surrounding land uses. The effects from these actions would depend on the geographic location; compatibility with surrounding land uses; and characteristics of the ROW, easement, or access road. These characteristics, such as the length, width, and location could conflict with surrounding land use patterns or restrict options for surrounding land uses.

Based on the impact significance criteria presented in Table 7.2.7-1, less than significant impacts would be anticipated as any new land use would be small scale only short-term impacts during the construction phase would be expected.

Loss of Access to Public or Private Recreation Land or Activities

The deployment, operation, and maintenance of facilities and the acquisition of ROW or easement could influence access to public or private recreation land or activities. Localized, short-term accessibility to recreation land or activities could be impacted by the deployment and maintenance of structures, towers, roads, and other permanent features but these impacts are expected to be less than significant due to the short duration of deployment activities. In the long-term, the deployment and installation of poles, towers, structures, or other aboveground facilities could alter the types and locations of recreation activities.

Based on the impact significance criteria presented in Table 7.2.7-1, less than significant impacts would be anticipated as restricted access or a loss of access to recreation areas would not occur; only short-term impacts or small-scale limitations during the construction phase would be expected.

Loss of Enjoyment of Public or Private Recreation Land

The deployment of new towers, and the resulting built tower, could influence the enjoyment of public or private recreation land. Crews accessing the site during the deployment and maintenance of structures, towers, roads, and other permanent features could temporarily impact enjoyment of recreation land. The deployment of poles, towers, structures, or other aboveground facilities could affect the enjoyment of recreational land based on the characteristics of the structures or facilities, including permanent impacts to scenery, short-term noise impacts, and the presence of deployment or maintenance crews.

Based on the impact significance criteria presented in Table 7.2.7-1, less than significant impacts would be anticipated as only small reductions, if any, in recreational visits or durations would occur due to the relatively small-scale nature of likely FirstNet activities. Only short-term impacts during the construction phase would be expected.

Use of Airspace

Primary concerns to airspace include the following: if aspects of the Proposed Action would result in violation of FAA regulations; undermine the safety of civilian, military, or commercial aviation; or infringe on flight activity and flight corridors. Potential 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, but are not likely to, obstruct navigable airspace in the state. Use of aerial technologies could result in SUA considerations.

Based on impact significance criteria presented in Table 7.2.7-1, airspace impacts are not likely to change or alter flight patterns or airspace usage. Drones, balloons, and piloted aircraft would likely only be deployed in an emergency and for a short period, FirstNet would not impact airspace resources.

7.2.7.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - <u>Land Use:</u> See Activities Likely to Have Impacts below.
    - <u>Recreation:</u> See Activities Likely to Have Impacts below.
    - <u>Airspace:</u> No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on Federal Aviation Regulation (FAR) 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 7.1.7.5 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.
    - <u>Land Use:</u> It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
    - <u>Recreation:</u> See Activities Likely to Have Impacts below.
    - <u>Airspace:</u> It is anticipated that there would be no impacts to airspace since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and*

Preservation of the Navigable Airspace (See Section 7.1.7.5 Obstructions to Airsapce Considerations).

- New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) ROWs or easements and the potential construction of access roads.
  - Land Use: See Activities Likely to Have Impacts below.
  - Recreation: See Activities Likely to Have Impacts below.
  - Airspace: Installation of new poles would not have an effect on airspace because utility poles are an average of 40 feet in height and do not intrude into useable airspace.
- Collocation on Existing Aerial Fiber Optic Plant: Installation of new fiber on existing poles would be limited to previously disturbed areas.
  - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
  - Recreation: No impacts to recreation would be anticipated since the activities that would be conducted would not cause disruption or loss of access to recreational lands or activities or the enjoyment of those lands or activities.
  - Airspace: No impacts are anticipated to airspace from collocations.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber and installation of new equipment in existing huts.
  - Land Use: It is anticipated that there would be no impacts to land use since the activities would not directly or indirectly result in changes to existing and surrounding land uses.
  - Recreation: Use of existing dark fiber would not impact recreation because it would not impede access to recreational resources.
  - Airspace: Lighting of dark fiber would have no impacts to airspace.
- New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore or inland bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
  - Land Use: See Activities Likely to Have Impacts below.
  - Recreation: See Activities Likely to Have Impacts below.
  - Airspace: The installation of cables in or near bodies of water and construction of landings/facilities on shores and banks of water bodies would not impact flight patterns or cause obstructions that would require FAA and/or state review based

on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 7.1.7.5 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.
  - <u>Land Use:</u> See Activities Likely to Have Impacts below.
  - <u>Recreation:</u> See Activities Likely to Have Impacts below.
  - <u>Airspace:</u> No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 7.1.7.5 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.
    - <u>Land Use:</u> 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.
    - <u>Recreation:</u> See Activities Likely to Have Impacts below.
    - <u>Airspace:</u> 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.
    - <u>Land Use:</u> 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.
    - <u>Recreation:</u> No impacts to recreation are anticipated as deployable technologies would not affect the use or enjoyment of recreational lands.
    - <u>Airspace:</u> Use of land-based deployable technologies (COW, COLT, and SOW) is not expected to result in impacts to airspace, provided antenna masts do not exceed 200 ft. AGL or do not trigger any of the other FAA obstruction to airspace criteria. For potential impacts associated with Deployable Aerial Communications Architecture see *Activities Likely to Have Impacts,* below.

- 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: Deployment activities could result in term potential impacts to land uses. Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New structures, poles, or access roads on previously undisturbed ROWs or easements could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new structures with existing and surrounding land uses.
  - Recreation: Deployment activities may cause temporary, localized restricted access to recreation land or activities, which may persist for the duration of the deployment phase. Small reductions to visitation during the deployment phase may be anticipated.
  - Airspace: No impacts are anticipated – see previous section.
- New Build – Submarine Fiber Optic Plant: Installing cables in limited nearshore or inland bodies of water and the constructing landings and/or facilities on shore to accept submarine cable.
  - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New landings and/or facilities on shore could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
  - Recreation: Deployment may temporarily restrict recreation on or within limited nearshore 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 Kansas's airports.
    - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower.
        - Land Use: No impacts are anticipated – see previous section.
        - Recreation: Installation of antennas or microwaves to existing towers may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.

        - Airspace: Collocation of mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, addition of power units, structural hardening, and physical security measures could result in impacts if located near airports or air navigation facilities.

- Deployable Technologies
    - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
        - Land Use: No impacts are anticipated – see previous section.
        - Recreation: No impacts are anticipated – see previous section.
        - Airspace: Implementation of deployable aerial communications architecture could result in temporary or intermittent impacts to airspace. Deployment of tethered systems (such as balloons or blimps) could pose an obstruction hazard if deployed above 200 ft. and near Kansas airports. Potential impacts to airspace (such as SUAs and MTRs) may be possible depending on the planned use of drones, piloted aircraft, untethered balloons, and blimps (e.g., frequency of deployment, altitudes, proximity to airports and airspaces classes/types, length of deployment, etc.). Coordination with the FAA would be required to determine the actual impact and the required certifications. It is expected that FirstNet would attempt to avoid changes to airspace and the flight profiles (boundaries, flight altitudes, operating hours, etc.).
- Satellites and Other Technologies
    - Satellite-Enabled Devices and Equipment: The installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
        - Land Use: No impacts are anticipated – see previous section.
        - Recreation: It is anticipated the installation of equipment on existing structures may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
        - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology may impact airspace if equipment creates an obstruction.

In general, the abovementioned activities could potentially involve construction activities, including the construction of access roads. Potential impacts to land uses associated with deployment of this infrastructure could include temporary restrictions to existing and surrounding land uses in isolated locations. Potential impacts to recreation land and activities could include temporary, localized restricted access and reductions in visitation or duration of recreational activities. Potential impacts to airspace are expected to be less than significant due to the temporary and small-scale nature of deployment activities. Additionally, FirstNet (or its network partners) would prepare an OE/AAA for any proposed tower that might affect navigable airways or flight patterns of an airport. 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 7.2.8, Visual Resources)—and therefore the potential indirect impact on a landowner's ability to use or sell of their land as desired—would be highly dependent on the specific deployment location and length of deployment. The use of deployable aerial communications architecture could temporarily add new air traffic or aerial navigation hazards. The magnitude of these effects would depend on the specific location of airborne resources along with the duration of their use. 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.

7.2.7.5. Alternatives Impact Assessment

The following section assesses potential impacts to land use, recreation resources, and airspace associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific infrastructure associated with the

Deployable Technologies Alternative would be the same as the deployable technologies implemented as part of the Preferred Alternative but would likely be implemented in greater numbers, over a larger geographic extent, and used with greater frequency and duration. Therefore, potential impacts to land use, recreation, and airspace resources as a result of implementation of this alternative could be as described below.

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to land use. While a single deployable technology may have imperceptible impact, multiple technologies operating in close proximity for longer periods could impact existing and surrounding land uses. There could be impacts to recreation activities during the deployment of technologies if such deployment were to occur within or near designated recreation areas. Enjoyment of activities dependent upon the visibility of wildlife or scenic vistas may be affected; however, impacts would be less than significant due to the temporary nature of likely deployment activities. If deployment triggers any obstruction criterion or result in changes to flight patterns and airspace restrictions, FirstNet (or its partners) would consult with the FAA to determine how to proceed. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. Operation of deployable technologies would result in land use, land ownership, airspace, and recreation (access and enjoyment) similar in type to those described for the Preferred Alternative. The frequency and extent of those potential impacts would be greater than for the Proposed Action because under this Alternative, deployable technologies would be the only options available. As a result, this alternative would require a larger number of terrestrial and airborne deployable vehicles and a larger number of deployment locations in—all of which would potentially affect a larger number of properties and/or areas of airspace. Overall, these potential impacts would be less than significant due to the temporary nature of deployment activities. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to land use, recreation resources, or airspace. Environmental conditions would therefore be the same as those described in Section 7.1.7, Land Use, Recreation, and Airspace.

7.2.8. Visual Resources

7.2.8.1. Introduction

This section describes potential impacts to visual resources in Kansas associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.8.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 7.2.8-1. 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 addressed in this section are presented as a range of possible impacts.

Table 7.2.8-1: Impact Significance Rating Criteria for Visual Resources

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

7.2.8.3. Description of Environmental Concerns

Adverse Change in Aesthetic Character of Scenic Resources or Viewsheds

A primary concern during and following construction of structures, towers, roads or other permanent features is the long-term disruption of scenery and viewsheds. In Kansas, residents and visitors travel to many national monuments, historic sites, and state parks. 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.

Kansas regulates impacts to visual resources for historic properties through their State Historical Society to “engage in a comprehensive program of historic preservation and to foster and promote the conservation and use of historic property…” Historic properties in Kansas are assessed prior to a proposed project to determine if any adverse effects to the integrity or historic significance could occur. 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. If new towers were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas.

Based on the impact significance criteria presented in Table 7.2.8-1, impacts to the aesthetic character of scenic resources or viewsheds would be considered potentially significant if landscapes were permanently removed or fragmented, or if damage to historic or cultural resources occurred. Given the small scale of likely FirstNet activities, impacts are expected to be less than significant.

Nighttime Lighting

If new towers or facilities were constructed to a height that required lighting, nighttime vistas could be affected in areas where the night skies do not have light disruptions or are within unpopulated areas. 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 7.2.8 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.

