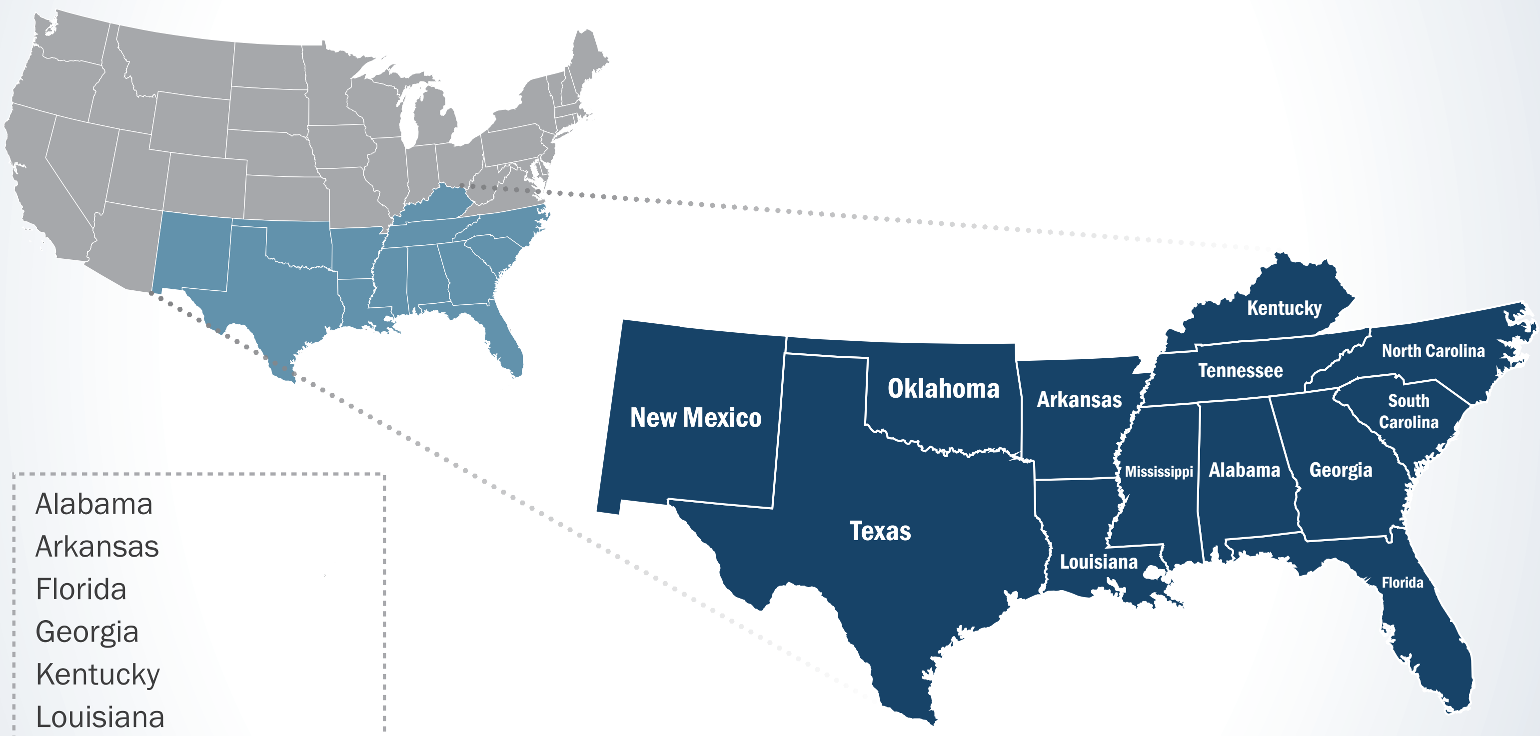
FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Southern United States

VOLUME 8 - CHAPTER 10



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First Responder Network Authority

FirstNet®

Nationwide Public Safety Broadband Network

Draft Programmatic Environmental Impact Statement for the Southern United States

VOLUME 8 - CHAPTER 10

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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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10. NEW MEXICO

American Indian tribes with a rich cultural history lived in what is now the state of New Mexico for centuries before the 1600s. In the late 1600s, Spanish colonists led by Juan de Onate started settling in New Mexico. The area became part of Mexico after the Mexican War of Independence in 1821, but was ceded to the United States almost 30 years later as part of the Treaty of Guadalupe Hidalgo. New Mexico became a territory in 1850 and the 47th state in 1912 (Office of the State Historian, 2015). New Mexico is bordered by Mexico and Texas to the south, Oklahoma and Texas to the east, Colorado to the north, ad Arizona to the west. This chapter provides details about the existing environment of New Mexico as it relates to the Proposed Action.

General facts about New Mexico are provided below:

- **State Nickname:** Land of Enchantment
- **Land Area:** 121,298.15 square miles; **U.S. Rank:** 5 (U.S. Census Bureau, 2015a)
- **Capital:** Santa Fe
- **Counties:** 33 (U.S. Census Bureau, 2015b)
- **2014 Estimated Population:** Over 2 million people; **U.S. Rank:** 36 Sources: (U.S. Census Bureau, 2015c)
- **Most Populated Cites:** Albuquerque, Las Cruces, and Santa Fe (U.S. Census Bureau, 2015b)
- **Main Rivers:** Rio Grande, Pecos, San Francisco, San Juan, Cimarron, Canadian, Vermejo, and Gila Rivers
- **Bordering Waterbodies:** None
- **Mountain Ranges:** Sangre de Christo Mountains, Black Range, Sacramento Mountains, San Andres Mountains, and Guadalupe Mountains
- **Highest Point:** Wheeler Peak (13,163 ft.) (USGS, 2015a)

10.1. AFFECTED ENVIRONMENT

10.1.1. Infrastructure

10.1.1.1. Definition of the Resource

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

Section 10.1.1.3 provides an overview of New Mexico’s traffic and transportation infrastructure, including road and rail networks and waterway facilities. New Mexico’s public safety infrastructure could include any infrastructure utilized by a public safety entity[1] as defined in Title VI of the Middle Class Tax Relief and Job Creation Act of 2012 (Public Law [Pub. L.] No. 112-96, Title VI Stat. 156 (codified at 47 United States Code [U.S.C.] 1401 et seq.) (the Act), including infrastructure associated with police, fire, and emergency medical services (EMS). However, other organizations can qualify as public safety services as defined by the Act. Public safety services in New Mexico are presented in more detail in Section 10.1.1.4. Section 10.1.1.5 describes New Mexico’s public safety communications infrastructure and commercial telecommunications infrastructure. An overview of New Mexico utilities, such as power, water, and sewer, is presented in Section 10.1.1.6.

10.1.1.2. Specific Regulatory Considerations

Multiple New Mexico laws and regulations pertain to the state’s public utility and transportation infrastructure and its public safety community. Table 10.1.1-1 identifies the relevant laws and regulations, the affected agencies, and their jurisdiction as derived from the state’s applicable statutes and administrative rules referenced in column one. Appendix C, Environmental Laws and Regulations, identifies applicable federal laws and regulations.

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

Table 10.1.1-1: Relevant New Mexico Infrastructure Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
New Mexico Administrative Code: Title 10 Public Safety and Law Enforcement	Department of Homeland Security and Emergency Management (DHSEM)	Protect the people of New Mexico and the nation through a comprehensive, consolidated, and coordinated program of mitigating hazards, preparing for emergencies, preventing attacks, and responding and recovering from events that occur without regard to cause.
New Mexico Administrative Code: Title 17 Public Utilities and Utility Services	Public Regulation Commission	Regulates the utilities, telecommunications, and motor carrier industries to ensure fair and reasonable rates, and to assure reasonable and adequate services to the public as provided by law.
New Mexico Administrative Code: Title 18 Transportation and Highways; New Mexico Statutes: Chapter 63 Railroads and Communications	New Mexico Department of Transportation	Provide a safe and efficient transportation system for the traveling public, while promoting economic development and preserving the environment while managing travel: transit, rail, aviation and highways.

10.1.1.3. Transportation

This section describes the traffic and transportation infrastructure in New Mexico, 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 New Mexico are based on a review of maps, aerial photography, and federal and state data sources.

The New Mexico Department of Transportation (NMDOT) has jurisdiction over freeways and major roads, airports, and railroads in the state; local counties have jurisdiction for smaller streets and roads. The mission of the NMDOT is to “provide a safe and efficient transportation system for the traveling public, while promoting economic development and preserving the environment of New Mexico” (NMDOT, 2012a).

New Mexico has an extensive and complex transportation system across the entire state. The state’s transportation network consists of:

- 70,772 miles of public roads (FHWA, 2014) and 3,719 bridges (FHWA, 2015a);
- 2,055 miles of rail network that includes passenger rail and freight (NMDOT, 2014);
- 173aviation facilities, including airstrips and heliports (FAA, 2015a); and
- No major harbors or ports.

Road Networks

As identified in Figure 10.1.1-1, the major urban centers of the state from north to south are Albuquerque, Santa Fe, Las Cruces, and Carlsbad (USDOC, 2013a). New Mexico has three 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, and state and county roads. Table 10.1.1-2 lists the interstates and their start/end points in New Mexico. Per the national standard, even numbered interstates run from west to east with the lowest numbers beginning in the south; odd numbered interstates run from north to south with the lowest numbers beginning in the west (FHWA, 2015b).

Table 10.1.1-2: New Mexico Interstates

Interstate	Southern or western terminus in NM	Northern or eastern terminus in NM
I-10	AZ line near Steins	TX line in Anthony
I-25	I-10 in Las Cruces	CO line near Raton
I-40	AZ line in Gallup	TX line at Glenrio

In addition to the Interstate System, New Mexico has both National Scenic Byways and State Scenic Byways. National and State Scenic Byways are roads that are recognized for one or more archaeological, cultural, historic, natural, recreational, and scenic qualities (FHWA, 2013). Figure 10.1.1-1 illustrates the major roadways in New Mexico. Section 10.1.8, Visual Resources, describes the National and State Scenic Byways found in New Mexico from an aesthetic perspective.

National Scenic Byways are roads with nationwide interest; the U.S. Department of Transportation’s Federal Highway Administration (FHWA) designates and manages the byways. New Mexico has eight National Scenic Byways (FHWA, 2015c):

- Billy the Kid Trail: 84 miles in south-central New Mexico;
- El Camino Real: 299 miles in central New Mexico;
- Geronimo Trail Scenic Byway: 154 miles in southwest New Mexico;
- Historic Route 66: 1,408.6 through Arizona, Illinois, New Mexico, and Oklahoma;
- Jemez Mountain Trail: 163 miles in north-central New Mexico;
- Santa Fe Trail: 565 miles through Colorado and New Mexico;
- Trail of the Mountain Spirits Scenic Byway: 95 miles in southwest New Mexico; and
- Turquoise Trail: 62 miles in north-central New Mexico.

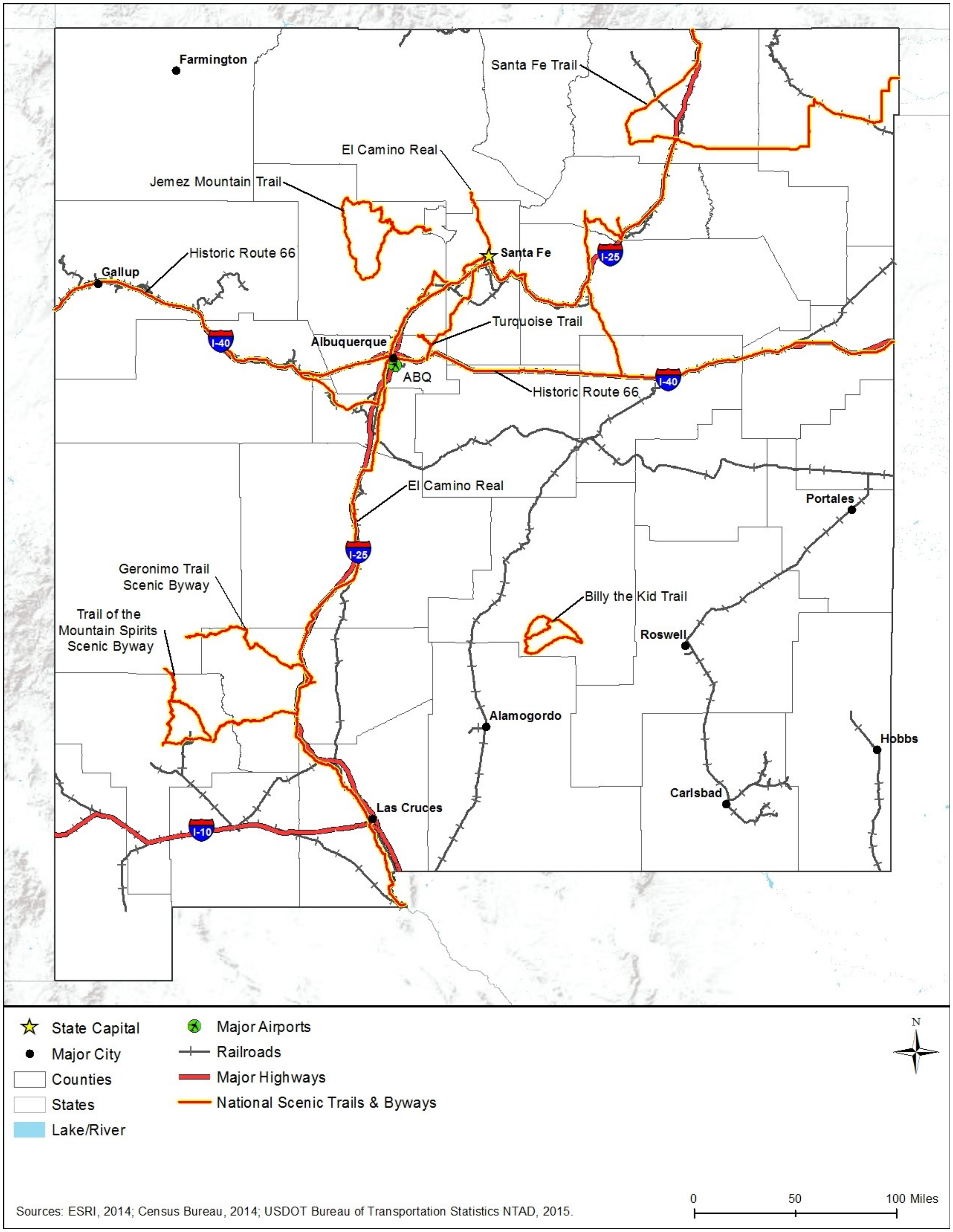

Figure 10.1.1-1: New Mexico Transportation Networks

State Scenic Byways are roads with statewide interest; NMDOT designates and manages State Scenic Byways. Some State Scenic Byways may be designated on portions of National Scenic Byways.[2] New Mexico has 25 State Scenic Byways in the entire state (NMDOT, 2012b):

- Abo Pass Trail
- Billy the Kid National Scenic Byway
- Corrales Road Scenic Byway
- El Camino Real National Scenic Byway
- Enchanted Circle Scenic Byway
- Geronimo Trail National Scenic Byway
- Guadalupe Back Country Byway
- Jemez Mountain Trail National Scenic Byway
- La Frontera Del Llano
- Lake Valley Back Country Byway
- Mesalands Scenic Byway
- Narrow Gauge Scenic Byway
- Puye Cliffs Scenic Byway
- Quebradas Back Country Byway
- Route 66 National Scenic Byway
- Salt Missions Trail Byway
- Santa Fe National Forest Scenic Byway
- Santa Fe Trail National Scenic Byway
- Socorro Historical District Scenic Byway
- Sunspot Scenic Byway
- The High Road to Taos Byway
- Trail of the Ancients
- Trail of the Mountain Spirits National Scenic Byway
- Turquoise Trail National Scenic Byway
- Wild Rivers Back Country Byway

Airports

Air service to the state is provided by the Albuquerque International Sunport (ABQ), which is owned and operated by the City of Albuquerque (ABQ, 2015). In 2014, ABQ served 4,871,901 passengers, facilitated 130,002 aircraft operations, and moved over 60,000 tons of cargo (ABQ, 2015). ABQ is the 58th busiest airport in the nation, in terms of the number of passengers served (FAA, 2015b). Figure 10.1.1-1 shows the location of the airport in the state. Section 10.1.7.5, Airspace, provides greater detail on airports and airspace in New Mexico.

Rail Networks

New Mexico is connected to a network of passenger rail (Amtrak), public transportation (commuter rail), and freight rail. Figure 10.1.1-1 illustrates the major transportation networks, including rail lines, in New Mexico.

Amtrak runs three lines through New Mexico: Southwest Chief, Sunset Limited, and Texas Eagle. The Southwest Chief runs every day between Chicago and Los Angeles, making five stops in New Mexico; in fiscal year (FY) 2012, the Southwest Chief served 129,404 passengers in New Mexico (NMDOT, 2014). The Sunset Limited makes three trips per week between New Orleans and Los Angeles, with two stops in New Mexico; in FY 2012, the Sunset Limited served

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

1,653 passengers in New Mexico (NMDOT, 2014). The Texas Eagle provides daily service between Chicago and San Antonio, making two stops in New Mexico. Table 10.1.1-3 provides a complete list of Amtrak lines that run through New Mexico.

Table 10.1.1-3: Amtrak Train Routes Serving New Mexico

Route	Starting Point	Ending Point	Length of Trip	Cities Served in New Mexico
Southwest Chief	Chicago, IL	Los Angeles, CA	40+ hours	Raton, Las Vegas (NM), Lamy, Albuquerque, Gallup
Sunset Limited	New Orleans, LA	Los Angeles, CA	48 hours	Deming, Lordsburg
Texas Eagle	Chicago, IL	San Antonio, TX	32 hours 25 minutes	Deming, Lordsburg

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

In 2006, the New Mexico Rail Runner Express (Rail Runner) became New Mexico's first commuter railroad (NMDOT, 2014). Rail Runner has one line that runs north and south out of downtown Albuquerque, connects Santa Fe with Albuquerque, and stops at 14 stations (Rail Runner, 2015). It serves Valencia, Bernalillo, Sandoval, and Santa Fe Counties along a 97-mile corridor (NMDOT, 2014). In 2013, this commuter rail served over 1.1 million riders, with an average of around 3,800 passengers each weekday (NMDOT, 2014).

Two Class I freight rail companies operate in New Mexico: BNSF Railway and Union Pacific Railroad (NMDOT, 2014). Combined, these two railroads own 84 percent of the railroad tracks in the state, with 1,194.2 miles of track and 533.6 miles, respectively (NMDOT, 2014). In addition, five shortline railroads operate in New Mexico and own 8 percent of the tracks in the state (NMDOT, 2014). The NMDOT owns most of the other 8 percent of the state's railroad tracks (NMDOT, 2014). In 2009, over 127 million tons of commodities traveled via freight rail in New Mexico and 59.4 percent of that traffic carried coal (NMDOT, 2014). That same year, only 3 percent of the traffic originated in and 2 percent terminated in New Mexico, whereas 95 percent of the freight rail traffic simply passed through the state (NMDOT, 2014).

Harbors and Ports

New Mexico is completely landlocked and does not have any large bodies of water, harbors, or ports for shipping and transport.

10.1.1.4. Public Safety Services

New Mexico public safety services generally consist of public safety infrastructure and first responder personnel aligned with the demographics of the state. Table 10.1.1-4 presents New Mexico's key demographics including population; land area; population density; and number of counties, cities/towns, and municipal governments. More information about these demographics is presented in Section 10.1.9, Socioeconomics; however, these demographics are key to understanding the breadth of public safety services throughout the state.

Table 10.1.1-4: Key New Mexico Indicators

New Mexico Indicators	
Estimated Population (2014)	2,085,572
Land Area (square miles) (2010)	121,298.15
Population Density (persons per sq. mile) (2010)	17.0
Municipal Governments (2013)	101

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

Table 10.1.1-5 presents New Mexico's public safety infrastructure, including fire and police stations. Table 10.1.1-6 identifies first responder personal including dispatch, fire and rescue, law enforcement, and emergency medical personnel in the state.

Table 10.1.1-5: Public Safety Infrastructure in New Mexico by Type

Infrastructure Type	Number
Fire and Rescue Stations [a]	498
Law Enforcement Agencies [b]	146
Fire Departments [c]	244

[a] Data collected by the U.S. Fire Administration in 2015.
[b] Number of agencies from state and local law enforcement include: local police departments, sheriffs' offices, primary state law enforcement agencies, special jurisdictional agencies, and other miscellaneous agencies, collected by the U.S. Bureau of Justice Statistics in 2008.
[c] Data collected by the U.S. Fire Administration in 2015.
Sources: (U.S. Fire Administration, 2015) (U.S. Bureau of Justice Statistics, 2011)

Table 10.1.1-6: First Responder Personnel in New Mexico by Type

First Responder Personnel	Number
Police, Fire and Ambulance Dispatchers [a]	2,320
Fire and Rescue Personnel [b]	20,589
Law Enforcement Personnel [c]	33,712
Emergency Medical Technicians and Paramedics [d e]	3,610

[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)

10.1.1.5. 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, including coaxial cable (traditional copper cable), fiber optics, hybrid fiber optics/coaxial cable, microwave, wireless, and satellite systems providing voice, data, and video services (BLS, 2016). Figure 10.1.1-2 presents a typical wireless configuration including both a narrowband public safety land mobile radio network (traditional radio network) and a commercial broadband access network (wireless technology); backhaul (long-distance wired or wireless connections), core, and commercial networks including a long term evolution (LTE) evolved packet core (modern broadband cellular networks); and network applications (software) delivering voice, data, and video communications (FCC, 2016a).

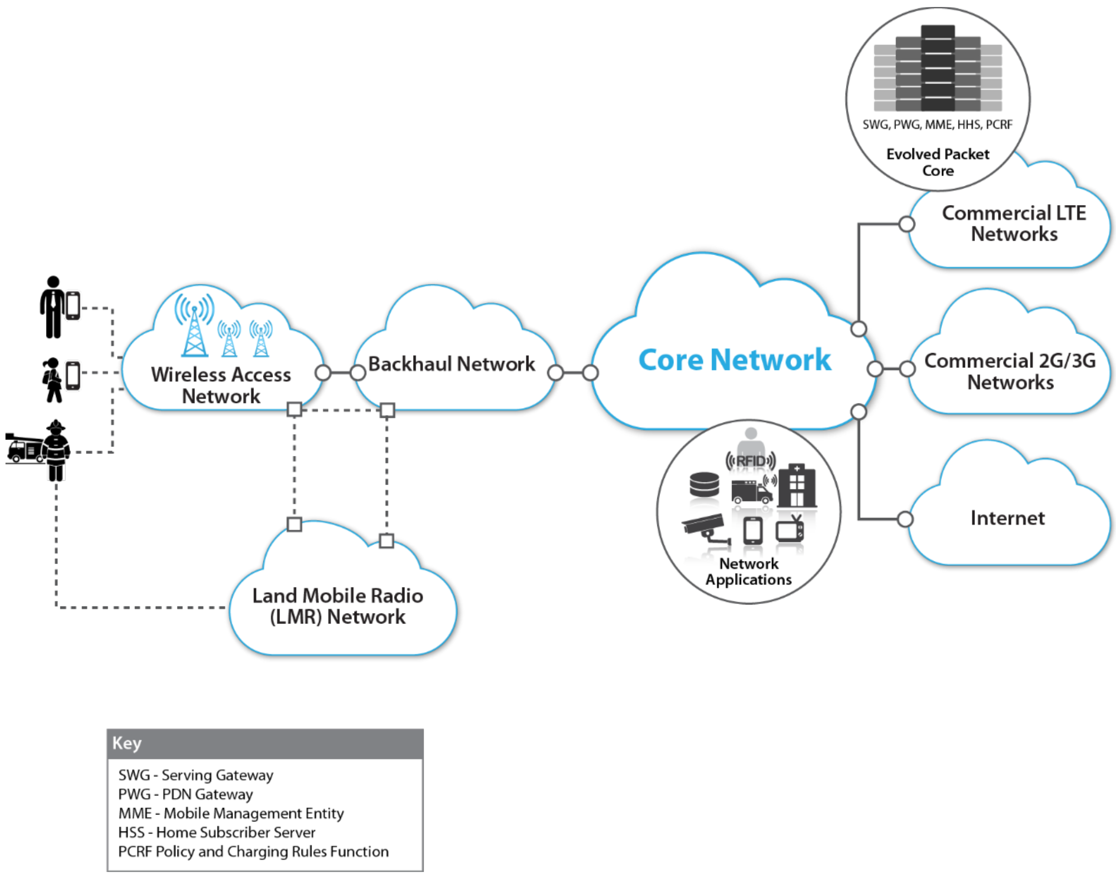

Figure 10.1.1-2: Wireless Network Configuration

Prepared by: Booz Allen Hamilton

Public Safety Communications

In order to protect and best serve the public interest, first responder and law enforcement communities must be able to communicate effectively. The evolution of the communications networks used by public safety stakeholders toward a broadband wireless technology, such as LTE (see Section 10.1.1), 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, which is national

(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 New Mexico. 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 Program (PSCR) – Boulder Laboratories, in 2015, prepared a locations-based services (LBS) research and development roadmap to examine the current state of location-based technologies, forecast the evolution of LBS capabilities and gaps, and identify potential research and development opportunities that would improve the public safety community's use of LBS within operational settings. This is the first of several technology roadmaps that PSCR plans to develop over the next few years to better inform investment decisions (PSCR, 2015).

Like most states, New Mexico's public safety LMR network environment is facing transition and the LMR environment reflects the challenges of the need for greater system capabilities, expanded digitization, and improved public safety system interoperability. Existing public safety networks in New Mexico are predominantly Very High Frequency (VHF)[3] and 800 MHz networks with limited adoption of digital P25 systems (Project 25.org, 2015).

In 2010, New Mexico's Department of Information Technology (DoIT) was awarded a National Telecommunications Information Administration (NTIA) Broadband Technology Opportunities Program (BTOP) communications infrastructure grant to both modernize the states analog microwave wireless network and enable broadband 700 MHz public safety communications using the fourth generation (4G) long-term evolution (LTE) standard. The project's grant award name is the New Mexico Statewide Interoperable Radio Communication Internet Transport System *(*SIRCITS*)* (NTIA, 2010). The objectives of the project were to: complete the ten-year modernization of the state's backbone analog microwave to digital; introduce 700 MHz broadband capabilities to public safety agencies via a new LTE network; facilitate connections to priority anchor locations such as public safety, schools, health care facilities; and enable new

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

broadband applications such as patient data transmission to Emergency Medical Services (EMS) vehicles (NTIA, 2010). The New Mexico BTOP broadband 700 MHz project was one of seven "early builders projects" awarded by NTIA prior to the funding of the National Public Safety Broadband Network (NPSBN) by Congress in February 2012 through the Act.

New Mexico's DoIT, in addition to being the BTOP SIRCITS project grantee, is a cabinet level department charged with the lead responsibility for broadband program management, public safety network oversight, and FirstNet broadband 700MHz planning and stakeholder coordination.

Statewide/Multi-County Public Safety Networks

New Mexico State Police are organized around twelve districts and are served by a four-region VHF LMR network, which provide for dispatch and tactical communications (RadioReference.com, 2015a). In addition, State Police statewide mobile car-to-car communications is provided over a VHF network, with an Ultra High Frequency (UHF) [4] portable LMR repeater system also available to the State Police (RadioReference.com, 2015a). A statewide emergency communications network also operates in New Mexico on VHF in support of disaster and incident response needs in the state (RadioReference.com, 2015a).

Currently the New Mexico has no digital P25 multi-county large footprint or statewide coverage network, although when expanded and fully-deployed in the state, the NPSBN ("FirstNet") 700 MHz broadband network will form the basis for a broad coverage and ultimately statewide LMR network (Project 25.org, 2015).

New Mexico's SIRCITS network is currently comprised of two main elements: (1) a statewide digital microwave backbone network and (2) a group of 700 MHz LTE network towers. These 700 MHz towers will provide public safety broadband communications for users in an initial coverage area and in the future will be expanded to provide voice and data communications over multiple counties in New Mexico, leveraging the upgraded SIRCITS digital microwave backbone network. Figure 10.1.1-3 below depicts the SIRCITS 700 MHz tower locations based on feasibility analysis done by New Mexico's DoIT (DoIT, 2011).

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

Construction of the last mile 700 MHz portion of the BTOP project in the Rio Grande corridor of New Mexico began in the spring of 2015 and is currently in the close-out period of completion (DoIT, 2016).

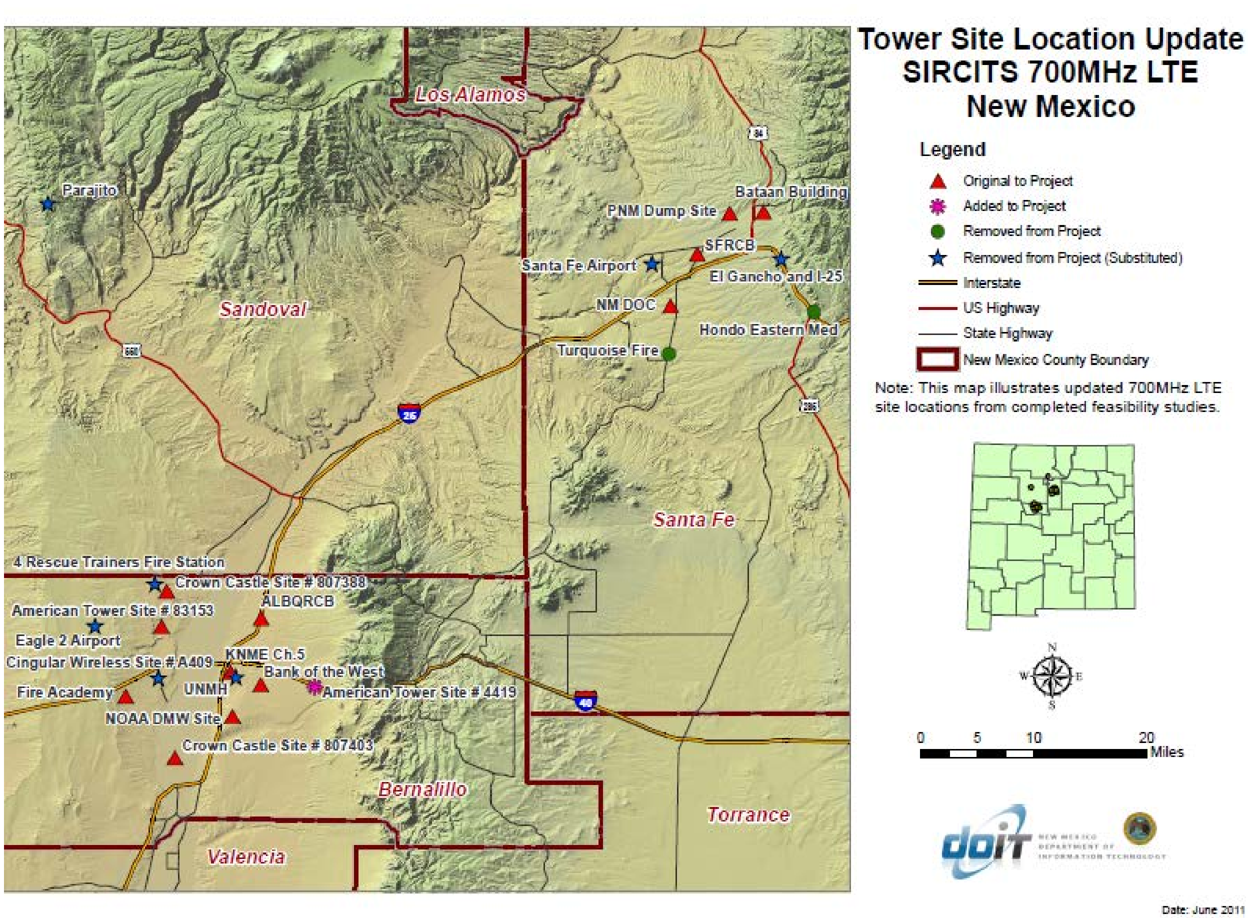

Figure 10.1.1-3: SIRCITS 700 MHz Tower Site Locations

Source: (DoIT, 2011)

County/City Public Safety Networks

In New Mexico, the three largest counties based on population are Bernalillo, Donna Anna, and Santa Fe, where the cities of Albuquerque, Las Cruces, and Santa Fe respectively are located. Currently New Mexico has no operational public safety digital P25 system originating in New Mexico, although Colorado's Digital Trunked Radio System (DTRS) does cover Taos County (RadioReference.com, 2015b).

Public safety agencies in Bernalillo County, as well as public safety agencies in the city of Albuquerque, share an Enhanced Digital Access System (EDACS) network operating on seven sites in the county at 800 MHz (RadioReference.com, 2015b). Public safety mutual aid talk groups operate on this 800MHz system using three interoperability channels and have access to twelve additional mutual aid channels. This EDACs network supports all public safety talkgroups including: police, fire, hospital/EMS, and county public safety personnel (RadioReference.com, 2015b).

In Donna Anna County, the county public safety agencies (police, sheriff, and fire) operate on a VHF system, while in Las Cruces city an EDACS system operating at 800 MHz, supports the city's police, fire, and EMS agencies as well as municipal agencies. The Las Cruces 800 MHz EDACS system is slated for upgrade to digital P25 in the near future to improve performance and interoperability (RadioReference.com, 2015c).

In the county of Santa Fe, the sheriff and fire departments operate on a VHF system for dispatch, tactical communications, and primary operations. In the city of Santa Fe, public safety agencies operate on 800 MHz for dispatch, tactical communications, and primary operations with the exception of the city fire department, which uses VHF for fire dispatch (RadioReference.com, 2015d).

Public Safety Answering Points

According to the Federal Communication Commission's (FCC) Master PSAP registry, there are 91 PSAPs in New Mexico serving New Mexico's 33 counties (FCC, 2015a).

Commercial Telecommunications Infrastructure

New Mexico's commercial telecommunications industry and infrastructure is composed of multiple service providers, offering products, and services via various telecommunications technologies (FCC, 2014a) (FCC, 2014b). The following sub-sections present information on New Mexico'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

New Mexico'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 10.1.1-7 presents the number of providers of switched access[5] lines, Internet access[6], and mobile wireless services including coverage.