7.2.8.4. 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, 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 next to existing roadways would not affect visual resources unless vegetation were removed or excavation occurred in scenic areas.
  - New Build – Aerial Fiber Optic Plant: Construction and installation of new or replacement poles and hanging cables could result in impacts to the aesthetic character of scenic resources or viewsheds depending on the location of the installation. In most cases, development in public rights-of-ways would not affect visual resources unless vegetation were removed or construction occurred in scenic areas. If new lighting were necessary, impacts to night skies could occur. Construction of new roadways could result in linear disruptions to the landscape, surface disturbance, and vegetation removal; all of which could impact the aesthetic character of scenic resources or viewsheds, depending on the location of the installation.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact visual resources. However, impacts to the aesthetic character of scenic resources or viewsheds could potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading, vegetation removal, or other ground disturbance to install small boxes or huts, or access roads, potential impacts to visual resources could occur but effects would be temporary and localized.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to visual resources. Land/vegetation clearing, excavation activities, landscape

grading, and other surface disturbing activities during the installation of new wireless towers and associated structures or access roads could result in the degradation of the aesthetic character of scenic resources or viewsheds. Impacts may be experienced by viewers if new towers were 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 the additional power units are needed, 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 above-mentioned activities could potentially involve land/vegetation clearing, and potential scenic intrusion of towers, poles, roads, infrastructure, and other structures. Potential impacts to visual resources associated with deployment could include interruptions of landscapes, degradation of the aesthetic character of scenic resources or viewsheds, and overall changes in valued scenic resources, particularly for permanent fixtures such as towers or facilities. These impacts are expected to be less than significant due to the temporary and small-scale nature of deployment activities. Chapter 19, BMPs and Mitigation Measures, provides a 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 NPSto address any concerns they might have if a tower needed to be placed in an area that might affect the nighttime sky at a NPS unit. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.8.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas. If staging or landing areas (depending on the type of technology) require surface disturbance or vegetation clearing, or if these areas were within scenic landscapes or required new nighttime lighting, impacts could occur to the aesthetic character of scenic resources or viewsheds. These impacts are expected to be less than significant as generally they would be limited to the deployment location and could often be screened or otherwise blocked from view. 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 given the limited geographic scope for individual activities. 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. 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 visual resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 7.1.8, Visual Resources.

7.2.9. Socioeconomics

7.2.9.1. Introduction

This section describes potential impacts to socioeconomics in Kansas associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.9.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 7.2.9-1. As described in Section 7.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 7.2.9-1: Impact Significance Rating Criteria for Socioeconomics

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Impacts to real estate (could be positive or negative)	Magnitude or Intensity	Changes in property values and/or rental fees, constituting a significant market shift.	Effect that is potentially significant, but with mitigation is less than significant.	Indiscernible impact to property values and/or rental fees.	No impacts to real estate in the form of changes to property values or rental fees.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Changes to spending, income, industries, and public revenues	Magnitude or Intensity	Economic change that constitutes a market shift.	Effect that is potentially significant, but with mitigation is less than significant.	Indiscernible economic change.	No change to 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

7.2.9.3. Description of Environmental Concerns

This section discusses at a high level the types of socioeconomic impacts that could result from deployment of the NPSBN. Socioeconomic impacts could be negative or positive. Subsections below address socioeconomic impacts in four general areas, following the breakdown of the significance rating criteria in the table above:

- Impacts to Real Estate;
- Economic Benefits or Adverse Impacts related to changes in Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; and
- Changes in Population Number or Composition.

In addition to the specific impacts noted below, the Proposed Action would likely have broad, beneficial impacts to all four areas in times of disaster, by improving the response of public safety personnel. Reduced damages and faster recovery would result. This would support property values; maintain corporate income, personal income, and government revenues; preserve jobs; and reduce disruptions to populations.

Impacts to Real Estate

Deployment of the NPSBN has the potential to improve property values in areas that have reduced property values due to below average public safety communication services. Improved services would reduce response times and improve responses (provide a better fit of the response to the need). 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 Kansas. Median values of owner-occupied housing units in the 2009–2013 period ranged from over $189,000 in the greater Kansas City area (Kansas portion), to below $90,000 in Hutchison. 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 et al., 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 et al., 2013). These studies all focused on residential properties. One study identified a positive effect on price in one neighborhood due to the presence of a wireless communications tower. Most studies identified negative effects on price. Generally, these negative effects were small: an approximately two percent decrease in property price. In one case, the average reduction in price was 15 percent. In all cases, the effects declined rapidly with distance, with some cases showing no effect beyond 100 meters (328 feet) and one case showing effects up to about 300 meters (984 feet).

Based on review of the particulars of each study, the literature review authors hypothesize that many additional factors regarding communications towers, besides distance, may affect property value. These include the type, height, size, and appearance of communication towers; grouping of towers; the level of activity in the property market at the time properties are listed or sold; and the level of negative local media focus on potential health effects of communication towers at the time properties are listed or sold.

Economic Benefits or Adverse Impacts Related to changes in Spending, Income, Industries, and Public Revenues

Developing the NPSBN may increase economic activity as governments and partners make expenditures to deploy, operate, and maintain telecommunications and broadband infrastructure. Funds for such expenditures would come primarily from federal, state, and local government sources or through private entities under a written agreement with such governmental entities. FirstNet has three primary sources of funding to carry out its mission: (1) up to $7 billion in cash funded by proceeds of incentive auctions authorized by the Act; (2) network user or subscriber fees; and (3) fees from covered leasing agreements that allow FirstNet to permit a secondary 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. The use of NPSBN capacity on a secondary basis for non-public safety services, including commercial services, by parties entering into a covered leasing agreement with FirstNet may also increase economic activity and generation of income for such party.

Direct spending of federal, state, and private sector funds to deploy and operate the NPSBN would likely represent new income to businesses that provide goods and services for the network, resulting in a positive impact. This direct impact would lead to indirect impacts (as directly impacted businesses purchase supporting goods and services) and induced impacts (as the employees of all affected businesses spend the wages they have earned). Because most FirstNet infrastructure investments would be dispersed across the nation, the business income and wages generated in any particular state or community would generally be small relative to the overall state or community economy, but measurable. Based on the significance criteria above, the business income and wage impacts would be considered positive and less than significant. It is also highly unlikely that these impacts would lead to significant market shifts or other significant changes to local/regional economic structure.

Spending and income generation related to developing the NPSBN would also result in changes to public revenues. Property taxes may change as property values increase or decrease due to the installation of new infrastructure. General and selective sales taxes may change (most likely increase), reflecting expenditures during system development and maintenance. Public utility tax revenues may change. These taxes are a subcategory of selective sales taxes that includes taxes on providers of land and mobile telephone, telegraph, cable, and internet services (U.S. Census Bureau, 2006). These service providers may obtain new taxable revenues from operation of components of the public safety broadband network. In such cases, public utility tax revenues may increase, but they could also remain the same or decrease if providers are granted tax breaks in return for operating portions of the network. Individual and corporate income taxes may change as FirstNet infrastructure development and operation creates new taxable income for involved companies and workers.

FirstNet's partner(s) may be given the right to use excess NPSBN capacity commercially. This would result in additional economic activity and generation of income. In turn, this could have revenue implications for federal and state governments, through taxes on sales and on corporate income generated by commercial use of the network.

FirstNet may have an additional, non-revenue benefit to the public sector. The network is likely to create operational cost savings and increased productivity for public safety personnel.

Impacts to Employment

Private companies and government organizations that receive income from deploying and operating the NPSBN would use portions of that income to hire the employees they need to provide their support to the network. This generation of new employment could be a minor, direct, beneficial impact of expenditures on FirstNet. Additional, indirect employment increases would occur as additional businesses hire workers to provide supporting goods and services. For instance, FirstNet partner(s) and their subcontractors and vendors would need engineers and information technology professionals, project managers, construction workers, manufacturing workers, maintenance workers, and other technical and administrative staff. Further employment gains would occur as businesses throughout the economy benefit from consumer spending by wage-earners in direct and indirectly affected businesses.

For the most part, employment gains in any particular state or community would generally be measurable, but small relative to the overall state or community economy. This is because FirstNet infrastructure investments would be dispersed across the nation. Based on the significance criteria above, the employment impacts would be considered positive and less than significant. However, even small employment gains are beneficial, and would be especially welcomed in areas that have high unemployment. As discussed in Affected Environment, unemployment rates (as shown by the unemployment rate map and selected economic indicators table) vary across Kansas. The average unemployment rate in 2014 was 4.5 percent, considerably lower than the national rate. The vast majority of counties in Kansas had unemployment rates below the national average (that is, better employment performance).

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 in one or a few specific offices. While such employment concentrations could be important to specific communities, these and other employment impacts would still not be significant based on the criteria in Table 7.2.9-1 because they would not constitute a "high level of job creation *at the state or territory level*."

Changes in Population Number or Composition

In general, changes in population numbers occur when employment increases or decreases to a degree that affects the decisions of workers on where they can find employment; that is, when workers and their families move to or leave an area because of employment opportunities or the lack thereof. As noted above, deployment and operation of the NPSBN is likely to generate new employment opportunities (directly and indirectly), but employment changes would not be large enough in any state to be considered significant. Therefore, it is highly unlikely that the NPSBN would lead to significant changes in population numbers according to the significance criteria table above. Further, it is unlikely that the NPSBN would lead to any measurable changes in population numbers in any geographic areas, with the possible exception of cities where companies that win major NPSBN contracts establish centers for NPSBN deployment and operation activities. Smaller numbers of employees in any area would not produce measurable population changes because population is always in flux due to births, deaths, and in-migration and out-migration for other reasons.

Population composition refers to age, gender, race, ethnicity, and other characteristics of the individuals making up a population. Given the low potential for changes to population numbers, it is highly unlikely that the NPSBN would lead to any changes in population composition.

7.2.9.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Almost all deployment activities would have socioeconomic impacts, because 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 7.2.2-1.

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 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 socioeconomic resources, it is anticipated that this activity would have no impact on socioeconomic resources.

Activities with the Potential to Have Impacts

Potential impacts to socioeconomics for the Preferred Alternative would encompass a range of impacts that could result from deployment activities. The discussion below indicates which of the four types of socioeconomic impacts discussed above and listed again here apply to each type of deployment activity. For greater detail on the nature of these impacts, see the Description of Environmental Concerns section above.

- Impacts to Real Estate;
- Changes to Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; and
- Changes in Population Number or Composition.

Positive impacts on property values would generally not result from one or a few particular activities, but instead would result from the totality of the new NPSBN infrastructure and operational systems that enable improved public safety services to currently underserved areas. Similarly, any change to population numbers in a few locations as discussed above would result from large contract awards and contractor decisions about employee locations, not from specific deployment activities. Therefore, these types of impacts are not included in the activity-focused discussions below.

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - Collocation on Existing Aerial Fiber Optic Plant: Collocation of new aerial fiber optic plant on existing utility poles and other structures would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.

    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water, and associated onshore activities at existing or new facilities would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment through existing or new boxes or huts would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities and would have the following types of socioeconomic impacts:

    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - New Build – Aerial Fiber Optic Plant: Pole/structure installation would have the following types of socioeconomic impacts:
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads would have the following types of socioeconomic impacts:
    - Impacts to Real Estate – As discussed above, communication towers sometimes have adverse impacts on nearby property values (Bond et al., 2013). Such impacts, if they occur, would be limited to a small area around each project and would generally be a small percentage reduction in property value; thus the impacts would be less than significant.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility would have the following types of socioeconomic impacts. While communication towers

sometimes have adverse impacts on nearby property values (Bond et al., 2013), the impacts of existing wireless towers are presumably already factored into property values and would not be affected by the addition of new equipment.

  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch/landing areas. Development of such areas, or enlargement of existing areas to accommodate FirstNet equipment, would have the following types of socioeconomic impacts:
  - Impacts to Real Estate – It is possible that development or enlargement of storage, staging, and launch/landing areas could have adverse impacts on nearby property values. This is because such facilities may have adverse aesthetic aspects (e.g., parked vehicles in new parking lots), equipment maintenance activities at such facilities may generate noise, and operational activities may generate traffic. Such factors could affect nearby property values. These impacts, if they occur, would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and state. Therefore, these impacts would be less than significant.
  - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would be similar to collocation of wireless equipment on existing wireless towers, structures, or buildings, and would have the following types of socioeconomic impacts.
    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate

income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant.

- Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

In general, the abovementioned activities would have less than significant beneficial socioeconomic impacts. To the extent that certain activities could have adverse impacts to property values, those impacts are also expected to be less than significant, as described above. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

The discussion above characterized the impacts of each type of activity. The socioeconomic impacts of all activities considered together would also be less than significant. Even when considered together, the impacts would be very small relative to the total economic activity and property value of any region or the state. In addition, with the possible exception of property values, all deployment impacts would be limited to the construction phase.

Operation 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. Public or private sector employees would conduct all operational activities, and therefore support employment and involve payment of wages. Even if these economic effects are a very small for each operational activity, and not significant across the entire state, they are measurable socioeconomic impacts.

Potential socioeconomic impacts would primarily be beneficial, and generally of these types:

- Changes to Spending, Income, Industries, and Public Revenues – Operational activities would require expenditures, which then generate business income and employee wages, and may result in new public sector revenues such as taxes on sales and income. All such effects would be small in scale relative to the regional and state economy; their impacts would be less than significant.
- Impacts to Employment – Public and private sector organizations responsible for operating the NPSBN would sustain existing employees and/or hire new employees to carry out operational activities. They would generate a less than significant number of jobs regionally and statewide.

The potential negative impacts on property values mentioned above for deployment of new wireless communication towers and deployable technology storage, staging, and launch/landing areas may also apply in the operations phase. The ongoing presence of such facilities has aesthetic and other effects that may reduce nearby property values, relative to values in the absence of such facilities. These impacts, if they occur, would to be less than significant as they would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and state. 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.

7.2.9.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, all deployment activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, such as generation of business income and employee wages, and creation or sustainment of jobs. The impacts would be small for each activity and therefore less than significant.

Deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, would require storage, staging, and launch/landing areas. Development or enlargement of these facilities could have adverse impacts on nearby property values. The potential for such impacts is higher under this alternative than the Preferred Alternative because it is likely that these facilities would be implemented in greater numbers and over a larger geographic extent. These potential impacts are anticipated to be less than significant as described above. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

All operational activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, and because they are small individually, overall impacts would be less than significant.

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) or other aspects (e.g., noise and traffic) that could negatively affect the value of surrounding properties. The potential for such impacts is higher under this alternative than the Preferred Alternative because it is likely that these facilities would be more numerous, present over a larger geographic extent, and used with greater frequency and duration. These impacts, if they occur, would be less than significant as they would be limited to a relatively small number of sites within the region and state. 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 7.1.9, Socioeconomics.

7.2.10. Environmental Justice

7.2.10.1. Introduction

This section describes potential impacts to environmental justice in Kansas associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.10.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 7.2.10-1. As described in Section 7.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 7.2.10-1: Impact Significance Rating Criteria for Environmental Justice

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	No Impact
Effects associated with other resource areas (e. g., human health and safety, cultural resources, socioeconomics) that have a disproportionately high and adverse impact on low-income populations and minority populations	Magnitude or Intensity	Direct and disproportionately high and adverse effects on environmental justice communities (as defined by EO 12898) that cannot be fully mitigated.	Effect that is potentially significant, but with mitigation is less than significant.	Direct effects on environmental justice communities (as defined by EO 12898) that are not disproportionately high and adverse, and therefore do not require mitigation.	No direct effects on environmental justice communities, as defined by EO 12898.
	Geographic Extent	Effects realized within counties at the Census Block Group level.		Effects realized within counties at the Census Block Group level.	Effects realized within counties at the Census Block Group level.
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

NA = Not Applicable

7.2.10.3. Description of Environmental Concerns

Effects Associated with Other Resource Areas that have a Disproportionately High and Adverse Impact on Low-Income Populations and Minority Populations

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (Executive Office of the President, 1994), and guidance from CEQ, require federal agencies to evaluate potential human health and environmental effects on environmental justice populations. Specifically, "Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment" (CEQ, 1997). Thus, effects associated with other resource areas are of interest from an environmental justice perspective. This includes Human Health and Safety, Cultural Resources, Socioeconomics, Noise, Aesthetics and Visual Resources, and other resources.

Potential concerns noted in the impact analyses for these resources include dust, noise, traffic, and other adverse impacts of construction activities. New wireless communication towers sometimes have adverse impacts on nearby property values (Bond et al., 2013). (See Socioeconomics Environmental Consequences for additional discussion.) The presence and operation of large storage, staging, and launch/landing areas for deployable technologies could raise environmental justice concerns as described below. Indian tribes are considered environmental justice populations (CEQ, 1997); thus, impacts on tribal cultural resources (for instance, due to construction) could be a concern from an environmental justice perspective.

Impacts are considered environmental justice impacts only if they are *both* "adverse" and "disproportionately high" in their incidence on environmental justice populations relative to the general population (CEQ, 1997). The focus in environmental justice impact assessments is always, by definition, on adverse effects. However, telecommunications projects, such as those proposed by FirstNet, could have beneficial effects. These effects may include better provision of police, fire, and emergency medical services; improvements in property values; and the generation of jobs and income. These impacts are considered in the Socioeconomics Environmental Consequences (Section 5.2.9).

Construction impacts are localized, and property value impacts of wireless telecommunications projects rarely extend beyond 300 meters (984 feet) of a communications tower (Bond et al., 2013). In addition, impacts related to deployment are of short duration. The potential for significant environmental justice impacts from the FirstNet deployment activities would be limited. Most, but not all, of the FirstNet operational activities have very limited potential for impacts as these activities are limited in scale and short in their duration.

Before FirstNet deploys projects, additional site-specific analyses to identify specific environmental justice populations and assess specific impacts on those populations may be necessary. Such analyses could tier-off the methodology and results of this PEIS. The areas shown in the environmental justice screening map of Existing Environment (Section 7.1.10.4) as having Moderate potential or High potential for environmental justice populations would particularly warrant further screening. As discussed in Section 7.1.10.3, Environmental Setting: Minority and Low-Income Populations, the population of Kansas has lower percentages of minorities than the region or the nation. Kansas also has a lower poverty rate poverty than the region and nation. Compared to many other states, a smaller proportion of the state's land area is classified as having High potential for environmental justice populations. The distribution of these High potential areas is fairly even across the state, and occurs both within and outside of the ten largest population concentrations, including some of the state's most sparsely populated areas. The distribution of areas with Moderate potential for environmental justice populations is also fairly even across the state. Further analysis using the data developed for the screening analysis in Section 7.1.10.4, 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, 2015i; USEPA, 2016e).

A site-specific analysis would also evaluate whether an actual environmental justice impact on those populations would be likely to occur. Analysts can use the evaluation presented below under "Activities with the Potential to Have Impacts" as a starting point. Analysts should bear in mind that any such activities that are problematic based on the adverse impact criterion of environmental justice may also have beneficial impacts on those same environmental justice communities.

7.2.10.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Installation of fiber optic cable in existing conduit would be through existing hand holes, pulling vaults, junction boxes, huts, and POP structures. Activities at these small entry points would be limited and

temporary and thus are not likely to produce perceptible changes affecting any surrounding communities. Therefore, they would not affect environmental justice communities.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, and therefore would have no impacts to environmental justice. If physical access is required to light dark fiber, it would likely be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures, with no resulting impacts on environmental justice communities.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the deployment of such devices and equipment would not involve new ground disturbance, impacts to environmental justice communities would not occur. Impacts associated with satellite-enabled devices requiring construction activities are addressed below.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN, however it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact environmental justice communities, it is anticipated that this activity would have no impact on environmental justice issues.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to environmental justice for the Preferred Alternative would encompass a range of impacts that could occur as a result of disturbance to communities from construction activities, such as noise, dust, and traffic. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to environmental justice communities include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities such as trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures. These activities could temporarily generate noise and dust, or disrupt traffic. If such impacts occur disproportionately to environmental justice communities, they would be considered environmental justice impacts.
  - New Build – Aerial Fiber Optic Plant: Pole/structure installation could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact environmental justice because there would be no ground disturbance or other impacts associated with this activity that would adversely impact

communities. Associated onshore activities occurring at existing facilities such as staging of equipment and materials, or connection of cables, would be small in scale and temporary; thus, they would not impact environmental justice communities. Construction of new landings and/or facilities onshore to accept submarine cable could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no adverse impacts on surrounding communities, and thus no potential for environmental justice impacts. Installation of optical transmission equipment or centralized transmission equipment requiring construction of new utility poles, hand holes, pulling vaults, junction boxes, huts, and POP structures could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads requires construction activities that could temporarily generate noise and dust, or disrupt traffic. New communication towers sometimes have adverse impacts on nearby property values (Bond et al., 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. 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 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 given the short-term nature and limited geographic scope of individual 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.

7.2.10.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, deployable technologies such as COWs, COLTs, and SOWs, along with aerial deployable technologies, could require storage, staging, and launch/landing areas. To the extent such areas require new construction, noise, and dust could be generated temporarily, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be less than significant because they would be temporary in nature. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) that could negatively affect the value of surrounding properties. In addition, equipment maintenance activities at such facilities may temporarily generate noise, and operational activities may generate traffic. These effects may be adverse in themselves, and may impact property values. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be less than significant as operations are expected to be temporary in nature. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation activities to deploy wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to environmental justice as a result of deployment and operation of the No Action Alternative. Environmental conditions would therefore be the same as those described in Section 7.1.10, Environmental Justice.

7.2.11. Cultural Resources

7.2.11.1. Introduction

This section describes potential impacts to cultural resources in Kansas associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.11.2. Impact Assessment Methodology and Significance Criteria

The potential impacts of the Proposed Action on cultural resources were evaluated using the significance criteria presented in Table 7.2.11-1. As described in Section 7.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 7.2.11-1: Impact Significance Rating Criteria for Cultural Resources

Type of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	**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.
	Geographic Extent	Direct and/or indirect effects APE.		Direct and/or indirect effects APE.	Direct and/or indirect effects APE.

Type of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	**Mitigated Adverse Effect[1]**	**Effect, but Not Adverse**	**No Effect**
	Duration or Frequency	Long-term or permanent loss of character defining attributes of a single or many historic properties.		Infrequent, temporary, or short-term changes to character defining attributes of a single or many historic properties.	No direct or indirect effects to historic properties.
Loss of access to historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No segregation or loss of access to historic properties.
	Geographic Extent	Any area surrounding historic properties that would cause segregation or loss of access to a single or many historic properties.		Any area surrounding historic properties that could cause segregation or loss of access to a single or many historic properties.	No segregation or loss of access to historic properties.
	Duration or Frequency	Long-term or permanent segregation or loss of access to a single or many historic properties.		Infrequent, temporary, or short-term changes in access to a single or many historic properties.	No segregation or loss of access to historic properties.