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

Table 10.1.1-7: Telecommunications Access Providers and Coverage

Commercial Telecommunications Access Providers	Number of Service Providers	Coverage of Households
Switched access lines [a]	111	96.8% of households [b]
Internet access [c]	52	46% of households
Mobile wireless [d]	9	86% 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 as the total of ILEC and non-ILEC providers (FCC, 2014b).
[b] Household coverage data provided by the FCC in "Universal Service Monitoring Report" as a Voice Penetration percentage (percentage of household with a telephone in the unit) and is current as of 2013.
[c] Internet access providers are presented in Table 21 by technology provided; the number of service providers is calculated by subtracting the reported Mobile Wireless number from the total reported number of providers. Household coverage is provided in Table 13 (FCC, 2014a).
[d] Mobile wireless provider data was retrieved from the FCC National Broadband Map website (www.broadbandmap.gov/data-download). The process of the data collection is explained in the broadband footnote.
Sources: (FCC, 2014c) (FCC, 2014b) (NTIA, 2014) (FCC, 2013a)

Table 10.1.1-8 shows the wireless providers in New Mexico along with their geographic coverage. The following four maps: Figure 10.1.1-4, Figure 10.1.1-5, Figure 10.1.1-6, and Figure 10.1.1-7 show the combined coverage for the top two providers: Sprint and T-Mobil's coverage; NMobile, Transworld Network Corp, ENMR Plateau Telecommunications, and CityLink Wireless LLC's coverage; and, the coverage of all other providers with less than 5% coverage area, respectively.[7]

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

Table 10.1.1-8: Wireless Telecommunications Coverage by Providers in New Mexico

Wireless Telecommunications Providers	Coverage
Verizon Wireless	70.22%
AT&T Mobility LLC	60.11%
T-Mobile	41.75%
Sprint	15.65%
NMobile	10.68%
Transworld Network, Corp	9.20%
ENMR Plateau Telecommunications	8.85%
CityLink Wireless, LLC	5.21%
Other[a]	10.85%

[a] Other: Provider with less than 5% coverage area. Providers include: Cricket Wireless; Southwestern Wireless; Lobo Internet; CNSP Internet; Higher-Speed Internet, LLC; Agave Broadband LLC; Sacred Wind Communications, Inc.; Leaco; PVT Networks; Kit Carson Telecom; Tularosa Communications, Inc.; La Canada Wireless Association; Yucca Telecom; La Jicarita; Yucca Telecom; Sierra Communications (a subsidiary of Baca Valley Telephone).
Source: (NTIA, 2014)

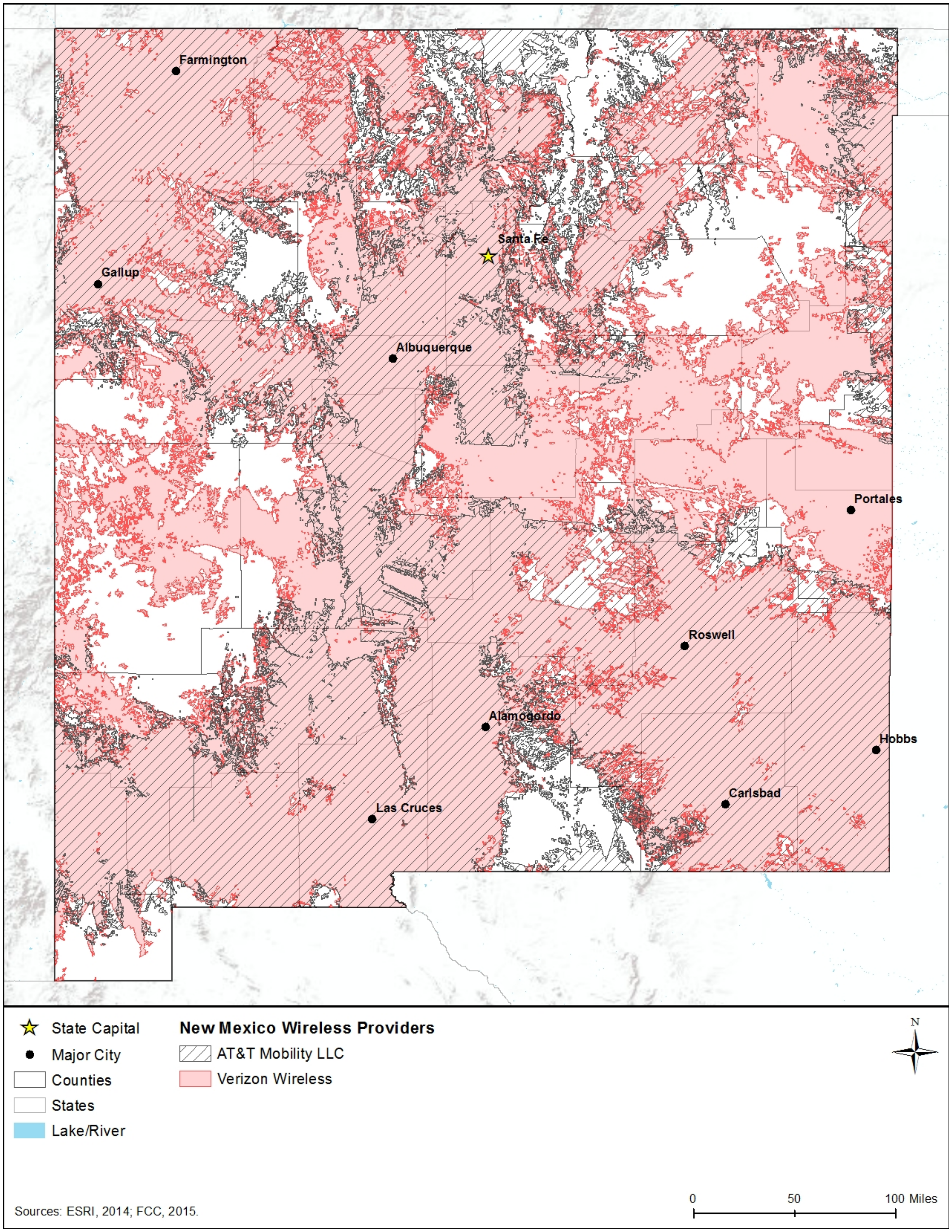

Figure 10.1.1-4: Top Wireless Providers Availability in New Mexico

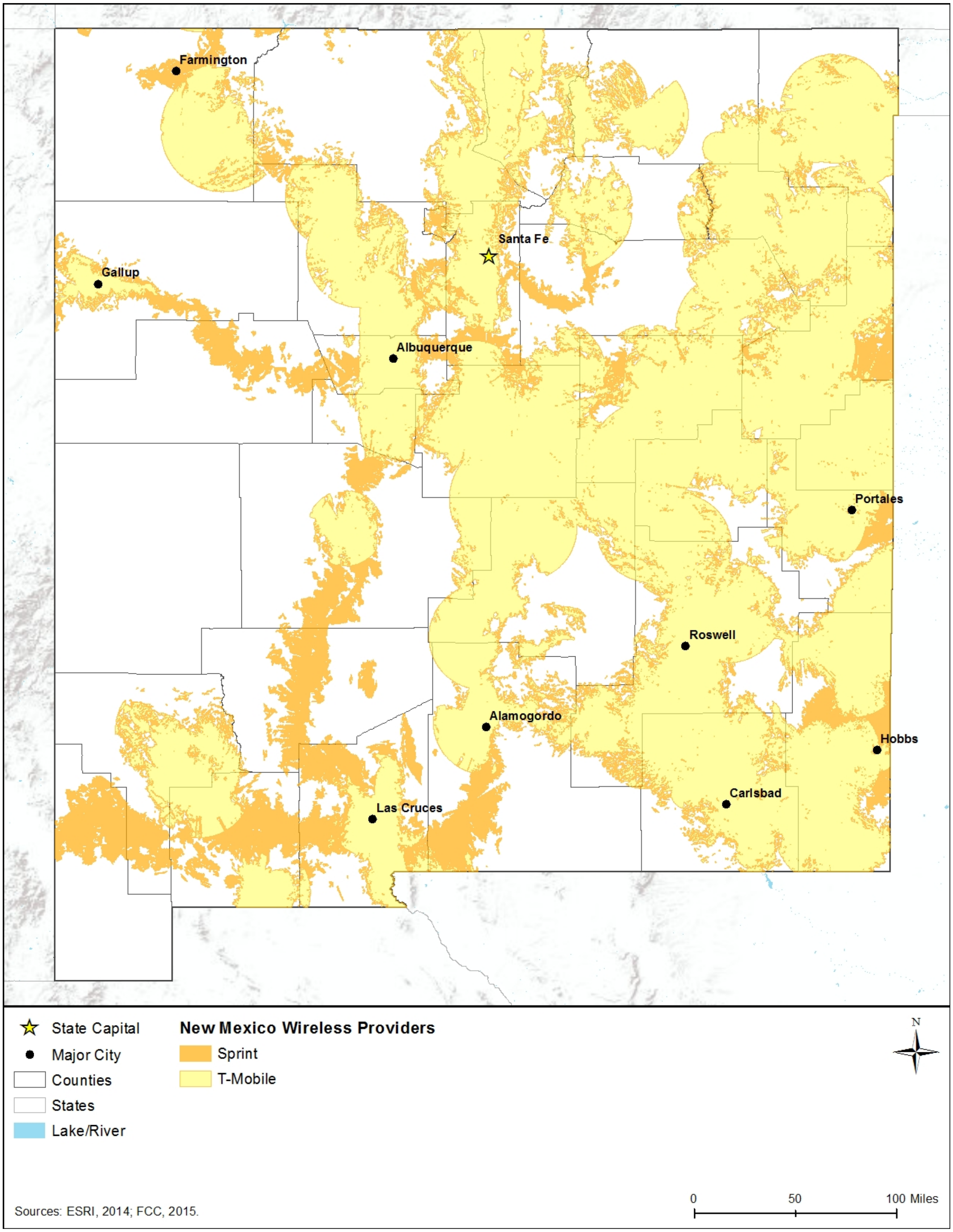

Figure 10.1.1-5: Sprint and T-Mobile Wireless Availability in New Mexico

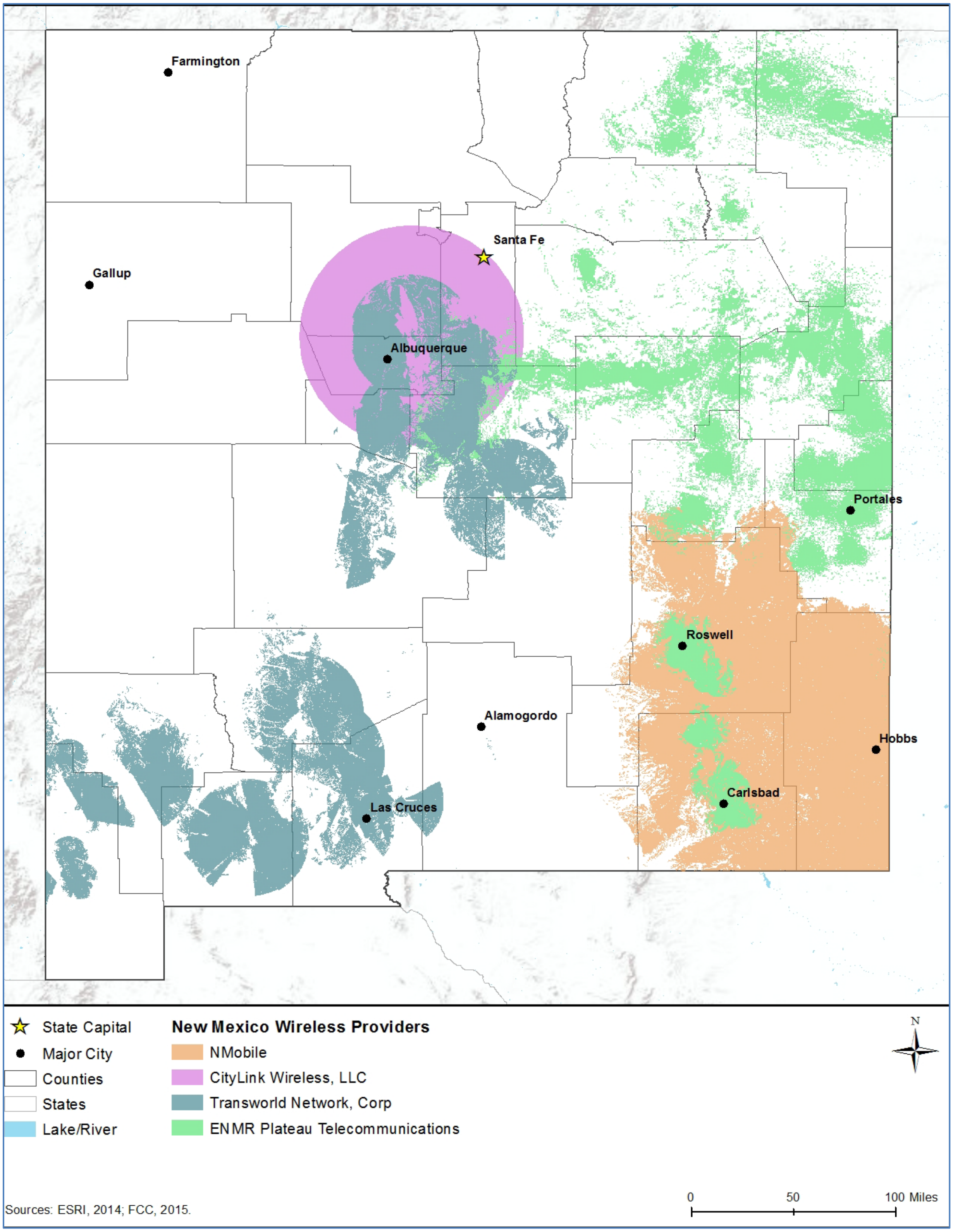

Figure 10.1.1-6: NMobile, Transworld Network Corp., ENMR Plateau Telecommunications, and CityLink Wireless LLC Wireless Availability in New Mexico

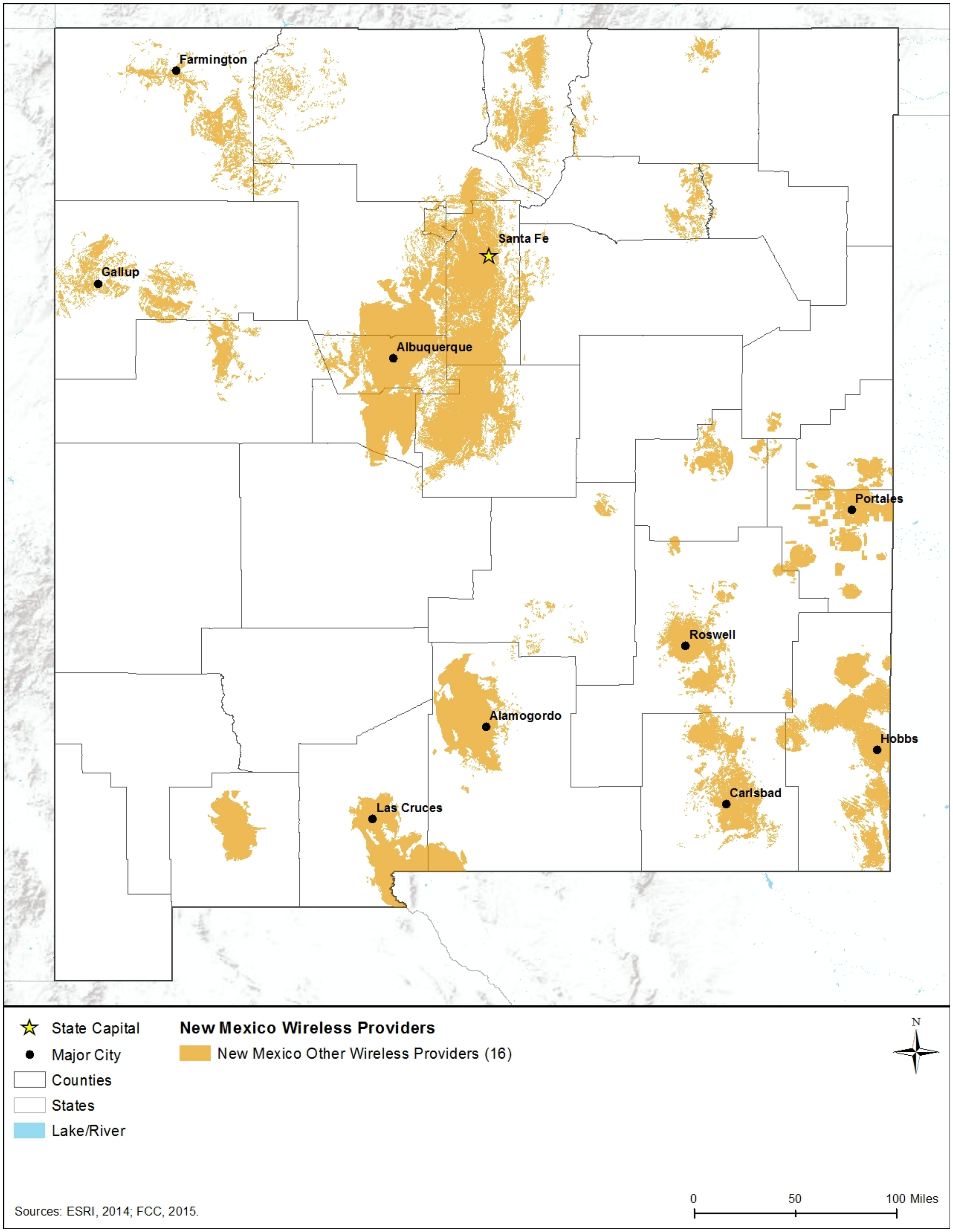

Figure 10.1.1-7: Other Providers Fiber Availability in New Mexico

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 10.1.1-8 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 10.1.1-8: Types of Towers

Telecommunications tower infrastructure proliferates throughout New Mexico, although tower infrastructure is concentrated in the higher and more densely populated areas of New Mexico. Owners of towers and some types of antennas are required to register those infrastructure assets with the FCC (FCC, 2016b).[8] Table 10.1.1-10 presents the number of towers (including broadcast towers) registered with the FCC in New Mexico, by tower type, and Figure 10.1.1-9presents the location of those 820 structures, as of June 2016.

[8] 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 10.1.1-10: Number of Commercial Towers in New Mexico by Type

Constructed[a] Towers[b]		**Constructed Monopole Towers**	
100 ft. and over	125	100 ft. and over	0
75 ft. – 100 ft.	151	75 ft. – 100 ft.	1
50 ft. – 75 ft.	137	50 ft. – 75 ft.	6
25 ft. – 50 ft.	90	25 ft. – 50 ft.	13
25 ft. and below	100	25 ft. and below	18
Subtotal	**603**	**Subtotal**	**28**
Constructed Guyed Towers		**Buildings with Constructed Towers**	
100 ft. and over	48	100 ft. and over	0
75 ft. – 100 ft.	31	75 ft. – 100 ft.	0
50 ft. – 75 ft.	11	50 ft. – 75 ft.	1
25 ft. – 50 ft.	1	25 ft. – 50 ft.	0
25 ft. and below	1	25 ft. and below	2
Subtotal	**92**	**Subtotal**	**3**
Constructed Lattice Towers		**Multiple Constructed Structures[c]**	
100 ft. and over	8	100 ft. and over	0
75 ft. – 100 ft.	26	75 ft. – 100 ft.	0
50 ft. – 75 ft.	29	50 ft. – 75 ft.	0
25 ft. – 50 ft.	21	25 ft. – 50 ft.	0
25 ft. and below	7	25 ft. and below	0
Subtotal	**91**	**Subtotal**	**0**
Constructed Tanks[d]			
Tanks	3		
Subtotal	**3**		
Total All Tower Structures		**820**	

[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, 2013b).
[b] Free standing or guyed structure used for communication purposes (FCC, 2013b).
[c] Multiple constructed structures per antenna registration (FCC, 2013b).
[d] Any type of tank – water, gas, etc. with a constructed antenna (FCC, 2013b).
Source: (FCC, 2015b)

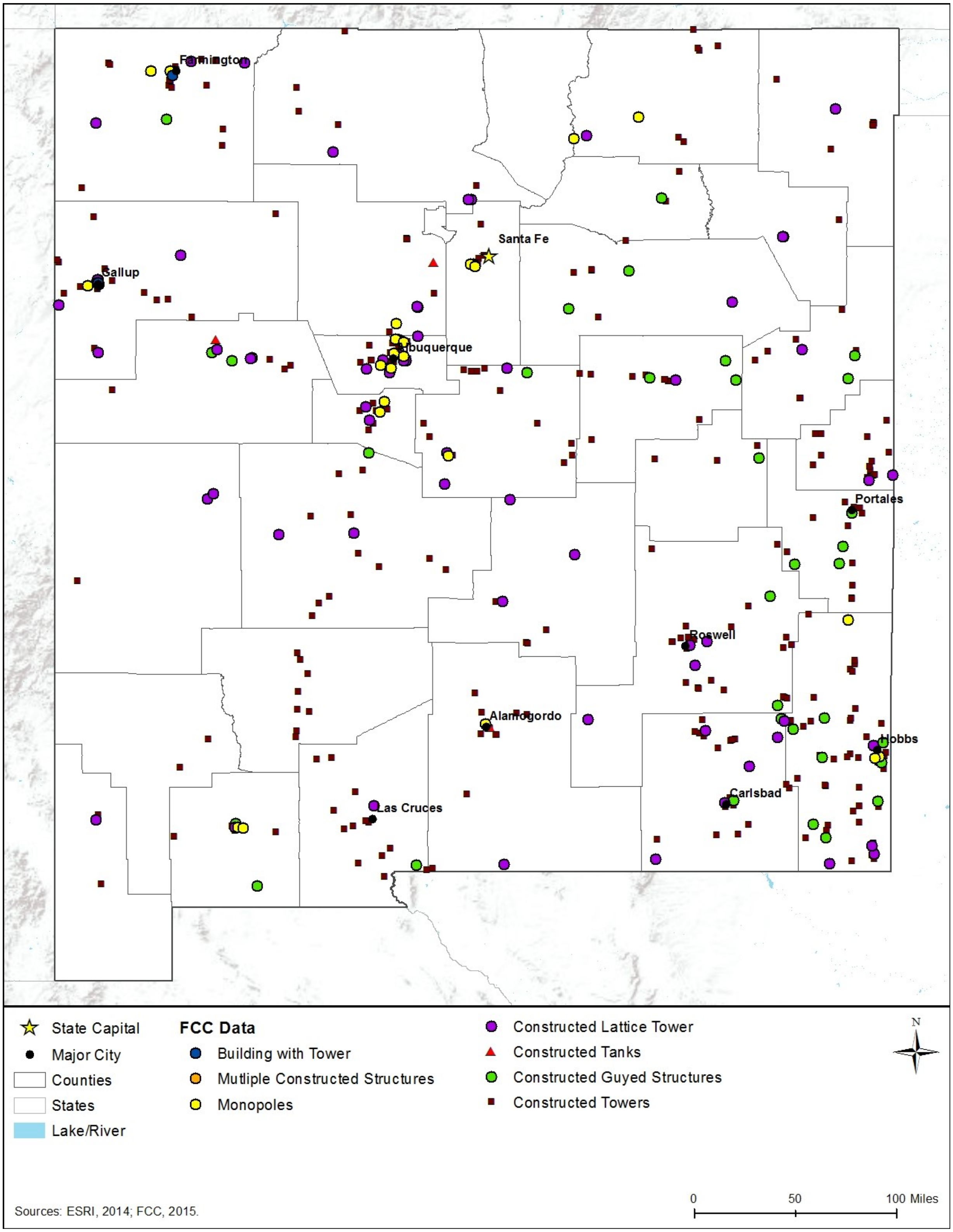

Figure 10.1.1-9: FCC Tower Structure Locations in New Mexico

Fiber Optic Plant (Cables)

Fiber optic plant, or cables, can be buried directly in the ground; pulled, blown, or floated into ducts, conduits, or innerduct (flexible plastic protective sleeves or tubes); placed under water; or installed aerially between poles, typically on utility rights-of-way. A fiber optic network includes an access network consisting of a central office, distribution and feeder plant (cables of various sizes directly leaving a central office and splitting to connect users to the network), and a user location, as shown in Figure 10.1.1-10. 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)

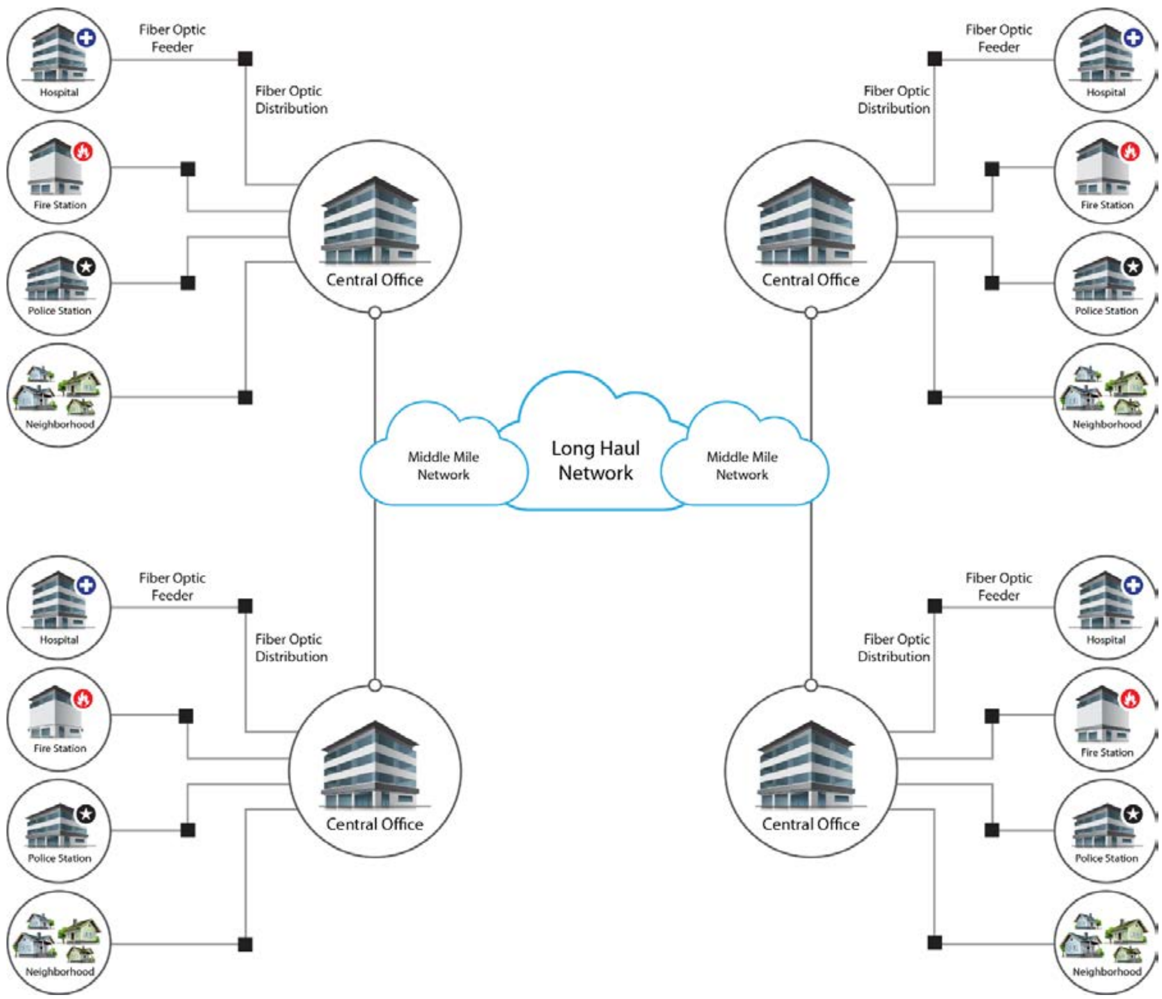

Figure 10.1.1-10: Typical Fiber Optic Network in New Mexico

Source: (ITU-T 2012)
Prepared by: Booz Allen Hamilton

Last Mile Fiber Assets

In New Mexico, fiber access networks are concentrated in the highest population centers as shown in the figures below. In New Mexico, there are 28 fiber providers that offer service in the state, as listed in Table 10.1.1-9. Table 10.1.1-9 shows coverage CenturyLink, ENMR Telephone Cooperative, and MegaPath, and Figure 10.1.1-12 shows coverage for all other providers with less than 5 percent coverage area, respectively.

Table 10.1.1-9: Fiber Provider Coverage

Fiber Provider	Coverage
CenturyLink	1.56%
ENMR Telephone Cooperative	1.42%
MegaPath	1.16%
Other[a]	3.11%

[a] Other: Provider with less than 5% coverage area. Providers include: Comcast; Sacred Wind Communications, Inc.; Frontier Navajo Communications; WNM Communications; Windstream Corporation; PVT Networks; TDS TELECOM; Leaco; Cable ONE; La Jicarita; Tularosa Communications, Inc.; Yucca Telecom; Sierra Communications (a subsidiary of Baca Valley Telephone); Valley Telecom Group; MATI Networks; Cyber Mesa Telecom; Time Warner Cable; TW Telecom of New Mexico, LLC; Suddenlink Communications; Zayo Group, LLC; Dell Telephone Cooperative, Inc.; Baca Valley Telephone Company; CityLink Telecommunications; Level 3 Communications, LLC; Cogent Communications.
Source: (NTIA, 2014)

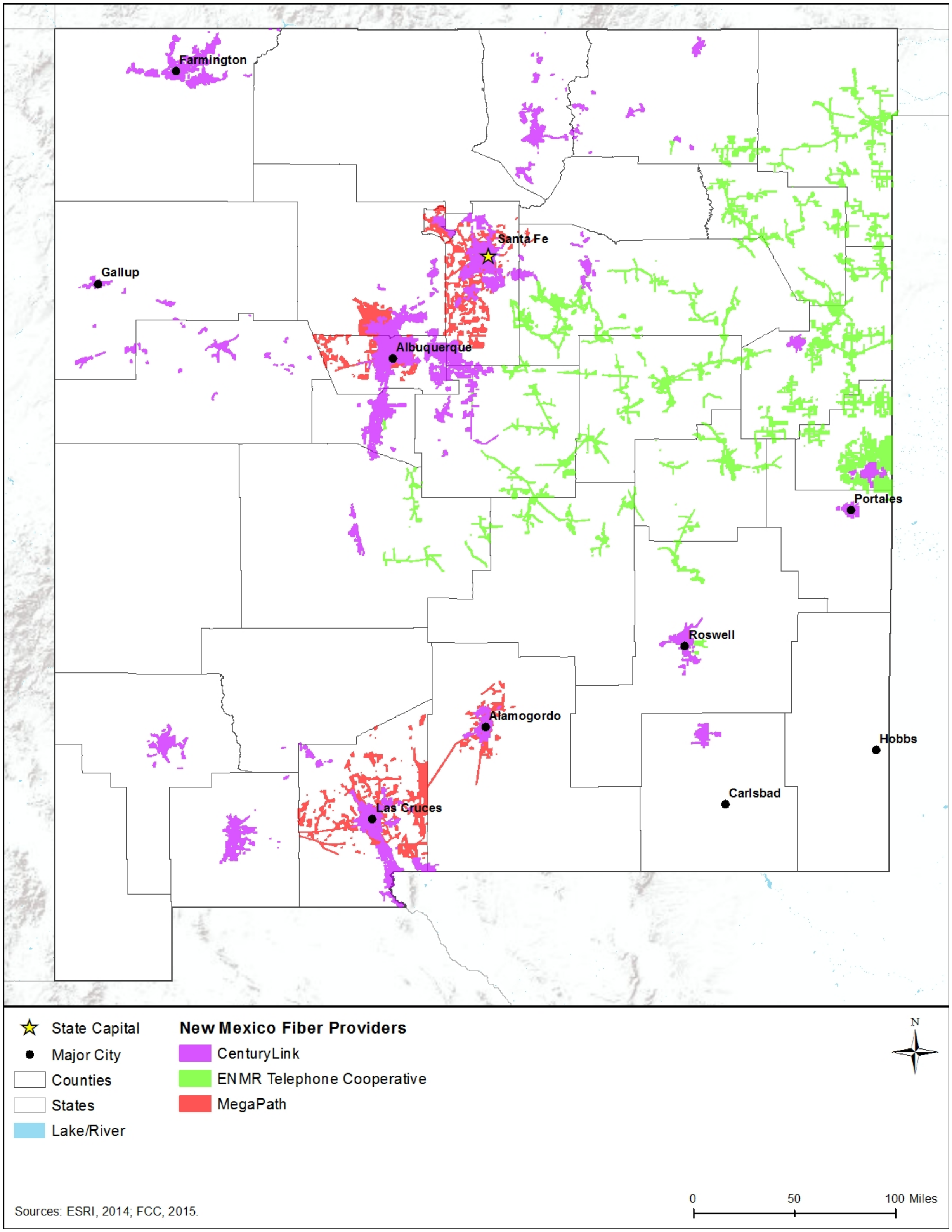

Figure 10.1.1-11: Fiber Availability in New Mexico for CenturyLink, ENMR Telephone Cooperative, and MegaPath

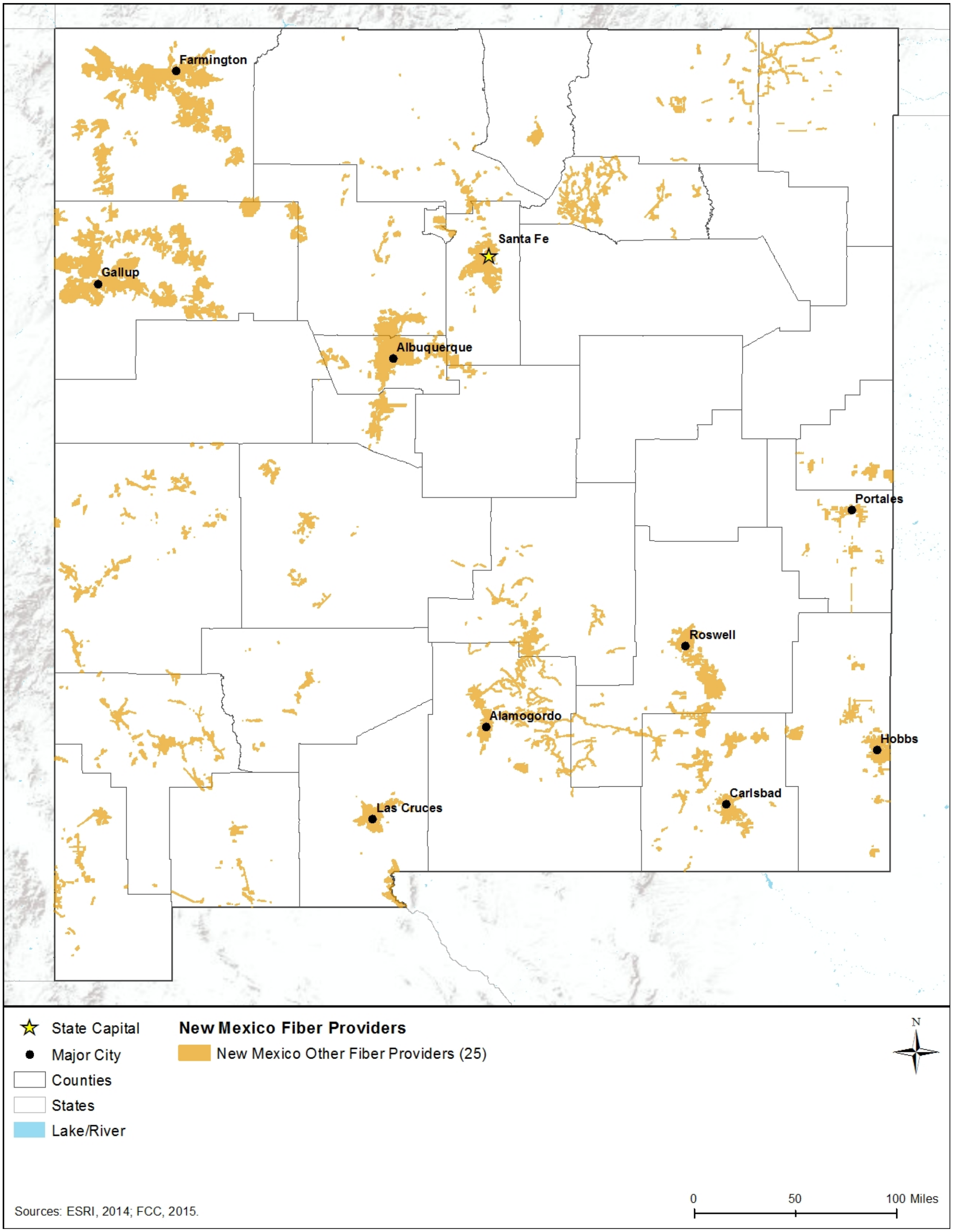

Figure 10.1.1-12: Other Providers' Fiber Availability in New Mexico

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 (CIO Council, 2015; GAO, 2013). These facilities also provide racks and cages for equipment, power and cooling, cabling, physical security, and 24x7 monitoring. 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.

10.1.1.6. 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 10.1.4, Water Resources, describes the potable water sources in the state.

Electricity

In the state of New Mexico, electric utilities have aspects of their service regulated by the New Mexico Public Regulation Commission (NMPRC). The NMPRC's oversight of utilities helps to "ensure fair and reasonable rates, and to assure reasonable and adequate services to the public as provided by law" (NMPRC, 2015a). They assist in settling disputes between customers and service providers, ranging from issues of rates to conflicts over billing responsibility. The NMPRC's jurisdiction extends to investor owned electric companies and electric cooperatives, but not to municipal electric providers (NMPRC, 2015b). The state is home to three investor owned electric utilities: El Paso Electric, the Public Service Company of New Mexico, and Xcel Energy (NMPRC, 2015c). There are also twenty-one electric cooperatives that fall within the jurisdiction of the NMPRC (NMPRC, 2015d). The NMPRC organizes electric providers into five classes, based on their annual revenues: Class A requires an annual operating revenue of at least $2,500,000, while Class E requires annual operating revenues of less than $25,000 with B through D ranging in between (NMPRC, 2015e).