[1] Whereas mitigation measures for other resources discussed in this PEIS may be developed to achieve an impact that is "Less than Significant with Mitigation Incorporated," historic properties are considered to be "non-renewable resources," given their very nature. As such, any and all unavoidable adverse effects to historic properties, per Section 106 of the NHPA (as codified in 36 CFR Part 800.6), would require FirstNet to consult with the SHPO/THPO and other consulting parties, including Indian Tribes and Native Hawaiian Organizations, to develop appropriate mitigation.

[2] Per NHPA, a "historic property" is defined as any district, archaeological site, building, structure, or object that is either listed or eligible for listing in the NRHP. Cultural resources present within a project's APE are not historic properties if they do not meet the eligibility requirements for listing in the NRHP. Sites of religious and/or cultural significance refer to areas of concern to Indian Tribes and other consulting parties that, in consultation with the respective party(ies), may or may not be eligible for listing in the NRHP. These sites may also be considered TCPs. Therefore, by definition, these significance criteria only apply to cultural resources that are historic properties, significant sites of religious and/or cultural significance, or TCPs. For the purposes of brevity, the term historic property is used here to refer to either historic properties, significant sites of religious and/or cultural significance, or TCPs.

7.2.11.3. Description of Environmental Concerns

Physical Damage to and/or Destruction of Historic Properties

One of the primary environmental concerns during deployment activities is damage to or destruction of historic and cultural resources. Deployment involving ground disturbance has the potential to damage or destroy archaeological sites, and the attachment of communications equipment to historic building and structures has the potential to cause damage to features that are historically significant.

Based on the impact significance criteria presented in Table 7.2.11-1, direct deployment impacts could be potentially significant if FirstNet's deployment locations were in areas with moderate to high probabilities for archaeological deposits, within historic districts, or at historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas with archaeological deposits or within historic districts. However, given archaeological sites and historic properties are present throughout Kansas, 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 can be avoided or minimized through BMPs (see Chapter 19).

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 by conducting research on particular areas and through the NHPA consultation process, and would minimize deployment activities that would cause such loss of access.

7.2.11.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action 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 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 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 scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to cultural resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - New Build – Aerial Fiber Optic Plant: Ground disturbance during the installation of new utility poles and the use of heavy equipment during the installation of new utility poles and hanging of cables could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties and structures within the state.
  - 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 the shore or bank of water bodies to accept submarine cable, which could result in the disturbance of archaeological sites (archaeological deposits tend to be associated with bodies of water and have high probabilities for archaeological deposits), and the associated structures could have visual effects on historic properties.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to cultural resources. If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be impacts to cultural resources. Ground disturbance could impact archaeological sites, and the associated structures could have visual effects on historic properties.
  - Collocation on Existing Aerial Fiber Optic Plant: Soil excavation and excavated material placement during the replacement of poles and structural hardening could result in direct and indirect effects to cultural resources, although any effects to access would be short-term. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in direct and indirect effects to cultural resources.

- Wireless Projects
  - New Wireless Communication Towers: Deployment of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to historic properties. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the deployment of new wireless towers and associated structures or access roads, could result in the disturbance of archaeological sites. The deployment of new wireless communication towers and their associated structures could result in visual impacts to historic properties or the loss of access to historic properties.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower could result in impacts to historic properties. Ground disturbance activities could result in the disturbance of archaeological sites, and the deployment of co-located equipment could result in visual impacts or physical damage to historic properties, especially in urban areas such as Omaha that have larger numbers of historic public buildings.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to historic properties could occur if the deployment is long-term, or if the deployment involves aerial technologies with the potential for visual or other indirect impacts.

In general, the abovementioned activities could potentially involve ground disturbance, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to cultural resources associated with deployment could include physical damage to or destruction of historic properties, indirect impacts including visual effects, the loss of access to historic properties, or the loss of character-defining features of historic properties. These activities could affect, but not adversely affect, cultural resources as the potential adverse effects would be temporary and limited to the area near individual Proposed Action deployment sites. Additionally, some equipment proposed to be installed on or near properties that are listed or eligible for listing on the NRHP could potentially be removed. Additionally, as appropriate, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no effect to cultural resources associated with routine inspections of the Preferred Alternative. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, or if the acceptable load of the surface is exceeded, ground disturbance impacts on archaeological sites could result as explained above. These potential impacts would be associated with ground disturbance or modificants of properties, however, due to the small scale of expected activities, these actions could affect, but would not likely adversely affect, cultural resources. In the event that maintenance and inspection activities occur off existing roads, FirstNet would engage in consultation as required under Section 106 of the NHPA. 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.

7.2.11.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in impacts to archaeological sites. These activities could affect, but not adversely affect, cultural resources due to the limited amount of expected ground disturbing activities and the short-term nature of deployment activities. However, in the event that land/vegetation clearing is required, Firstnet would engage in consultation as required under Section 106 of the NHPA. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the deployment impacts, it is anticipated that there would be effects, but no adverse effects to historic properties associated with implementation/running of the deployable technology. No adverse effects would be expected to either site access or viewsheds due to the temporary nature of expected activities. As with the Preferred Alternative, it is anticipated that there would be no effects to cultural resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, impacts to archaeological sites could occur; however, in the event that this is required, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to cultural resources as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 7.1.11, Cultural Resources.

7.2.12. Air Quality

7.2.12.1. Introduction

This section describes potential impacts to Kansas' air quality from deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.12.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on Kansas's air quality were evaluated using the significance criteria presented in Table 7.2.12-1. As described in Section 7.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 7.2.12-1: Impact Significance Rating Criteria for Air Quality

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

7.2.12.3. Description of Environmental Concerns

Increased Air Emissions

The Proposed Action has the potential to generate air pollutant emissions. These emissions could be above and beyond what is typically generated in a given area and may alter ambient air quality. Deployment activities may involve the use of vehicles, heavy equipment, and other equipment that could emit exhaust and create fugitive dust in localized areas. During operations, routine maintenance and other use of generators at tower facilities may emit exhaust for specific durations (maintenance) or unpredicable 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. Only Saline County is in maintenance or nonattainment for one or more criteria pollutants (see Section 7.1.12, Air Quality).

Based on the significance criteria presented in Table 7.2.12-1, air emission impacts would likely be less than significant given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of emission sources be deployed/operated long-term in the same area from fixed or mobile sources or construction activities. Less than significant emissions could occur for any of the criteria pollutants within attainment areas in Kansas; however, NAAQS exceedances are not anticipated. Only Saline County is in nonattainment in Kansas; FirstNet would try to minimize potential emissions where possible and would recommend the implementation of BMPs, where feasible and practicable, to avoid or minimize potential impacts.

7.2.12.4. Potential Impacts of the Preferred Alternative

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

Deployment and Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to air quality and others would not. The potential impacts could range from no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, 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 the shore or banks of water bodies to accept submarine cable could result in products of combustion and fugitive dust from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Emissions associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the power requirements for optical networks are relatively low.

- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in products of combustion. Operating vehicles and other heavy equipment, running generators while conducing excavation activities, and landscape grading to install new wireless towers and associated structures or access roads could result in products of combustion and fugitive dust.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, such as antennas or microwave dishes, on an existing tower could impact air quality. However, if the additional power units, structural hardening, and physical security measures required grading or excavation, then exhaust and fugitive dust from heavy equipment used for these activities could also result in increased air emissions.
  - Deployable Technologies: The type of deployable technology used would dictate the types of air pollutants generated. For example, mobile equipment deployed via heavy trucks could generate products of combustion from the internal combustion engines associated with the vehicles and onboard generators. These units may also generate

fugitive dust depending on the type of road traveled during deployment (i.e., paved versus unpaved roads). Aerial platforms (e.g., UASs or other aircraft) would generate pollutants during all phases of flight.

In general, the pollutants of concern from the abovementioned activities would be products of combustion from burning fossil fuels in internal combustion engines and fugitive dust from site preparation activities and vehicles traveling on unpaved road surfaces. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are anticipated to be less than significant due to the limited nature of the deployment. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be less than significant impacts to air quality associated with routine inspections of the Preferred Alternative due to the limited nature of the activity. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, additional air quality impacts may occur; however, they would be less than significant as they would still be limited in nature. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.12.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative could include heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and other equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations, and the duration of deployment. The potential impacts to air quality are as follows:

Deployment and Operation Impacts to Air Quality

Implementing deployable technologies could result in products of combustion from mobile equipment deployed via heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a greater cumulative impact, although this is expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term. These vehicles may also produce fugitive dust if traveling on unpaved roads. Some staging or landing areas (depending on the type of technology) may require excavation, site preparation, and paving. Heavy equipment used for these activities could emit products of combustion as a result of burning fossil fuels in internal combustion engines. The deployment and operation of aerial technology is anticipated to generate pollutants during all phases of flight, except for balloons. The products of combustion from ground support vehicles, as well as the duration of ground support operations and travel between storage and deployment locations would dictate the concentrations and associated impacts. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration. 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 air quality. By not deploying NPSBN, FirstNet would avoid generating emissions from construction, installation, or operation of wired, wireless, or deployable infrastructure or technologies; satellites; and other technologies.

7.2.13. Noise

7.2.13.1. Introduction

This section describes potential noise impacts from construction, deployment, and operation of the Proposed Action and Alternatives in Kansas. 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.

7.2.13.2. Impact Assessment Methodology and Significance Criteria

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 7.2.13-1. As described in Section 7.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 7.2.13-1: Impact Significance Rating Criteria for Noise

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Increased noise levels	Magnitude or Intensity	Noise levels would exceed typical noise levels from construction equipment and generators. Noise levels at noise sensitive receptors (such as residences, hotels/motels/inns, hospitals, and recreational areas) would exceed 55 dBA or specific state noise limits. Noise levels plus baseline noise levels would exceeds 10 dBA increase from baseline noise levels (i.e., louder). Project noise levels near noise receptors at National Parks would exceed 65 dBA.	Effect that is potentially significant, but with mitigation is less than significant.	Noise levels resulting from project activities would exceed natural sounds, but would not exceed typical noise levels from construction equipment or generators.	Natural sounds would prevail. Noise generated by the action (whether it be construction or operation) would be infrequent or absent, mostly immeasurable.
	Geographic Extent/Context	County or local.		County or local.	County or local.
	Duration or Frequency	Permanent or long-term.		Short term.	Temporary.

7.2.13.3. Description of Environmental Concerns

Increased Noise Levels

The Proposed Action has the potential to generate noise during construction and operation of various equipment used for deployment. These noise levels could be above what is typically generated in a given area and may alter the ambient acoustical environment. If significant, the noise could cause impacts on residential areas, or other facilities that are sensitive to noise, such as churches, hospitals, or schools. The construction activities for deploying some of the various equipment evaluated under the Proposed Action could cause short-term impacts to nearby populations. However, it is likely that there would be less long-term effects from operational use of the proposed equipment (see Section 7.1.13, Noise).

Based on the significance criteria presented in Table 7.2.13-1, noise impacts would likely be less than significant given the size and nature of the majority of the proposed deployment activities. The majority of FirstNet's deployment activities would not be located in sensitive areas nor would a large number of noise sources be deployed/operated long-term in the same area. Noise levels from deployment activities are not expected to exceed typical noise levels for short-term/temporary construction equipment or generators.

To the extent practicable, FirstNet would attempt to mitigate or minimize noise effects during construction or operation. BMPs and mitigation measures would be followed to limit impacts on nearby noise-sensitive receptors. However, given that much of the 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.

7.2.13.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementing the Preferred Alternative could result in deploying various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential noise impacts and while others would not.

In addition, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
    - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and is not expected to create perceptible impacts.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction 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 the shore or banks of bodies of water to accept submarine cable could result in short-term and temporarily increased noise levels to local residents and other noise sensitive receptors from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Noise associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the noise emissions from optical networks are relatively low. Heavy equipment used to grade and construct access roads could generate increased levels of noise over baseline levels temporarily.

- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in localized construction noise. Operating vehicles, other heavy equipment, and generators would be used on a short-term basis and could increase noise levels.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, or to grade or excavate additional land on sites for installation of equipment, such as antennas or microwave dishes on an existing tower, could impact the local noise environment temporarily.
  - Deployable Technologies: The type of deployable technology used would dictate the types of noise generated. For example, mobile equipment deployed via heavy trucks could generate noise from the internal combustion engines associated with the vehicles and onboard generators. Aerial platforms (e.g., UASs or other aircraft, except balloons) generate noise during all phases of flight, including takeoff, landing, and flight operations over necessary areas that could impact the local noise environment.

In general, noise from the abovementioned activities would be products of site preparation, installation, and construction activities, as well as additional construction vehicles traveling on nearby roads and localized generator use. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are expected to be less than significant due to the temporary duration of deployment activites. Additionally, pre-existing noise levels are achieved after some months (typically less than a year but could be a few hours for linear activities such as pole construction). Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Preferred Alternative would be less than significant, and for routine maintenance and inspection of the facilities because of the temporary nature of the activities, which would not create new permanent sources of noise. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise impacts would be similar to or less than those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections or onsite generator use occurs, potential noise impacts could result as explained above. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.13.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative would be heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations and the duration of deployment. The potential noise impacts are as follows:

Deployment Noise Impacts

Implementing deployable technologies could result in noise from mobile equipment deployed via heavy trucks, including not only onboard generators, but also the vehicles themselves. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have increase localized noise levels. Several vehicles traveling together could also create short-term noise impacts on residences or other noise-sensitive receptors as they pass by. With the exception of balloons, the deployment of aerial technology is anticipated to generate noise during all phases of flight. Aerial technologies would have the highest level of noise impact if they are required to fly above residential areas, areas with a high concentration of noise-sensitive receptors (i.e., schools or churches), or over national parks or other areas where there is an expectation of quiet and serenity on their way to their final destinations. Residences near deployment areas for aerial technologies (i.e., airports or smaller airfields) could also be affected during takeoff and landing operations. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Deployable Technologies Alternative would be similar to several of the deployment activities related to routine maintenance and inspection of the facilities. Operation of generators could also generate noise in the area. However, deployable technologies could be deployed to areas with few existing facilities, so noise impacts 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.

7.2.14. Climate Change

7.2.14.1. Introduction

This section describes potential impacts to climate and climate change-vulnerable resources in Kansas associated with deployment and operation of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.14.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on climate and potential climate change impacts on the Proposed Action's installations and infrastructure were evaluated using the significance criteria presented in Table 7.2.14-1. As described in Section 7.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

CEQ requires the consideration of climate change from two perspectives. The first is the potential for impacts on climate change through GHG emissions resulting from the Proposed Action or Alternatives. The second is related to the implications and possible effects of climate change on the environmental consequences of the Proposed Action or Alternatives. This extends to the impacts of climate change on facilities and infrastructure that would be part of the Proposed Action or Alternatives (KDHE, 2007).

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 (KDHE, 2007). Although 25,000 MT is a very small fraction (one $266{,}920^{th}$) of the total U.S. emissions of 6,673 MMT CO_2e in 2013 (USEPA, 2015c), 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 (KDHE, 2007). 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 7.2.14-1: Impact Significance Rating Criteria for Climate Projected Future Climate

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than Significant	Impact Level: No Impact
Contribution to climate change through GHG emissions	Magnitude or Intensity	Exceedance of 25,000 metric tons of CO_2e/year, and global level effects observed.	Effect that is potentially significant, but with mitigation is less than significant.	Only slight change observed.	No increase in greenhouse gas emissions or related changes to the climate as a result of project activities.
	Geographic Extent	Global impacts observed.		Global impacts observed.	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term.		Changes occur on a longer time scale. Changes cannot be reversed in the short term.	NA
Effect of climate change on FirstNet installations and infrastructure	Magnitude or Intensity	Climate change effects (such as sea level rise or temperature change) negatively impact FirstNet infrastructure.	Effect that is potentially significant, but with mitigation is less than significant.	Only slight change observed.	No measurable impact of climate change on FirstNet installations or infrastructure.
	Geographic Extent	Local and regional impacts observed.		Local and regional impacts observed.	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term.		Changes occur on a longer time scale. Changes cannot be reversed in the short term.	NA

NA = Not Applicable

7.2.14.3. Projected Future Climate

Climate model forecasts of future temperatures are highly dependent on emissions scenarios (low versus high), particularly in projections beyond 2050. For an average of seven days per year, maximum temperatures reach more than about 95 °F in the Northern Plains. These high temperatures are projected to occur much more frequently with days over 100 °F projected to double in number in the Northern Plains even in a low emissions scenario. Increases are also expected in the number of nights with minimum temperatures higher than 60 °F in the north part of the plains. These increases in extreme heat will have many negative consequences, including increases in surface water losses, heat stress, and demand for air conditioning. (USGCRP, 2014a)

Air Temperature

Figure 7.2.14-2 illustrates the anticipated temperature changes for low and high GHG emission scenarios for Kansas from a 1969 to 1971 baseline.

Bsk **–** Figure 7.2.14-1 shows that by mid-century (2040 to 2059), temperatures in the entire state of Kansas 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 Kansas would increase by approximately 6 °F (USGCRP, 2009).

Figure 7.2.14-2 shows that under a high emissions scenario for the period (2040 to 2059), temperatures would increase by approximately 5 °F. Under a high emissions scenario for the period (2080 to 2099) in the Cfa region of Kansas, temperatures would increase by approximately 9 °F and 10 °F depending on the portion of the region (USGCRP, 2009).

Cfa **–** Temperatures in this region are expected to increase by mid-century (2040 to 2059) and by the end of the century (2080 to 2099) at the same rate as the Bsk region under both low and high emissions scenarios (USGCRP, 2009).

Dfa **–** Temperatures in this region are expected to increase by mid-century (2040 to 2059) and by the end of the century (2080 to 2099) at the same rate as the Bsk and Cfa region under both low and high emissions scenarios (USGCRP, 2009).

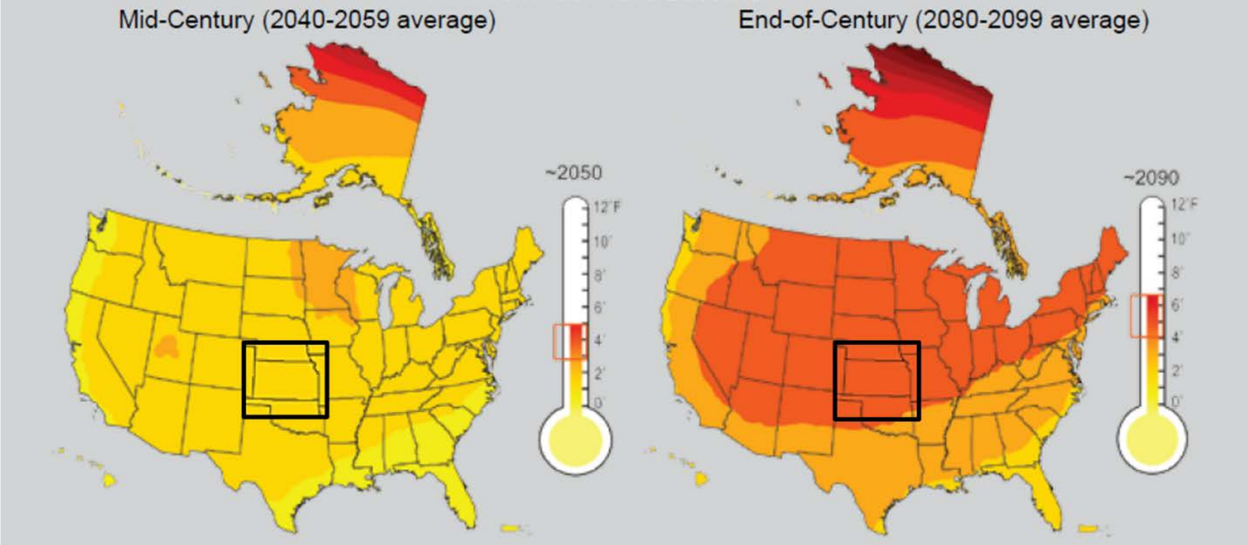
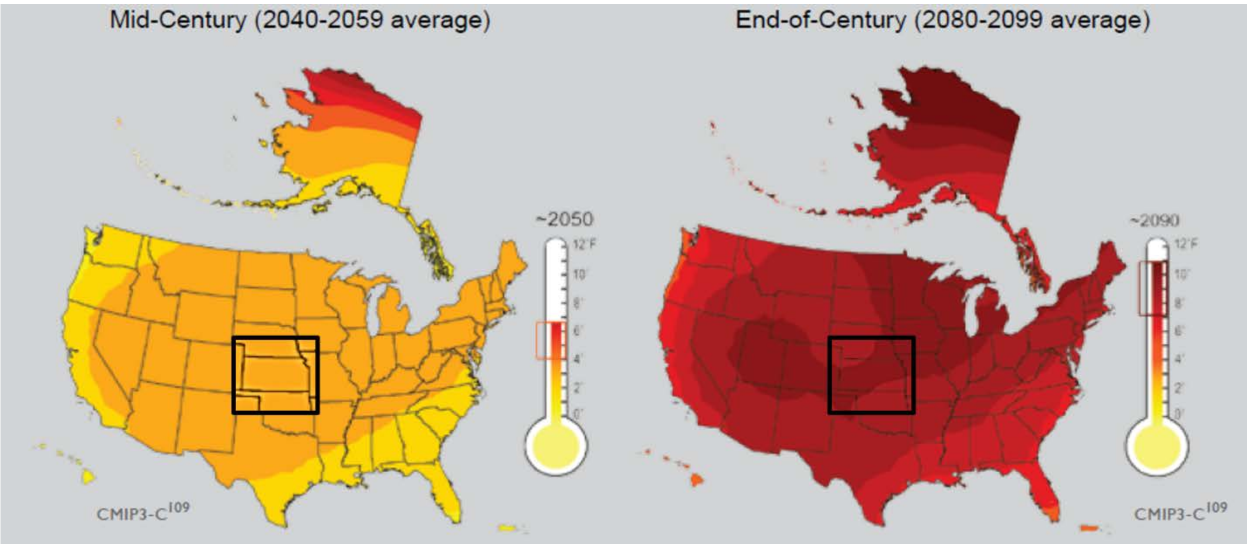


Figure 7.2.14-1: Kansas Low Emission Scenario Projected Temperature Change



Source: (USGCRP, 2009)

Figure 7.2.14-2: Kansas High Emission Scenario Projected Temperature Change

Precipitation

Winter and spring precipitation is projected to increase in the northern states of the Great Plains region relative to a 1971-2000 average. In central areas, changes are projected to be small relative to natural variations. Projected changes in summer and fall precipitation are also small except for summer drying in the central Great Plains. The number of days with heavy precipitation is expected to increase by mid-century, especially in the Northern Plains. (USGCRP, 2014a)

Total seasonal snowfall has generally increased in the northern Great Plains although snow is melting earlier in the year and more precipitation is falling as rain versus snow. Overall snow cover has decreased in the Northern Hemisphere, due in part to higher temperatures that shorten the time snow spends on the ground. (USGCRP, 2014c)

In the majority of Kansas, there is an expected increase in the number of consecutive dry days by more than four days under a high emissions scenarios by mid-century (2041 to 2070) as compared to the period (1971 – 2000). An increase in consecutive dry days could lead to drought. (USGCRP, 2014a).