The majority of New Mexico's electricity comes from three sources: coal, natural gas or wind power (EIA, 2015a). In 2014, 32,306,210 megawatthours[9] of electricity were produced. Of this, 8,975,656 megawatthours (28 percent) came from electric generation plants using natural gas as a fuel source, and coal powered facilities created 20,355,631 megawatthours (63 percent) of electricity (EIA, 2015a). Hydroelectric power created 98,381 megawatthours (0.3 percent) of electricity, wind power facilities produced 2,274,750 megawatthours (7 percent), and solar thermal and photovoltaic facilities produced 515,054 megawatthours (1.5 percent). Other sources of electricity generation such as petroleum, geothermal, or biomass all produced negligible amounts of electricity (EIA, 2015a). "New Mexico's Renewable Portfolio Standard

[9] One megawatt hour is defined as "one thousand kilowatthours or one million watthours." One watthour is "the electrical energy unit of measure equal to one watt of power supplied to, or taken from, an electric circuit steadily for one hour" (EIA, 2016).

requires that 20 percent of all electricity sold by investor-owned electric utilities, and 10 percent sold by cooperatives, come from renewable energy resources by 2020; in 2013, renewable energy supplied 7.8 percent of the electricity generated in the state" (EIA, 2015b).

Regarding the consumption of this electricity, a portion of the electricity generated in New Mexico is sent to Texas, California, Utah, and Arizona. Within the state in 2014, the industrial sector used 34.5 percent of the total electricity produced, while the transportations sector used 29.3 percent, the commercial sector used 18.3 percent, and the residential sector used 18 percent (EIA, 2015b).

Water

Investor owned water utilities in New Mexico are also regulated by the NMPRC. Their oversight includes the regulation of utility rates and the quality of service provided to customers, but does not extend to municipal utilities (NMPRC, 2015a). There are 28 investor owned water utilities that do have their activities regulated by the NMPRC (NMPRC, 2015f). The quality of New Mexico's drinking water is subject to the Safe Drinking Water Act (SDWA). The New Mexico Environment Department (NMED) Drinking Water Bureau operates and enforces the directives of the SDWA under authority from the U.S. Environmental Protection Agency (USEPA) (NMED, 2015a). These requirements apply to public water systems, defined as "a system for the provision to the public of piped water for human consumption, if such a system has at least fifteen service connections or regularly serves an average of at least twenty-five individuals daily at least 60 days out of the year" (NMED, 2015b). The regulations placed on public water systems include defining and regulating acceptable levels of contaminants that may be found in drinking water, as well as establishing, monitoring, and reporting standards (NMED, 2015b). Violations of SWDA standards are met with administrative orders to rectify the violation within a given timeframe. If compliance is not achieved, the Drinking Water Bureau issues daily fines until the situation is resolved (NMED, 2015c). Public Water Systems are also required to complete annual Consumer Confidence Reports (CCR), which is a report on water quality to be made available for the system's consumers. CCRs include information on "the system's water source(s), any detected contaminants, and any violations of drinking water regulations" (NMED, 2015d). The state also maintains a Source Water Protection Program, which helps to identify the sources of water used by public water systems as well as contaminants that may affect them (NMED, 2015e).

Wastewater

Most of the management of New Mexico's wastewater is handled by the Surface Water Quality Bureau of the NMED. This management is accomplished through the certification of wastewater facility operators and the reviewing/enforcement of USEPA issued permits for the discharge of wastewater. They also conduct inspections to ensure regulatory compliance and help provide information to both the public and the wastewater community (NMED, 2015f). The NMED maintains a Utility Operator Certification Program, whose duties include the "development, scheduling and administration of certification examinations, processing applications for certification and renewal, tracking all certified operators continuing education courses, evaluating training courses for relevance to program, tracking compliance with operator certification requirements and working with the New Mexico Water Quality Control Commission and the Utility Operators Certification Advisory Board" (NMED, 2015g). The program issues certifications for both wastewater facility operators and the employees of wastewater testing laboratories (NMED, 2015g).

The USEPA uses the National Pollutant Discharge Elimination System (NPDES) permit program to authorize discharges of wastewater from point sources-pipes or manmade ditches (USEPA, 2015a). While some states maintain their own USEPA authorized versions of the NPDES program, permits in New Mexico are issued by the USEPA directly (USEPA, 2015b). The NMED reviews these permits and provides oversight of the facilities themselves (NMED, 2015f). The NPDES program issues both general and individual permits. General permits are used for a large category of dischargers that have similar characteristics such as the type or amount of pollutants to be discharged, which make up the bulk of construction and industrial discharge facilities. Individual permits are issued for a single facility to "address the specific design and applicable water quality standards" (USEPA, 2015c). Inspections of NPDES permitted facilities are conducted by the NMED, who then reports inspection results back to the USEPA (NMED, 2015h).

Solid Waste Management

The management of New Mexico's solid waste and related facilities is the responsibility of the New Mexico Solid Waste Bureau, part of the NMED. The Bureau is broken into sections dedicated to issuing permits, inspecting facilities, and enforcing regulations, administrative tasks, and outreach to stakeholders and the public (NMED, 2015i). The 2010 New Mexico Solid Waste Report recorded that there were 3,421,647 tons of solid waste managed in 2009. Of this, 1,953,643 tons came from municipal sources, 535,810 tons came from construction and demolition, and 547,065 tons came from out of state sources. Clean Fill (brick, concrete, asphalt) accounted for 291,962 tons and special waste accounted for 93,168 tons. "Compared to the 2008 data, the total tonnage of waste generated in the state fell by 169,108 tons, while waste received from out-of-state declined by 65,959 tons" (NMED, 2015j). Of the 1,953,643 tons of municipal waste managed, 285,546 tons (about 14.6 percent) was recycled. When added to materials that were reused beneficially, the report lists a diversion rate of 20.6 percent, or 580,209 tons. "The diversion rate in New Mexico includes all materials recycled plus materials beneficially used. The diversion rate is calculated by dividing all in-state generated recycled and beneficially used material, by all in-state generated MSW, C & D, clean fill, and divertible special waste (Sludge, Offal, PCS, etc.) totals" (NMED, 2015j). At the time the report was written, there were 25 permitted landfills in the state that accepted solid waste, which accepted 2,836,449 tons of solid waste in 2009.

10.1.2. Soils

10.1.2.1. Definition of the Resource

The Soil Science Society of America defines soil as:

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

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

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

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

10.1.2.2. 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 Appendix C, Environmental Laws and Regulations. A list of applicable state laws and regulations is included in Table 10.1.2-1.

Table 10.1.2-1: Relevant New Mexico Soils Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
NPDES Manual	New Mexico Department of Transportation, the City of Albuquerque, the Albuquerque Metropolitan Arroyo Flood Control Authority, the University of New Mexico, the Southern Sandoval County Arroyo Flood Control Authority, the City of Rio Rancho, Bernalillo County, and the New Mexico Environment Department Surface Water Quality Bureau	Erosion, sediment, and runoff control best management practices (BMPs) to use for construction sites permitted under an NPDES permit.

10.1.2.3. Environmental Setting

New Mexico is composed of four Land Resource Region (LRR),[10] as defined by the National Resources Conservation Service (NRCS) (NRCS, 2006):

- Central Great Plains Winter Wheat and Range Region.
- Rocky Mountain Range and Forest Region.
- Western Great Plains Range and Irrigated Region.
- Western Range and Irrigated Region.

Within and among New Mexico's four LRRs are 16 Major Land Resource Areas (MLRA),[11] which are characterized by patterns of soils, climate, water resources, land uses, and type of farming. The locations and characteristics of New Mexico's MLRAs are presented in and Table 10.1.2-2.

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[12] such as bacteria, fungi, biological crusts, vegetation, animals, and climatic variables such as precipitation and temperature. For example, expansive soils[13] with wet and dry seasons alternately swell and shrink, which presents integrity risks to structural foundations (Rogers, Olshansky, & Rogers, 2004). Soils can also be affected by a variety of surface uses that loosen topsoil and damage or remove vegetation or other groundcover, which may result in accelerated erosion, compaction, and rutting[14] (discussed further in the subsections below).

[10] Land Resource Region: "A geographical area made up of an aggregation of Major Land Resource Areas (MLRA) with similar characteristics" (NRCS, 2006).
[11] Major Land Resource Area: "A geographic area, usually several thousand acres in extent, that is characterized by a particular pattern of soils, climate, water resources, land uses, and type of farming" (NRCS, 2006).
[12] All living organisms of an area. (USGS, 2013a)
[13] Expansive soils are characterized by "the presence of swelling clay minerals" that absorb water molecules when wet and expand in size or shrink when dry leaving "voids in the soil" (Rogers, Olshansky, & Rogers, 2004).
[14] Rutting is indentations in soil from operating equipment in moist conditions or soils with lower bearing strength (USFS, 2009b).

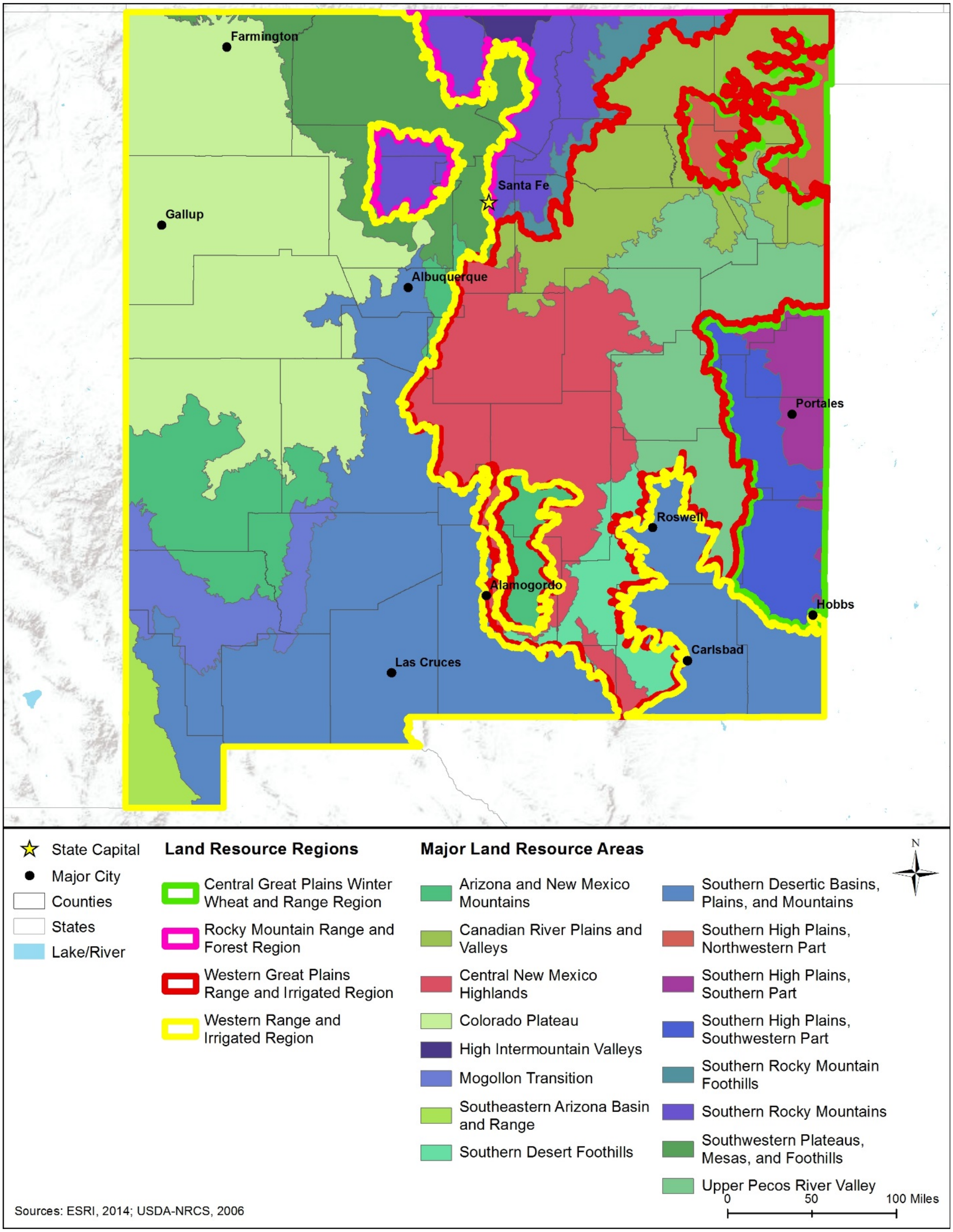

Figure 10.1.2-1: Locations of Major Land Resource Areas in New Mexico

Table 10.1.2-2: Characteristics of Major Land Resource Areas in New Mexico

MLRA Name	Region of State	Soil Characteristics
Arizona and New Mexico Mountains	Central and Western New Mexico	Alfisols,[a] Entisols,[b] Inceptisols,[c] and Mollisols[d] are the dominant soil orders.
Canadian River Plains and Valleys	Northeastern New Mexico	Alfisols, Entisols, and Mollisols are the dominant soil orders. These well-drained soils are moderately textures or fine textured and range from shallow to deep.
Central New Mexico Highlands	Central New Mexico	Aridisols,[e] Entisols, and Mollisols are the dominant soil orders. These well-drained soils range from very shallow to very deep, and are moderately fine textured to moderately coarse textured.
Colorado Plateau	Northwestern New Mexico	Alfisols, Aridisols, Entisols, and Mollisols are the dominant soil orders. These loamy[f] or clayey soils are typically well drained or somewhat excessively drained. They range from very shallow to very deep.
High Intermountain Valleys	Northern New Mexico	Aridisols and Entisols are the dominant soil orders. These soils have varied texture and range from somewhat poorly drained to somewhat excessively drained. They are typically deep or very deep.
Mogollon Transition	Southwestern New Mexico	Alfisols, Aridisols, and Mollisols are the dominant soil orders. These well drained to somewhat excessively drained soils range from very shallow to very deep.
Southeastern Arizona Basin and Range	Southwestern New Mexico	Alfisols, Aridisols, Entisols, and Mollisols are the dominant soil orders. These well drained to somewhat excessively drained soils range from very shallow to very deep.
Southern Desert Foothills	Southeastern New Mexico	Aridisols and Mollisols are the dominant soil orders. These typically shallow soils are well drained, and are loamy-skeletal.
Southern Desertic Basins, Plains, and Mountains	Southern New Mexico	Aridisols, Entisols, Mollisols, and Vertisols[g] are the dominant soil orders. These loamy or clayey soils are typically moderately deep to very deep, and are well drained.
Southern High Plains, Northwestern Part	Northeastern New Mexico	Alfisols are the dominant soil orders. These well-drained soils are typically very deep, and are sandy or loamy.
Southern High Plains, Southern Part	Eastern New Mexico	Alfisols, Inceptisols, Mollisols, and Vertisols are the dominant soil orders. These well-drained soils are typically moderately deep to very deep, and are loamy, clayey, or sandy.
Southern High Plains, Southwestern Part	Eastern New Mexico	Aridisols and Entisols are the dominant soil orders. These well-drained soils range from very shallow to very deep, and are typically sandy or loamy.
Southern Rocky Mountain Foothills	Northern New Mexico	Alfisols, Entisols, Inceptisols, and Mollisols are the dominant soil orders. These soils are generally well drained and loamy or clayey. They range from very shallow to very deep.
Southern Rocky Mountains	Northern New Mexico	Alfisols, Entisols, Inceptisols, and Mollisols are the dominant soil orders.
Southwestern Plateaus, Mesas, and Foothills	Northern New Mexico	Alfisols, Aridisols, Entisols, Inceptisols, and Mollisols are the dominant soil orders. These soils range from shallow to very deep and are loamy, clayey, or silty.
Upper Pecos River Valley	Eastern New Mexico	Aridisols and Entisols are the dominant soil orders. These well-drained soils range from shallow to very deep, and are coarse textured to fine textured.

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

[b] Entisols: "Soils that show little to no pedogenic horizon development. They occur in areas of recently deposited parent materials or in dunes, steep slopes, or flood plains where erosion or deposition rates are faster than rate of soil development. They make up nearly 16% of the world's ice-free land surface." (NRCS, 2015b)
[c] Inceptisols: "Soils found in semiarid to humid environments that exhibit only moderate degrees of soil weathering and development. They have a wide range of characteristics, can occur in a wide variety of climates, and make up nearly 17% of the world's ice-free land surface." (NRCS, 2015b)
[d] 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)
[e] Aridisols: "Soils that are too dry for the growth of mesophytic plants. Lack of moisture greatly restricts the intensity of the weathering process and limits most soil development processes to the upper part of the soils. They make up about 12% of the world's ice-free land surface." (NRCS, 2015b)
[f] Loamy Soil: "[A soil] that combines [sand, silt, and clay] in relatively equal amounts." (Purdue University Consumer Horticulture, 2006)
[g] Vertisols: "Vertisols have a high content of expanding clay minerals. They undergo pronounced changes in volume with changes in moisture, and have cracks that open and close periodically, and that show evidence of soil movement. Vertisols transmit water very slowly, have undergone little leaching, and tend to be high in natural fertility. They make up about 2% of the world's ice-free land surface." (NRCS, 2015b)
Source: (NRCS, 2006)

10.1.2.4. Soil Suborders

Soil suborders are part of the soil taxonomy (a system of classification used to make and interpret soil surveys). Soil orders are the highest level in the taxonomy; there are twelve soil orders in the world and they are characterized by both observed and inferred 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, 2015e). The STATSGO2[15] soil database identifies 22 different soil suborders in New Mexico (NRCS, 2015c). Figure 10.1.2-2 depicts the distribution of the soil suborders, and Table 10.1.2-3 provides a summary of the major physical-chemical characteristics of the various soil suborders found.

[15] STATSGO2 is the Digital General Soil Map of the United States 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.

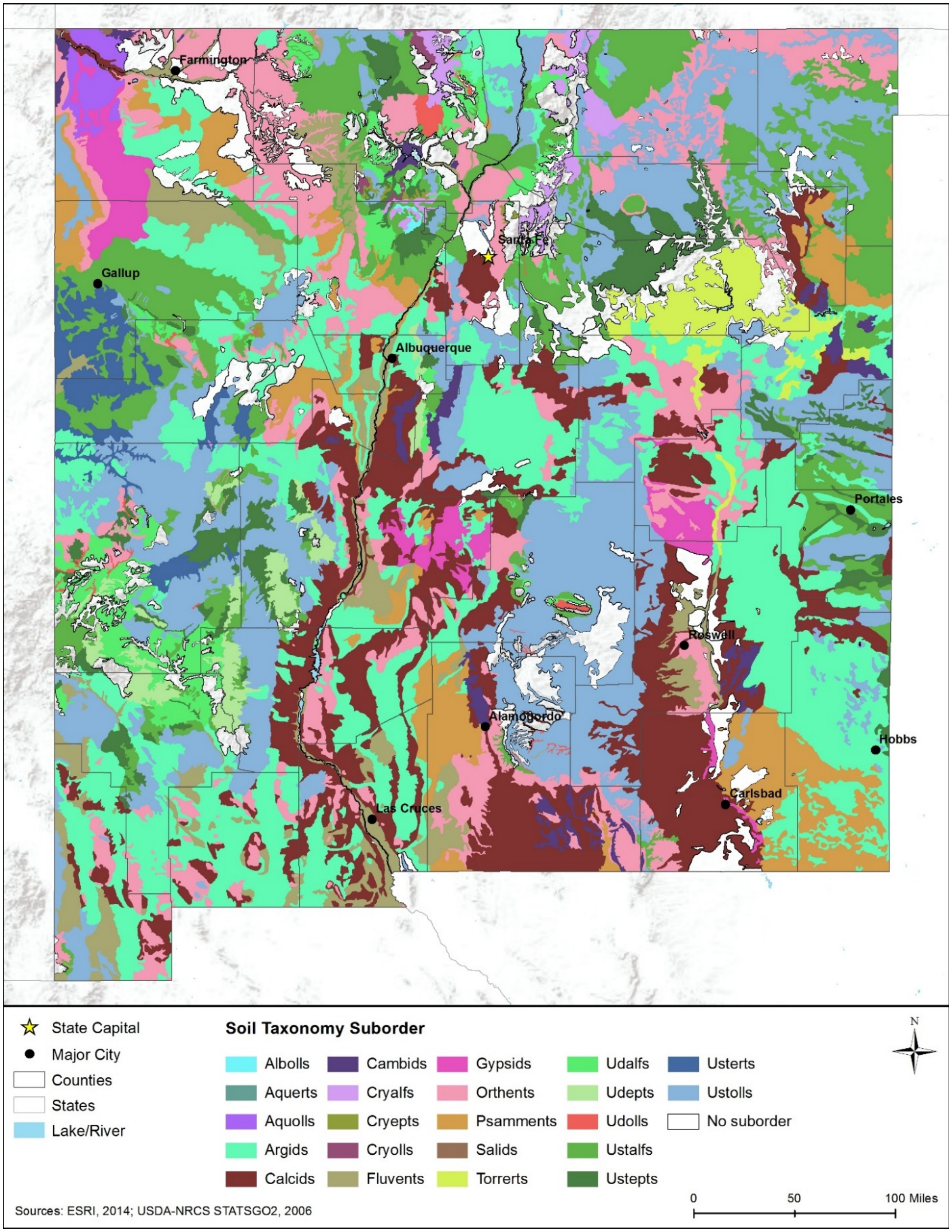

Figure 10.1.2-2: New Mexico Soil Taxonomy[16] Suborders

[16] Soil taxonomies are defined in Table 10.1.2-3.

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Table 10.1.2-3: Major Characteristics of Soil Suborders[a] Found in New Mexico, as depicted in Figure 10.1.2-2

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 ground water table, with gentle slopes. They supported grasses and shrubs, and are typically used as cropland.	Clay	1-5	Poorly drained	Yes	C	Medium	Low	Medium	High, due to hydric soil and poor drainage conditions
Vertisols	Aquerts	Aquerts are wet soils, with prolonged moisture at or near the soil surface. Their natural vegetation includes savanna, grass, and forest. They are used as forest, rangeland, and cropland, although drainage for cropland can be difficult due to poor drainage.	Clay	0-1	Somewhat 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[d] vegetation, as well as some forest vegetation. However, most have been artificially drained and utilized as cropland.	Loam, Very fine sandy loam	0-4	Poorly drained to well drained	No, Yes	B, D	Medium, High	Moderate, Very Low	Medium to High, depending on slope	High, due to hydric soil and poor drainage conditions
Aridisols	Argids	Argids are found in the western United States. They are primarily used as wildlife habitat or rangeland, although some can also be used as cropland, if irrigated.	Channery[e] loam, Clay loam, Fine sand, Fine sandy loam, Gravelly clay, Gravelly loam, Gravelly sandy loam, Gravelly very fine sandy loam, Loam, Loamy fine sand, Sandy clay loam, Sandy loam, Silty clay loam, Very cobbly sandy loam, Very gravelly fine sandy loam, Very gravelly loam, Very gravelly sandy clay loam	0-55	Moderately well drained to well drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low
Aridisols	Calcids	Calcids are found in the western United States, and used primarily as wildlife habitat or rangeland, although some have been utilized as irrigated cropland. They have high levels calcium carbonates that persist due to insufficient precipitation.	Extremely gravelly loam, Fine sandy loam, Gravelly fine sandy loam, Gravelly loam, Gravelly sandy clay loam, Gravelly very fine sandy loam, Indurated, Loam, Sandy loam, Unweathered bedrock, Variable, Very fine sandy loam, Very gravelly clay loam, Very gravelly fine sandy loam, Very gravelly loam, Very gravelly sandy clay loam, Very gravelly sandy loam, Very gravelly silt loam, Weathered bedrock	0-60	Well drained to excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low
Aridisols	Cambids	Cambids are found in the western United States, with little soil development. They are primarily used as wildlife habitat or rangeland, although some can also be used as cropland, if irrigated.	Extremely cobbly sandy clay loam, Fine sandy loam, Loam, Loamy fine sand, Sandy clay loam, Sandy loam, Silt loam, Stratified loamy fine sand to gravelly loam, Very fine sandy loam	0-35	Well drained	No	B, C	Medium	Moderate, Low	Medium	Low
Alfisols	Cryalfs	Cryalfs are cold weather soils found primarily at high elevations. Due to the cold, short growing season, the majority of these soils are utilized as forest.	Cobbly coarse sandy loam, Cobbly loam, Gravelly sandy loam, Sandy loam, Very gravelly loam, Very stony fine sandy loam	10-80	Well drained	No	B, C	Medium	Moderate, Low	Medium	Low

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
Inceptisols	Cryepts	Cryepts are soils of high latitudes or high elevations, and support cold weather vegetation such as conifers and hardwoods. They are mostly used as forest or wildlife habitat, although some are also used as cropland.	Gravelly sandy loam, Very gravelly sandy loam	15-40	Somewhat excessively drained	No	C	Medium	Low	Medium	Low
Mollisols	Cryolls	Cryolls are generally freely drained, cold weather soils. They are primarily used as rangeland, along with some forest and pasture. Forest, grass, or grass/shrub vegetation are supported with these soils.	Gravelly clay loam, Loam, Silty clay loam	0-40	Somewhat poorly drained to well drained	No	B, C	Medium	Moderate, 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.	Clay loam, Fine sandy loam, Gravelly fine sandy loam, Gravelly sand, Loam, Loamy sand, Sandy loam, Silt loam, Silty clay loam, Stratified gravelly loamy sand to silty clay loam, Stratified very fine sandy loam to silty clay loam	0-9	Poorly drained to well drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low
Aridisols	Gypsids	Gypsids are soils with a petrogypsic or gypsic horizon. These soils have limited uses, and are predominantly utilized for wildlife habitat or rangeland.	Cobbly fine sandy loam, Gypsiferous material, Loam, Sandy clay loam	0-10	Well drained	No	B, C	Medium	Moderate, Low	Medium	Low
Entisols	Orthents	Orthents are commonly found on recent erosional surfaces and are used primarily as rangeland, pasture, or wildlife habitat.	Clay loam, Extremely cobbly sand, Fine sandy loam, Gypsiferous material, Loam, Sandy clay loam, Sandy loam, Silt loam, Silty clay, Silty clay loam, Stony loam, Unweathered bedrock, Very cobbly clay, Very gravelly fine sandy loam, Very stony loam, Very stony sandy loam, Weathered bedrock	0-80	Moderately well drained to somewhat excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, 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, Fine sandy loam, Loamy fine sand, Loamy sand, Stratified fine sand to gravelly loamy fine sand, Stratified loamy fine sand to very fine sandy loam, Stratified sand to very fine sandy loam	0-30	Somewhat excessively drained to excessively drained	No	A	Low	High	Low	Low
Aridisols	Salids	Salids are primarily found in Nevada and Utah, and commonly located in depressions (playas). They have a saline horizon that makes them unsuitable for agricultural use unless they are leached of salts. Therefore, most of these soils are utilized for wildlife habitat or rangeland.	Clay loam	3-12	Well drained	No	D	High	Very Low	High	Low
Vertisols	Torrerts	Torrerts are soils that consist of primarily grasses and forbs and are used as rangeland. Their slow permeability means that irrigation can cause waterlogging and accumulation of salinity without other means of drainage.	Clay loam, Silty clay	0-3	Well drained	No	D	High	Very Low	High	Low

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 a udic (humid or subhumid climate) moisture regime, and are believed to have supported forest vegetation at some time during development.	Cobbly loam, Extremely gravelly sandy clay loam, Extremely stony clay, Gravelly loam, Unweathered bedrock, Very cobbly loam, Very cobbly sandy clay, Very cobbly sandy clay loam, Very cobbly sandy loam	0-80	Well drained	No	B	Medium	Moderate	Medium	Low
Inceptisols	Udepts	Udepts have a udic or perudic (saturated with water long enough to cause oxygen depletion) moisture regime, and are mainly freely drained. Most of these soils currently support or formerly supported forest vegetation, with mostly coniferous forest in the Northwest and mixed or hardwood forest in the East. Some also support shrub or grass vegetation, and in addition to being used as forest, some have been cleared and are used as cropland or pasture.	Extremely cobbly silty clay loam	40-60	Well drained	No	B	Medium	Moderate	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.	Fine sandy loam, Loam, Silt loam, Silty clay, Very gravelly loam	0-65	Somewhat poorly drained to well drained	No	B, C, D	Medium, High	Moderate, Low, Very Low	Medium to High, depending on slope	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.	Clay, Clay loam, Cobbly clay, Cobbly loam, Cobbly sandy clay, Cobbly sandy clay loam, Extremely gravelly sandy loam, Fine sand, Fine sandy loam, Gravelly clay, Loam, Sandy clay, Sandy clay loam, Sandy loam, Silt loam, Silty clay loam, Stratified very cobbly sand to extremely cobbly sandy clay, Unweathered bedrock, Very cobbly sandy clay, Very cobbly sandy loam, Very gravelly clay loam, Very gravelly sandy clay loam	0-80	Well drained to somewhat excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, 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.	Clay loam, Fine sandy loam, Flaggy loam, Loam, Loamy fine sand, Loamy sand, Silt loam, Very channery silty clay loam, Very gravelly loam, Very gravelly sandy loam, Very stony loam	0-60	Well drained to somewhat excessively drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low 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.	Silty clay, Silty clay loam	0-3	Well drained	No, Yes	D	High	Very Low	High	High, due to hydric soil

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	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.	Channery loam, Clay, Clay loam, Cobbly loam, Extremely cobbly loam, Extremely gravelly coarse sandy loam, Fine sandy loam, Gravelly clay, Gravelly clay loam, Gravelly loam, Indurated, Loam, Silt loam, Silty clay loam, Stratified very gravelly sand to very gravelly clay, Unweathered bedrock, Very cobbly clay loam, Very cobbly loam, Very cobbly sandy clay loam, Very gravelly clay loam, Very gravelly loam, Very stony loam, Weathered bedrock	0-60	Well drained	No	A, B, C, D	Low, Medium, High	High, Moderate, Low, Very Low	Low to High, depending on slope	Low

[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, 2015d). 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 Infiltration Characteristics.
[d] Forb/herb: "Vascular plant without significant woody tissue above or at the ground. Forbs and herbs may be annual, biennial, or perennial but always lack significant thickening by secondary woody growth and have perennating buds borne at or below the ground surface." (NRCS, 2015g)
[e] Channery: An accumulation of thin, flat, course fragments of sandstone, limestone of schist up to 6 inches (University of Delaware, 2016).
Source: (NRCS, 2015c) (NRCS, 1999)

10.1.2.5. Runoff Potential

The NRCS uses four Hydrologic Soil Groups (A, B, C, and D) that are based on a soil's runoff potential.[17] Group A generally has the smaller runoff potential, whereas Group D generally has the greatest (Purdue University, 2015). Table 10.1.2-3 provides a summary of the runoff potential for each soil suborder in New Mexico.

Group A. **Sand, loamy sand or sandy loam soils.** This group of soils has "low runoff potential and high infiltration rates[18] 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). Argids, Calcids, Fluvents, Orthents, Psamments, Ustalfs, Ustepts, and Ustolls fall into this category in New Mexico.

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. Aquolls, Argids, Calcids, Cambids, Cryalfs, Cryolls, Fluvents, Gypsids, Orthents, Udalfs, Udepts, Udolls, Ustalfs, Ustepts, and Ustolls fall into this category in New Mexico.

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. Albolls, Argids, Calcids, Cambids, Cryalfs, Cryepts, Cryolls, Fluvents, Gypsids, Orthents, Udolls, Ustalfs, Ustepts, and Ustolls fall into this category in New Mexico.

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). Aquerts, Aquolls, Argids, Calcids, Fluvents, Orthents, Salids, Torrerts, Udolls, Ustalfs, Ustepts, Usterts, and Ustolls fall into this category in New Mexico.

10.1.2.6. Soil Erosion

"Soil erosion involves the breakdown, detachment, transport, and redistribution of soil particles by forces of water, wind, or gravity" (NRCS, 2015f). Water-induced erosion could 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 could cause human health problems and reduced visibility, creating a

[17] 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.
[18] 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).

public safety hazard (NRCS, 1996a). Table 10.1.2-3 provides a summary of the erosion potential for each soil suborder in New Mexico. Soils with medium to high erosion potential in New Mexico include those in the Albolls, Aquerts, Aquolls, Argids, Calcids, Cambids, Cryalfs, Cryepts, Cryolls, Fluvents, Gypsids, Orthents, Salids, Torrerts, Udalfs, Udepts, Udolls, Ustalfs, Ustepts, Usterts, and Ustolls suborders, which are found throughout most of the state (NRCS, 1996a).

10.1.2.7. 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, 2009a). 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 could 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 10.1.2-3 provides a summary of the compaction and rutting potential for each soil suborder in New Mexico. Soils with the highest potential for compaction and rutting in New Mexico include those in the Albolls, Aquerts, Aquolls, and Usterts suborders, which are found throughout most of the state (NRCS, 1996b).

10.1.3. Geology

10.1.3.1. Definition of the Resource

The U.S. Geological Survey (USGS) is the primary government organization responsible for the nation’s geological resources. USGS defines geology as an interdisciplinary science with a focus on the following aspects of earth sciences: geologic hazards and disasters, climate variability and change, energy and mineral resources, ecosystem and human health, and ground-water availability. Several of these elements are discussed in other sections of this PEIS, including Water Resources (Section 10.1.4), Human Health and Safety (Section 10.1.15), and Climate Change (Section 10.1.14).

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

- Section 10.1.3.3, Environmental Setting: Physiographic Regions[19] and Provinces;[20]
- Section 10.1.3.4, Surface Geology;

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

- Section 10.1.3.5, Bedrock Geology;[21]
- Section 10.1.3.6, Paleontological Resources;[22]
- Section 10.1.3.7, Fossil Fuel and Mineral Resources; and
- Section 10.1.3.8, Geologic Hazards.[23]

10.1.3.2. 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 10.1.3-1.

Table 10.1.3-1: Relevant New Mexico Geology Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Chapter 62 Article 14 New Mexico Statutes Annotated (NMSA) 1978	State of New Mexico	A person who engages in excavation must plan and prepare proper excavation to avoid damage with underground facilities.
New Mexico Administrative Code, Title 14 – Housing and Construction Chapter 7 Building Codes General	New Mexico Construction Industries Division CID of the Regulation and Licensing Department	Guidelines on seismic design.

10.1.3.3. 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, 1916).

New Mexico has three major physiographic regions: Interior Plains (Great Plains Province), Rocky Mountain System (Southern Rocky Mountains Province), and Intermontane Plateaus (Colorado Plateaus and Basin and Range Provinces). The locations of these regions and provinces are shown in and their general characteristics summarized in the following subsections.

[21] Bedrock: Solid rock beneath the soil and superficial rock (USGS, 2015b).
[22] Paleontology: "Study of life in past geologic time based on fossil plants and animals" (USGS, 2015c).
[23] 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).