Figure 7.2.14-3 and Figure 7.2.14-4 show predicted seasonal precipitation change for an approximate 30-year period of 2071 to 2099 compared to a 1970 to 1999 approximate 30-year baseline. Figure 7.2.14-3 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 7.2.14-4 shows a high emissions scenario, which assumes continued increases in emissions, with associated large increases in warming and major precipitation changes. (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)

Bsk - Figure 7.2.14-3 shows the low emissions scenario in the 30-year period for 2071 to 2099, precipitation would increase by 10 percent in winter and spring for the Bsk region of Kansas. However, there are no expected increases in precipitation in summer or fall other than fluctuations due to natural variability. (USGCRP, 2014b)

Figure 7.2.14-4 shows that if emissions continue to increase, winter precipitation could increase as much as 20 to 30 percent over the period 2071 to 2099 depending on the portion of the region. In spring, precipitation in this scenario could increase up 10 percent or remain constant depending on the portion of the region. Summer precipitation is expected to decrease 20 percent. No significant change to fall precipitation is anticipated for portions of the region while some portions of the region are expected to have a decline of 10 percent in precipitation in fall. (USGCRP, 2014b)

Cfa – Under a low emissions scenario, precipitation is anticipated to remain constant in winter, summer and fall in the Cfa region of Kansas. In spring, precipitation is expected to increase 10 percent in this scenario. (USGCRP, 2014b)

In winter under a high emissions scenario precipitation is expected to increase 20 percent in the Cfa region. Spring precipitation is expected to increase 10 or 20 percent depending on the portion of the region. In summer, precipitation is expected to decrease 10 or 20 percent depending on the portion of the Cfa region. There are no expected changes in precipitation in fall other than natural variations. (USGCRP, 2014b)

Dfa – Precipitation changes for the Dfa region are consistent with projected changes for the Bsk region of Kansas in a low emissions scenario. (USGCRP, 2014b)

Under a high emissions scenario, winter precipitation is expected to increase 20 or 30 percent depending on the portion of the Dfa region of Kansas. In spring, precipitation is expected to increase 10 or 20 percent depending on the portion of the region while summer precipitation will decrease by 10 or 20 percent depending on the portion of the region. Fall precipitation is anticipated to remain constant. (USGCRP, 2014b)

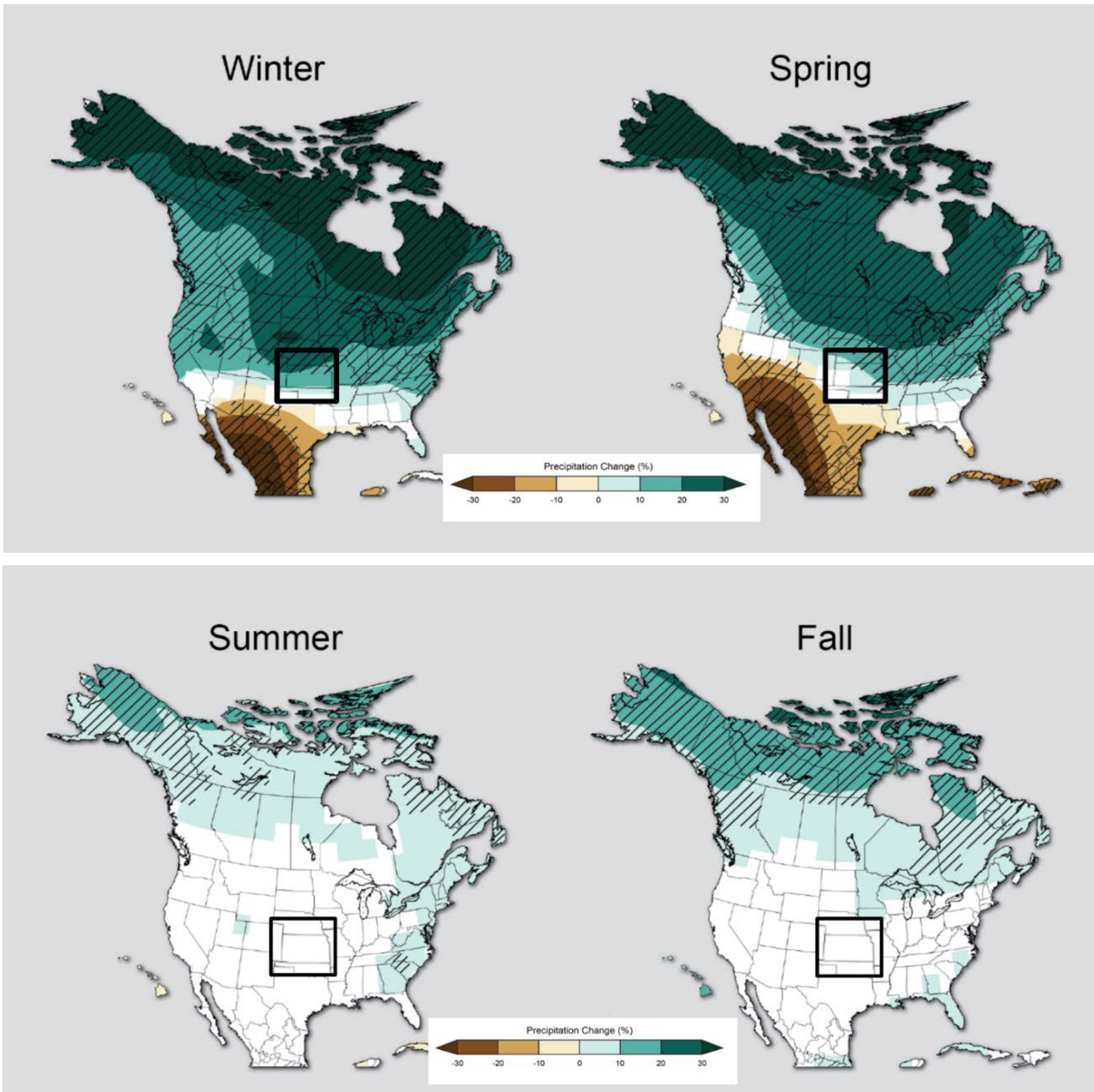


Figure 7.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario

Source: (USGCRP, 2014b)

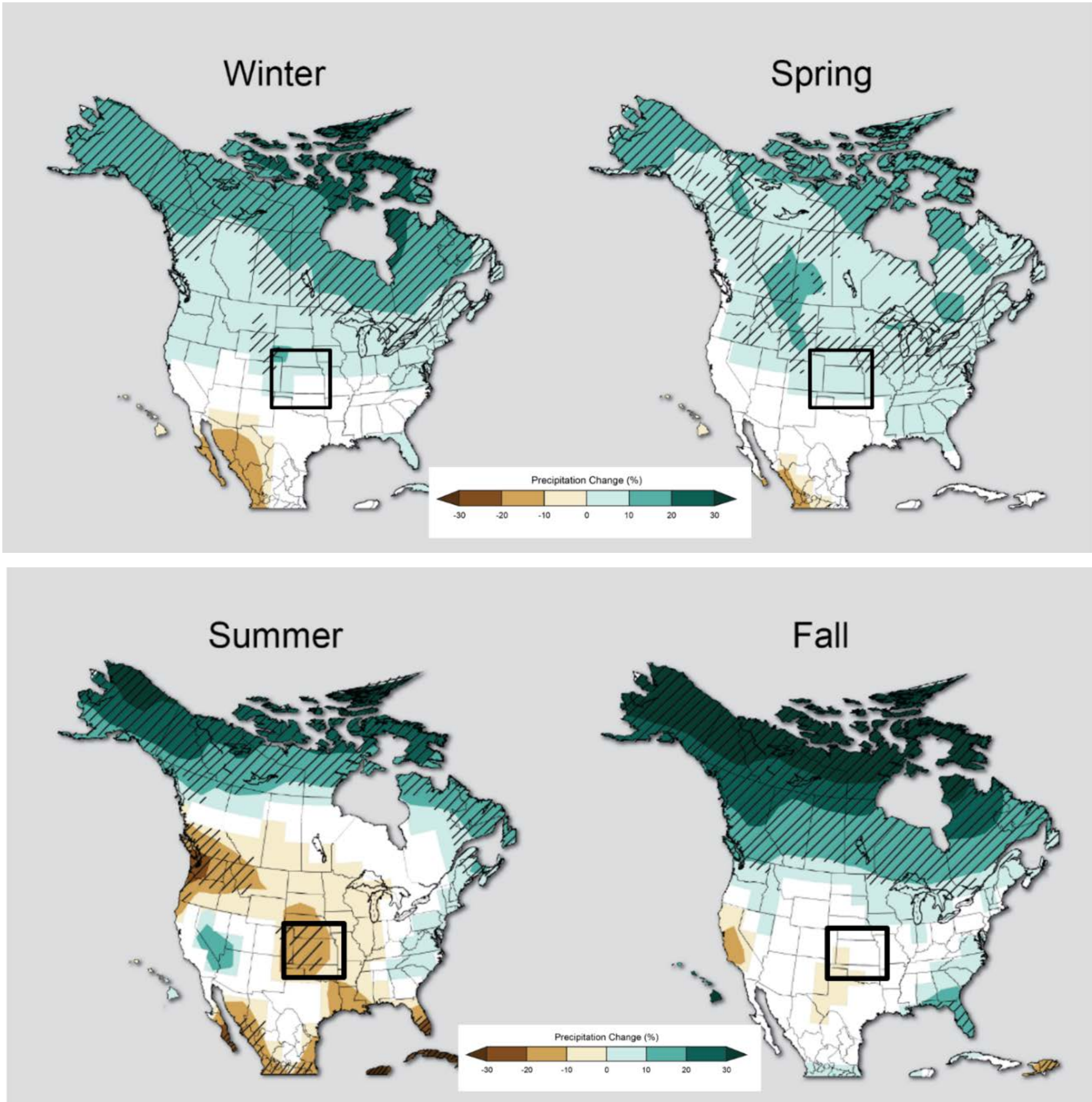


Figure 7.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

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 establish definitive links between severe weather events and climate change. (USGCRP, 2014c)

7.2.14.4. Description of Environmental Concerns

Greenhouse Gas Emissions

Increases in GHG emissions have altered the global climate, leading to generalized temperature increases, weather disruption, increased droughts and heatwaves, and may have potentially catastrophic long-term consequences for the environment. Although GHGs are not yet regulated by the federal government, many states have set various objectives related to reducing GHG emissions, particularly CO_2 emissions from fossil fuels.

Based on the impact significance criteria presented in Table 7.2.14-1, climate change impacts as a result of GHG emissions could be significant and require a quantitative analysis if FirstNet's deployment of technology was responsible for increased emissions of 25,000 MT/year or more. The GHG emissions resulting from FirstNet activities fall into two categories: short-term and long-term. Short-term emissions could be associated with deployment activities (vehicles and other motorized construction equipment) and would have no long-term or permanent impact on GHG emissions or climate change. Long-term (both temporary and permanent) emission increases could result from operations, including the use of grid-provided electricity by FirstNet equipment such as transmitters and optical fiber, and from the temporary use of portable or 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. 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, 2015n), the same transmitter would be responsible for approximately 271 MT of CO_2 per year running continuously. Actual emissions would depend on the fuel mix and efficiency of the systems from which electricity was generated. Actual emissions would depend on the fuel mix and efficiency of the systems from which electricity was generated. Some may even run on low/no-emissions renewable energy. Therefore, this scenario is a "worst-case" for GHG emissions. If the system deployment resulted in the operation of more than 50 60 kW towers operating at maximum power in remote locations on diesel generators on a continuous basis, the 25,000 MT/year threshold may be exceeded and a quantitative analysis required. By comparison optical fiber is considerably more energy efficient and consumes considerably less power than transmitters (Vereecken, et al., 2011), and would not impact GHG emissions in such a way as to require a quantitative analysis.

Impact of Climate Change on Project-Related Resource Effects

Climate change may impact project-related effects by magnifying or otherwise altering impacts in other resources areas. For example climate change may impact air quality, water resource availability, and recreation. Climate change may expose areas of Kansas to increased intensity and duration of heat waves and extended periods of drought which together would negatively impact both natural and cultivated ecosystems (USGCRP, 2014d). Extended heat waves would also increase ozone formation and exacerbate human morbidity and mortality due to extreme and prolonged heat (USGCRP, 2014e). Projected increases in the frequency and intensity of extreme rainfall events could damage topsoil and increase sedimentation in receiving water bodies, leading to water quality and ecosystem impairment (USGCRP, 2014e).

These effects would vary from state to state depending on the resources in question and their relationship to climate change. These impacts will be considered fully in Chapter 18, Cumulative Impacts. No BMPs will be described for this aspect of the resource.

Impact of Climate Change on FirstNet Installations and Infrastructure

Climate change impacts on FirstNet installations and infrastructure will vary from state to state, depending on the placement and vulnerability of the installations and infrastructure, and the impacts that climate change is anticipated to have in that particular location. For areas of Kansas 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, 2014e). The projected increased frequency and duration of extreme heat waves would increase general demand on the electric grid, reduce electricity transmission capacity (DOE, 2015), and potentially overwhelm the capacity on-site equipment needed to keep microwave and other transmitters cool. Based on the impact significance criteria presented in Table 7.2.14-1 climate change effects on FirstNet installations and infrastructure would be significant if they negatively affected the operation of these facilities.

7.2.14.5. Potential Impacts of the Preferred Alternative

Greenhouse Gas Emissions

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

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment and operation of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to GHG emissions, climate impacts in other resource areas, and FirstNet infrastructure and operations, and others would not. In addition, and as explained in this section, the same type of Proposed

Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: There would be no short-term emissions associated with construction, as construction would not take place. The equipment required to blow or pull fiber through existing conduit would be used temporarily and infrequently, resulting in no perceptible generation of GHG emissions.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short- or long-term emissions.
- 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 ROWs or easements. It could also include construction

of POPs, huts, or other facilities to house outside plant equipment. These activities could generate GHG emissions.

- Collocation on Existing Aerial Fiber Optic Plant: These projects would require equipment for replacement of existing wiring and poles. GHG emissions associated with these projects would arise from use of machinery and vehicles to complete these activities.
- New Build – Submarine Fiber Optic Plant: The deployment of small work boats with engines similar to recreational vehicle engines may be required to transport and lay small wired cable. The emissions from these small engine sources would contribute to GHGs.

- Wireless Projects
  - New Wireless Tower Construction: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in short-term, temporary GHG emissions from vehicles and construction equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and back-up), and would depend on their size, number, and the frequency and duration of their use.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on existing towers. There would be no short-term GHG emissions associated with construction as construction would not take place. Minor, short-term, temporary GHG emissions may result from any associated equipment used for installation, such as cranes or other equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and back-up), and would depend on their size, number, and the frequency and duration of their use.
- Deployable Technologies
  - COWs, COLTs, SOWs: The long-term operations of these mobile systems have the potential to have GHG emission impacts in excess of 25,000 MT if operated in large numbers over the long-term. However, this would be highly dependent on their size, number, and the frequency and duration of their use. Emissions associated with the deployment and maintenance of a complete network solution of this type may be significant if large numbers of piloted or unmanned aircraft were used for a sustained period of time (i.e., months to years). Emissions would depend on the type of platforms used, their energy consumption, and the duration of the network's operation.

Potential climate change impacts associated with deployment activities as a result of implementation of the Preferred Alternative include increased GHG emissions. GHG emissions would arise from the combustion of fuel used by equipment during construction and changes in land use. Emissions occurring as a result of soil disturbance and loss of vegetation are expected to be less than significant due to the limited and localized nature of deployment activities.

Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Climate Change Impacts on FirstNet Infrastructure or Operations

Climate change effects on the Preferred Alternative could be potentially significant to less than significant with BMPs and mitigation measures incorporated because climate change may potentially impact FirstNet installations or infrastructure during periods of extreme heat, severe storms, and other weather events. Mitigation measures could minimize or reduce the severity or magnitude of a potential impact resulting to the project, including adaptation, which refers to anticipating adverse effects of climate change and taking appropriate action to prevent and minimize the damage climate change effects could cause.

Climate change's anticipated impact on extreme weather events such as hurricanes or heat waves may increase the severity of the emergencies to which first responders are responding in vulnerable areas, and thus the extent and duration of their dependence on FirstNet resources. FirstNet would likely prepare to sustain these operations in areas experiencing climate and weather extremes through the design and planning process for individual locations and operations. 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.

7.2.14.6. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could involve use of fossil-fuel-powered vehicles, powered generators, and/or aerial platforms. There could be some emissions and soil and vegetation loss as a result of excavation and grading for staging and/or landing areas depending on the type of technology. GHG emissions are expected to be less than significant based on the defined significance criteria, since activities would be temporary and short-term.

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.

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. These activities are expected to be less than significant due to the limited duration of deployment activities.

Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant, given that these activities are of low-intensity and short duration. 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 Deployable Infrastructure or Operations

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. These projects may also consist of deploying aerial vehicles including, but not limited to, drones, balloons, blimps, and piloted aircraft, which could involve fossil fuel combustion. Climate change effects have the most noticeable impacts over a long period of time. Climate change effects such as temperature, precipitation changes, and extreme weather during operations would be expected but could have little to no impact on the deployed technology due to the temporary nature of deployment. However, if these technologies are deployed continuously (at the required location) for an extended period, climate change effects on deployables could be similar to the Proposed Action, as explained above. 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 GHG emissions or climate as a result of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 7.1.14, Climate Change.

7.2.15. Human Health and Safety

7.2.15.1. Introduction

This section describes potential impacts to human health and safety in Kansas associated with deployment of the Proposed Action and Alternatives. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.15.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on human health and safety were evaluated using the significance criteria presented in Table 7.2.15-1. The categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 7.2.15-1: Impact Significance Rating Criteria for Human Health and Safety

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Exposure to Worksite Occupational Hazards as a Result of Activities at Existing or New FirstNet Sites	Magnitude or Intensity	Exposure to concentrations of chemicals above occupational regulatory limits and time weighted averages (TWAs). A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Exposure to recognized workplace safety hazards (physical and chemical). Violations of various regulations including: OSHA, RCRA, CERCLA, Toxic Substances Control Act (TSCA), EPCRA.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe working conditions or other workplace safety hazards.	No exposure to chemicals, unsafe working conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Mine Lands as a Result of FirstNet Site Selection and Site-Specific Land Disturbance Activities	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Site contamination conditions could preclude development of sites for the proposed use. Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA. Unstable ground and seismic shifting.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unstable ground conditions or other workplace safety hazards.	No exposure to chemicals, unstable ground conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Exposure to Hazardous Materials, Hazardous Waste, and Occupational Hazards as a Result of Natural And Manmade Disasters	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the general public. Site contamination conditions could preclude development of sites for the proposed use. Physical and biologic hazards. Loss of medical, travel, and utility infrastructure.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe conditions. No loss of medical, travel, or utility infrastructure.	No exposure to chemicals, unsafe conditions, or other safety and exposure hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

NA = Not Applicable

7.2.15.3. Description of Environmental Concerns

Worksite Physical Hazards, Hazardous Materials, and Hazardous Waste

The human health and safety concern having the greatest likelihood to occur during FirstNet deployment activities is occupational injury to telecommunication workers. The nature of telecommunication work requires workers to execute job responsibilities that are inherently dangerous. Telecommunication work activities present physical and chemical hazards to workers. The physical hazards have the potential to cause acute injury, long-term disabilities, or in the most extreme incidents, death. Other occupational activities such as handling hazardous materials and hazardous waste often do not result in acute injuries, but may compound over multiple exposures, resulting in increased morbidity. Based on the impact significance criteria presented in Table 7.2.15-1, occupational injury impacts could be potentially significant if the FirstNet deployment locations require performing occupational activities that have the highest relative potential for physical injury and/or chemical exposure. Examples of activities that may present increased risk and higher potential for injury include working from heights (i.e., from towers and roof tops), ground-disturbing activities like 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.

To protect occupational workers, OSHA mandates that employers be required to protect their employees from occupational hazards that could result in injury. Depending on the source of the hazard and the site-specific work conditions, OSHA generally recommends the following hierarchy for protecting onsite workers (OSHA, 2015b).

- Engineering controls;
- Work practice controls;
- Administrative controls; and then
- Personal protective equipment (PPE).

Engineering controls are often physical barriers that prevent access to a worksite, areas of a worksite, or from idle and operating equipment. Physical barriers take many forms like perimeter fences, trench boxes,[146] chain locks, bollards, storage containers (for storing equipment and chemicals), or signage and caution tape. Other forms of engineering controls could include machinery designed to manipulate the quality of the work environment, such as ventilation blowers. Whenever practical, engineering controls may result in the complete removal of the hazard from the work site, an example of which would be the transport and offsite disposal of hazardous waste or asbestos containing materials.

[146] Trench boxes are framed metal structures inserted into open trenches to support trench faces, to protect workers from cave-ins and similar incidents. (OSHA, 2016c)

Work practice controls could be implemented as abiding by specific OSHA industry standards, such as the Confined Space Entry standard (29 CFR 1910.146) or thru the development of employer specific workplace rules and operational practices (OSHA, 2015b). To the extent practicable, FirstNet partner(s) would likely implement and abide by work practice controls through employee safety training and by developing site-specific health and safety plans (HASP). The HASPs would identify all potential hazardous materials and hazardous wastes, potential physical hazards, and applicable mitigation steps. Other components of a HASP identifying appropriate PPE for each task and the location of nearby medical facilities. Safety Data Sheets (SDS) describing the physical and chemical properties of hazardous materials used during FirstNet deployment and maintenance activities, as well as the physical and health hazards, routes of exposure, and precautions for safe handling and use would be kept and maintained at all FirstNet project sites. In addition to HASPs and SDSs, standard operating procedures (SOPs) would be developed and implemented by FirstNet partner(s) for critical and/or repetitive tasks that require attention to detail, specialized knowledge, or clear step-wise directions to prevent worker injury and to ensure proper execution.