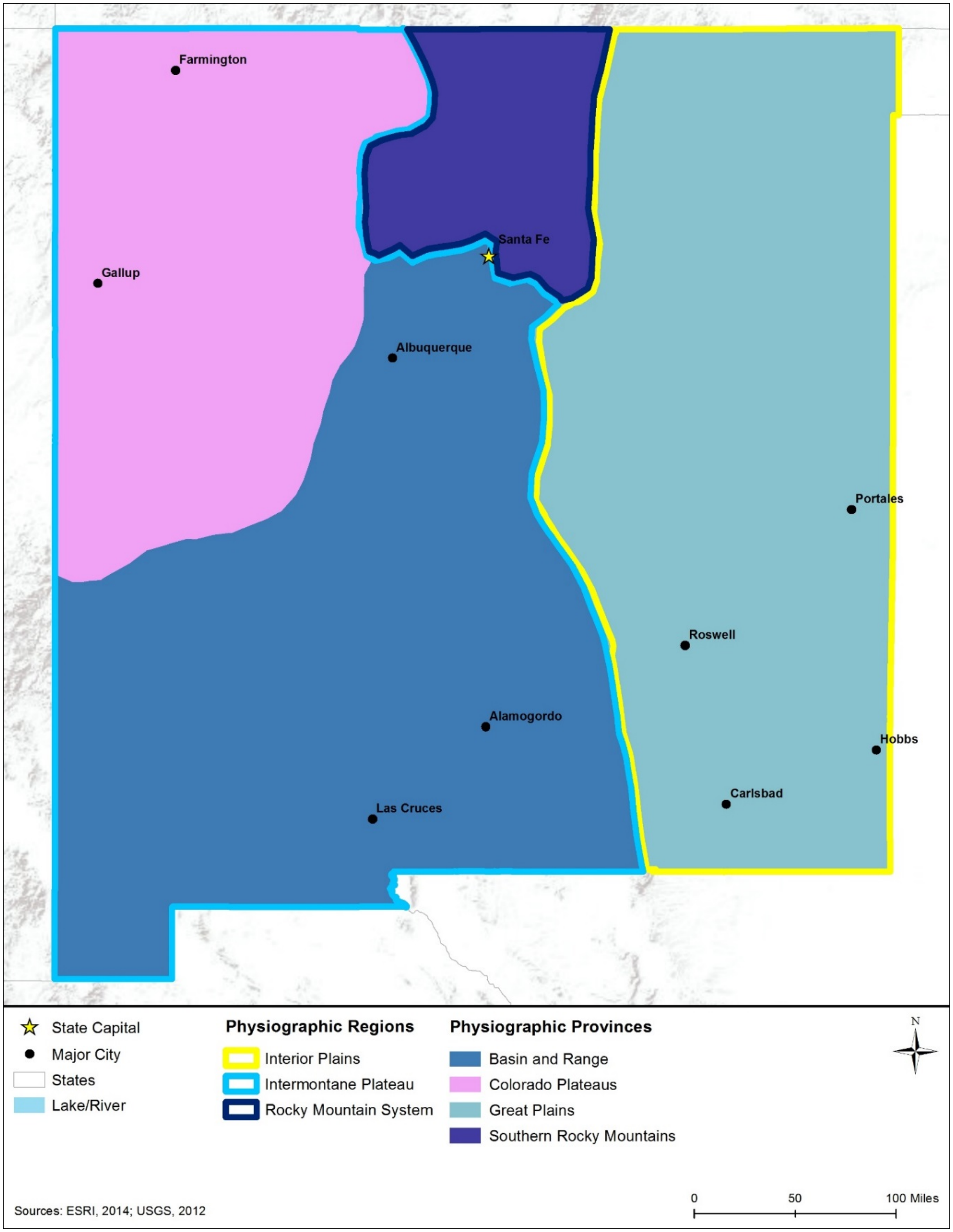

Figure 10.1.3-1: Physiographic Regions and Provinces of New Mexico

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, Colorado, and New Mexico) (Fenneman, 1916). Metamorphic[24] and igneous[25] rocks dating to the Precambrian Era (older than 542 million years ago [MYA]) underlie the entire region.[26] 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[27] 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,[28] mudstone,[29] and clay (USGS, 2014a).

<u>Great Plains Province</u> – Within New Mexico, the Great Plains Province includes much of the eastern portion of the state. "The Great Plains run from high plateaus in the north, south to the Pecos River Valley" (BLM, 2011). The topography is noted for being a "flat to rolling prairie with scattered hills and bluffs gradually [that rise] westward to 5,000 to 7,000 feet [above sea level (ASL)] and abruptly [give] way to the frontal ranges of the Rocky Mountains in the Southern Rocky Mountain and Basin and Range Physiographic Provinces" (USGS, 1995a).

Rocky Mountain System

The Rocky Mountains form a line from the northern border with Canada south into central New Mexico. The Rocky Mountains were created during the Laramide orogeny,[30] which occurred between 70 and 40 MYA. They formed due to the collision of the Pacific Ocean oceanic crust[31] with the North American continental crust. In most cases, convergence of oceanic crust with continental crust results in mountain formation 200 to 400 miles from the coastline. However, the low angle of subduction of the oceanic crust under the less dense continental crust formed the Rocky Mountains several hundred miles further inland than is normally observed. (USGS, 2014b)

<u>Southern Rocky Mountains</u> – Within New Mexico, the Southern Rocky Mountains Province includes north-central portions of the state to the north of Santa Fe. Topography ranges from 5,000 feet ASL at the boundary with the Great Plains to the east (USGS, 1995a), to more than 13,000 feet at Wheeler Peak, the highest point in New Mexico (USGS, 2001). The Southern

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[24] Metamorphic Rocks: "A rock that has undergone chemical or structural changes produced by increase in heat or pressure, or by replacement of elements by hot, chemically active fluids" (USGS, 2015d).
[25] Igneous Rock: "Rock that forms when hot, molten rock (magma) crystallizes and solidifies" (USGS, 2014c).
[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. (University of California Museum of Paleontology, 2011)
[27] 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, 2014d).
[28] Sandstone: "Sedimentary rock made mostly of sand-sized grains" (USGS, 2015d).
[29] Mudstone: "A very fine-grained sedimentary rock formed from mud" (USGS, 2015d).
[30] Orogeny: "An episode of mountain building and/or intense rock deformation" (USGS, 2015d).
[31] Crust: "The rocky, relatively low density, outermost layer of the Earth" (USGS, 2015d).

Rocky Mountains include the Jemez and Nacimiento Mountains (BLM, 2011). The Jemez Mountains are remains of a collapsed volcano that erupted 1.4 and 1.1 MYA (NPS, 2005).

Intermontane Plateaus Region

The Intermontane Plateau Region describes the area between the Rocky Mountains and the Sierra Nevada and Cascade Ranges. The Intermontane Plateau Region dates to 80 MYA and predates the younger Rocky Mountain System to the east (which was created roughly 60 MYA). The region is characterized by interspersed higher-elevation plateaus and mountains and lower-lying basins. The Colorado Plateaus Province is one of the major elevated areas in this region. (Lew, 2004)

Colorado Plateaus Province – The Colorado Plateaus Province includes much of western Colorado, including the area surrounding the Four Corners region. "Ancient volcanic mountains, plateaus and buttes, deeply carved canyons, and amazing ranges in color are the region's defining characteristics." The province's plateaus are roughly 5,000 to 7,000 feet ASL, with the bottoms of the carved valleys at roughly 2,000 feet ASL. The highest mountain peaks in this province are roughly 13,000 feet ASL (NPS, 2014a). Within New Mexico, the Colorado Plateaus Province includes the northwestern portion of the state. "The Rio Grande Rift Valley in New Mexico defines the eastern boundary [of the Colorado Plateaus]." The portion of the Colorado Plateaus within New Mexico is referred to as the Datil section, and is largely volcanic in origin (Foos, 1999).

Basin and Range Province – The Basin and Range Province is characterized by north-south trending mountains and valleys that were created as the landscape in the region underwent extension[32] over the past 30 million years (NPS, 2014b). This tectonic activity has thinned the Earth's crust and created large faults that have resulted in the "distinctive alternating pattern of linear mountain ranges and valleys" (USGS, 2014e). Within New Mexico, the Basin and Range Province includes portions of the central and southwestern parts of the state. This area is marked by rugged mountain ranges, such as the southernmost Guadalupes, Mogollon, Organ, Sacramento, and the northern San Andres Mountain ranges, separated by numerous desert basins (BLM, 2011). The mountain peaks are typically 3,000 to 6,000 feet above the basins and the ranges extend about 20 to 50 miles from north to south (USGS, 1995a).

10.1.3.4. Surface Geology

Surficial geology is characterized by materials such as till,[33] sand and gravel, or clays that overlie bedrock. The surface terrain, which can include bedrock outcrops, provides information on the rock compositions and structural characteristics of the underlying geology. Because surface materials are exposed, they are subject to physical and chemical changes due to weathering from

[32] Extension: "In geology, the process of stretching the Earth's crust. Usually cracks (faults) form, and some blocks sink, forming sedimentary basins" (USGS, 2015d).
[33] Till: "An unsorted and unstratified accumulation of glacial sediment, deposited directly by glacier ice. Till is a heterogeneous mixture of different sized material deposited by moving ice (lodgement till) or by the melting in-place of stagnant ice (ablation till). After deposition, some tills are reworked by water" (USGS, 2013b).

precipitation (rain and snow), wind and other weather events, and human-caused interference. Depending on the structural characteristics and chemical compositions of the surface materials, heavy precipitation can cause slope failures[34], subsidence[35], and erosion (Thompson, 2015).

New Mexico was not covered by continental glaciers during the Pleistocene Ice Age. However, alpine glaciers existed at the state's higher elevations, particularly in the Sangre de Cristo Mountains in northern New Mexico and in the Sierra Blanca mountains in south-central New Mexico. Ancient glacial till has also been observed in north-central New Mexico, west of the Rio Grande River (Richmond, 1962). Surficial rocks throughout New Mexico have a wide range of geologic ages and composition, due to the state's past deposition and deformation. In general, geologic units from the Tertiary (66 to 2.6 MYA) and Quaternary (2.6 MYA to present) Periods are not as consolidated as older geologic units from the Precambrian (older than 542 MYA) and Paleozoic (542 to 251 MYA) Eras that are typically well consolidated or crystalline (USGS, 1995a). Figure 10.1.3-2 depicts the main surficial composition of New Mexico.

[34] Slope failure, also referred to as mass wasting, is the downslope movement of rock debris and soil in response to gravitational stresses. (Idaho State University 2000)
[35] Subsidence: "Gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000).

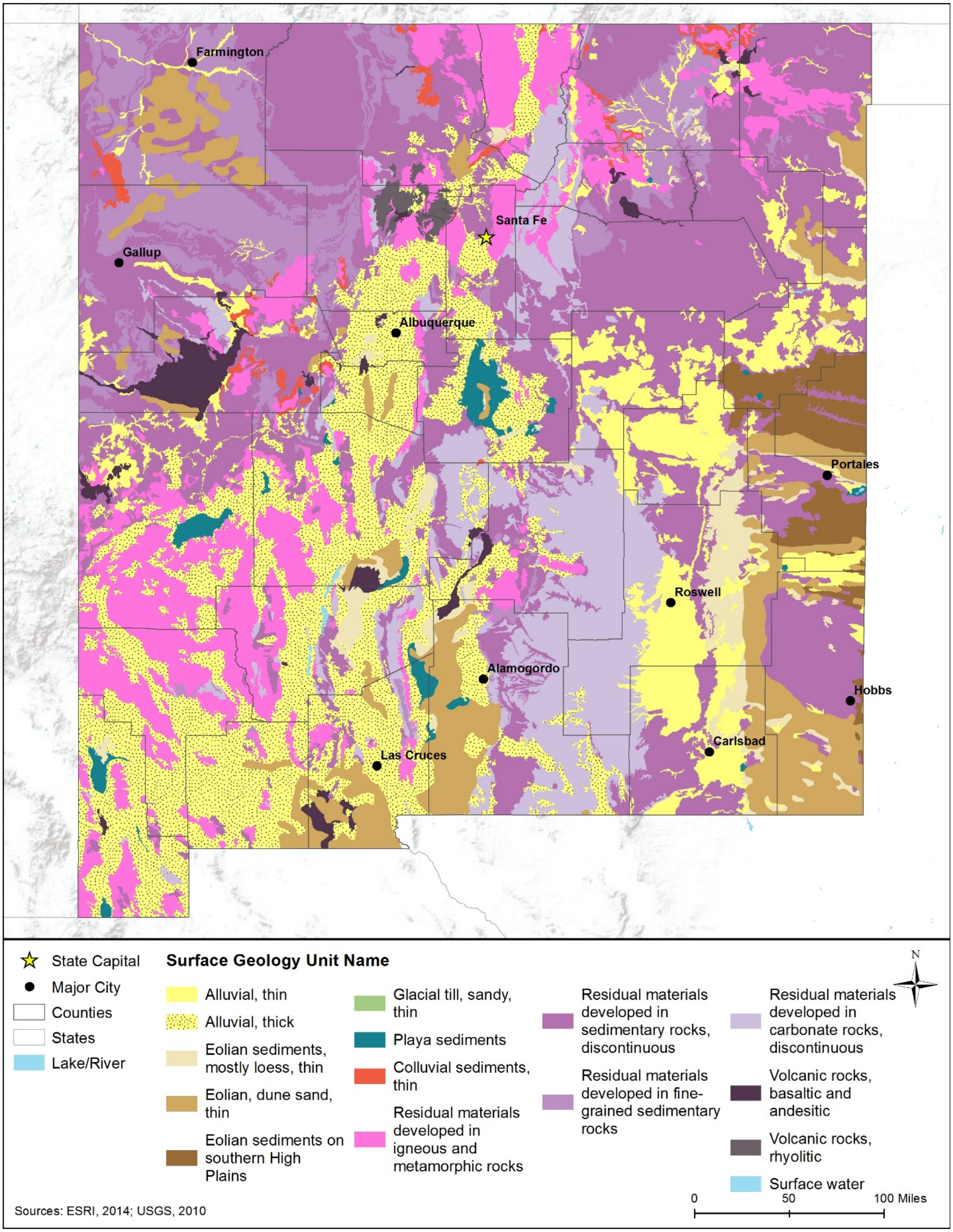

Figure 10.1.3-2: Generalized Surface Geology for New Mexico

10.1.3.5. Bedrock Geology

Bedrock geology analysis, and "the study of distribution, position, shape, and internal structure of rocks" (USGS, 2015e) reveals important information about a region's surface and subsurface characteristics (i.e., three-dimensional geometry), including dip (slope of the formation),[36] rock composition, and regional tectonism[37]. 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).

Most of New Mexico was originally covered by millions of years of sediments that formed layers of rock. While eastern New Mexico is still underlain by this mostly flat and undeformed rock layer, central and western New Mexico bedrock has been extensively deformed from the uplift of the Rocky Mountains. This uplift distorted, faulted, and elevated not only the surface, but also the underlying bedrock. Faulting was widespread, and as uplift occurred, erosion exposed underlying crystalline rock that form many of the main mountain ranges in New Mexico. Tectonic units in New Mexico include both uplifted and subsided structural basins. Subsided structural basins, such as the San Juan structural basin in northeastern New Mexico, formed between surrounding uplifted areas, and generally have undeformed rock sequences. Other smaller basins, formed from block faulting, are underlain with volcanic or sedimentary rock and a thick overlying layer of Tertiary and Quaternary Period sediment. The Rio Grande rift area in central New Mexico has many of these types of basins (USGS, 1995a). Figure 10.1.3-3 shows the general bedrock geology for New Mexico. Additional New Mexico bedrock geology information is available from the USGS, the New Mexico Mining and Minerals Division (http://www.emnrd.state.nm.us/MMD/), and the New Mexico Bureau of Geology and Mineral Resources (https://geoinfo.nmt.edu/).

[36] 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).
[37] Tectonism: "Structure forces affecting the deformation, uplift, and movement of the earth's crust" (NPS, 2000).

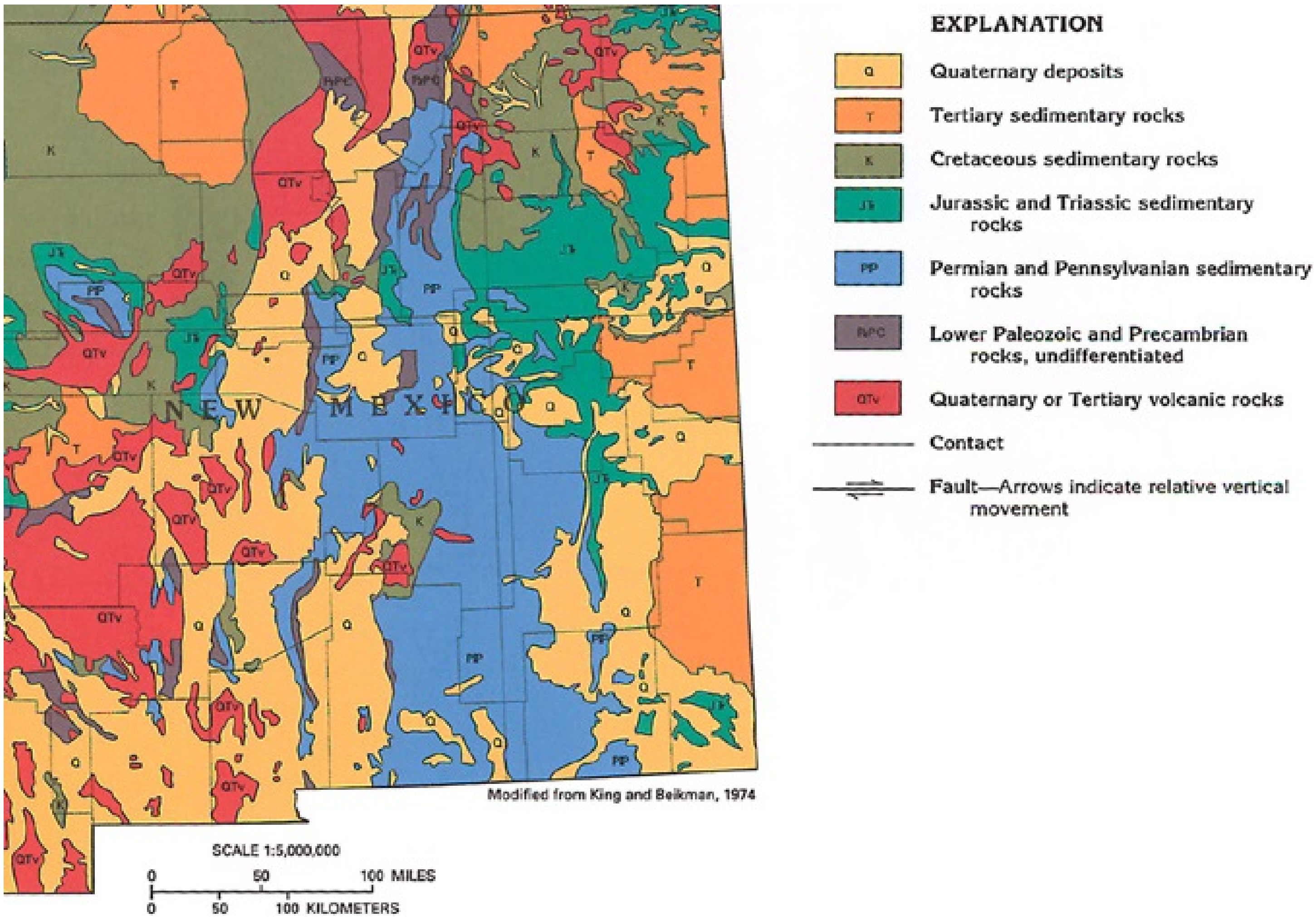

Figure 10.1.3-3: Generalized Bedrock Geology for New Mexico

Source: (USGS, 1995b)

10.1.3.6. Paleontological Resources

New Mexico State Fossil
Coelophysis bauri

Source: (NMLCS, 2015)

The Paleozoic Era (542 to 251 MYA) was dominated by warm, shallow seas in the southern and western portions of New Mexico, with marine fossils including trilobites,[38] brachiopods,[39] and nautiloids recorded. Marine conditions continued through the Silurian (444 to 416 MYA) and Devonian (416 to 359 MYA) Periods, as evidenced by marine fossils such as corals and ammonites. The Carboniferous Period (359 to 299 MYA) has yielded fossils of clams and brachiopod fossils. Broad river floodplains dominated the northern portion of New Mexico in the Permian (299 to 251 MYA) Period, and as climates became dry, dune fields appeared, but were ultimately replaced by shallow marine environments that yielded fossils from brachiopods, clams, and ammonites. The Triassic Period (251 to 200 MYA) was dominated by heavy vegetation in floodplains and large rivers in northwest New Mexico. Fossils recorded from this time period include cycads, ferns, and large amphibians, such as the *Buettnerial* (The Paleontology Portal, 2015). The *Coelophysis bauri*, a theropod dinosaur, is New Mexico's state fossil, and is the only dinosaur found in the Triassic (NMLCS, 2015). Dinosaurs from the Jurassic Period (200 to 146 MYA) have also been recorded, such as the *Seismosaurus* and *Allosaurus*. New Mexico was divided by a seacoast in the Cretaceous (146 to 66 MYA) Period, with the sea to the east and land to the west. Dinosaurs, oysters, other mollusks, and ammonites were recorded during this period. The Cenozoic Era (66 MYA to present) began with a mountain-building event called the Laramide Orogeny, followed by volcanic and tectonic activity. Fossils of mammals, such as the four-tusked elephant, *Gomphotherium,* a hippopotamus-like mammal, *Coryphodon*, and a garfish, *Atractosteus,* have been recorded from Tertiary Period (approximately 66 to 2.6 MYA) rocks. Alpine glaciers existed from the north to south-central portions of New Mexico during the Quaternary Period (2.6 MYA to present), and terrestrial mammals, such as mammoths and camels have been recorded (The Paleontology Portal, 2015).

10.1.3.7. Fossil Fuel and Mineral Resources

Oil and Gas

In 2013, New Mexico produced 101,451 thousand barrels of oil. In August 2015, the state produced 13,004 thousand barrels. This level of production accounted for 4.5 percent of the country's total production and ranked 4th nationwide. The Permian Basin in southeast New

[38] 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)
[39] 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)

Mexico contains three of the biggest oil fields in the country, and the San Juan Basin in northwest New Mexico also has oil production (EIA, 2014a).

In 2014, New Mexico produced 1,180,808 million cubic feet of natural gas, which ranked seventh nationwide. "Coalbed methane continues to account for nearly three-tenths of New Mexico's natural gas production, and the state, with one-fifth of the national total, is second only to Colorado in proved coalbed methane reserves" (EIA, 2014a). The San Juan Basin is one of the largest natural gas reserves in the country, and the Permian Basin and shale[40] gas reserves also produce natural gas in New Mexico (EIA, 2014a).

Minerals

As of 2015, New Mexico nonfuel mineral production value was $1.76B, which ranked 15th nationwide (in terms of dollar value). This level of production accounted for 1.7 percent of the total production value nationwide. As of 2015, New Mexico's leading nonfuel minerals were copper, potash, construction sand and gravel, crushed stone, and salt. Other minerals produced in the state include cement, common clay and shale, dimension stone,[41] gemstones, gypsum, mica, molybdenum, pumice, sulfur, vermiculite, helium, and volcanic cinder (USGS, 2015f).

As of 2013, New Mexico produced 21,969 thousand short tons of coal, which accounted for 2.2 percent of the nation's total production. New Mexico ranks 12th among coal producing states nationwide. New Mexico has four active coalmines in the San Juan Basin, one underground mine, and three surface mines (EIA, 2014a).

10.1.3.8. Geologic Hazards

The three major geologic hazards of concern in New Mexico are earthquakes, landslides, and subsidence. Volcanoes were considered but not analyzed further for New Mexico because they do not occur in New Mexico and therefore do not present a hazard to the state (USGS, 2015g). "The 2013 State [Hazard Mitigation] Plan states that there are no estimates of future occurrence of volcanic activity in New Mexico in the near future" (City of Albuquerque, 2014). A discussion of each geologic hazard is included below.

Earthquakes

While New Mexico is not subject to frequent significant (greater than magnitude 6.0 on the Richter scale[42]) earthquakes, portions of the state are susceptible to moderate (greater than 4.5) earthquakes. Areas of greatest seismicity in New Mexico are concentrated in the central and north-central portions of the state. Between 1869 and 1998, there were 18 earthquakes of a magnitude 4.5 (on the Richter scale) or greater in New Mexico (New Mexico Bureau of Geology and Mineral Resources, 2015a). Earthquakes are the result of large masses of rock moving

[40] Shale: "Sedimentary rock derived from mud. Commonly finely laminated (bedded). Particles in shale are commonly clay minerals mixed with tiny grains of quartz eroded from pre-existing rocks" (USGS, 2015d).

[41] Dimension stone: "Natural rock material quarried for the purpose of obtaining blocks or slabs that meet specifications as to size (width, length, and thickness) and shape" (USGS, 2016b).

[42] 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).

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, typically occur at depths of 6 to 12 miles; these earthquakes typically do not reach magnitudes higher than 6.0 on the Richter scale. Subduction zone earthquakes 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. Convergence boundaries between two tectonic plates can result in earthquakes with magnitudes that exceed 8.0 on the Richter scale (Oregon Department of Geology, 2015).

Figure 10.1.3-4 depicts the seismic risk throughout New Mexico. Central New Mexico along the Rio Grande River valley has the greatest risk for seismic activity (City of Albuquerque, 2014). The map indicates levels of horizontal shaking (measured in Peak Ground Acceleration (PGA)) that have a 2 percent chance of being exceeded in a 50-year period. Units on the map are measured in terms of acceleration due to gravity (% g). Most pre-1965 buildings are likely to experience damage with exceedances of 10% g. Post-1985 buildings (in California) have experienced only minor damage with shaking of 60% g. (USGS, 2010)

While geologic evidence suggests that earthquakes as large as magnitude 7.5 may have occurred in New Mexico in ancient times, the largest recorded earthquake in New Mexico occurred in 1906 in Socorro. The earthquake measured 6.5 on the Richter scale (New Mexico Bureau of Geology and Mineral Resources, 2015b) and was felt throughout New Mexico and portions of Arizona and Texas (USGS, 2014g).

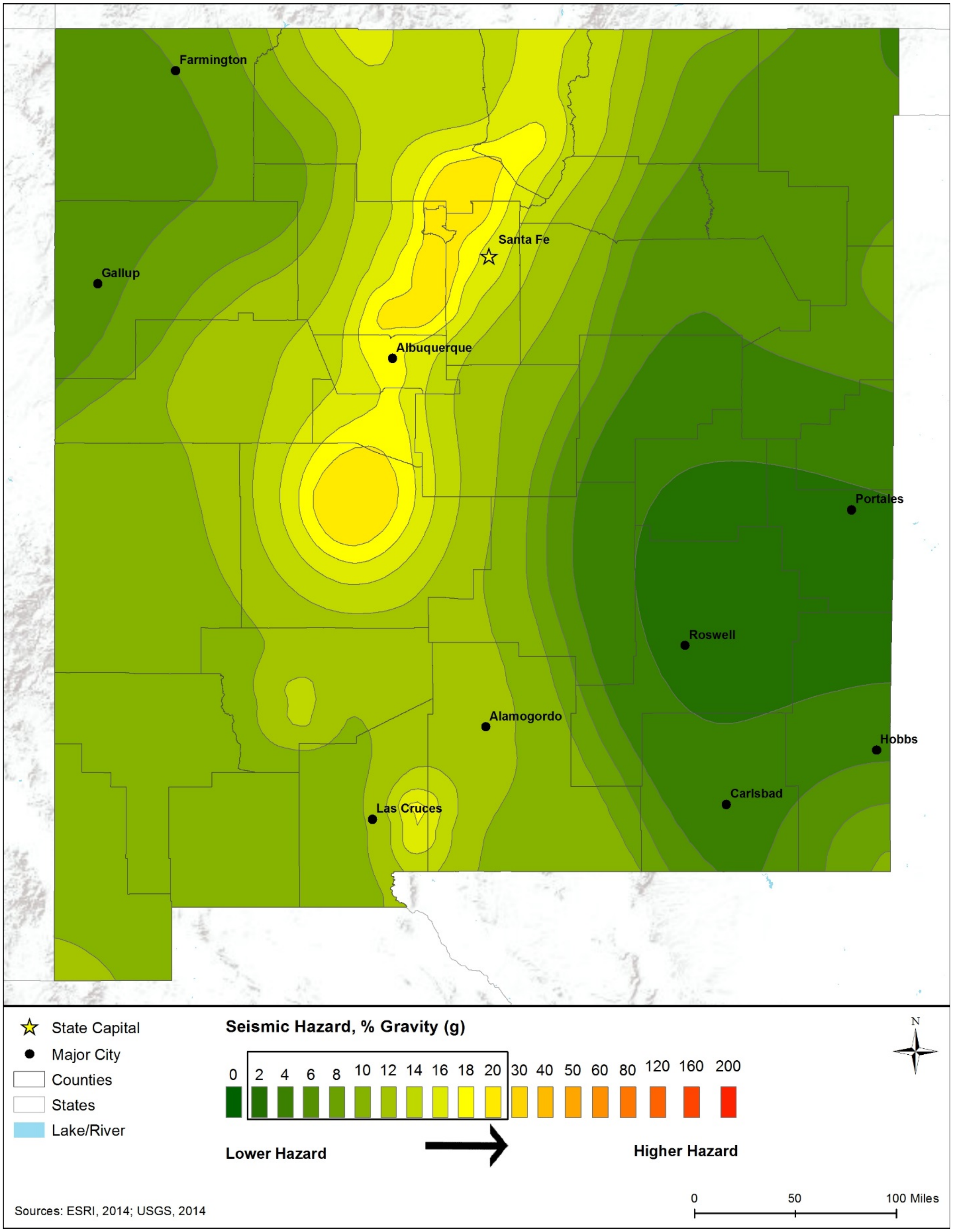

Figure 10.1.3-4: New Mexico 2014 Seismic Hazard Map

Landslides

"Slope instability is not currently a significant geologic hazard in most parts of New Mexico although landslides, debris flows, and rockfalls are a persistent problem along some mountain highways" (Haneberg, 1992). "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, 2003). Geologists use the term "mass movement" to describe a great variety of processes such as rock fall, creep, slump, mudflow, earth flow, debris flow, and debris avalanche regardless of the time scale (USGS, 2003).

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

Landslide susceptibility in New Mexico is greatest in northern portions of the state (Figure 10.1.3-5) that have slopes greater than ten degrees. Heavy rainfall events can trigger dormant landslides. For example, in September 1991, a 200 by 200 meter siltstone landmass in De Baca County (in east-central New Mexico) was displaced by 3 to 4 meters following heavy summer rains (Haneberg, 1992). Heavy rains in the Basin and Range Province can also trigger debris flow[43] landslides, especially at higher elevations. Road building in mountainous areas can increase the probability of landslides in those areas (Radbruch-Hall, et al., 1982). Figure 10.1.3-5 shows landslide incidence and susceptibility throughout New Mexico.

"Failures are [often] concentrated in cut and fill slopes along the right of way" (Haneberg, 1992). One area that has been particularly problematic for landslides due to road construction is Brazos Pass in Rio Arriba County in the north-central portion of the state. The underlying geology of the area, which includes the Cretaceous (151 to 66 MYA) Mancos Shale and Pleistocene (2.6 MYA to 11,700 years ago) glacial deposits, is a significant contributing factor to the volume of landslides in this area. During the construction of U.S. Highway 64 through the Brazos Mountains, "cut-slope failures began soon after completion of [the] project in 1966[,] and continued [into the 1970s]. Only a few cuts remained unaffected" (Bennett, 1974).

[43] Debris Flow "A type of landslide made up of a mixture of water-saturated rock debris and soil with a consistency similar to wet cement. Debris flows move rapidly downslope under the influence of gravity. Sometimes referred to as earth flows or mud flows." (USGS, 2015d)

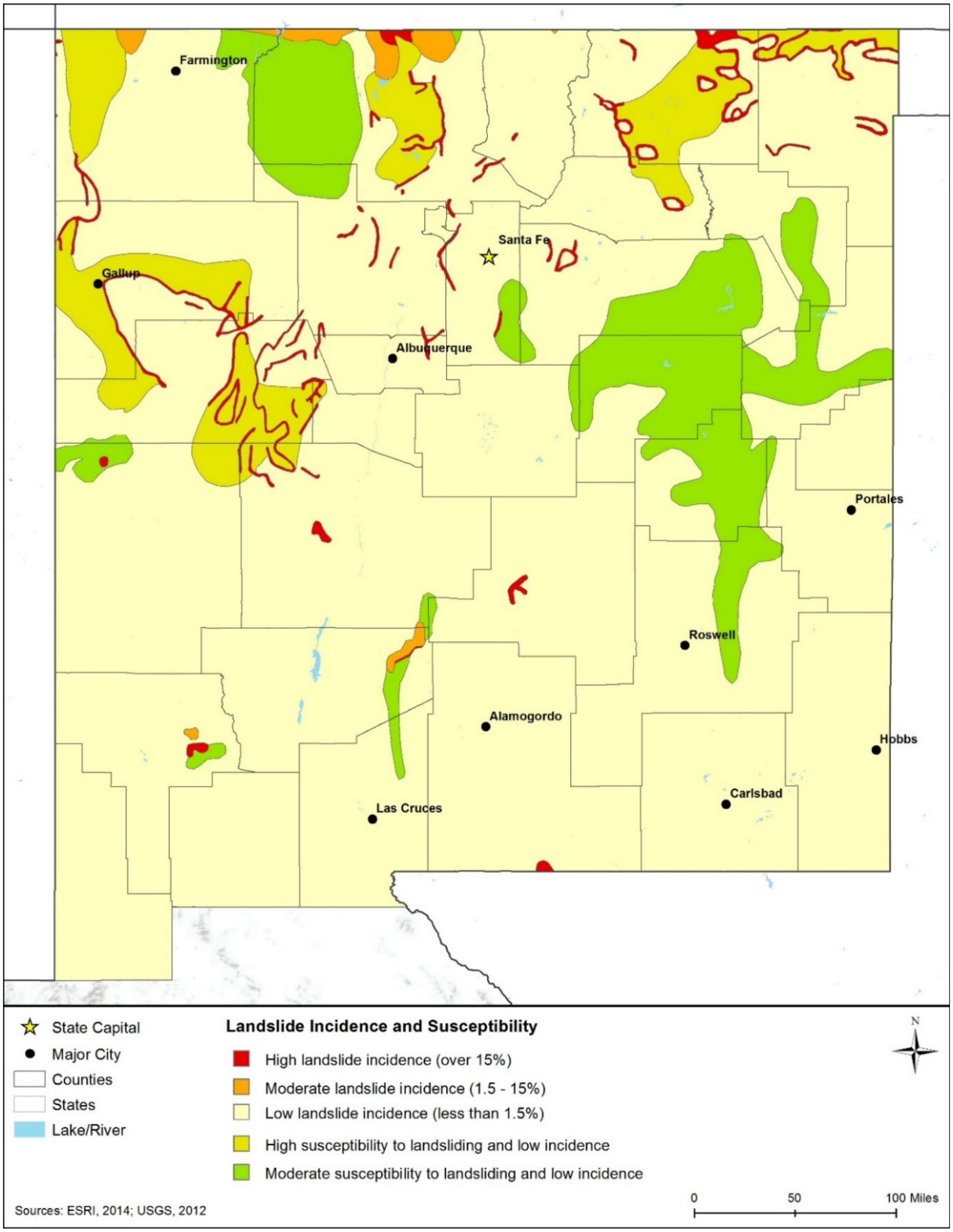

Figure 10.1.3-5: New Mexico Landslide Incidence and Susceptibility Hazard Map[44]

[44] Susceptibility hazards not indicated in Figure 10.1.3-5 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, 2014h)

Subsidence

Land subsidence is a "gradual settling or sudden sinking of the Earth's surface owing to subsurface movement of earth materials" (USGS, 2000). Extensive land subsidence has been observed in New Mexico due to collapsible soils (Love, 2015) and karst[45] topography (Figure 10.1.3-6). 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 United States 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. Lowered terrain is more susceptible to inundation during high tides. Additionally, land subsidence can affect vegetation and land use (USGS, 2013c). One cause of land subsidence in New Mexico is collapsible soils. "Collapsible soils are soils that compact and collapse after they get wet. The soil particles are originally loosely packed and barely touch each other before moisture soaks into the ground. As water is added to the soil in quantity and moves downward, the water wets the contacts between soil particles and allows them to slip past each other to become more tightly packed." Collapsible soils are common in areas that are underlain by clay and where unconsolidated eroded sediments have collected at the bases of foothills and within adjacent valleys. Within New Mexico, the effects of collapsible soils have been observed in Las Cruces (south-central New Mexico), Alamogordo (south-central New Mexico), and Socorro (west-central New Mexico) (Love, 2015).

In New Mexico, a significant cause of land subsidence is the formation of caves and sinkholes due to karst topography. Karst topography is particularly common in southeastern portions of New Mexico, including the Roswell Basin, that are underlain by carbonate[46] sedimentary rocks (USGS, 1995a). Carlsbad Caverns, within the Guadalupe Mountains, is an example of a significant karst feature in New Mexico. The Caverns' longest cave measures more than 135 miles in length (NPS, 2015a). Sinkholes have been observed in other parts of southeastern New Mexico due to the dissolution of evaporate[47] rocks (Powers, 2000). Figure 10.1.3-6 shows the location of areas in New Mexico that are susceptible to land subsidence due to karst topography.

[45] Karst Topography: "A distinctive landscape (topography) that can develop where the underlying bedrock, often limestone or marble, is partially dissolved by surface or ground water" (USGS, 2015d).
[46] Carbonate: "A sedimentary rock made mainly of calcium carbonate ($CaCO3$). Limestone and dolomite are common carbonate sedimentary rock" (USGS, 2015d).
[47] Evaporite: "A mineral precipitated as a result of evaporation, such as halite" (USGS, 2005).

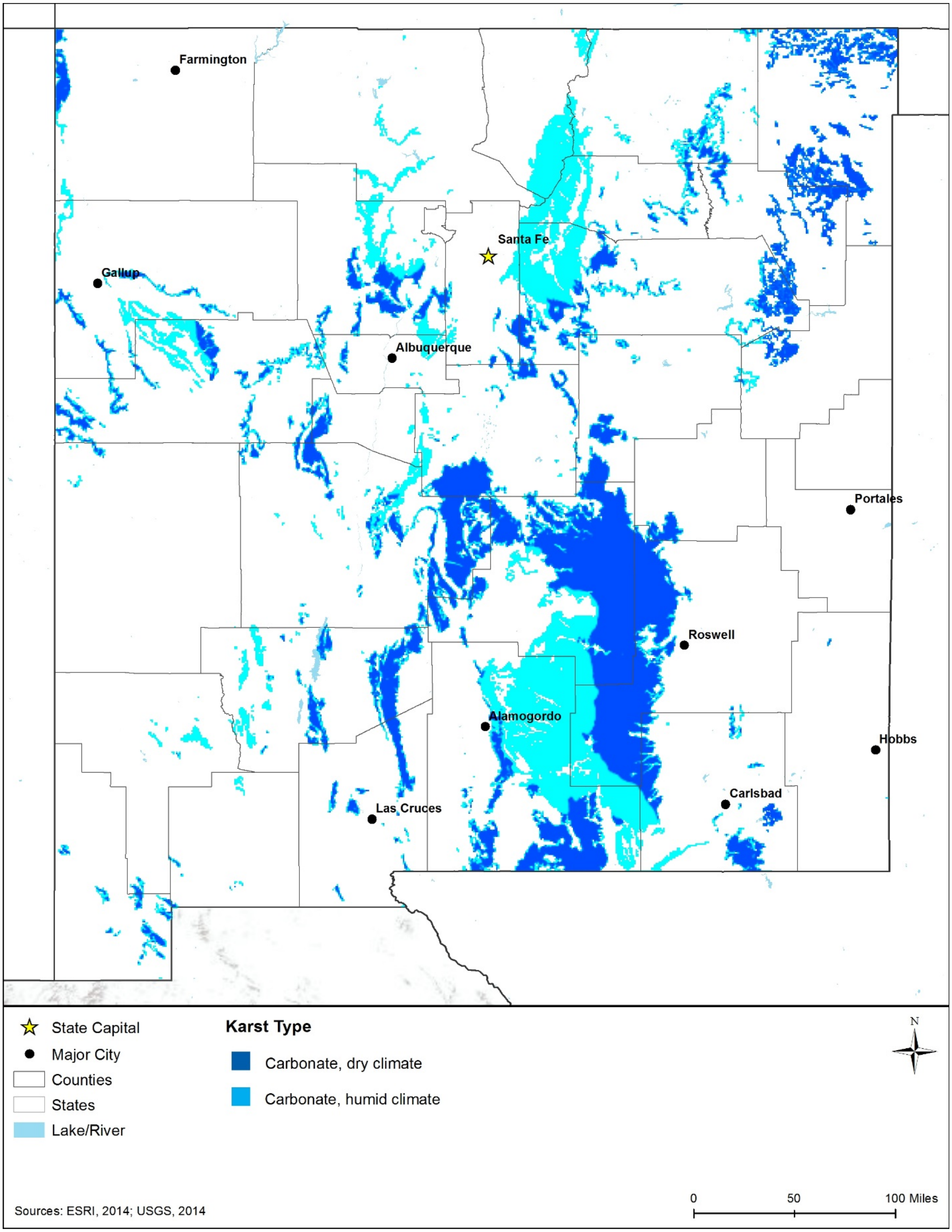

Figure 10.1.3-6: Areas Susceptible to Subsidence due to Karst Topography in New Mexico

10.1.4. Water Resources

10.1.4.1. 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 10.1.5). 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, 2014i)

10.1.4.2. Specific Regulatory Considerations

Federal laws relevant to protecting the quality and use of water resources are summarized in Appendix C, Environmental Laws and Regulations, and Section 1.8, Overview of Relevant Federal Laws and Executive Orders. Table 10.1.4-1 summarizes the major New Mexico laws and permitting requirements relevant to the state's water resources.

Table 10.1.4-1: Relevant New Mexico Water Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
CWA Section 401 Water Quality Certification	NMED	In accordance with Section 401 of the CWA, activities that may result in a discharge to waters of the U.S. require a WQC from NMED indicating that the proposed activity will not violate water quality standards.
CWA Section 401 Water Quality Certification	Tribes	"WQCs for NWPs on tribal lands are issued by the tribes where the tribes have water quality certifying authority. On tribal lands where the tribes do not have water quality certifying authority, the EPA has issued WQC."
CWA Section 404 Nationwide Permits (NWPs), New Mexico regional requirements	U.S. Army Corps of Engineers (USACE) Albuquerque District	Regional conditions apply to any activities within Outstanding National Resource Waters[a] authorized by USACE NWPs, and General Conditions 25 (Water Quality) and 27 (Regional and Case-by-Case Conditions).
19.26.2 Natural Resources and Wildlife Surface Water Administration	New Mexico Office of the State Engineer (NMOSE)	"The administration of all natural waters flowing in streams and watercourses, and supplemental groundwater, within the limits of the state of New Mexico" (NMOSE, 2005).

[a] Outstanding National Resource Waters include all surface waters within the Valle Vidal; and perennial streams and rivers, lakes, and wetlands within USFS Wilderness Areas (NMED, 2015k).

State Law/Regulation	Regulatory Agency	Applicability
19.27.1 Natural Resources and Wildlife Underground Water General Provisions	NMOSE	"For the purpose of carrying out the provisions of the statutes governing underground waters and describing the present extent of all declared underground water basins in New Mexico" (NMOSE, 2001).

10.1.4.3. Environmental Setting: Surface Water

Surface water resources are lakes, ponds, rivers, and streams. According to the NMED, New Mexico has more than 108,649 miles of rivers and streams and nearly 196 lakes, ponds, and reservoirs. These surface waters supply drinking water; provide flood control and aquatic habitat; and support recreation, tourism, agriculture, fishing, power generation, and manufacturing across the state. (NMED, 2014a)

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). New Mexico's waters (lakes, rivers, and streams) are divided into 8 major watersheds, or drainage basins: Upper Colorado, Canadian, Gila, Mimbres, Pecos, Rio Grande, San Juan, Tularosa, and Zuni (Figure 10.1.4-1). Information and additional maps about each New Mexico's watershed locations, sizes, and water quality are available at this website: http://fws-case-12.nmsu.edu/cwcs/PNG_Files/Watershed_Map.png. (NMDGF, 2006)

The Canadian Watershed encompasses about one-sixth the land area of the state or about 1.1 million acres. Canadian River tributaries flow east and southeast from their origins on the east slopes of the Sangre de Cristo cordillera of northern New Mexico and southern Colorado. The Gila Watershed includes two major streams, the Gila and San Francisco Rivers. The Pecos Watershed encompasses 1.6 million acres in New Mexico and includes large reservoirs, spring/seep/marsh/cienega wetlands, and perennial streams of many sizes. The Rio Grande Watershed is approximately 1.9 million acres in New Mexico. There are a number of streams that drain into the Rio Grande. The Tularosa Watershed covers approximately 3.2 million acres in south central New Mexico in the northern Chihuahuan Desert. It is a closed basin with no inlet or outlet, so all of the water in the watershed remains within the basin. The Zuni River drains 840,155 acres as it flows from its headwaters in west central New Mexico to the Little Colorado River in Arizona. (NMDGF, 2006)

Freshwater

As shown in Figure 10.1.4-1, there are eight major rivers in New Mexico: Rio Grande, Pecos, San Francisco, San Juan, Cimarron, Canadian, Vermejo, and Gila Rivers. The Gila River is the only undammed major river in New Mexico. The Rio Grande originates in the San Juan Mountains of southern Colorado and flows south 470 miles through the entire length of New Mexico. The main stem of the Rio Grande and its major tributaries have been dammed to form five irrigation reservoirs. These include Heron, El Vado, Abiquiu, Bluewater, and Elephant Butte and three flood control lakes Cochiti, Jemez Canyon, and Caballo. The San Juan River originates in the San Juan Mountains of southwestern Colorado. It enters New Mexico in the northeastern part of the state, flows 93 miles, and exits near the Four Corners region. (NMDGF, 2006)

Some of the state's large lakes and dammed reservoirs provide flood control, hydropower[48] generation, and drinking water sources (USEPA, 2009). There are 196 publically-owned lakes, reservoirs, and playas that cover approximately 108,900 acres. These waterbodies consist of large main stem reservoirs, high-altitude natural lakes, and small fishing impoundments ranging in size from less than one acre up to 40,000 acres (NMED, 2014a). The three main lakes/reservoirs include Elephant Butte Reservoir, Conchas Lake, and Navajo Reservoir. (NMDGF, 2006)

10.1.4.4. Sensitive or Protected Waterbodies

Wild and Scenic Rivers

New Mexico has 124.3 miles of rivers federally designated as National Wild and Scenic Rivers on the Jemez (East Fork), Pecos, Rio Chama, and Rio Grande Rivers (National Wild and Scenic Rivers System, 2015a).

- The east fork of the Jemez River has a total of 11.0 designated miles: 4.0 Wild, 5.0 Scenic, and 2.0 Recreational (National Wild and Scenic Rivers System, 2015b);
- The Pecos River has a total of 20.5 designated miles: 13.5 Wild and 7.0 Recreational (National Wild and Scenic Rivers System, 2015c);
- The Rio Chama has a total of 24.6 designated miles: 21.6 Wild and 3.0 Scenic (National Wild and Scenic Rivers System, 2015d); and
- The Rio Grande has a total of 68.2 designated miles: 54.9 Wild, 12.5 Scenic, and 0.8 Recreational (National Wild and Scenic Rivers System, 2015e).

The New Mexico also designated 30 miles of the Rio Chama as a state "Scenic and Pastoral River" (BLM, New Mexico State Office, 1986).

Outstanding Natural Resource Waters

New Mexico's Water Quality Standards establish designated uses for waterbodies, set criteria to protect those uses, and establish provisions to preserve water quality. Outstanding Natural Resource Waters (ONRWs) receive additional protection aimed at preserving water quality. Degradation of water quality is not allowed in ONRWs except under very limited circumstances. Where water quality meets or exceeds standards, that higher water quality must be protected. (NMED, 2015l)

[48] Hydropower: "electrical energy produced by falling or flowing water" (USEPA, 2004).

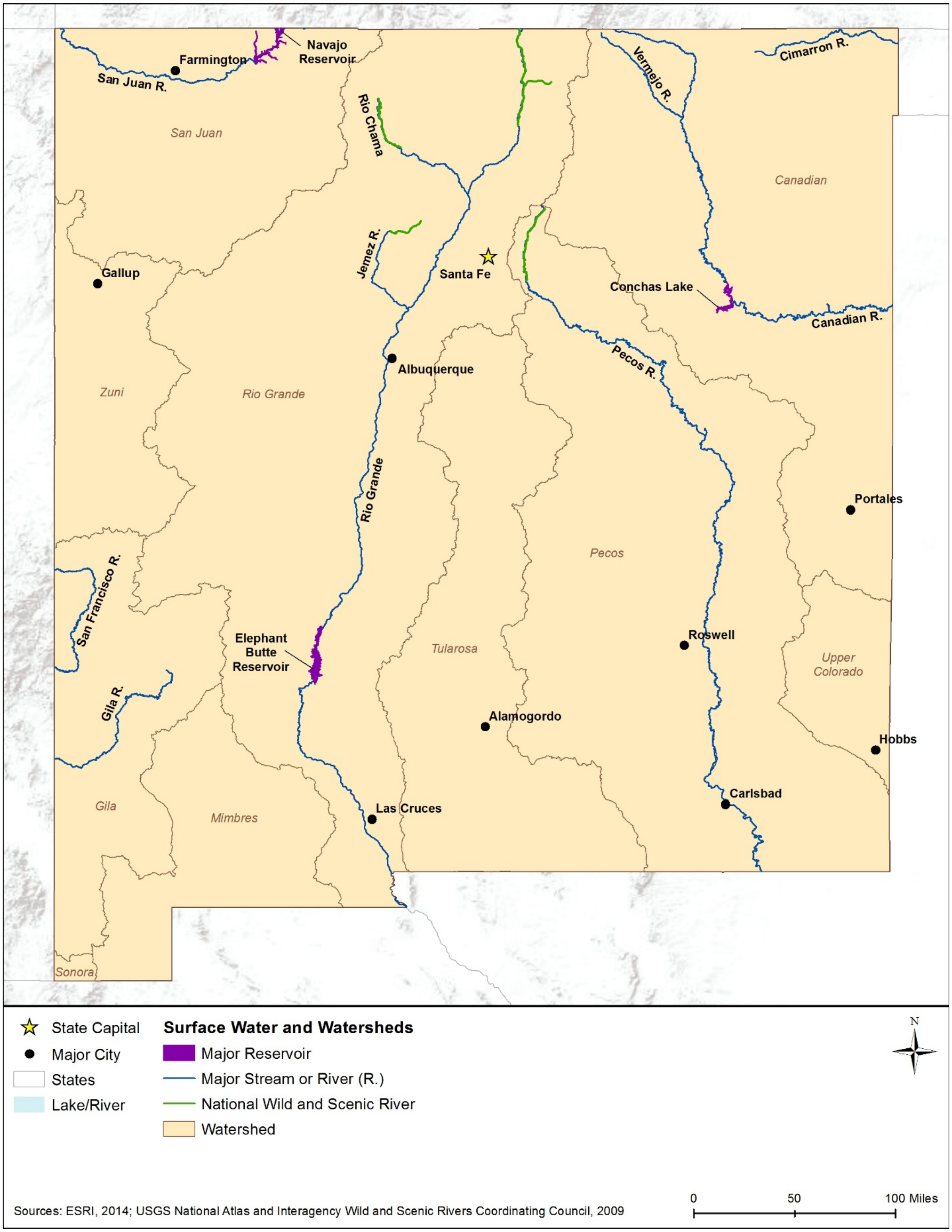

Figure 10.1.4-1: Major New Mexico Watersheds and Surface Waterbodies

ONRWs in New Mexico include:

- All surface waters within the U.S. Forest Service (USFS) Valle Vidal Special Management Unit;
- Approximately 700 miles of 192 perennial streams, 29 lakes and approximately 6,000 acres of wetlands in USFS Wilderness Areas; and
- The Rio Santa Barbara, including its west, middle and east forks.

For a list of all ONRWs, visit https://www.env.nm.gov/swqb/documents/swqbdocs/Standards/ONRW/ONRW_List-Table.pdf. (NMED, 2015l)

10.1.4.5. Impaired Waterbodies

Several elements, including temperature, dissolved oxygen, suspended sediment, nutrients, metals, oils, observations of aquatic wildlife communities, and sampling of fish tissue, are used to evaluate water quality. Under Section 303(d) of the Clean Water Act, states are required to assess water quality and report a listing of impaired waters,[49] the causes of impairment, and probable sources. Table 10.1.4-2 summarizes the water quality of New Mexico's assessed major waterbodies by category, percent impaired, designated use,[50] cause, and probable sources. Figure 10.1.4-2 shows the Section 303(d) waters in New Mexico as of 2014.

As shown in Table 10.1.4-2, various sources affect New Mexico's waterbodies, causing impairments. Over 90 percent of the state's assessed lakes, reservoirs, and ponds are impaired due to various contaminants, such as mercury and polychlorinated biphenyls (USEPA, 2015d). Elevated concentrations of these contaminants have resulted in fish consumption advisories for various lakes and reservoirs, such as the Conchas Lake (NMED, 2014b). Approximately 65 percent of New Mexico's rivers and streams are impaired. Designated uses include aquatic life, domestic water supply, irrigation, livestock watering, recreating, and wildlife habitat. NMED has found that temperature, nutrients, pathogens are the three most common causes of water quality impairments in New Mexico's rivers and streams (USEPA, 2015d).

According to the New Mexico 2014-2016 Integrated Report, most of the state's rivers and streams and publically-owned lake, reservoir, or playa acres do not fully support designated uses. Temperature, nutrient/eutrophication,[51] and *E. coli* are the three most common causes of river and stream water quality impairments in New Mexico, mostly due to nonpoint sources (e.g., rangeland grazing, onsite treatment systems, and loss of riparian habitat). Mercury in fish tissue, polychlorinated biphenyls in fish tissue, and temperature are the three most common causes of water quality impairments in lakes and reservoirs. (NMED, 2014a)

[49] 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, 2015e).
[50] 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, 2015e).
[51] Eutrophication: the process where a body of water acquires a high concentration of nutrients, especially phosphates and nitrates, which can lead to excessive growth of algae (USGS, 2014j).

Table 10.1.4-2: Section 303(d) Impaired Waters of New Mexico, 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	6%	66%	aquatic life, domestic water supply, irrigation, livestock watering, recreation, and wildlife habitat	temperature, pathogens,[c] nutrients, turbidity, dissolved oxygen, and sediment	agriculture, municipal discharges/sewage, habitat alterations, wildlife, and hydromodification[d]
Lakes, Reservoirs, and Ponds	7%	91%	aquatic life, domestic water supply, irrigation, irrigation storage, livestock watering, recreation, and wildlife habitat	mercury, temperature, polychlorinated biphenyls, nutrients, metals, dissolved oxygen, and acidity	unknown

[a] Some waters may be considered for more than one water type.
[b] New Mexico has not assessed all waterbodies within the state.
[c] Pathogen: a bacterium, virus, or other microorganism that can cause disease (USEPA, 2015e).
[d] Hydrologic modifications are “activities that disturb natural flow patterns of surface water and groundwater,” (e.g., construction, dams and impoundments, channelization, dredging, and land reclamation activities) (USEPA, 1975).
Source: (USEPA, 2015d)

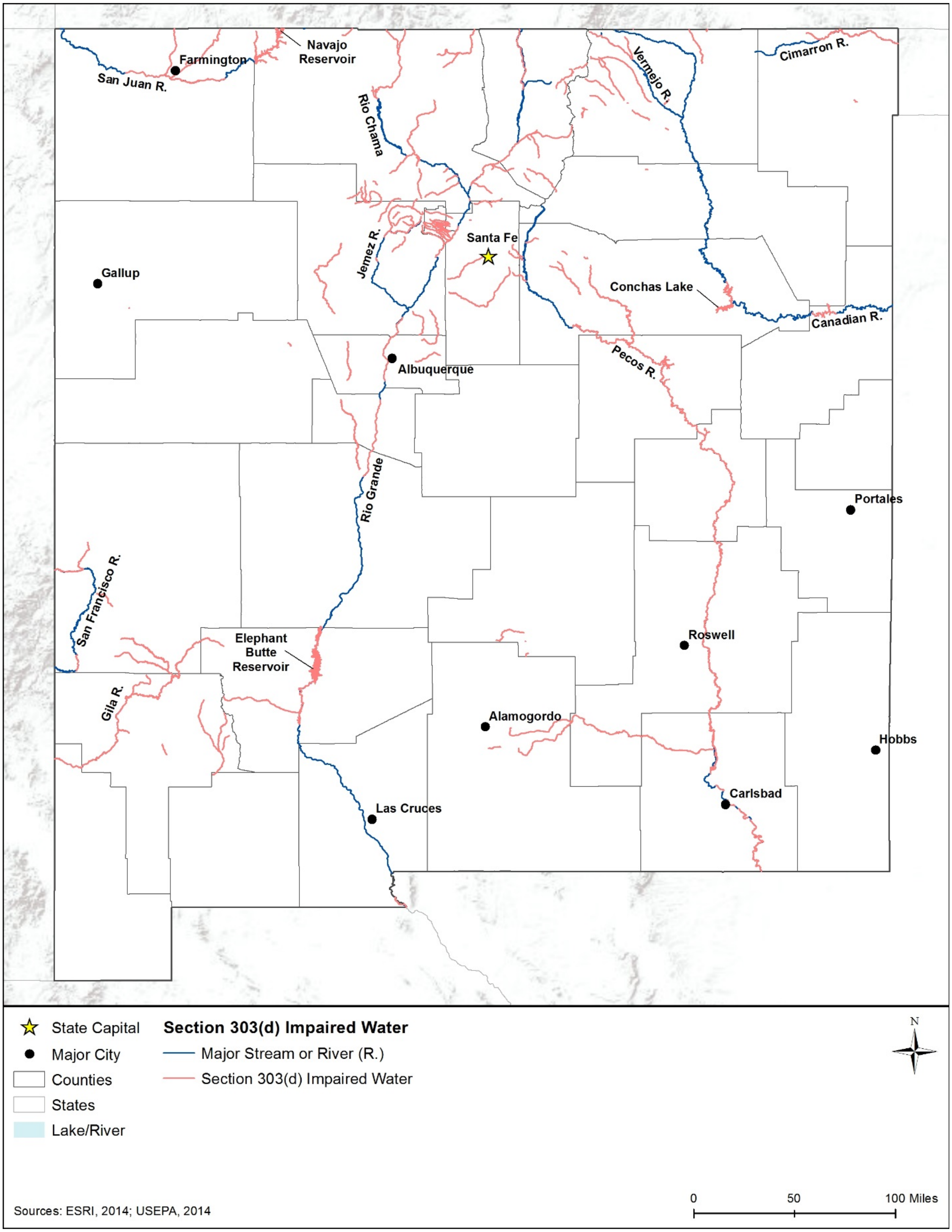

Figure 10.1.4-2: Section 303(d) Impaired Waters of New Mexico, 2014

10.1.4.6. 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).[52] Through FEMA's flood hazard mapping program, the agency identifies flood hazards and risks associated with the 100-year flood, which is defined as "a flood that has a 1 percent chance of occurring in any given year," to allow communities to prepare and protect against flood events (FEMA, 2013).

Floodplains provide suitable and sometimes unique habitat for a wide variety of plants and animals, and are typically more biologically diverse than upland areas due to the combination of both terrestrial and aquatic ecosystems. Vegetation along stream banks provides shade, which helps to regulate water temperature for aquatic species. During flood events, sediment and debris settle out and collect on the floodplain, enriching the soil with additional nutrients. Pollutants from floodwater runoff are also filtered by floodplain vegetation and soils; thereby improving water quality. Furthermore, floodplains protect natural and built infrastructure by providing floodwater storage, erosion control, water quality maintenance, and groundwater recharge. Historically, floodplains have been favorable locations for agriculture, aquaculture, and forest production due to the relatively flat topography and nearby water supply. Floodplains can also offer recreational activities, such as boating, swimming, and fishing, as well as hiking and camping (FEMA, 2014a).

The primary type of flooding in New Mexico are riverine floodplains, occurring along rivers, streams, or lakes where overbank flooding may occur, inundating adjacent land areas. In mountainous areas, floodwaters can build and recede quickly, with fast moving and deep water. Flooding in these areas can cause greater damage than typical riverine flooding due to the high velocity of water flow, the amount of debris carried, and the broad area affected by floodwaters. 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, 2015). There are several causes of flooding in New Mexico, often resulting in loss of life and damage to property, infrastructure, agriculture, and the environment. These include severe rain events, ice jams, rapid snowmelt, over-development/impervious[53] surfaces, and dam failure. Although some areas, such as floodplains, are more prone to flooding than others, no area in the state is exempt from flood hazards. Based on historical flooding from 2006-2012, New Mexico reported a total of 310 flood/flash flood events with nearly 50 million in property and crop damage. (NMDHSEM, 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 103 communities in New

[52] To search for and locate CFR records, see the Electronic Code of Federal Regulations (e-CFR): www.ecfr.gov.
[53] 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, 2015e).

Mexico through the National Flood Insurance Program (NFIP) (FEMA, 2014c). Established to reduce the economic and social cost of flood damage, the NFIP encourages communities "to adopt and enforce floodplain management regulations and to implement broader floodplain management programs" and allows property owners in participating communities to purchase insurance protection against losses from flooding (FEMA, 2015). As an incentive, communities can voluntarily participate in the NFIP Community Rating System (CRS), which is a program that rewards communities by reducing flood insurance premiums in exchange for doing more than the minimum NFIP requirements for floodplain management. As of May 2014, New Mexico had 11 communities participating in the CRS (FEMA, 2014d).[54]

10.1.4.7. 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.

New Mexico's principal aquifers consist of carbonate-rock[55] and sandstone aquifers,[56] sand and gravel aquifers of alluvial and glacial origin,[57] and unconsolidated coastal-plain aquifers. Approximately 78 percent of New Mexican residents depend on groundwater for drinking water. Groundwater makes up nearly 50 percent of the total water annually withdrawn for all uses in New Mexico, including agriculture and industry, and is the only practicable source of water in many areas of the state. Generally, the water quality of New Mexico's aquifers is suitable for drinking and daily water needs. Statewide, the most serious threats to groundwater quality include leaking household septic tanks or cesspools, publicly- and privately-owned sewage treatment plants, dairy lagoons, mines, food processing operations, industrial discharges, landfills, and spills or leaks. (NMED, 2014a)

Table 10.1.4-3 provides details on aquifer characteristics in the state, and Figure 10.1.4-3 shows New Mexico's principal and sole source aquifers.

[54] A list of the 11 CRS communities can be found in the most recent FEMA CRS report dated May 1, 2014 (FEMA, 2014e) and additional program information is available from FEMA's NFIP CRS website (www.fema.gov/national-flood-insurance-program-community-rating-system).

[55] 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).

[56] 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).

[57] 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 10.1.4-3: Description of New Mexico's Principal Aquifers

Aquifer Type and Name	Location in State	Groundwater Quality
Basin and Range basin-fill aquifers Coarse sediments with sandstone, limestone, or unconsolidated sand and gravel	Southwest corner of the state along the border with Arizona	These are the most productive and widespread aquifers in New Mexico. Water is suitable for most uses with low levels of dissolved concentrations.
Colorado Plateaus aquifers Sandstone	Northwest corner of the state	Generally, water is suitable for most purposes. Primary use is for rural domestic supplies or livestock watering.
High Plains aquifer Unconsolidated or partly consolidated gravel, sand, silt, or clay	Eastern part of the state, along the border with Texas	Principal source of water for agricultural use. Contains low levels of dissolved solid concentrations making it useful for irrigation.
Pecos River Basin alluvial aquifer clay, silt, sand, gravel	Southeast corner of the state	Water is generally hard and unsuitable for most uses due to higher levels of salinity compared to other aquifers. Contains higher levels of dissolved solids as well. Water use is limited to isolated rural areas.
Rio Grande aquifer system Unconsolidated to moderately consolidated deposits of gravel, sand, and clay	Stretches from the border with Colorado through the center part of the state, curving to the southwest corner to the border with Mexico	Water in the aquifer varies significantly from chemical composition to level of dissolved solids. Generally, the water contains calcium bicarbonates or calcium sulfates. Primary use is for public supply.
Roswell Basin aquifer system Carbonate (limestone)	Southeast corner of the state, around Roswell and stretching south	The water is very hard. Salinity varies widely and while sodium concentrations are small, sulfate concentrations are considered high. Primary water uses are for domestic, community, livestock, irrigation, and industrial supplies.

Source: (Moody, Carr, Chase, & Paulson, 1986) (Robson & Bansta, 1995) (NMED, 2014a)

Sole Source Aquifers

The USEPA defines sole source aquifers (SSAs) as "an aquifer that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer" and are areas with no other drinking water sources (USEPA, 2015f). New Mexico has one designated SSA within the state, Espanola Basin SSA, in the northern part of the state (as shown in Figure 10.1.4-3). Designating a groundwater resource as an SSA helps to protect the drinking water supply in that area and requires reviews for all federally funded proposed projects to ensure that the water source is not jeopardized (USEPA, 2015f).

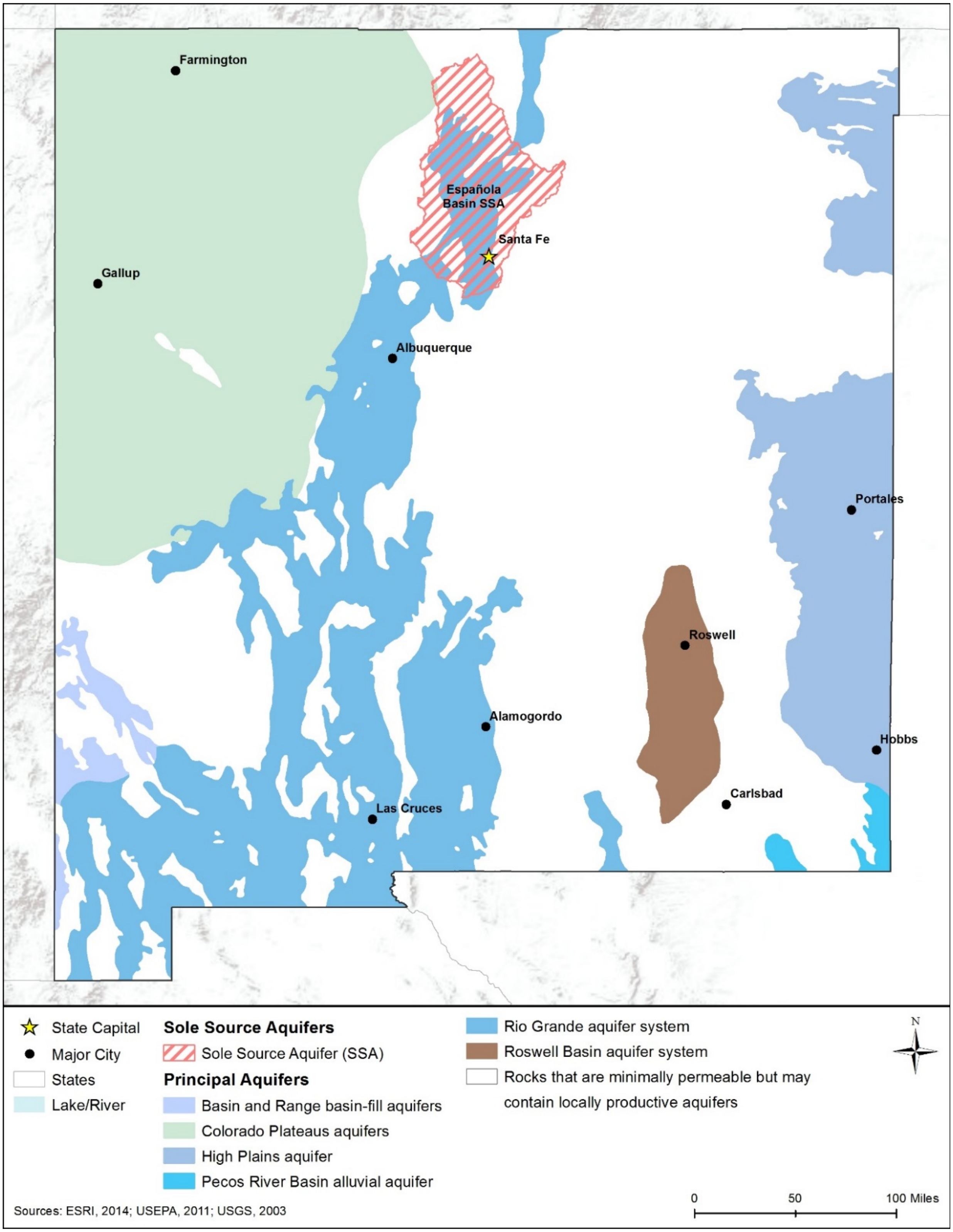

Figure 10.1.4-3: Principal and Sole Source Aquifers of New Mexico

10.1.5. Wetlands

10.1.5.1. Definition of the Resource

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

The 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)

10.1.5.2. Specific Regulatory Considerations

Appendix C, Environmental Laws and Regulations, explains the pertinent federal laws protecting wetlands in detail. Table 10.1.5-1 summarizes the major New Mexico state laws and permitting requirements relevant to the state's wetlands.

Table 10.1.5-1: Relevant New Mexico Wetlands Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
CWA Section 401 Water Quality Certification	NMED	In accordance with Section 401 of the CWA, activities that may result in a discharge to waters of the U.S. require a WQC from NMED indicating that the proposed activity will not violate water quality standards.
CWA Section 401 Water Quality Certification	Tribes	"WQCs for NWPs on tribal lands are issued by the tribes where the tribes have water quality certifying authority. On tribal lands where the tribes do not have water quality certifying authority, the EPA has issued WQC."
CWA Section 404 NWPs, New Mexico Regional requirements	USACE Albuquerque District	Regional conditions apply to any activities within Outstanding National Resource Waters[a] authorized by USACE NWPs, and General Conditions 25 (Water Quality) and 27 (Regional and Case-by-Case Conditions).

[a] Outstanding National Resource Waters include all surface waters within the Valle Vidal; and perennial streams and rivers, lakes, and wetlands within USFS Wilderness Areas (NMED, 2015k).

10.1.5.3. Environmental Setting: Wetland Types and Functions

The U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) mapping adopted a national Wetlands Classification Standard that classifies wetlands according to shared environmental factors, such as vegetation, soils, and hydrology, as defined by Cowardin, Carter, Golet, & LaRoe (1979). The Wetlands Classification System includes five major wetland Systems: Marine, Estuarine, Riverine, Lacustrine, and Palustrine. New Mexico includes one of these Systems, as detailed in Table 10.1.5-2. 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 the open ocean overlying the continental shelf and its associated high-energy coastline. Marine habitats are exposed to the waves and currents of the open ocean and the Water Regimes are determined primarily by the ebb and flow of oceanic tides. Salinities exceed 30 parts per thousand (ppt), with little or no dilution except outside the mouths of 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, 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, Classification of wetlands and deepwater habitats of the United States, FWS/OBS-79/31, 1979) (FGDC, 2013).

In New Mexico, the main type of wetland is palustrine (freshwater) wetlands found on river and lake floodplains across the state, as shown in Figure 10.1.5-1. Table 10.1.5-2 uses 2014 NWI data to characterize and map New Mexico wetlands on a broad-scale.[58] 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 10.1.5-2 correspond to the wetland types in the figures.

[58] 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 contain wetlands classification codes, 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.

Table 10.1.5-2: New Mexico 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	58,867
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 present for most of the growing season in most years. PEM wetlands include freshwater marshes, wet meadows, fens,[c] prairie potholes, and sloughs.	Northern part of the state	139,314
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	43,838
Palustrine aquatic bed	PAB	PAB wetlands include wetlands vegetated by plants growing mainly on or below the water surface line.		
Other Palustrine wetland	Misc. Types	Farmed wetland, saline seep,[d] and other miscellaneous wetlands are included in this group.	Abandoned fields, depressions (seeps), along hillsides and highways	10,235
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	27,737
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	24,192
			TOTAL	**304,183**

[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).

[c] Fens are nutrient-rich, grass- and sedge-dominated emergent wetlands that are recharged from groundwater and have continuous running water. (Edinger, et al., 2014)
[d] Saline seep is an area where saline groundwater discharges at the soil surface. These wetland types are characterized by saline soils and salt tolerant plants (City of Lincoln, 2015)
Source: (Cowardin, Carter, Golet, & LaRoe, Classification of wetlands and deepwater habitats of the United States, FWS/OBS-79/31, 1979) (USFWS, 2015a) (FGDC, 2013)

Palustrine Wetlands

In New Mexico, palustrine wetlands include the majority of vegetated freshwater wetlands (freshwater marshes, swamps, bogs,[59] and ponds). Common vegetation found in palustrine forested wetlands (PFO) in New Mexico are narrowleaf cottonwood (*Populus angustifolia*), boxelder (*Acer negundo*), peachleaf willow (*Salix amygdaloides*), and blue spruce (*Picea pungens*). (Muldavin, et al., 2011) Palustrine scrub-shrub wetlands (PSS) in New Mexico consist of bluestem willow (*Salix irrorata*), coyote willow (*S. exigua*), water birch (*Betula occidentalis*), thinleaf alder (*Alnus incana*), New Mexico olive (*Forestiera pubescens*), or chokecherry (*Prunus virginiana*). Saltcedar (*Tamarix chinensis*) is a common exotic species. (Muldavin, et al., 2011)

High quality palustrine emergent wetlands (PEM), or freshwater marsh, fen, and slough[60], in New Mexico support diverse plant and animal populations. Common PEM marsh plants in New Mexico include Baltic rush (*Juncus balticus*), beaked sedge (*Carex rostrata*), broadleaf cattail (*Typha latifolia*), common spikerush (*Eleocharis palustris*), reed canarygrass (*Phalaris arundinacea*), softstem bulrush (*Scirpus tabernaemontani*), threesquare bulrush (*Scirpus pungens*), and water sedge (*Carex aquatilis*). (Muldavin, et al., 2011) PEM are the most common type of palustrine wetlands within New Mexico.