Administrative controls are employer-initiated methods to reduce the potential for injury and physical fatigue (OSHA, 2015b). Administrative controls may take the form of limiting the number of hours an employee is allowed to work per day, requiring daily safety meetings before starting work, utilizing the buddy system for dangerous tasks, and any other similar activity or process that is designed to identify and mitigate unnecessary exposure to hazards. When engineering controls, work practice controls, and administrative controls are not feasible or do not provide sufficient protection, employers must also provide appropriate PPE to their employees and ensure its proper use. PPE 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.

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 7.2.15-1, 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 the Interior's Abandoned Mine Lands inventory, through the KDHE, or through an equivalent commercial resource.

By screening sites for environmental contamination, mining activities, and reported environmental liabilities, the presence of historic contamination and unsafe ground conditions could be evaluated and may influence the site selection process. In general, the lower the density of environmental contamination or mining activities, the more favorable the site will be for FirstNet deployment projects. If sites containing known environmental contamination (or mine lands) are selected for proposed FirstNet deployment activities it may be necessary to implement additional controls (e.g., engineering, work practice, administrative, and/or PPE) to ensure workers, and the general public, are not unnecessarily exposed to the associated hazards. Additionally, for any proposed FirstNet deployment site, it is possible undocumented environmental contamination is present.

During FirstNet deployment activities, if any soil or groundwater is 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 Kansas 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 KDHE 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

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 7.2.2-1, human health impacts could be significant if FirstNet deployment sites are 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.

7.2.15.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

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

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure 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 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 human health and safety resources, it is anticipated that this activity would have no impact on human health and safety resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to human health and safety as a result of implementation of the Preferred Alternative would encompass a range of impacts that occur as a result of ground disturbance activities, construction activities, equipment upgrade activities, management of hazardous materials and/or hazardous waste, and site selection. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to human health and safety include the following:

- Wired Projects
   - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber would require the use of heavy equipment and hazardous materials. The additional noise and activity at the site would require workers to demonstrate a high level of situational awareness. Failure to follow OSHA and industry controls could result in injuries. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. Additionally, some of this work would likely be performed along road ROWs, increasing the potential for vehicle traffic to collide with site workers or equipment. If a proposed deployment activity involves the operation of heavy equipment, managing hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
   - New Build – Aerial Fiber Optic Plant: Installation of new poles and fiber optic lines could require excavation activities, working from heights, use of hazardous materials, and site locations in ROWs. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide

with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- Collocation on Existing Aerial Fiber Optic Plant: Installation of overhead fiber optic lines would require work from height. In some instances, new poles would be installed requiring excavation activities with heavy equipment. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- New Build – Submarine Fiber Optic Plant: The installation of fiber optic cables in limited nearshore or inland bodies of water requires workers to operate over aquatic environments, which presents opportunities for drowning. When working over water exposure to sun, high or low temperatures, wind, and moisture could impact worker safety. Construction of landings and/or facilities on shore to accept submarine cable would require site preparation, construction, and management of hazardous materials and hazardous waste. Excavation of soils or sediments at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads would require site preparation, construction activities, and management of hazardous materials

and hazardous waste. Communication towers would be erected, requiring workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of RF 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 RF 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 RF emissions, refer to Section 2.4, Radio Frequency Emissions. Use of aerial vehicles would not involve telecommunication site work. Prior to deployment and when not in use, the aerial vehicles would likely require preventive maintenance. Workers responsible for these activities may handle hazardous materials, not limited to fuel, solvents, and adhesives.

- Satellites and Other Technologies

- Satellite-Enabled Devices and Equipment: The use of portable devices that utilize satellite technology would not impact human health and safety because there is no construction activities or use of hazardous materials. The installation of permanent equipment on existing structures may require workers to operate from heights or in sensitive environments. As a result, the potential for falling, overhead hazards, and falling objects is greater and there is a potential to impact human health and safety.

In general, the abovementioned FirstNet activities could potentially involve site preparation work, construction activities, work in potentially harmful environments (road ROWs, work over water, 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 the Proposed Project 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. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be less than significant impacts to human health and safety associated with routine inspections of the Preferred Alternative, assuming that the inspections do not require climbing towers or confined space entry. In those instances, PPE or other mitigation measures could be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small scale of likely FirstNet activities that would be temporary and of short duration. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

7.2.15.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to human health and safety. The largest of the land-based deployable technologies may require site preparation work or stabilization work to ensure the self-contained trailers are stable. Heavy equipment may be necessary to complete the site preparation work. However, in general, the deployable technologies are small mobile units that could be transported as needed. While in operation, the units are parked and operate off electrical generators or existing electrical power sources. Connecting deployable technology to a power supply may present increased electrocution risk during the process of connecting power. If the power source is an electrical generator, then there would also likely be a need to manage hazardous materials (fuel) onsite. These activities could result in less than significant impacts to human health and safety. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant due to the small scale of likely FirstNet activities that would be temporary and of short duration. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to human health and safety associated with routine inspections of the Preferred Alternative, assuming that the inspections do not require climbing towers or confined space entry. In those instances, PPE or other mitigation measures may be necessary to adequately protect workers. If usage of heavy equipment is part of routine maintenance, the potential for impacts to human health and safety would also increase. These impacts would be less than significant because of the small scale of likely FirstNet activities; activities associated would routine maintenance, inspection, and deployment of deployable technologies would be temporary and often of limited duration. Chapter 19, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partners would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to human health and safety as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 7.2.15, Human Health and Safety.

ACRONYMS

Acronym	Definition
A.D.	Anno Domini
AARC	Average Annual Rate of Change
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
AFB	Air Force Base
AGL	Above Ground Level
AIM	Aeronautical Information Manual
AML	Abandoned Mine Lands
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
ATV	All-terrain vehicle
B.C.	Before Christ
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BMP	Best Management Practice
BNSF	Burlington Northern and Santa Fe
BOA	Bureau of Air
CAA	Clean Air Act
CCS	Center for Climate Strategies
CDC	Center 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
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COLT	Cell on Light Truck
COW	Cell on Wheels
CRS	Community Rating System
CWA	Clean Water Act

Acronym	Definition
D.C.	District of Columbia
DoD	Department of Defense
DOE	Department of Energy
EFH	Essential Fish Habitat
EIA	Energy Information Administration
EMS	Emergency Medical Services
EO	Executive Order
EPCRA	Emergency Planning and Community Right to Know Act
EPHT	Environmental Public Health Tracking
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FHWA	Federal Highway Administration
FL	Flight Level
FLM	Federal Land Manager
FR	Federal Register
FRA	Federal Railway Administration
FSDO	Flight Standards District Office
FSS	Flight Service Station
FTA	Federal Transit Administration
GAO	Government Accountability Office
GAP	Gap Analysis Program
GBT	Golden Belt Telephone
GHG	Greenhouse Gas
GWP	Global Warming Potential
HAP	Hazardous Air Pollutants
HASP	Health and Safety Plans
HHRA	Human Health Risk Assessment
IBA	Important Bird Area
ICT	Wichita Dwight D. Eisenhower National Airport
IFR	Instrument Flight Rules
IPCC	Intergovernmental Panel on Climate Change
ITU	International Telecommunication Union
KAQR	Kansas Air Quality Regulation
KAR	Kansas Administrative Regulations
KCC	Kansas Corporation Commission
KDEM	Kansas Division of Emergency Management

Acronym	Definition
KDHE	Kansas Department of Health and Environment
KDOL	Kansas Department of Labor
KDOT	Kansas Department of Transportation
KDWPT	Kansas Department of Wildlife, Parks, and Tourism
KHP	Kansas Highway Patrol
KMEA	Kansas Municipal Power Agency
KNHP	Kansas Natural Heritage Program
KSA	Kansas Statutes Annotated
KSICS	Kansas State Interoperable Communication System
KWO	Kansas Water Office
LBS	Locations-Based Services
LLC	Limited Liability Company
LMR	Land Mobile Radio
LPG	liquefied petroleum gas
LRR	Land Resource Regions
LTE	Long Term Evolution
MARRS	Kansas City Metropolitan Regional Radio System
MBTA	Migratory Bird Treaty Act
MHI	Median Household Income
MHz	Megahertz
MLRA	Major Land Resource Areas
MMPA	Marine Mammal Protection Act
MMT	Million Metric Tonnes
MOA	Military Operation Area
MSFCMA	Magnuson Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
MT	Metric Ton
MTR	Military Training Route
MYA	Million Years Ago
N_2O	Nitrous Oxide
NA	Not Applicable
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAS	National Airspace System
NASAO	National Association of State Aviation Officials
NASCAR	National Association of Stock Car Auto Racing
NCED	National Conservation Easement Database
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NGPC	Nebraska Game and Parks Commission

Acronym	Definition
NHL	National Historic Landmark
NHP	Natural Heritage Program
NHPA	National Historic Preservation Act
NIST	National Institute of Standards and Technology
NM	Nautical Miles
NNL	National Natural Landmarks
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notices to Airmen
NO_X	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NPSBN	Nationwide Public Safety Broadband Network
NRC	National Response Center
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSA	National Security Areas
NTFI	National Task Force on Interoperability
NTIA	National Telecommunications and Information Administration
NWI	National Wetlands Inventory
NWP	Nationwide Permit
NWR	National Wildlife Refuge
NWS	National Weather Service
OE/AAA	Obstruction Evaluation and Airport Airspace Analysis
OEC	Kansas Office of Emergency Communications
OSHA	Occupational Safety and Health Administration
OTR	Ozone Transport Region
PEIS	Programmatic Environmental Impact Statement
PGA	Peak Ground Acceleration
PL	Public Law
PM	Particulate Matter
POP	Point of Presence
PPE	Personal Protective Equipment
PSAP	Public Safety Answering Point
PSC	Public Service Commission
PSCR	Public Safety Communications Research
PSD	Prevention of Significant Deterioration
PTE	potential to emit
RCRA	Resource Conservation and Recovery Act

Acronym	Definition
RF	Radio Frequency
ROW	Right-of-way
SAA	Sense and Avoid
SAIPE	Small Area Income and Poverty Estimates
SASP	State Aviation System Plan
SCEC	State Climate Extremes Committee
SDS	Safety Data Sheets
SDWA	Safe Drinking Water Act
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SOC	Standard Occupational Classification
SOP	Standard Operating Procedure
SOW	Site on Wheels
SO_X	Sulfur Oxides
SPL	Sound Pressure Level
STATSGO2	State Soil Geographic
SUA	Special Use Airspace
SWPPP	Stormwater Pollution Prevention Plan
TFR	Temporary Flight Restriction
TMDL	Total Maximum Daily Load
TRI	Toxics Release Inventory
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average
U.S.	United States
U.S.C.	U.S. Code
UA	Unmanned Aircraft
UAS	Unmanned Aerial Systems
UHF	Ultra High Frequency
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFA	U.S. Fire Administration
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGCRP	U.S. Global Change Research Program
USGS	U.S. Geological Survey
UVA	University of Virginia

Acronym	Definition
VFR	Visual Flight Rules
VHF	Very High Frequency
VOC	Volatile Organic Compound
WCS	Wetlands Classification Standard
WONDER	Center for Disease Control and Prevention Wide-ranging Online Data for Epidemiologic Research
WWF	World Wildlife Fund
WWI	World War I
WWII	World War II

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The citations in this Draft PEIS reflect the most recent information on the referenced site at the time the document was written. If the site was updated after that point, the more recent information will be incorporated into the final document, as feasible.

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