Common types of palustrine wetlands in New Mexico include depressional wetlands, slope wetlands, and mineral soil flats. Depressional wetlands occur in shallow depressions that fill from spring or fall precipitation, and are usually dry by late summer or during droughts since they are not connected to a permanent water source. Depressional wetlands fill from rain, snowmelt, or groundwater. These small wetlands contribute to storage and filtration of surface water and help recharge aquifers. Playas of the eastern Llano Estacado are a common example of depressional wetlands where the dominant water source is precipitation. Zuni Lake is an example of a predominantly groundwater supported depressional wetland. (NMED, 2012) (NMED, 2015m)

Seeps and springs and on a larger scale, fens, cienegas, and outflow from the tow of an alluvial fan are common examples of slope wetlands. In fen wetlands, groundwater maintains constant water level year-round, with water at or near the surface most of the time. Slope wetlands are found throughout mountainous regions of New Mexico. (NMED, 2012) (NMED, 2015m)

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

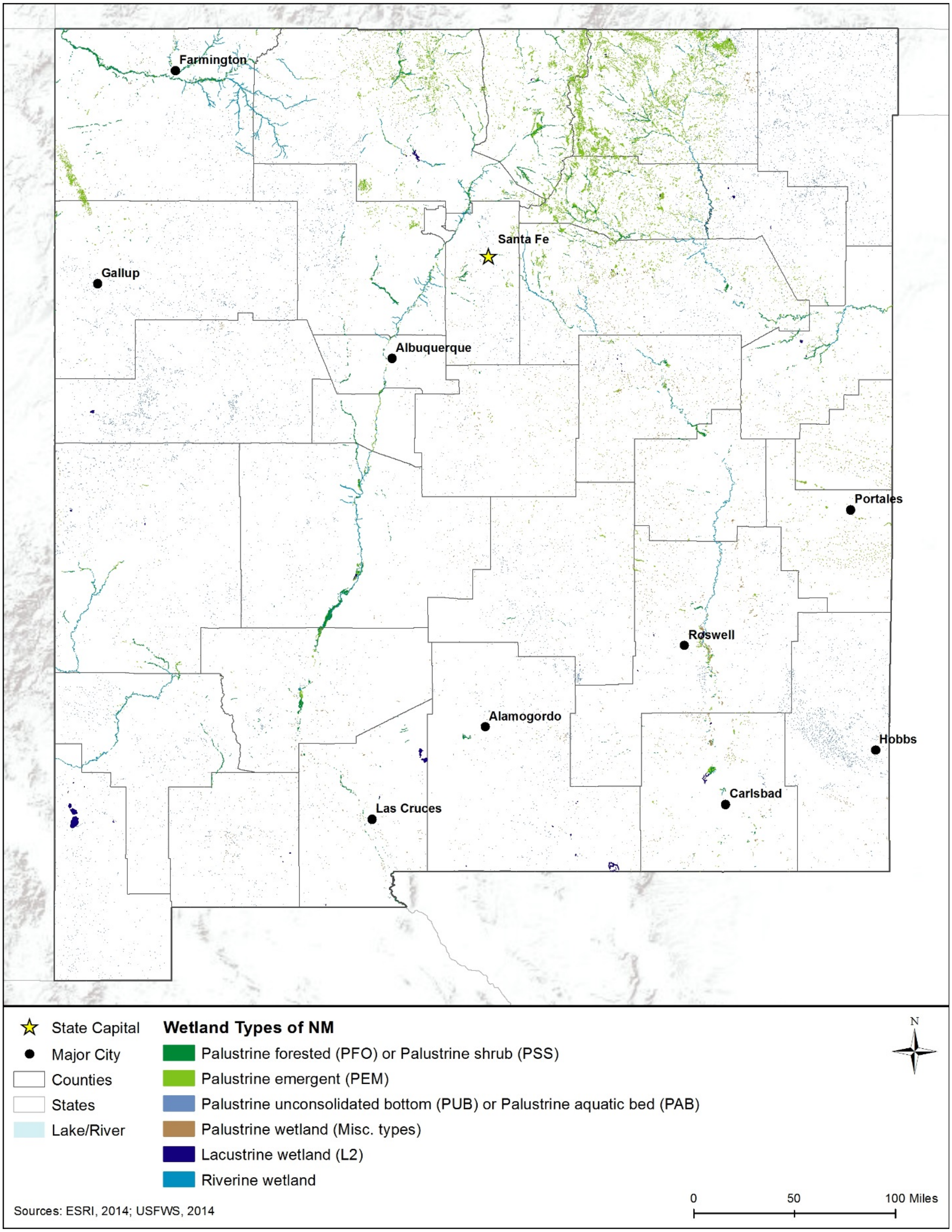

Figure 10.1.5-1: Wetlands by Type, in New Mexico, 2014

Mineral soil flats are common on regions of higher land between two rivers, historic lake bottoms, or large floodplain terraces where the main source of water is precipitation. They receive virtually no groundwater discharge. The Lordsburg Playa is an example of a mineral soil flat wetland. (NMED, 2015m) (NMED, 2012)

Palustrine aquatic (PAB/PUB) wetlands have water that is greater than 2 feet in depth and often contain water for an extended period during the growing season. Deep water marshes are primarily open water and are sparsely vegetated with floating plants such as water lily (*Nymphaea odorata*), duckweeds (*Lemna minor*), and pondweed (*Potamogeton natans*) and submerged aquatic plants such as pondweeds (*P. richardsonii*), coontail (*Ceratophyllum demersum*), water milfoil (*Myriophyllum spicatum*), and bladderwort (*Utricularia macrorhiza*). Deep water marshes are not pond and lakes. These are the easiest wetlands to recognize and occur throughout the state. (NMED, 2012)

Riverine Wetlands

Riverine wetlands occur in floodplains and riparian corridors in association with stream channels. At their headwaters, riverine wetlands often intergrade with slope or depressional wetlands as the channel (bed) and bank disappear, or they may intergrade with poorly drained flats or uplands. Bosque floodplains are a common example of riverine wetlands. (Muldavin et al. 2011) (NMED, 2012) (NMED, 2015m)

Lacustrine Wetlands

Lacustrine fringe wetlands are adjacent to lakes where the water elevation of the lake maintains the water table in the wetland. Lacustrine fringe wetlands are indistinguishable from depressional wetlands where the size of the lake becomes so small relative to fringe wetlands that the lake is incapable of stabilizing water tables. Marshy areas bordering Abiquiu Lake are an example of lacustrine fringe wetlands. (NMED, 2012) (NMED, 2015m)

Status and Trends

There are approximately 300,000 acres of wetlands across New Mexico, a large decrease from the 1 million acres that used to exist in the early 1800s (USFWS, 2014a) (NMED, 2014a) (FGDC, 2013). Main threats to wetlands in New Mexico include agricultural conversion, diversion of water for irrigation, urbanization, and groundwater depletion (NMED, 2012).

10.1.5.4. Wetlands of Special Concern or Value

New Mexico’s Water Quality Standards establish designated uses for waterbodies, which include all waters of the US, set criteria to protect those uses, and establish provisions to preserve water quality. Outstanding Natural Resource Waters (ONRWs) receive additional protection to ensure that the biological, chemical, and physical integrity of all New Mexico wetlands are adequately protected. Designation protects wetlands from degradation by human activities that may occur in wilderness wetlands. (NMED, 2015l)

Wetlands that are considered ONRWs in New Mexico include approximately 6,000 acres of wetlands in USFS Wilderness Areas (NMED, 2015l). For a list of all protected wetlands, visit https://www.env.nm.gov/OOTS/HearingOfficer/WQCC10-01/21/102/index.html.

Other Important Wetland Sites in New Mexico

- Wildlife Management Areas are designated for outdoor recreation and to protect and conserve wildlife habitat; these public lands include 57 management areas with diverse habitats, many containing wetlands (NMDGF, 2015a). To learn more about state Wildlife Management Areas, visit www.wildlife.state.nm.us/conservation/wildlife-management-areas/.
- 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 Agricultural Conservation Easement Program and easements managed by natural resource conservation groups such as state land trusts, The Nature Conservancy, USFWS, and State of New Mexico. According to the National Conservation Easement Database, a national electronic repository of government and privately held conservation easements (http://conservationeasement.us/), The Nature Conservancy holds more almost 250,000 acres in conservation easements in New Mexico. (NCED, 2015)

10.1.6. Biological Resources

10.1.6.1. Definition of the Resource

This section describes the biological resources of New Mexico. Biological resources include terrestrial[61] vegetation, wildlife, fisheries and aquatic[62] habitats, and threatened[63] and endangered[64] species as well as species of conservation concern. Wildlife habitat and associated biological ecosystems are also important components of biological resources. The geologic history of New Mexico has created a mosaic of topographic features such as mountains, valleys, and basins throughout the state. These features have resulted in a broad range of habitats ranging from desert to alpine forest that support a wide diversity of biological resources in New Mexico. The state of New Mexico may be considered one of the most biologically diverse[65] in the nation, with elevations ranging from 2,844 to 13,161 feet, resulting in a variety of habitats including hot and cold deserts, prairies, oak and pinyon-juniper woodlands, mixed conifer and spruce-fir forests, and alpine tundra (NMDGF, 2015b). Each of these topics is discussed in more detail below.

[61] Terrestrial: “Pertaining to land” (USEPA, 2015g).
[62] Aquatic: “Pertaining to water” (USEPA, 2015g).
[63] 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)).
[64] 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)).
[65] Diverse: “An ecological measure of the variety of organisms present in a habitat” (USEPA, 2015g).

10.1.6.2. Specific Regulatory Considerations

The federal laws relevant to the protection and management of biological resources in New Mexico are summarized in detail in Appendix C, Environmental Laws and Regulations, and Section 1.8, Overview of Relevant Federal Laws and Executive Orders. Table 10.1.6-1 summarizes major state laws relevant to New Mexico's biological resources.

Table 10.1.6-1: Major Federal and New Mexico Laws Relevant to Biological Resources

State Law/Regulation	Regulatory Agency	Applicability
Endangered and Protected Species (New Mexico Administrative Code [NMAC] 19.33)	New Mexico Department of Game and Fish (NMDGF)	Protects endangered and protected species from removal, capture, or destruction and establishes procedures for threatened and endangered species listing.
Wildlife Conservation Act (17-2-37 to 17-2-46 New Mexico Statutes Annotated [NMSA] 1978)	NMDGF	Regulates the take, possess, transport, export, process, or sale of any species on state or federal endangered or threatened species lists.
Aquatic Invasive Species (NMAC 19.30.14)	NMDGF	Establishes and defines the procedures and restrictions in place for controlling or preventing aquatic invasive species.
Aquatic Invasive Species Act (NMSA 17-4-35)	New Mexico Department of Agriculture	Establishes the authority of the New Mexico Department of Game and Fish to designate aquatic invasive species and infested waters and establish requirements for decontamination of conveyances and equipment.
Noxious Weed Management Act (76-7D-1 to 76-7D-6 NMSA 1978)	New Mexico Department of Agriculture	Stipulates that noxious weeds be managed in New Mexico through integrated noxious weed management programs.
Noxious Weed Control Act (76-7-1 to 76-7-22 NMSA 1978)	New Mexico Department of Agriculture	Establishes authority for prescribing and enforcing rules and regulations pertaining to the sale, transportation or distribution of noxious weed seeds, necessary to carry out the provisions of the Noxious Weed Act.

10.1.6.3. Terrestrial Vegetation

The distribution of flora within the state is a function of the characteristic geology,[66] soils, climate,[67] and water of a given geographic area and correlates with distinct areas identified as ecoregions.[68] Ecoregions are broadly defined areas that share similar characteristics, such as climate, geology, soils, and other environmental conditions and represent ecosystems contained within a region. The boundaries of an ecoregion are not fixed, but rather depict a general area with similar ecosystem types, functions, and qualities (National Wildlife Federation, 2015), (USDA, 2015a), (World Wildlife Fund, 2015). 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

[66] 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.

[67] 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, 2015g)

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

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 New Mexico at USEPA Level III. (USEPA, 2016a)

As shown in Figure 10.1.6-1, the USEPA lists eight Level III ecoregions in New Mexico. These ecoregions support a variety of different plant communities, which are greatly influenced by their general location within the state and at times occur within multiple regions of the state. Plant communities range generally from Ponderosa pine and other mixed conifer forests in the higher elevations, and pinyon-juniper woodlands at elevations below ponderosa pine forests, of the northern, central, and western portions of the state, grasslands and scrublands in the central, northwestern, and eastern portions of the state, and desert communities in the southern, eastern, and northwestern portions of the state (Griffith, et al., 2006) (USEPA, 2015h). Table 10.1.6-2 provides a summary of the general abiotic[69] characteristics, vegetative communities, and the typical vegetation found within each of the eight New Mexico ecoregions, broken down by commonly referred geographic regions.

[69] 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, 2015g).

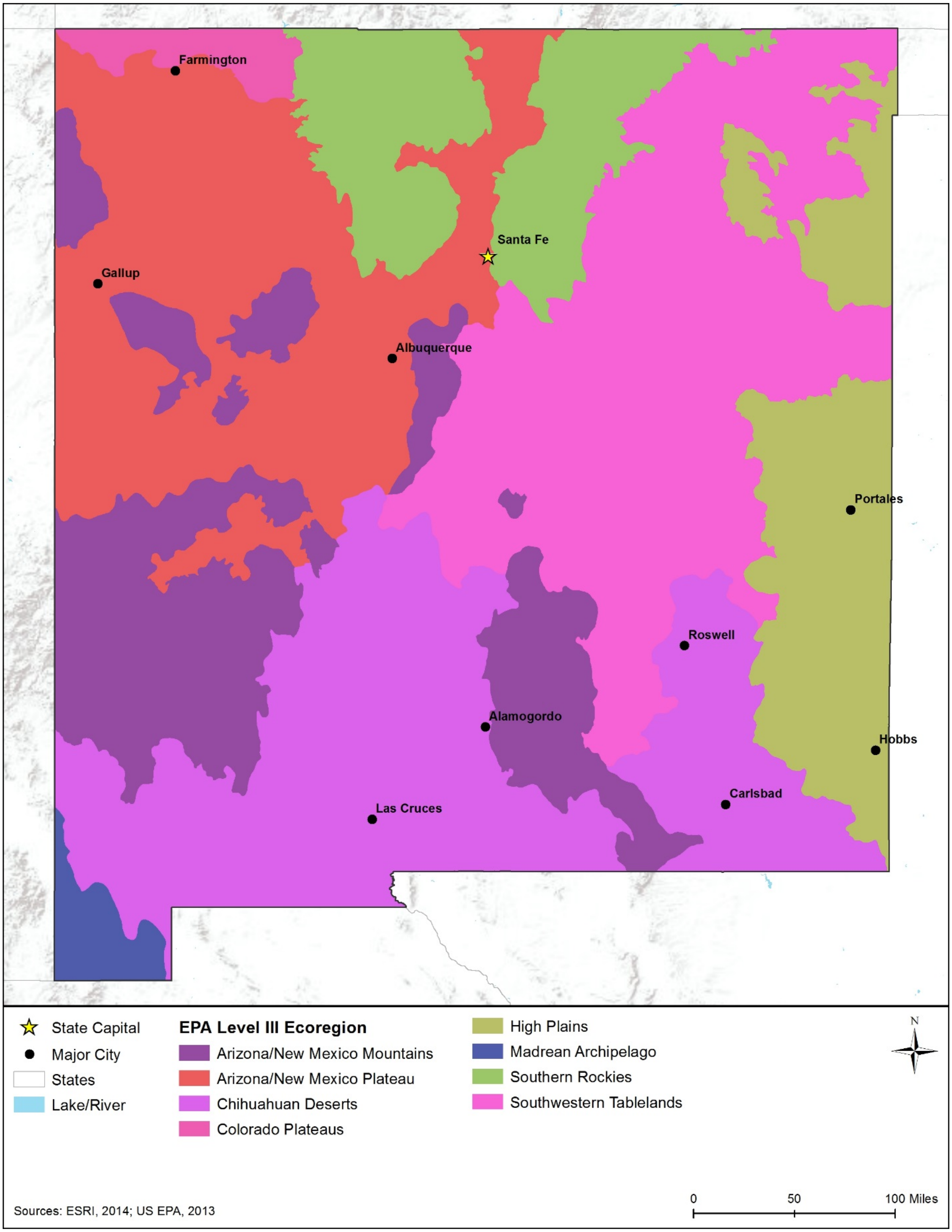

Figure 10.1.6-1: USEPA Level III Ecoregions in New Mexico

Table 10.1.6-2: USEPA Level III Ecoregions of New Mexico

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
Geographic Region: Northwest (Gallup, Farmington)				
20	Colorado Plateaus	Rugged tableland topography dissected by canyons, mesas, plateaus and arroyos. Precipitous sidewalls mark abrupt changes in local relief, often of 1,000 to 2,000 feet or more. Climate is dry, characterized by hot summers and cold winters. Except for major tributaries, surface water occurs primarily as ephemeral streams following summer precipitation events.	Great Basin desertscrub, Plains and Great Basin grassland, Great Basin conifer woodland	**Shrubs** – Bigelow sagebrush (*Artemisia bigelovii*), Big sagebrush (*Artemisia tridentata*), Fourwing saltbush (*Atriplex canescens*), Shadscale (*Atriplex confertifolia*), Greasewood (*Sarcobatus* spp.), Antelope bitterbrush (*Purshia tridentata*) **Conifer Trees** –Juniper species (*Juniperus monosperma, J. scopulorum, J. utahensis*), Pinyon pine (*Pinus edulis*) **Hardwood Trees** – Cottonwood (*Populus fremontii*), Willow (*Salix* spp.), Ash (*Fraxinus* spp.), Tamarisk (*Tamarix* spp.) **Grasses and Forbs**– Galleta (*Pleuraphis* sp.), Indian ricegrass (*Achnatherum hymenoides*), Blue grama (*Bouteloua gracilis*), Sand dropseed (*Sporobolus cryptandrus*), Poverty threeawn (*Aristida divaricata*)
22	Arizona/New Mexico Plateau	Somewhat rugged terrain of mesas, plateaus, canyons, and rolling uplands, with local relief varying from a few feet to well over 1,000 feet along tableland side slopes. A large, transitional region between the drier, higher relief tablelands to the north; lower, hotter regions to the west; semiarid grasslands to the east; and forested mountains to the northeast and south. Average annual precipitation typically ranges from 7 to 15 inches.	Great Basin desertscrub, Plains and Great Basin grassland, Great Basin conifer woodland, Montane conifer forest	**Shrubs** – Big sagebrush, Rabbitbrush, Winter fat (*Krascheninnikovia lanata*), Broom snakeweed (*Gutierrezia sarothrae*), Shadscale, Fourwing saltbush, Greasewood, Mormon tea (*Ephedra viridis*), Cottonwood, Willow, New Mexico olive (*Forestiera pubescens* var. *pubescens*), Tamarisk, Russian olive (*Elaeagnus angustifolia*), Ponderosa pine (*Pinus ponderosa*) **Grasses** – Western wheatgrass (*Pascopyrum smithii*), Needleandthread (*Hesperostipa comata*), Blue grama, Sand dropseed, Galleta, Alkali sacaton (*Sporobolus airoides*), Black grama (*Bouteloua eriopoda*), three-awns (*Aristida* spp.), Indian ricegrass

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
23	Arizona/New Mexico Mountains	This region is comprised of nine separate mountain complexes. Distinct from other mountainous ecoregions in the vicinity by its lower elevation and drier, warmer environment. Because these mountains are surrounded by deserts or grasslands, these are considered biogeographical islands. Annual precipitation typically averages between 12 and 25 inches, but varies widely within this ecoregion. Surface water sources include many ephemeral and some perennial streams and reservoirs.	Chihuahuan desertscrub, Madrean encinal woodland, Madrean pine-oak/conifer-oak forest and woodland, Rocky Mountain montane mixed conifer forest and woodland, Western great plains shortgrass prairie	**Cacti** –Pricklypear (*Opuntia* spp.) **Shrubs –** Ocotillo (*Fouquieria splendens*), Sotol (*Dasylirion* spp.), Yucca (*Yucca* spp.), Manzanita (*Arctostaphylos* spp.), Mountain mahogany (*Cercocarpus montanus*), Big sagebrush **Conifer Trees –** Mexican pinyon (***Pinus Cembroides***), Junipers, Ponderosa pine, Douglas-fir (*Pseudotsuga menziesii*), Corkbark fir (*Abies lasiocarpa*), White fir (*A. concolor*), Blue spruce (*Picea pungens*), Engelmann spruce (*Picea engelmannii*) **Hardwood Trees** – Oaks (*Q. gambellii*, *Q. grisea*, *Q. emoryi*, *Q. hypoleucoides*, *Q. rugosa*), Arizona sycamore (*Platanus wrightii*), Aspen (*Populus tremuloides*), Southwestern white pine (*Pinus strobiformis*) **Grasses and Forbs –** Blue grama, Black grama, Sideoats grama (*Bouteloua curtipendula*), purple threeawn (*Aristida purpurea*), Lovegrass (*Eragrostis* spp.), Mountain junegrass (*Koeleria macrantha*), Galleta
Geographic Region: North-Central (Albuquerque, Santa Fe, Taos)				
21	Southern Rockies	Includes the Sangre de Cristo, Jemez and San Juan mountains. Terrain is characterized by steep rugged mountains, complex masses of peaks and intermontane valleys. Climate is considered mid-latitude continental but subarctic at high elevations. Surface water present as medium and high-gradient perennial streams and rivers, alpine lakes and several reservoirs. Numerous perennial mountain streams with deciduous riparian vegetation support coldwater fisheries. Vegetation follows a pattern of elevational banding.	Rocky Mountain montane mixed conifer forest and woodland, Pinyon-juniper woodland, Rocky Mountain montane grassland	**Shrubs** – Mountain mahogany, Antelope bitterbrush, Currant (*Ribes* spp.), Skunkbush (*Rhus trilobata*), Wood rose (*Rosa woodsii*), Sagebrush, Huckleberry (*Gaylussacia* spp.), Whortleberry **Conifer Trees** – Ponderosa pine, Engelmann spruce, Subalpine fir, Corkbark fir, Limber pine (*Pinus flexilis*), Pinyon pine, Junipers **Hardwood Trees –** Willow, Aspen, Gambel oak **Grasses and Forbs –** Arizona fescue (*Festuca arizonica*), Mountain muhly (*Muhlenbergia montana*), Blue grama, Western wheatgrass, Prairie junegrass (*Koeleria macrantha*), Needleandthread

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
22	Arizona/New Mexico Plateau	Somewhat rugged terrain of mesas, plateaus, canyons, and rolling uplands, with local relief varying from a few feet to well over 1000 feet along tableland side slopes. A large, transitional region between the drier, higher relief tablelands to the north; lower, hotter regions to the west; semiarid grasslands to the east; and forested mountains to the northeast and south. Average annual precipitation typically ranges from 7 to 15 inches.	Great Basin desertscrub, Plains and Great Basin grassland, Great Basin conifer woodland, Montane conifer forest	**Shrubs** – Big sagebrush, Rabbitbrush, Winter fat, Broom snakeweed, Shadscale, Fourwing saltbush, Greasewood, Mormon tea **Hardwood Trees** – Cottonwood, Willow, New Mexico olive, Tamarisk, Russian olive **Conifer Trees** – Ponderosa pine **Grasses and Forbs** – Western wheatgrass, Needleandthread, Blue grama, Sand dropseed, Galleta, Alkali sacaton, Black grama, three-awns, Indian ricegrass
23	Arizona/New Mexico Mountains	This region is comprised of nine separate mountain complexes. Distinct from other mountainous ecoregions in the vicinity by its lower elevation and drier, warmer environment. Because these mountains are surrounded by deserts or grasslands, these are considered biogeographical islands. Annual precipitation typically averages between 12 and 25 inches, but varies widely within this ecoregion. Surface water sources include many ephemeral and some perennial streams and reservoirs.	Chihuahuan desertscrub, Madrean encinal woodland, Madrean pine-oak/conifer-oak forest and woodland, Rocky Mountain montane mixed conifer forest and woodland, Western great plains shortgrass prairie	**Shrubs**– Sotol, Yucca, Ocotillo, Manzanita, Mountain mahogany, Big sagebrush **Cacti –** Pricklypear **Conifer Trees –** Mexican pinyon, Junipers, Ponderosa pine, Douglas-fir, Corkbark fir, White fir, Blue spruce, Engelmann spruce, Southwestern white pine **Hardwood Trees –** Oaks, Arizona sycamore, Aspen, **Grasses and Forbs**– Blue grama, Black grama, Sideoats grama, purple threeawn, Lovegrass, Mountain junegrass Pricklypear, Galleta

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
26	Southwestern Tablelands	Broad plains and tablelands with canyons, mesas, badlands, and dissected river valleys and plains. Climate consists of hot summers and cold winters, with half of annual precipitation occurring as late summer thunderstorms. Average annual precipitation ranges from 12-16 inches.	Western Great Plains shortgrass prairie, Rocky Mountain montane mixed conifer forest and woodland, Pinyon-juniper woodland	**Shrubs and Cacti** – Skunkbush, Fourwing saltbush, Yucca, Sand sagebrush (*Artemisia filifolia*), Broom snakeweed, Winter fat **Cacti –** Cholla (*Cylindroptunia* spp.) **Conifer Trees** – Junipers, Pinyon pine **Hardwood Trees** - Honey mesquite (*Prosopis glandulosa*), Cottonwood, Willow, Hackberry (*Celtis* spp.), Tamarisk **Grasses and Forbs –** Grama, Western wheatgrass, Alkali sacaton, Galleta, Sand dropseed, Western wheatgrass, Three-awn, Ring muhly (*Muhlenberegia torreyi*), Little bluestem (*Schizachyrium scoparium*)
Geographic Region: Northeast (Raton, Tucumcari)				
25	High Plains	Part of a contiguous semi-arid prairie that extends eastward to Kansas and Oklahoma and northward to Wyoming. Characterized by smooth to slightly irregular terrain with intermittent mesas and plateaus. Climate consists of hot summers and cold winters, with half of annual precipitation occurring as late summer thunderstorms. Surface water is limited to few rivers and numerous ephemeral playas.[a] Includes the Llano Estacado, which has thousands of playa lakes, many of which serve as recharge for the Ogallala Aquifer and are important to the Central Flyway migratory bird corridor.	Western Great Plains shortgrass prairie, Western Great Plains sandhill sagebrush shrubland	**Shrubs**–Sand sagebrush, Harvard oak (*Quercus havardii*), Yucca, Fourwing saltbush, Sand sagebrush, Ephedra, Tarbush (*Flourensia cernua*) **Conifer Trees** – Juniper **Hardwood Trees** – Mesquite (*Prosopis* spp.) **Grasses and Forbs**– Blue grama, Buffalograss (*Bouteloua dactyloides*), Sand dropseed, Sideoats grama, Switchgrass (*Panicum virgatum*), Western wheatgrass, Little bluestem, Alkali sacaton, Squirreltail (*Elymus elymoides*)

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
26	Southwestern Tablelands	Broad plains and tablelands with canyons, mesas, badlands, and dissected river valleys and plains. Climate consists of hot summers and cold winters, with half of annual precipitation occurring as late summer thunderstorms. Average annual precipitation ranges from 12-16 inches.	Western Great Plains shortgrass prairie, Rocky Mountain montane mixed conifer forest and woodland, Pinyon-juniper woodland	**Shrubs**– Skunkbush, Fourwing saltbush, Yucca, Sand sagebrush, Broom snakeweed, Winter fat **Cacti –** Cholla **Conifer Trees** – Junipers, Pinyon pine **Hardwood Trees** - Honey mesquite, Cottonwood, Willow, Hackberry, Tamarisk **Grasses and Forbs**– Grama, Western wheatgrass, Alkali sacaton, Galleta, Sand dropseed, Western wheatgrass, Three-awn, Ring muhly, Little bluestem
21	Southern Rockies	Includes the Sangre de Cristo, Jemez and San Juan mountains. Terrain is characterized by steep rugged mountains, complex masses of peaks and intermontane valleys. Climate is considered mid-latitude continental but subarctic at high elevations. Surface water present as medium and high-gradient perennial streams and rivers, alpine lakes and several reservoirs. Numerous perennial mountain streams with deciduous riparian vegetation support coldwater fisheries. Vegetation follows a pattern of elevational banding.	Rocky Mountain montane mixed conifer forest and woodland, Pinyon-juniper woodland, Rocky Mountain montane grassland	**Shrubs** – Mountain mahogany, Antelope bitterbrush, Currant, Skunkbush, Wood rose, Sagebrush, Huckleberry, Whortleberry **Conifer Trees** – Ponderosa pine, Engelmann spruce, Subalpine fir, Corkbark fir, Limber pine, Pinyon pine, Junipers **Hardwood Trees –** Willow, Aspen, Gambel oak **Grasses and Forbs**– Arizona fescue, Mountain muhly, Blue grama, Western wheatgrass, Prairie junegrass Pricklypear, Needleandthread
Geographic Region: Southeast (Ruidoso, Roswell, Carlsbad, Clovis)				

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
24	Chihuahuan Deserts	The northernmost portion of the southernmost desert in North America, this region extends 500 miles south into Mexico. Terrain consists of broad basins bordered by isolated, rugged mountains. Climate is arid with hot summers and mild winters, and the majority of annual precipitation occurs in summer. Surface water is mostly ephemeral except for major river drainages and widely scattered springs; outside of major river drainages the landscape is largely internally drained.	Chihuahuan semi-desert grassland, Western Great Plains sandhill sagebrush shrubland	**Shrubs**– Fourwing saltbush, Seepweed (*Suaeda* spp.), Pickleweed (*Salicornia* sp.), Ephedra, Beargrass (*Nolina* spp.), Sotol, Lechuguilla (*Agave lechuguilla*), Creosotebush (*Larrea tridentata*), Tarbush, Yucca, Sand sagebrush, Acacia (*Acacia* spp.), Ocotillo, Lotebush (*Ziziphus obtusifolia*), Skunkbush **Cacti –** Pricklypear **Hardwood Trees** – Mesquites, Junipers, Oaks, Cottonwood, Willow, Velvet ash (*Fraxinus velutina*), Tamarisk **Conifer Trees** – Pinyon pine, Ponderosa pine **Grasses and Forbs** – Alkali sacaton, Grama, Sand dropseed, Bush muhly, Three-awns, Sandhill muhly (*Muhlenbergia pungens*), Tobosagrass (*Pleuraphis mutica*), Little bluestem, Gypsum grama (*Bouteloua breviseta*)
26	Southwestern Tablelands	Broad plains and tablelands with canyons, mesas, badlands, and dissected river valleys and plains. Climate consists of hot summers and cold winters, with half of annual precipitation occurring as late summer thunderstorms. Average annual precipitation ranges from 12-16 inches.	Western Great Plains shortgrass prairie, Rocky Mountain montane mixed conifer forest and woodland, Pinyon-juniper woodland	**Shrubs**– Skunkbush, Fourwing saltbush, Yucca, Sand sagebrush, Broom snakeweed, Winter fat **Cacti –** Cholla **Conifer Trees** – Junipers, Pinyon pine **Hardwood Trees –** Honey mesquite, Cottonwood, Willow, Hackberry, Tamarisk **Grasses and Forbs** – Grama, Western wheatgrass, Alkali sacaton, Galleta, Sand dropseed, Western wheatgrass, Three-awn, Ring muhly, Little bluestem

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
25	High Plains	Part of a contiguous semi-arid prairie that extends eastward to Kansas and Oklahoma and northward to Wyoming. Characterized by smooth to slightly irregular terrain with intermittent mesas and plateaus. Climate consists of hot summers and cold winters, with half of annual precipitation occurring as late summer thunderstorms. Surface water is limited to few rivers and numerous ephemeral playas. Includes the Llano Estacado, which has thousands of playa lakes, many of which serve as recharge for the Ogallala Aquifer and are important to the Central Flyway migratory bird corridor.	Western Great Plains shortgrass prairie, Western Great Plains sandhill sagebrush shrubland	**Shrubs**–Sand sagebrush, Shinnery oak (*Quercus havardii*), Yucca, Fourwing saltbush, Sand sagebrush, Ephedra, Tarbush **Conifer Trees** – Juniper **Hardwood Trees** – Mesquite **Grasses and Forbs** – Blue grama, Buffalograss, Sand dropseed, Sideoats grama, Switchgrass, Western wheatgrass, Little bluestem, Alkali sacaton, Squirreltail
23	Arizona/New Mexico Mountains	This region is comprised of nine separate mountain complexes and is distinctive in its lower elevation and drier, warmer environment. Because these mountains are surrounded by deserts or grasslands, these are considered biogeographical islands. Annual precipitation typically averages between 12 and 25 inches, but varies widely within this ecoregion. Surface water sources include many ephemeral and some perennial streams and reservoirs.	Chihuahuan desertscrub, Madrean encinal woodland, Madrean pine-oak/conifer-oak forest and woodland, Rocky Mountain montane mixed conifer forest and woodland, Western great plains shortgrass prairie	**Shrubs**– Sotol, Yucca, Ocotillo, Manzanita, Mountain mahogany, Big sagebrush **Cacti –** Pricklypear **Conifer Trees** – Mexican pinyon, Junipers, Ponderosa pine, Douglas-fir, Corkbark fir, White fir, Blue spruce, Engelmann spruce, Southwestern white pine **Hardwood Trees –** Oaks, Arizona sycamore, Aspen **Grasses and Forbs** – Blue grama, Black grama, Sideoats grama, purple threeawn, Lovegrass, Mountain junegrass Pricklypear, Galleta

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
Geographic Region: Southwest (Las Cruces, Silver City, Socorro)				
24	Chihuahuan Deserts	The northernmost portion of the southernmost desert in North America, this region extends 500 miles south into Mexico. Terrain consists of broad basins bordered by isolated, rugged mountains. Climate is arid with hot summers and mild winters, and the majority of annual precipitation occurs in summer. Surface water is mostly ephemeral except for major river drainages and widely scattered springs; outside of major river drainages the landscape is largely internally drained.	Chihuahuan semi-desert grassland, Western Great Plains sandhill sagebrush shrubland	**Shrubs**– Fourwing saltbush, Seepweed, Pickleweed, Ephedra, Beargrass, Sotol, Lechuguilla, Creosotebush, Tarbush, Yucca, Sand sagebrush, Acacia (*Acacia* spp.), Ocotillo, Lotebush, Skunkbush **Cacti –** Pricklypear **Conifer Trees** – Junipers, Pinyon pine, Ponderosa pine **Hardwood Trees –** Mesquites, Oaks, Cottonwood, Willow, Velvet ash, Tamarisk **Grasses and Forbs –** Alkali sacaton, Grama, Sand dropseed, Bush muhly, Three-awns, Sandhill muhly, Tobosagrass, Little bluestem, Gypsum grama
79	Madrean Archipelago	Also referred to as the "Sky Islands" (biogeographical islands), this is a region of broad basins bordered by isolated, rugged mountains with medium to high local relief, typically 3,000 to 5,000 feet. Climate is considered a dry, subtropical steppe with hot summers and mild winters. Annual rainfall typically averages between 11 to 26 inches, with strong monsoonal influence (precipitation occurs mostly in late summer). Surface water is primarily ephemeral with some scattered permanent springs. This region has ecological significance as both a barrier and a bridge between the Rocky Mountains and the Sierra Madre Occidental Mountains.	Chihuahuan semi-desert grassland, Madrean encinal woodland, Madrean pine-oak/conifer-oak forest and woodland	**Shrubs**– Ephedra, Mimosa (*Mimosa* spp.), Yucca, Ocotillo, Agave (*Agave* spp.) **Conifer Trees –** Pinyon, Juniper, Ponderosa, Southwestern white pine, Apache pine (*Pinus engelmannii*), Chihuahuan pine (*Pinus leiophylla*), Douglas-fir **Hardwood Trees –** Oaks, Mesquite, Cottonwood, Sycamore, Willow, **Grasses –** Grama, Cane beardgrass (*Bothriochloa barbinodis*), Plains lovegrass (*Eragrostis intermedia*), Sand dropseed, Vine mesquite (*Panicum obtusum*), Curly-mesquite (*Hilaria belangeri*)

Ecoregion Number	Ecoregion Description	Abiotic Characterization	General Vegetative Communities	Typical Dominant Vegetation
23	Arizona/New Mexico Mountains	This region is comprised of nine separate mountain complexes and is distinctive in its lower elevation and drier, warmer environment. Because these mountains are surrounded by deserts or grasslands, these are considered biogeographical islands. Annual precipitation typically averages between 12 and 25 inches, but varies widely within this ecoregion. Surface water sources include many ephemeral and some perennial streams and reservoirs.	Chihuahuan desertscrub, Madrean encinal woodland, Madrean pine-oak/conifer-oak forest and woodland, Rocky Mountain montane mixed conifer forest and woodland, Western great plains shortgrass prairie	**Shrubs**– Sotol, Yucca, Ocotillo, Manzanita, Mountain mahogany, Big sagebrush **Cacti –** Pricklypear **Conifer Trees** – Mexican pinyon, Junipers, Ponderosa pine, Douglas-fir, Corkbark fir, White fir, Blue spruce, Engelmann spruce, Southwestern white pine **Hardwood Trees –** Oaks, Arizona sycamore, Aspen **Grasses** – Blue grama, Black grama, Sideoats grama, purple threeawn, Lovegrass, Mountain junegrass Pricklypear, Galleta
22	Arizona/New Mexico Plateau	Somewhat rugged terrain of mesas, plateaus, canyons, and rolling uplands, with local relief varying from a few feet to well over 1000 feet along tableland side slopes. A large, transitional region between the drier, higher relief tablelands to the north; lower, hotter regions to the west; semiarid grasslands to the east; and forested mountains to the northeast and south. Average annual precipitation typically ranges from 7 to 15 inches.	Great Basin desertscrub, Plains and Great Basin grassland, Great Basin conifer woodland, Montane conifer forest	**Shrubs**– Big sagebrush, Rabbitbrush, Winter fat, Broom snakeweed, Shadscale, Fourwing saltbush, Greasewood, Mormon tea **Conifer Trees** – Ponderosa pine **Hardwood Trees –** Cottonwood, Willow, New Mexico olive, Tamarisk, Russian olive **Grasses** – Western wheatgrass, Needleandthread, Blue grama, Sand dropseed, Galleta, Alkali sacaton, Black grama, three-awns, Indian ricegrass

[a] Playa: "Playas are shallow, short-lived lakes that form where water drains into basins with no outlet to the sea and quickly evaporates. Playas are common features in arid (desert) regions and are among the flattest landforms in the world" (USEPA, 2015g).
Sources: (Griffith, et al., 2006) (USEPA, 2015h) (CEC, 2011)

Communities of Concern

The state of New Mexico recognizes natural vegetation communities[70] that include relatively rare or imperiled plant communities or communities that provide habitat for rare plant and wildlife species within the state. New Mexico does not specifically identify and track individual vegetation communities of concern. However, the state does evaluate individual plant and animal species as well as ecosystems for rarity. This is done through the Natural Heritage New Mexico (NHNM) statewide inventory, which includes lists of sensitive plant and animal species and ecosystems known to occur, or that have historically occurred, in the state (NHNM, 2015). Historical occurrences are important for assessing previously undocumented occurrences or re-occurrences of previously documented species.

Natural vegetation communities of concern have been established using a ranking system based on the occurrence of globally sensitive plant communities. This dataset is incorporated by the Western Governors Association Wildlife Council in developing a square-mile hexagon grid across the state of New Mexico for use in defining and mapping crucial habitat statewide. Each square-mile hexagon is categorized by the majority natural vegetation community present and assigned a rank based on its rarity and vulnerability (NMCHAT, 2005). Riparian vegetation habitats are acknowledged in the New Mexico State Wildlife Action Plan as important habitats based on their roles in ecological function and wildlife value. All riparian woodland and wetland habitats were classified as Tier 1 (most urgent) terrestrial habitats for conservation.

Thirteen plant species are threatened or endangered in New Mexico and one candidate species occurs in the state. Section 10.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these species.

Nuisance and Invasive Plants

There are a large number of undesirable plant species that are considered nuisance and invasive[71] plants. Noxious weeds are typically non-native species that have been introduced into an ecosystem inadvertently; however, on occasion native species can be considered a noxious weed. Noxious weeds greatly affect agricultural areas, forest management, natural, and other open areas (GPO, 2011). The U.S. government has designated certain plant species as noxious weeds in accordance with the Plant Protection Act of 2000 (7 U.S.C. 7701 et seq.). As of September 2014, 112 federally recognized noxious weed species have been catalogued in the U.S., 88 are terrestrial, 19 aquatic, and 5 parasitic (USDA, 2015b). Many noxious weeds in New Mexico occur on rangelands and wild lands, where invasions of noxious weeds can pose a threat to livestock and wildlife as well as endangered native species (NMDA, 2009). The New Mexico Noxious Weed Management Act (76-7D-1 through 76-7D-6 NMSA 1998) stipulates that the New Mexico Department of Agriculture be responsible for establishing the noxious weed list and

[70] Community: "In ecology, an assemblage of populations of different species within a specified location in space and time. Sometimes, a particular subgrouping may be specified, such as the fish community in a lake or the soil arthropod community in a forest." (USEPA, 2015g)
[71] 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, 2015m)

coordination of integrated noxious weed management programs to identify noxious weed control methods and educate the public on noxious weeds. The New Mexico Noxious Weed Control Act (76-7-1 through 76-7-22 NMSA 1998) allows for the establishment of noxious weed control districts to determine which noxious weeds will be subject to management efforts. Currently, a total of 37 state-listed noxious plant species are targeted for control or eradication pursuant to the Noxious Weed Management Act of 1998. Three of these species occur on the Federal Noxious Weed List (USDA, 2014). Noxious weed species are designated under three classes based on ecological, distribution, impact and legal status criteria within New Mexico and adjoining states (NMDA, 2009). In addition, in 2009, the NMDA established a "watch list" category of plants with the potential to be problematic, with the intention that this list would raise awareness and promote data collection and reporting for further evaluation of potential listing. The most recent New Mexico noxious weed list is summarized below by vegetation type.

- **Aquatic –** hydrilla (*Hydrilla verticillata*), parrot feather watermilfoil (*Myriophyllum aquaticum*), watermilfoil (*Myriophyllum spicatum*), giant salvinia (*Salvinia molesta*)
- **Shrubs and Trees –** Tree of heaven (*Ailanthus altissima*), Russian olive (*Elaeagnus angustifolia*), saltcedar (*Tamarix* spp.), Siberian elm (*Ulmus pumila*)
- **Terrestrial Forbs and Grass-like Plants –** Russian knapweed (*Acroptilon repens*), jointed goatgrass (*Aegilops cylindrica*), camelthorn (*Alhagi maurorum*), giant cane (*Arundo donax*), Sahara mustard (*Brassica tourneortii*), cheatgrass (*Bromus tectorum*), hoary cress (*Cardaria* spp.), musk thistle (*Carduus nutans*), purple starthistle (*Centaurea calcitrapa*), diffuse knapweed (*Centaurea diffusa*), Malta starthistle (*Centaurea melitensis*), meadow knapweed (*Centaurea pratensis*), yellow starthistle (*Centaurea solstitialis*), spotted knapweed (*Centaurea stoebe* ssp. *macranthos*), chicory (*Cichorium intybus*), Canada thistle (*Cirsium arvense*), bull thistle (*Cirsium vulgare*), poison hemlock (*Conium maculatum*), pampas grass (*Cortaderia sellonana*), wallrocket (*Diplotaxis tenuifolia*), Fuller's teasel (*Dipsacus fullonum*), alfombrilla (*Drymaria arenarioides*), quackgrass (*Elytrigia repens*), leafy spurge (*Euphorbia esula*), halogeton (*Halogeton glomeratus*), black henbane (*Hyoscyamus niger*), dyers woad (*Isatis tinctoria*), perennial pepperweed (*Lepidium latifolium*), oxeye daisy (*Leucanthemum vulgare*), Dalmatian toadflax (*Linaria dalmatica* ssp. *dalmatica*), yellow toadflax (*Linaria vulgaris*), purple loosestrife (*Lythrum salicaria*), Scotch thistle (*Onopordum acanthium*), African rue (*Peganum harmala*), crimson fountaingrass (*Pennisetum setaceum*), Ravenna grass (*Saccharum ravennae*), spiny cocklebur (*Xanthium spinosum*) (NMDA, 2009).

10.1.6.4. Terrestrial Wildlife

This section discusses the terrestrial wildlife species in New Mexico, divided among mammals,[72] birds,[73] reptiles and amphibians,[74] and invertebrates.[75] Terrestrial wildlife are species, and their habitats, that live predominantly on land. Terrestrial wildlife includes common big game species, small game animals, furbearers,[76] nongame animals, game birds, waterfowl, and migratory birds as well as their habitats within New Mexico. A discussion of non-native and/or invasive terrestrial wildlife species is also included within this section. Information regarding the types and location of native and non-native/invasive wildlife is useful for assessing the importance of any impacts to these resources or the habitats they occupy. According to the Biota Information System of New Mexico (BISON-M) and NHNM, the state is home to approximately 205 mammal species, 529 bird species, 112 reptile species, 27 amphibian species, and an unknown number of invertebrate species (NMDGF, 2015c) (NHNM, 2015).

The NHNM and NMDGF maintain statewide databases of natural biological resources in New Mexico that emphasizes biological resources of conservation value and concern (NMDGF, 2015c) (NHNM, 2015). Historical occurrences are important for assessing previously undocumented occurrences or re-occurrences of previously documented species. Information from the database is used to establish the SGCN list, which consists of at-risk species that are rare or declining. Conservation and management activities for wildlife on the SGCN list can provide funding from State Wildlife Grants for efforts to reduce their potential to be listed as endangered. Although these species have been targeted for conservation, they are not currently under legal protection. The SGCN list is updated periodically and is used by the state of New Mexico to focus their conservation efforts and as a basis for implementing their State Wildlife Action Plan (SWAP) (NMDGF, 2015b).

Mammals

Mammal species documented in New Mexico include a total of 205 species (NMDGF, 2015c). Common and widespread mammalian species in New Mexico include the mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), jackrabbit (*Lepus californicus, L. callotis, L. townsendii, L. alleni*), raccoon (*Procyon lotor*), and gray fox (*Urocyon cinereoargenteus*). Less common but widespread mammals include species such as pronghorn (*Antilocapra americana americana*), black bear (*Ursus americanus*), elk (*Cervus elaphus nelsoni*), bat species, and bobcat (*Lynx rufus*). Most mammals are widely distributed in the state; however, there are some species, such as the river otter (*Lontra canadensis*) that is restricted to the north-central portion of the state, kit fox (*Vulpes macrotis*) that are restricted to deserts, grasslands, and woodlands in the western

[72] 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, 2015g).

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

[74] 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, 2015g).

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

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

portion of the state, or javelina (*Peccari tajacu sonoriensis; angulatus*) that are restricted to deserts and grasslands in the southeastern portion of the state. The NMDGF has identified 48 mammal SGCN (NMDGF, 2015b) several of which are also considered federally threatened or endangered. Section 10.1.6.6, Threatened and Endangered Species and Species of Conservation Concern, identifies these protected species.

In New Mexico deer (*Odocoileus* ssp.), elk, bear, cougar (*Puma concolor*), pronghorn antelope (*Antilocapra americana*), Barbary sheep (*Ammotragus lervia*), bighorn sheep (*Ovis canadensis*), javelina, oryx (*Oryx gazella*), and ibex (*Capra* ssp.) are classified as big game species, whereas upland game includes several squirrel species in addition to several migratory birds. Hunting is allowed for several nongame species including porcupine (*Erethizon dorsatum*), prairie dogs (genus *Cynomys*), rabbits (*Sylvilagus audubonii*; Genus *Lepus*), ground squirrels (*Callospermophilus lateralis*, *Ictidomys parvidens*, *Ictidomys tridecemlineatus arenicola; blanca; hollisteri. I. tridecemlineatus monticola*, *Xerospermophilus spilosoma*, *X. tereticaudus*), and Himalayan tahr (*Hemitragus jemlahicus*), as well as furbearer species including raccoon, badger (*Taxidea taxus*), weasel (*Mustela frenata*), fox (*Urocyon cinereoargenteus*), ringtail (*Bassariscus astutus*), bobcat, muskrat (*Ondatra zibethicus pallidus; osoyooensis; cinnamominus*), beaver (*Castor canadensis*), nutria (*Myocastor coypus*), coyote, and skunk (*Mephitis mephitis*) (NMDGF, 2015b).

Birds

The number of native bird species documented in New Mexico varies according to the timing of the data collection effort, changes in bird taxonomy[77], and the reporting organization's method for categorizing occurrence and determining native versus non-native status. Further, the diverse ecological communities (i.e., deserts, mountains, canyons, grasslands, forests, lakes, rivers and playas, etc.) and climate zones found in New Mexico support a large variety of bird species.

Currently, 529 species of resident and migratory birds have been documented in New Mexico (NHNM, 2015). Among the 529 extant[78] bird species in New Mexico, 82 SGCN have been identified (NMDGF, 2015b). Within New Mexico, seven threatened and endangered and candidate bird species are listed by the USFWS and are identified in Section 10.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

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

Examples of bird species that are considered to have established, self-sustaining, wild populations in New Mexico are listed below (Audubon New Mexico, 2015a):

ANATIDAE: Ducks, Geese, Swans

- Black-bellied Whistling-Duck (*Dendrocygna autumnalis*)
- Fulvous Whistling-Duck (*Dendrocygna bicolor*)
- Greater White-fronted Goose (*Anser albifrons*)
- Snow Goose (*Chen caerulescens*)
- Ross's Goose (*Chen rossii*)
- Brant (*Branta bernicla*)
- Cackling Goose (*Branta hutchinsii*)
- Canada Goose (*Branta Canadensis*)
- Trumpeter Swan (*Cygnus buccinators*)
- Tundra Swan (*Cygnus columbianus*)
- Wood Duck (*Aix sponsa*)
- Gadwall (*Anas strepera*)
- Eurasian Wigeon (*Anas penelope*)
- American Wigeon (*Anas americana*)
- Mallard (*Anas platyrhynchos*)
- Blue-winged Teal (*Anas discors*)
- Cinnamon Teal (*Anas cyanoptera*)
- Northern Shoveler (*Anas clypeata*)
- Northern Pintail (*Anas acuta*)
- Garganey (*Anas querquedula*)
- Green-winged Teal (*Anas crecca*)
- Canvasback (*Aythya valisineria*)
- Redhead (*Aythya americana*)
- Ring-necked Duck (*Aythya collaris*)
- Greater Scaup (*Aythya marila*)
- Lesser Scaup (*Aythya affinis*)
- Harlequin Duck (*Histrionicus histrionicus*)
- Surf Scoter (*Melanitta perspicillata*)
- White-winged Scoter (*Melanitta fusca*)
- Black Scoter (*Melanitta Americana*)
- Long-tailed Duck (*Clangula hyemalis*)
- Bufflehead (*Bucephala albeola*)
- Common Goldeneye (*Bucephala clangula*)
- Barrow's Goldeneye (*Bucephala islandica*)
- Hooded Merganser (*Lophodytes cucullatus*)
- Common Merganser (*Mergus merganser*)
- Red-breasted Merganser (*Mergus serrator*)
- Ruddy Duck (*Oxyura jamaicensis*)

ODONTOPHORIDAE: New World Quail

- Scaled Quail (*Callipepla squamata*)
- Gambel's Quail (*Callipepla gambelii*)
- Northern Bobwhite (*Colinus virginianus*)
- Montezuma Quail (*Cyrtonyx montezumae*)

PHASIANIDAE: Pheasants, Grouse, Turkeys

- White-tailed Ptarmigan (*Lagopus leucura*)
- Dusky Grouse (*Dendragapus obscurus*)
- Lesser Prairie-Chicken (*Tympanuchus pallidicinctus*)
- Wild Turkey (*Meleagris gallopavo*)

GAVIIDAE: Loons

- Red-throated Loon (*Gavia stellate*)
- Pacific Loon (*Gavia pacifica*)
- Common Loon (*Gavia immer*)
- Yellow-billed Loon (*Gavia adamsii*)

PODICIPEDIDAE: Grebes

- Pied-billed Grebe (*Podilymbus podiceps*)
- Horned Grebe (*Podiceps auritus*)
- Red-necked Grebe (*Podiceps grisegena*)
- Eared Grebe (*Podiceps nigricollis*)
- Western Grebe (*Aechmophorus occidentalis*)
- Clark's Grebe (*Aechmophorus clarkia*)

HYDROBATIDAE: Storm-Petrels

- Least Storm-Petrel (*Oceanodroma microsoma*)

CICONIIDAE: Storks

- Wood Stork (*Mycteria americana*)

FREGATIDAE: Frigatebirds

- Magnificent Frigatebird (*Fregata magnificens*)

SULIDAE: Boobies

- Blue-footed Booby (*Sula nebouxii*)

PHALACROCORACIDAE: Cormorants

- Neotropic Cormorant (*Phalacrocorax brasilianus*)
- Double-crested Cormorant (*Phalacrocorax auritus*)

ANHINGIDAE: Darters

- Anhinga (*Anhinga anhinga*)

PELECANIDAE: Pelicans

- American White Pelican (*Pelecanus erythrorhynchos*)
- Brown Pelican (*Pelecanus occidentalis*)

ARDEIDAE: Bitterns, Herons

- American Bittern (*Botaurus lentiginosus*)
- Least Bittern (*Ixobrychus exilis*)
- Great Blue Heron (*Ardea herodias*)
- Great Egret (*Ardea alba*)
- Snowy Egret (*Egretta thula*)
- Little Blue Heron (*Egretta caerulea*)
- Tricolored Heron (*Egretta tricolor*)
- Reddish Egret (*Egretta rufescens*)
- Cattle Egret (*Bubulcus ibis*)
- Green Heron (*Butorides virescens*)

- Black-crowned Night-Heron (*Nycticorax nycticorax*)
- Yellow-crowned Night-Heron (*Nyctanassa violacea*)

THRESKIORNITHIDAE: Ibises, Spoonbills

- White Ibis (*Eudocimus albus*)
- Glossy Ibis (*Plegadis falcinellus*)
- White-faced Ibis (*Plegadis chihi*)
- Roseate Spoonbill (*Platalea ajaja*)

CATHARTIDAE: American Vultures

- Black Vulture (*Coragyps atratus*)
- Turkey Vulture (*Cathartes aura*)

PANDIONIDAE: Ospreys

- Osprey (*Pandion haliaetus*)

ACCIPITRIDAE: Kites, Eagles, Hawks

- Swallow-tailed Kite (*Elanoides forficatus*)
- White-tailed Kite (*Elanus leucurus*)
- Mississippi Kite (*Ictinia mississippiensis*)
- Bald Eagle (*Haliaeetus leucocephalus*)
- Northern Harrier (*Circus cyaneus*)
- Sharp-shinned Hawk (*Accipiter striatus*)
- Cooper's Hawk (*Accipiter cooperii*)
- Northern Goshawk (*Accipiter gentilis*)
- Common Black Hawk (*Buteogallus anthracinus*)
- Harris's Hawk (*Parabuteo unicinctus*)
- Gray Hawk (*Buteo plagiatus*)
- Red-shouldered Hawk (*Buteo lineatus*)
- Broad-winged Hawk (*Buteo platypterus*)
- Short-tailed Hawk (*Buteo brachyurus*)
- Swainson's Hawk (*Buteo swainsoni*)
- Zone-tailed Hawk (*Buteo albonotatus*)
- Red-tailed Hawk (*Buteo jamaicensis*)
- Rough-legged Hawk (*Buteo lagopus*)
- Ferruginous Hawk (*Buteo regalis*)
- Golden Eagle (*Aquila chrysaetos*)

RALLIDAE: Rails, Gallinules, Coots

- Yellow Rail (*Coturnicops noveboracensis*)
- Black Rail (*Laterallus jamaicensis*)
- Clapper Rail (*Rallus crepitans*)
- King Rail (*Rallus elegans*)
- Virginia Rail (*Rallus limicola*)
- Rufous-necked Wood-Rail (*Aramides axillaris*)
- Sora (*Porzana carolina*)
- Purple Gallinule (*Porphyrio martinicus*)
- Common Gallinule (*Gallinula galeata*)
- American Coot (*Fulica americana*)

HELIORNITHIDAE: Finfoots

- Sungrebe (*Heliornis fulica*)

GRUIDAE: Cranes

- Sandhill Crane (*Grus Canadensis*)
- Common Crane (*Grus grus*)

RECURVIROSTRIDAE: Stilts, Avocets

- Black-necked Stilt (*Himantopus mexicanus*)
- American Avocet (*Recurvirostra Americana*)

CHARADRIIDAE: Plovers

- Black-bellied Plover (*Pluvialis squatarola*)
- American Golden-Plover (*Pluvialis dominica*)
- Snowy Plover (*Charadrius nivosus*)
- Semipalmated Plover (*Charadrius semipalmatus*)
- Piping Plover (*Charadrius melodus*)
- Killdeer (*Charadrius vociferous*)
- Mountain Plover (*Charadrius montanus*)

SCOLOPACIDAE: Sandpipers, Phalaropes

- Spotted Sandpiper (*Actitis macularius*)
- Solitary Sandpiper (*Tringa solitaria*)
- Wandering Tattler (*Tringa incana*)
- Greater Yellowlegs (*Tringa melanoleuca*)
- Willet (*Tringa semipalmata*)
- Lesser Yellowlegs (*Tringa flavipes*)
- Upland Sandpiper (*Bartramia longicauda*)
- Whimbrel (*Numenius phaeopus*)
- Long-billed Curlew (*Numenius americanus*)
- Hudsonian Godwit (*Limosa haemastica*)
- Marbled Godwit (*Limosa fedoa*)
- Ruddy Turnstone (*Arenaria interpres*)
- Black Turnstone (*Arenaria melanocephala*)
- Red Knot (*Calidris canutus*)
- Ruff (*Calidris pugnax*)
- Sharp-tailed Sandpiper (*Calidris acuminate*)
- Stilt Sandpiper (*Calidris himantopus*)
- Curlew Sandpiper (*Calidris ferruginea*)
- Sanderling (*Calidris alba*)
- Dunlin (*Calidris alpine*)
- Baird’s Sandpiper (*Calidris bairdii*)
- Little Stint (*Calidris minuta*)
- Least Sandpiper (*Calidris minutilla*)
- White-rumped Sandpiper (*Calidris fuscicollis*)
- Buff-breasted Sandpiper (*Calidris subruficollis*)
- Pectoral Sandpiper (*Calidris melanotos*)
- Semipalmated Sandpiper (*Calidris pusilla*)
- Western Sandpiper (*Calidris mauri*)

- Short-billed Dowitcher (*Limnodromus griseus*)
- Long-billed Dowitcher (*Limnodromus scolopaceus*)
- Wilson's Snipe (*Gallinago delicate*)
- American Woodcock (*Scolopax minor*)
- Wilson's Phalarope (*Phalaropus tricolor*)
- Red-necked Phalarope (*Phalaropus lobatus*)
- Red Phalarope (*Phalaropus fulicarius*)

STERCORARIIDAE: Skuas, Jaegers

- Pomarine Jaeger (*Stercorarius pomarinus*)
- Parasitic Jaeger (*Stercorarius parasiticus*)
- Long-tailed Jaeger (*Stercorarius longicaudus*)

ALCIDAE: Auks, Murres, Puffins

- Long-billed Murrelet (*Brachyramphus perdix*)
- Ancient Murrelet (*Synthliboramphus antiquus*)

LARIDAE: Gulls, Terns, Skimmers

- Black-legged Kittiwake (*Rissa tridactyla*)
- Sabine's Gull (*Xema sabini*)
- Bonapart's Gull (*Chroicocephalus philadelphia*)
- Little Gull (*Hydrocoloeus minutus*)
- Laughing Gull (*Leucophaeus atricilla*)
- Franklin's Gull (*Leucophaeus pipixcan*)
- Black-tailed Gull (*Larus crassirostris*)
- Heermann's Gull (*Larus heermanni*)
- Mew Gull (*Larus canus*)
- Ring-billed Gull (*Larus delawarensis*)
- Western Gull (*Larus occidentalis*)
- California Gull (*Larus californicus*)
- Herring Gull (*Larus argentatus*)
- Thayer's Gull (*Larus thayeri*)
- Iceland Gull (*Larus glaucoides*)
- Lesser Black-backed Gull (*Larus fuscus*)
- Glaucous-winged Gull (*Larus glaucescens*)
- Glaucous Gull (*Larus hyperboreus*)
- Sooty Tern (*Onychoprion fuscatus*)
- Least Tern (*Sternula antillarum*)
- Gull-billed Tern (*Gelochelidon nilotica*)
- Caspian Tern (*Hydroprogne caspia*)
- Black Tern (*Chlidonias niger*)
- Common Tern (*Sterna hirundo*)
- Arctic Tern (*Sterna paradisaea*)
- Forster's Tern (*Sterna forsteri*)
- Royal Tern (*Thalasseus maximus*)
- Elegant Tern (*Thalasseus elegans*)
- Black Skimmer (*Rynchops niger*)

COLUMBIDAE: Pigeons, Doves

- Band-tailed Pigeon (*Patagioenas fasciata*)
- Inca Dove (*Columbina inca*)
- Common Ground-Dove (*Columbina passerine*)
- Ruddy Ground-Dove (*Columbina talpacoti*)
- White-winged Dove (*Zenaida asiatica*)
- Mourning Dove (*Zenaida macroura*)

CUCULIDAE: Cuckoos, Roadrunners, Anis

- Yellow-billed Cuckoo (*Coccyzus americanus*)
- Black-billed Cuckoo (*Coccyzus erythropthalmus*)
- Greater Roadrunner (*Geococcyx californianus*)
- Groove-billed Ani (*Crotophaga sulcirostris*)

TYTONIDAE: Barn Owls

- Barn Owl (*Tyto alba*)

STRIGIDAE: Typical Owls

- Flammulated Owl (*Psiloscops flammeolus*)
- Western Screech-Owl (*Megascops kennicottii*)
- Eastern Screech-Owl (*Megascops asio*)
- Whiskered Screech-Owl (*Megascops trichopsis*)
- Great Horned Owl (*Bubo virginianus*)
- Northern Pygmy-Owl (*Glaucidium gnoma*)
- Elf Owl (*Micrathene whitneyi*)
- Burrowing Owl (*Athene cunicularia*)
- Spotted Owl (*Strix occidentalis*)
- Barred Owl (*Strix varia*)
- Long-eared Owl (*Asio otus*)
- Short-eared Owl (*Asio flammeus*)
- Boreal Owl (*Aegolius funereus*)
- Northern Saw-whet Owl (*Aegolius acadicus*)

CAPRIMULGIDAE: Nightjars

- Lesser Nighthawk (*Chordeiles acutipennis*)
- Common Nighthawk (*Chordeiles minor*)
- Common Poorwill (*Phalaenoptilus nuttallii*)
- Chuck-will's-widow (*Antrostomus carolinensis*)
- Buff-collared Nightjar (*Antrostomus ridgwayi*)
- Eastern Whip-poor-will (*Antrostomus vociferous*)
- Mexican Whip-poor-will (*Antrostomus arizonae*)

APODIDAE: Swifts

- Black Swift (*Cypseloides niger*)
- Chimney Swift (*Chaetura pelagica*)
- Vaux's Swift (*Chaetura vauxi*)

- White-throated Swift (*Aeronautes saxatalis*)

TROCHILIDAE: Hummingbirds

- Green Violetear (*Colibri thalassinus*)
- Magnificent Hummingbird (*Eugenes fulgens*)
- Blue-throated Hummingbird (*Lampornis clemenciae*)
- Lucifer Hummingbird (*Calothorax Lucifer*)
- Ruby-throated Hummingbird (*Archilochus colubris*)
- Black-chinned Hummingbird (*Archilochus alexandri*)
- Anna’s Hummingbird (*Calypte anna*)
- Costa’s Hummingbird (*Calypte costae*)
- Broad-tailed Hummingbird (*Selasphorus platycercus*)
- Rufous Hummingbird (*Selasphorus rufus*)
- Allen’s Hummingbird (*Selasphorus sasin*)
- Calliope Hummingbird (*Selasphorus calliope*)
- Broad-billed Hummingbird (*Cynanthus latirostris*)
- Berylline Hummingbird (*Amazilia beryllina*)
- Cinnamon Hummingbird (*Amazilia rutile*)
- Violet-crowned Hummingbird (*Amazilia violiceps*)
- White-eared Hummingbird (*Hylocharis leucotis*)

TROGONIDAE: Trogons

- Elegant Trogon (*Trogon elegans*)

ALCEDINIDAE: Kingfishers

- Belted Kingfisher (*Megaceryle alcyon*)
- Green Kingfisher (*Chloroceryle americana*)

PICIDAE: Woodpeckers

- Lewis’s Woodpecker (*Melanerpes lewis*)
- Red-headed Woodpecker (*Melanerpes erythrocephalus*)
- Acorn Woodpecker (*Melanerpes formicivorus*)
- Gila Woodpecker (*Melanerpes uropygialis*)
- Red-bellied Woodpecker (*Melanerpes carolinus*)
- Williamson’s Sapsucker (*Sphyrapicus thyroideus*)
- Yellow-bellied Sapsucker (*Sphyrapicus varius*)
- Red-naped Sapsucker (*Sphyrapicus nuchalis*)
- Red-breasted Sapsucker (*Sphyrapicus ruber*)
- Ladder-backed Woodpecker (*Picoides scalaris*)
- Downy Woodpecker (*Picoides pubescens*)
- Hairy Woodpecker (*Picoides villosus*)

- Arizona Woodpecker (*Picoides arizonae*)
- American Three-toed Woodpecker (*Picoides dorsalis*)
- Northern Flicker (*Colaptes auratus*)

FALCONIDAE: Caracaras, Falcons

- Crested Caracara (*Caracara cheriway*)
- American Kestrel (*Falco sparverius*)
- Merlin (*Falco columbarius*)
- Aplomado Falcon (*Falco femoralis*)
- Peregrine Falcon (*Falco peregrinus*)
- Prairie Falcon (*Falco mexicanus*)

TYRANNIDAE: Tyrant Flycatchers

- Northern Beardless-Tyrannulet (*Camptostoma imberbe*)
- Olive-sided Flycatcher (*Contopus cooperi*)
- Greater Pewee (*Contopus pertinax*)
- Western Wood-Pewee (*Contopus sordidulus*)
- Eastern Wood-Pewee (*Contopus virens*)
- Yellow-bellied Flycatcher (*Empidonax flaviventris*)
- Acadian Flycatcher (*Empidonax virescens*)
- Willow Flycatcher (*Empidonax traillii*)
- Least Flycatcher (*Empidonax minimus*)
- Hammond's Flycatcher (*Empidonax hammondii*)
- Gray Flycatcher (*Empidonax wrightii*)
- Dusky Flycatcher (*Empidonax oberholseri*)
- Pacific-slope Flycatcher (*Empidonax difficilis*)
- Cordilleran Flycatcher (*Empidonax occidentalis*)
- Buff-breasted Flycatcher (*Empidonax fulvifrons*)
- Black Phoebe (*Sayornis nigricans*)
- Eastern Phoebe (*Sayornis phoebe*)
- Say's Phoebe (*Sayornis saya*)
- Vermilion Flycatcher (*Pyrocephalus rubinus*)
- Dusky-capped Flycatcher (*Myiarchus tuberculifer*)
- Ash-throated Flycatcher (*Myiarchus cinerascens*)
- Great Crested Flycatcher (*Myiarchus crinitus*)
- Brown-crested Flycatcher (*Myiarchus tyrannulus*)
- Great Kiskadee (*Pitangus sulphuratus*)
- Sulphur-bellied Flycatcher (*Myiodynastes luteiventris*)
- Piratic Flycatcher (*Legatus leucophaius*)
- Tropical Kingbird (*Tyrannus melancholicus*)
- Couch's Kingbird (*Tyrannus couchii*)
- Cassin's Kingbird (*Tyrannus vociferans*)
- Thick-billed Kingbird (*Tyrannus crassirostris*)

- Western Kingbird (*Tyrannus verticalis*)
- Eastern Kingbird (*Tyrannus tyrannus*)
- Scissor-tailed Flycatcher (*Tyrannus forficatus*)

LANIIDAE: Shrikes

- Loggerhead Shrike (*Lanius ludovicianus*)
- Northern Shrike (*Lanius excubitor*)

VIREONIDAE: Vireos

- White-eyed Vireo (*Vireo griseus*)
- Bell's Vireo (*Vireo bellii*)
- Black-capped Vireo (*Vireo atricapilla*)
- Gray Vireo (*Vireo vicinior*)
- Yellow-throated Vireo (*Vireo flavifrons*)
- Plumbeous Vireo (*Vireo plumbeus*)
- Cassin's Vireo (*Vireo cassinii*)
- Blue-headed Vireo (*Vireo solitaries*)
- Hutton's Vireo (*Vireo huttoni*)
- Warbling Vireo (*Vireo gilvus*)
- Philadelphia Vireo (*Vireo philadelphicus*)
- Red-eyed Vireo (*Vireo olivaceus*)
- Yellow-green Vireo (*Vireo flavoviridis*)

CORVIDAE: Jays, Magpies, Crows

- Gray Jay (*Perisoreus Canadensis*)
- Pinyon Jay (*Gymnorhinus cyanocephalus*)
- Steller's Jay (*Cyanocitta stelleri*)
- Blue Jay (*Cyanocitta cristata*)
- Western Scrub-Jay (*Aphelocoma californica*)
- Mexican Jay (*Aphelocoma wollweberi*)
- Clark's Nutcracker (*Nucifraga columbiana*)
- Black-billed Magpie (*Pica hudsonia*)
- American Crow (*Corvus brachyrhynchos*)
- Chihuahuan Raven (*Corvus cryptoleucus*)
- Common Raven (*Corvus corax*)

ALAUDIDAE: Larks

- Horned Lark (*Eremophila alpestris*)

HIRUNDINIDAE: Swallows

- Purple Martin (*Progne subis*)
- Tree Swallow (*Tachycineta bicolor*)
- Violet-green Swallow (*Tachycineta thalassina*)
- Northern Rough-winged Swallow (*Stelgidopteryx serripennis*)
- Bank Swallow (*Riparia riparia*)
- Cliff Swallow (*Petrochelidon pyrrhonota*)
- Cave Swallow (*Petrochelidon fulva*)
- Barn Swallow (*Hirundo rustica*)

PARIDAE: Chickadees, Titmice

- Black-capped Chickadee (*Poecile atricapillus*)
- Mountain Chickadee (*Poecile gambeli*)
- Mexican Chickadee (*Poecile sclateri*)
- Bridled Titmouse (*Baeolophus wollweberi*)
- Juniper Titmouse (*Baeolophus ridgwayi*)

REMIZIDAE: Verdins

- Verdin (*Auriparus flaviceps*)

AEGITHALIDAE: Bushtits

- Bushtit (*Psaltriparus minimus*)

SITTIDAE: Nuthatches

- Red-breasted Nuthatch (*Sitta canadensis*)
- White-breasted Nuthatch (*Sitta carolinensis*)
- Pygmy Nuthatch (*Sitta pygmaea*)

CERTHIIDAE: Creepers

- Brown Creeper (*Certhia americana*)

TROGLODYTIDAE: Wrens

- Rock Wren (*Salpinctes obsoletus*)
- Canyon Wren (*Catherpes mexicanus*)
- House Wren (*Troglodytes aedon*)
- Pacific Wren (*Troglodytes pacificus*)
- Winter Wren (*Troglodytes hiemalis*)
- Sedge Wren (*Cistothorus platensis*)
- Marsh Wren (*Cistothorus palustris*)
- Carolina Wren (*Thryothorus ludovicianus*)
- Bewick's Wren (*Thryomanes bewickii*)
- Cactus Wren (*Campylorhynchus brunneicapillus*)

POLIOPTILIDAE: Gnatcatchers

- Blue-gray Gnatcatcher (*Polioptila caerulea*)
- Black-tailed Gnatcatcher (*Polioptila melanura*)
- Black-capped Gnatcatcher (*Polioptila nigriceps*)

CINCLIDAE: Dippers

- American Dipper (*Cinclus mexicanus*)

REGULIDAE: Kinglets

- Golden-crowned Kinglet (*Regulus satrapa*)
- Ruby-crowned Kinglet (*Regulus calendula*)

MUSCICAPIDAE: Old World Flycatchers

- Northern Wheatear (*Oenanthe oenanthe*)

TURDIDAE: Thrushes

- Eastern Bluebird (*Sialia sialis*)

- Western Bluebird (*Sialia mexicana*)
- Mountain Bluebird (*Sialia currucoides*)
- Townsend's Solitaire (*Myadestes townsendi*)
- Veery (*Catharus fuscescens*)
- Gray-cheeked Thrush (*Catharus minimus*)
- Swainson's Thrush (*Catharus ustulatus*)
- Hermit Thrush (*Catharus guttatus*)
- Wood Thrush (*Hylocichla mustelina*)
- Clay-colored Thrush (*Turdus grayi*)
- Rufous-backed Robin (*Turdus rufopalliatus*)
- American Robin (*Turdus migratorius*)
- Varied Thrush (*Ixoreus naevius*)

MIMIDAE: Mockingbirds, Thrashers

- Gray Catbird (*Dumetella carolinensis*)
- Curve-billed Thrasher (*Toxostoma curvirostre*)
- Brown Thrasher (*Toxostoma rufum*)
- Long-billed Thrasher (*Toxostoma longirostre*)
- Bendire's Thrasher (*Toxostoma bendirei*)
- Crissal Thrasher (*Toxostoma crissale*)
- Sage Thrasher (*Oreoscoptes montanus*)
- Northern Mockingbird (*Mimus polyglottos*)

MOTACILLIDAE: Wagtails, Pipits

- White Wagtail (*Motacilla alba*)
- American Pipit (*Anthus rubescens*)
- Sprague's Pipit (*Anthus spragueii*)

BOMBYCILLIDAE: Waxwings

- Bohemian Waxwing (*Bombycilla garrulous*)
- Cedar Waxwing (*Bombycilla cedrorum*)

PTILIOGONATIDAE: Silky-flycatchers

- Phainopepla (*Phainopepla nitens*)

PEUCEDRAMIDAE: Olive Warbler

- Olive Warbler (*Peucedramus taeniatus*)

CALCARIIDAE: Longspurs, Snow Buntings

- Lapland Longspur (*Calcarius lapponicus*)
- Chestnut-collared Longspur (*Calcarius ornatus*)
- Smith's Longspur (*Calcarius pictus*)
- McCown's Longspur (*Rhynchophanes mccownii*)
- Snow Bunting (*Plectrophenax nivalis*)

PARULIDAE: Wood-Warblers

- Ovenbird (*Seiurus aurocapilla*)
- Worm-eating Warbler (*Helmitheros vermivorum*)

- Louisiana Waterthrush (*Parkesia motacilla*)
- Northern Waterthrush (*Parkesia noveboracensis*)
- Golden-winged Warbler (*Vermivora chrysoptera*)
- Blue-winged Warbler (*Vermivora cyanoptera*)
- Black-and-white Warbler (*Mniotilta varia*)
- Prothonotary Warbler (*Protonotaria citrea*)
- Swainson's Warbler (*Limnothlypis swainsonii*)
- Tennessee Warbler (*Oreothlypis peregrine*)
- Orange-crowned Warbler (*Oreothlypis celata*)
- Lucy's Warbler (*Oreothlypis luciae*)
- Nashville Warbler (*Oreothlypis ruficapilla*)
- Virginia's Warbler (*Oreothlypis virginiae*)
- MacGillivray's Warbler (*Geothlypis tolmiei*)
- Mourning Warbler (*Geothlypis Philadelphia*)
- Kentucky Warbler (*Geothlypis formosa*)
- Common Yellowthroat (*Geothlypis trichas*)
- Hooded Warbler (*Setophaga citrina*)
- American Redstart (*Setophaga ruticilla*)
- Cape May Warbler (*Setophaga tigrina*)
- Cerulean Warbler (*Setophaga cerulean*)
- Northern Parula (*Setophaga americana*)
- Magnolia Warbler (*Setophaga magnolia*)
- Bay-breasted Warbler (*Setophaga castanea*)
- Blackburnian Warbler (*Setophaga fusca*)
- Yellow Warbler (*Setophaga petechial*)
- Chestnut-sided Warbler (*Setophaga pensylvanica*)
- Blackpoll Warbler (*Setophaga striata*)
- Black-throated Blue Warbler (*Setophaga caerulescens*)
- Palm Warbler (*Setophaga palmarum*)
- Pine Warbler (*Setophaga pinus*)
- Yellow-rumped Warbler (*Setophaga coronate*)
- Yellow-throated Warbler (*Setophaga dominica*)
- Prairie Warbler (*Setophaga discolor*)
- Grace's Warbler (*Setophaga graciae*)
- Black-throated Gray Warbler (*Setophaga nigrescens*)
- Townsend's Warbler (*Setophaga townsendi*)
- Hermit Warbler (*Setophaga occidentalis*)
- Golden-cheeked Warbler (*Setophaga chrysoparia*)

- Black-throated Green Warbler (*Setophaga virens*)
- Fan-tailed Warbler (*Basileuterus lachrymosus*)
- Rufous-capped Warbler (*Basileuterus rufifrons*)
- Golden-crowned Warbler (*Basileuterus culicivorus*)
- Canada Warbler (*Cardellina canadensis*)
- Wilson's Warbler (*Cardellina pusilla*)
- Red-faced Warbler (*Cardellina rubrifrons*)
- Painted Redstart (*Myioborus pictus*)
- Slate-throated Redstart (*Myioborus miniatus*)
- Yellow-breasted Chat (*Icteria virens*)

EMBERIZIDAE: Sparrows

- Green-tailed Towhee (*Pipilo chlorurus*)
- Spotted Towhee (*Pipilo maculatus*)
- Eastern Towhee (*Pipilo erythrophthalmus*)
- Rufous-crowned Sparrow (*Aimophila ruficeps*)
- Canyon Towhee (*Melozone fusca*)
- Abert's Towhee (*Melozone aberti*)
- Rufous-winged Sparrow (*Peucaea carpalis*)
- Botteri's Sparrow (*Peucaea botterii*)
- Cassin's Sparrow (*Peucaea cassinii*)
- American Tree Sparrow (*Spizelloides arborea*)
- Chipping Sparrow (*Spizella passerine*)
- Clay-colored Sparrow (*Spizella pallida*)
- Brewer's Sparrow (*Spizella breweri*)
- Field Sparrow (*Spizella pusilla*)
- Black-chinned Sparrow (*Spizella atrogularis*)
- Vesper Sparrow (*Pooecetes gramineus*)
- Lark Sparrow (*Chondestes grammacus*)
- Black-throated Sparrow (*Amphispiza bilineata*)
- Sagebrush Sparrow (*Artemisiospiza nevadensis*)
- Lark Bunting (*Calamospiza melanocorys*)
- Savannah Sparrow (*Passerculus sandwichensis*)
- Grasshopper Sparrow (*Ammodramus savannarum*)
- Baird's Sparrow (*Ammodramus bairdii*)
- Henslow's Sparrow (*Ammodramus henslowii*)
- Le Conte's Sparrow (*Ammodramus leconteii*)
- Nelson's Sparrow (*Ammodramus nelson*)
- Fox Sparrow (*Passerella iliaca*)
- Song Sparrow (*Melospiza melodia*)
- Lincoln's Sparrow (*Melospiza lincolnii*)
- Swamp Sparrow (*Melospiza georgiana*)

- White-throated Sparrow (*Zonotrichia albicollis*)
- Harris's Sparrow (*Zonotrichia querula*)
- White-crowned Sparrow (*Zonotrichia leucophrys*)
- Golden-crowned Sparrow (*Zonotrichia atricapilla*)
- Dark-eyed Junco (*Junco hyemalis*)
- Yellow-eyed Junco (*Junco phaeonotus*)

CARDINALIDAE: Tanagers, Cardinals, Grosbeaks

- Hepatic Tanager (*Piranga flava*)
- Summer Tanager (*Piranga rubra*)
- Scarlet Tanager (*Piranga olivacea*)
- Western Tanager (*Piranga ludoviciana*)
- Northern Cardinal (*Cardinalis cardinalis*)
- Pyrrhuloxia (*Cardinalis sinuatus*)
- Yellow Grosbeak (*Pheucticus chrysopeplus*)
- Rose-breasted Grosbeak (*Pheucticus ludovicianus*)
- Black-headed Grosbeak (*Pheucticus melanocephalus*)
- Blue Grosbeak (*Passerina caerulea*)
- Lazuli Bunting (*Passerina amoena*)
- Indigo Bunting (*Passerina cyanea*)
- Varied Bunting (*Passerina versicolor*)
- Painted Bunting (*Passerina ciris*)
- Dickcissel (*Spiza americana*)

ICTERIDAE: Blackbirds, Orioles

- Bobolink (*Dolichonyx oryzivorus*)
- Red-winged Blackbird (*Agelaius phoeniceus*)
- Eastern Meadowlark (*Sturnella magna*)
- Western Meadowlark (*Sturnella neglecta*)
- Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*)
- Rusty Blackbird (*Euphagus carolinus*)
- Brewer's Blackbird (*Euphagus cyanocephalus*)
- Common Grackle (*Quiscalus quiscula*)
- Great-tailed Grackle (*Quiscalus mexicanus*)
- Bronzed Cowbird (*Molothrus aeneus*)
- Brown-headed Cowbird (*Molothrus ater*)
- Orchard Oriole (*Icterus spurius*)
- Hooded Oriole (*Icterus cucullatus*)
- Streak-backed Oriole (*Icterus pustulatus*)
- Bullock's Oriole (*Icterus bullockii*)
- Baltimore Oriole (*Icterus galbula*)
- Scott's Oriole (*Icterus parisorum*)

FRINGILLIDAE: Finches

- Gray-crowned Rosy-Finch (*Leucosticte tephrocotis*)
- Black Rosy-Finch (*Leucosticte atrata*)

- Brown-capped Rosy-Finch (*Leucosticte australis*)
- Pine Grosbeak (*Pinicola enucleator*)
- House Finch (*Haemorhous mexicanus*)
- Purple Finch (*Haemorhous purpureus*)
- Cassin's Finch (*Haemorhous cassinii*)
- Red Crossbill (*Loxia curvirostra*)
- White-winged Crossbill (*Loxia leucoptera*)
- Common Redpoll (*Acanthis flammea*)
- Pine Siskin (*Spinus pinus*)
- Lesser Goldfinch (*Spinus psaltria*)
- Lawrence's Goldfinch (*Spinus lawrencei*)
- American Goldfinch (*Spinus tristis*)
- Evening Grosbeak (*Coccothraustes vespertinus*)

Source: (Audubon New Mexico, 2015a)

New Mexico is located within the Central and Pacific Flyways. Covering the eastern three-fourths of New Mexico, the Central Flyway spans from the Gulf Coast of Texas to the Canadian boreal forest. The Pacific Flyway covers the western one-fourth of New Mexico and spans from the west coast of Mexico to the arctic. Large numbers of migratory birds use these flyways and other migration corridors and pathways throughout the state each year during their annual migrations northward in the spring and southward in the fall. "The Migratory Bird Treaty Act (MBTA) makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to Federal regulations" (USFWS, 2013a). The USFWS is responsible for enforcing the MBTA and maintaining the list of protected species. The migratory bird species protected under the MBTA are listed in 50 CFR 10.13 (USFWS, 2013a).

Bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) are protected under the Bald and Golden Eagle Protection Act. Bald eagles are generally found near large rivers and lakes in New Mexico throughout the year, with bald eagles migrating to New Mexico from the north in the winter (NMDGF, 1996) (eBird, 2015a). Golden eagles are generally found in drier portions of the state and may be found in mountain habitats, grasslands, or open desert, but generally found around the mountains and cliffs where they nest. Golden eagles are also found throughout the state year-round (eBird, 2015b).

The Important Bird Area (IBA) program is an international bird conservation initiative with a goal of identifying the most important places for birds and to conserve these areas. IBAs are identified according to standardized, scientific criteria through a collaborative effort among state, national, and international conservation-oriented non-governmental organizations, state and federal government agencies, local conservation groups, academics, grassroots environmentalists, and birders. They link global and continental bird conservation priorities to local sites that provide critical habitat for native bird populations.[79] Generally, global IBAs are sites determined important for globally rare species or support bird populations at a global scale. Continental IBAs are sites determined important for continentally rare species or support bird populations at a continental scale, but do not meet the criteria for a global IBA. State IBAs are sites determined important for state rare species or support local populations of birds.

According to the New Mexico Audubon Society, 62 IBAs are in the state, as can be seen in Figure 10.1.6-2, including breeding ranges[80], migratory stop-over, feeding, and over-wintering areas, and a variety of habitats such as native grasslands, biogeographical "sky islands," high elevation pine forest, desert, rivers, canyons, and wetland/riparian[81] areas (Audubon New Mexico, 2015b). They are widely distributed throughout the state, with the largest concentration located along the Rio Grande and Pecos River drainage basins and the Lesser-prairie chicken complex in the east-central portion of the state.

[79] 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, 2015g).
[80] Breeding areas: "The area utilized by an organism during the reproductive phase of its lifecycle and during the time that young are reared" (USEPA, 2015g).
[81] Riparian: "Referring to the areas adjacent to rivers and streams with a differing density, diversity, and productivity of plant and animal species relative to nearby uplands" (USEPA, 2015g).

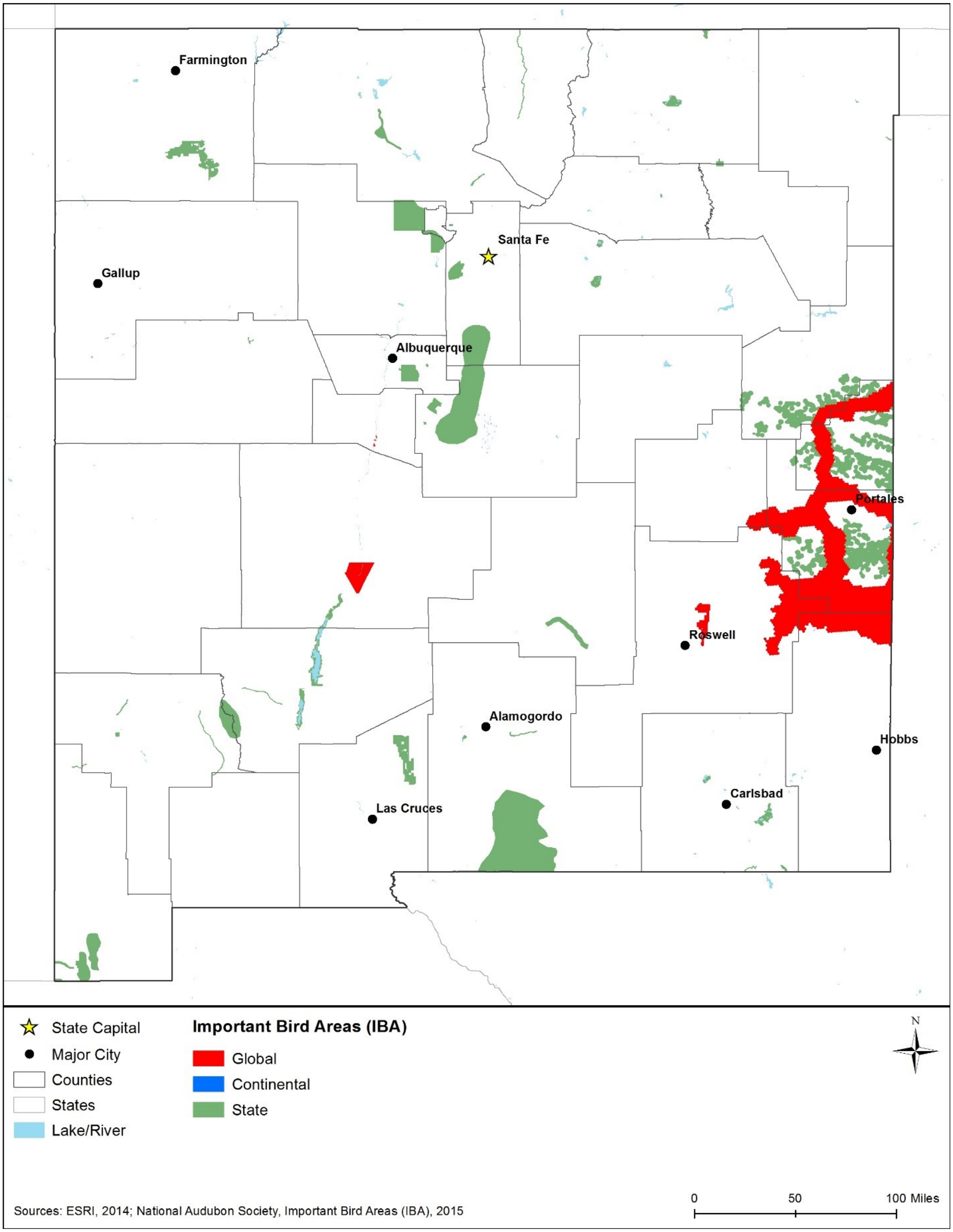

Figure 10.1.6-2: Important Bird Areas (IBA) of New Mexico

Reptiles and Amphibians

A total of 112 reptile species and 27 amphibian species, such as turtles and lizards, occur in the state of New Mexico, including 10 turtles, 49 lizards, 53 snakes, 24 frogs, and three salamanders. Reptiles can be found nearly everywhere in New Mexico in each type of vegetation community. Many species are widespread throughout the state, and a few are more commonly found in more specific habitats such as riparian areas or stock tanks.

Examples of reptiles found in the state of New Mexico, such as turtles, lizards, and snakes, include:

- Sonoran Mud Turtle (*Kinosternon sonoriense*)
- Western River Cooter (*Pseudemys gorzugi*)
- Big Bend Slider (*Trachemys gaigeae*)
- Arizona Black Rattlesnake (*Crotalus cerberus*)
- Rock Rattlesnake (*Crotalus lepidus*)
- New Mexico Ridge-nosed Rattlesnake (*Crotalus willardi*)
- Gray-checkered whiptail (*Aspidoscelis dixoni*)
- Gray-banded Kingsnake (*Lampropeltis alterna*)
- California Kingsnake (*Lampropeltis getula californiae*)
- Plain-bellied Water Snake (*Nerodia erythrogaster*)
- Green Rat Snake (*Senticolis triaspis*)
- Desert Massasauga (*Sistrurus catenatus edwardsii*)
- Mexican Gartersnake (*Thamnophis eques*)
- Arid Land Ribbonsnake (*Thamnophis proximus diabolicus*)
- Narrow-headed Gartersnake (*Thamnophis rufipunctatus*)
- Giant Spotted Whiptail (*Aspidoscelis stictogramma*)
- Reticulate Gila Monster (*Heloderma suspectum suspectum*)
- Mountain Skink (*Plestiodon callicephalus*)
- Dunes Sagebrush Lizard (*Sceloporus arenicolus*)
- Slevin's Bunchgrass Lizard (*Sceloporus slevini*)

Source: (NMDGF, 2015d)

Examples of amphibians found in the state of New Mexico include:

- Sacramento Mountain Salamander (*Aneides hardii*)
- Jemez Mountains Salamander (*Plethodon neomexicanus*)
- Boreal Toad (*Bufo boreas boreas*)
- Arizona Toad (*Anazyrus microscaphus*)
- Eastern Barking Frog (*Craugastor augusti*)
- Western Narrow-mouthed Toad (*Gastrophryne olivacea*)
- Arizona Treefrog (*Hyla wrightorum*)
- Sonoran Desert Toad (*Incilius alarius*)
- Rio Grande Leopard Frog (*Lithobates berlandieri*)
- Plains Leopard Frog (*Lithobates blairi*)
- Chiricahua Leopard Frog (*Lithobates chiricahuensis*)
- Northern Leopard Frog (*Lithobates pipiens*)
- Lowland Leopard Frog (*Lithobates yavapaiensis*)
- Boreal Chorus Frog (*Pseudacris maculata*)

Source: (NMDGF, 2015d)

Of the 139 native reptile and amphibian species, 47 SGCN have been identified (NMDGF, 2015d). Several threatened and endangered reptile and amphibian species occur in New Mexico and are identified in Section 10.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

All native reptile and amphibian species in New Mexico are protected nongame species and cannot be taken for commercial purposes under New Mexico game and fishing regulations (NMSA 17-2-4.2). Horned lizards (*Phrynosoma* spp.) are specifically protected such that no person may willfully kill or sell horned lizards (NMSA 17-2-15).

Invertebrates

In general, invertebrate species are poorly described and documented, resulting in an incomplete ecological understanding of this group of species. A complete list of invertebrate species known to occur in New Mexico has not been developed; however, certain groups of invertebrate species have been better studied and partially documented within the state (NHNM, 2015). Common invertebrate species in New Mexico include a wide variety of bees, wasps, ants, butterflies, moths, grasshoppers, beetles, flies, dragonflies, damselflies, spiders, scorpions, termites, mites, and nematodes. These invertebrates provide an abundant food source for mammals, birds, reptiles, amphibians, and other invertebrates. In the United States, one third of all agricultural output depends on pollinators[82]. In natural systems, the size and health of the pollinator population is linked to ecosystem health, with a direct relationship between pollinator diversity

[82] Pollinators: "Animals or insects that transfer pollen from plant to plant" (USEPA, 2015g).

and plant diversity. "As a group, native pollinators are threatened by habitat loss, pesticides, disease, and parasites" (NRCS, 2009).

Examples of invertebrates found in the state of New Mexico include:

- Lichen Grasshopper (*Leuronotina ritensis*)
- Mogollon Snowfly (*Capnia caryi*)
- Grande Stripetail (*Isoperla jewetti*)
- Southwest Willowfly (*Taenionema jacobii*)
- Yuma Skipper (*Ochlodes yuma anasazi*)
- Nevada Buckmoth (*Hemileuca nevadensis*)
- Northwestern Fritillary (*Speyeria hesperis ratonensis*)
- Arroyo Darner (*Rhionaeschna dugesi*)
- Barbara Anne's Tiger Beetle (*Cicindela politula barbarannae*)
- Bleached Skimmer (*Libellula composite*)
- Southwestern Hercules Beetle (*Dynastes granti*)
- Mescalero Shieldback (*Plagiostira mescaleroensis*)
- Guadalupe Mountains Tiger Beetle (*Cicindela politula petrophila*)
- Shotwell's Range Grasshopper (*Shotwellia isleta*)
- Minute Moss Beetle (*Limnebius aridus*)
- Bonita Diving Beetle (*Stictotarsus neomexicanus*)
- Poling's Hairstreak (*Satyrium polingi*)
- Nokomis Fritillary (*Speyeria nokomis nokomis*)
- Barrens Dagger Moth (*Acronicta albarufa*)
- Los Olmos Tiger Beetle (*Cicindela nevadica olmosa*)
- Anthony Blister Beetle (*Lytta mirifica*)
- Northwestern Fritillary (*Speyeria hesperis capitanensis*)
- Hoary Skimmer (*Libellula nodisticta*)
- Crimson Saltflat Tiger Beetle (*Cicindela fulgida rumppi*)

Source: (NHNM, 2015)

The NMDGF has identified 138 invertebrate SGCN, primarily various species of butterflies, beetles, grasshoppers, bees, and moths (NMDGF, 2015b). In New Mexico, nine federally listed and candidate terrestrial invertebrate species are known to occur and are discussed in Section 10.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Invasive Wildlife Species

New Mexico has not adopted official rules regarding invasive wildlife species. One species, however, the feral hog (*Sus scrofa*), is considered invasive and known to cause damage to habitat, contaminate water sources, destroy agricultural crops, and competes with native wildlife species as well as newborn livestock species (NMDGF, 2011). The NMDGF encourages legal hunting of feral hogs. Invasive wildlife species are important to consider when proposing a project since project activities may result in conditions that favor the growth and spread of invasive wildlife populations. These situations may result from directly altering the landscape or habitat to a condition that is more favorable for an invasive species, or by altering the landscape or habitat to a condition that is less favorable for a native species.

10.1.6.5. Fisheries and Aquatic Habitat

This section discusses the aquatic wildlife species in New Mexico, including freshwater fish and invertebrates. A summary of non-native and/or invasive aquatic species is also presented. The state of New Mexico contains a variety of aquatic habitats, including high-elevation lakes and streams, larger meandering rivers, and large reservoirs, as well as a variety of springs and ephemeral water features. No essential fish habitat identified by the Magnuson-Stevens Fishery Conservation and Management Act exists in New Mexico.[83]

Freshwater Fish

New Mexico is home to 96 species of native and introduced freshwater fish (NMDGF, 2015c). Fish present in the state range in size from small dace and topminnows to medium-sized species such as black bass (genus *Micropterus*), northern pike (*Esox lucius*), tiger muskie (*Esox Masquinongy X Esox Lucius*), walleye (*Sander vitreus*), and flathead catfish (*Pylodictis olivaris*). These species are grouped into 13 families, as follows: bullheads/catfishes, carps, darters/perches, killifishes, minnows, pikes/pickerels, pupfish, salmon/trout, sculpins, shads, shiners, silversides, and sticklebacks. Among these species are several important recreational and game fish, such as yellow perch (*Perca flavescens*), walleye, catfish (order *Siluriformes*), sunfishes, (*Micropterus* ssp.), northern pike, several species of trout (*Oncorhynchus* ssp.) and Kokanee salmon (*Oncorhynchus nerka*). Of the 96 extant fish species in New Mexico, 40 are identified as SGCN (NMDGF, 2015b). New Mexico also includes several federally listed fish species, which are identified in Section 10.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Fish communities in New Mexico follow a roughly defined distribution among two general habitat types: habitats along the larger rivers and reservoirs such as San Juan River, Red River, Rio Grande, Rio Guadalupe, Cimarron River, Elephant Butte, Conchas, and Ute, and those of small springs, mountain streams, headwater streams of larger rivers, lakes, and ponds, and isolated desert waters. Fish species of the larger rivers and reservoirs include native species such as bluehead sucker (*Catostomus discobolus*), Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), and speckled dace (*Rhinichthys osculus*); and game species such as largemouth bass (*Micropterus salmoides*), catfish, striped bass (*Morone saxatilis*), trout, among others. Species found in spring and small stream habitats as well as smaller lakes and cienegas include Gila trout (*Oncorhynchus gilae*), Pecos pupfish (*Cyprinodon*

[83] NOAA's Essential Fish Habitat Mapper v 3.0 was used to identify "EFH areas of particular concern" and "EFH areas protected from fishing". As of July 2016, the procedure to use this interactive tool is as follows: 1) Visit http://www.habitat.noaa.gov/protection/efh/habitatmapper.html. 2) Select "EFH Mapper" under Useful Links. 3) After closing the opening tutorial, select the "Region" of interest from the drop-down menu. 4) Select the species under "Essential Fish Habitat" to view the areas in the selected region protected for the various life states (i.e., eggs, larvae, juvenile, adult, or all).

pecosensis), Gila chub (*Gila intermedia*), headwater chub (*Gila nigra*), loach minnow (*Rhinichthys cobitis*), Gila topminnow (*Poeciliopsis occidentalis*), and spikedace (*Meda fulgida*), as well as game species such as trout, walleye, crappie (*Pomoxis annularis),* bass, bluegill (*Lepomis macrochirus*), and catfish (NMDGF, 2015c). Some fish species use both habitat types (for example but not limited to trout, crappie, and bass), but most tend to occur in one of the two general habitat types.

The salmon family is considered a very important fish family in the United States for many reasons, including commercial and recreational fishing value, their role in aquatic and terrestrial ecosystems, and their role in fisheries management. In New Mexico the salmon family is represented by two native species, Gila and Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*), as well as introduced game fish species, all of which tend to occur in headwater streams and rivers in the mountainous or upper elevation areas within the state. Both Apache trout (*Oncorhynchus apache*) and Gila trout are considered SGCN and occur in perennial headwater mountainous streams and rivers in the San Francisco Mountains and Black Range of west-central New Mexico, and have been introduced in several streams in west-central New Mexico, in the vicinity of Gila National Forest (NMDGF, 2015c). Brook trout (*Salvelinus fontinalis*) are uncommon in New Mexico but occur in small populations around the state. These trout species utilize gravel pools within headwater streams for spawning and nursery habitat. Ideal spawning habitat requires riverbeds with rapidly flowing water with good gravel substrate.

Freshwater fish and associated freshwater habitats are considered one of the most highly threatened ecosystems based on the decline in species population numbers. Approximately 40 percent of fish species in North America are considered at risk or vulnerable to extinction[84] (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. Desert fish species native to the southwestern US, including New Mexico, are predominantly endemic[85] to the region and are highly adapted to the unique desert conditions in which they inhabit (National Fish Habitat Board, 2010). Native fish species in New Mexico are considered to be the most threatened by habitat loss and degradation[86] resulting largely from urbanization, water diversion, and loss through damming of rivers and irrigation, overgrazing, introduced fishes, and drought. Salmonid and other fishes often outcompete and prey upon native desert fish, or in the case of native trout can interbreed and reduce the numbers of purebred native species (National Fish Habitat Board, 2010). Aquatic habitats have been largely altered as a result of water diversion projects, resulting in changes to major habitat constituents such as water temperature, seasonal flow regime, and sediment levels, among other factors.

[84] Extinction: “The disappearance of a species from part or all of its range” (USEPA, 2015g).

[85] Endemic: “A species that is restricted in its distribution to a particular locality or region.” (USEPA, 2015g).

[86] Degradation: “The reduction of the capacity of the environment to meet social and ecological objectives, and needs. Potential effects are varied and may contribute to an increase in vulnerability and the frequency and intensity of natural hazards” (USEPA, 2015g).

Shellfish and Other Invertebrates

New Mexico is home to 196 snails (terrestrial and aquatic), two native freshwater mussel species, and 36 crustacean species (primarily fairy shrimp, as well as crayfish) (NMDGF, 2015c). Little is known about most of the species in New Mexico, with many species assumed to be endemic to the state, occurring often in isolated springs, rock slides, and other undeveloped areas. New Mexico has identified a total of 32 crustacean and 68 mollusk SGCN (NMDGF, 2015b). Of the 196 extant species in New Mexico, nine are federally listed and are identified in Section 10.1.6.6, Threatened and Endangered Species and Species of Conservation Concern.

Invasive Aquatic Species

As previously discussed, New Mexico has implemented regulatory measures regarding aquatic invasive species (NMAC 19.30.14). NMGFD is responsible for establishing and implementing rules and regulations to assist with the control, management, and prevention of the spread of aquatic invasive species in the state. These may include developing a list of aquatic invasive species for New Mexico, designation of locations where listed aquatic invasive species are known to occur, and conditions for movement of watercraft, vehicles, and equipment in order to abate, eradicate, or prevent the spread of listed aquatic invasive species. The threat of zebra mussels (*Dreissena polymorpha*) and quagga mussels (*Dreissena bugensis*) becoming introduced in the state prompted the creation of the Aquatic Invasive Species program in New Mexico, and these two species remain the primary aquatic invasive species of concern (NMDGF, 2015e)

10.1.6.6. Threatened and Endangered Species and Species of Conservation Concern

The USFWS is responsible for administering the ESA (16 U.S.C §1531 et seq.) in state of New Mexico. The USFWS Southwest Region Office has identified 33 federally endangered and 20 federally threatened species known to occur in New Mexico (USFWS, 2015d). Two Experimental Populations (non-essential) of birds also occur in New Mexico (USFWS, 2016c) (USFWS, 2016d). Of these 55 federally listed species, 27of them have designated critical habitat[87] (USFWS, 2015e). The 55 federally listed species include 7 mammals, 3 reptiles, 2 amphibians, 8 birds (two Experimental Populations), 14 fishes, 8 invertebrates, and 13 plants, and are discussed in detail under the following sections.

The New Mexico Department of Game and Fish is directed under the New Mexico Wildlife Conservation Act to develop recovery plans for species listed by the state as threatened or endangered (NMDGF, 2015b). 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 might be required.

[87] Critical habitat includes "the specific areas (i) within the geographic area occupied by a species, at the time it is listed, on which are found those physical or biological features (I) essential to conserve the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographic area occupied by the species at the time it is listed upon determination that such areas are essential to conserve the species" (16 U.S.C §1532(5)(A)).

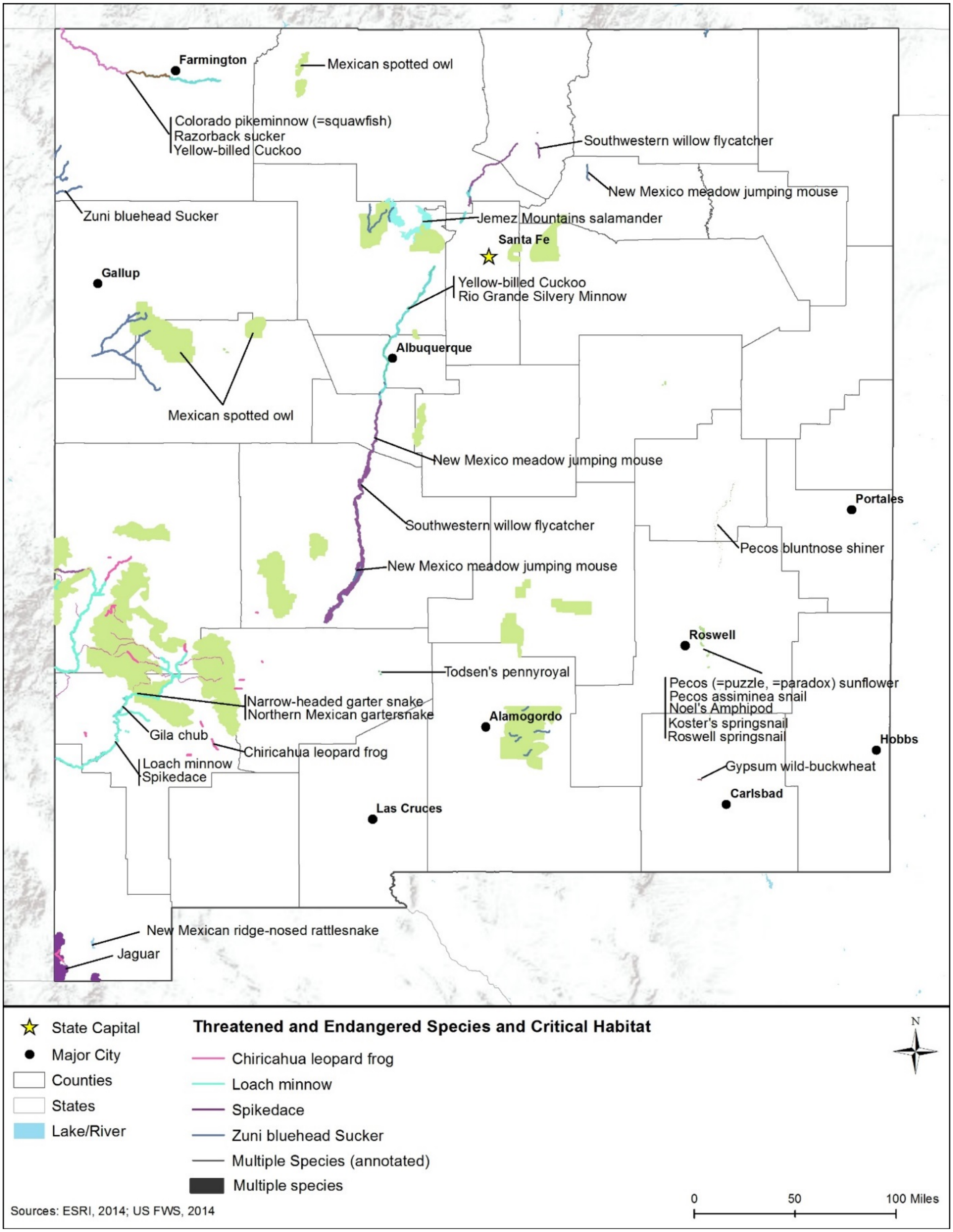

Figure 10.1.6-3: ESA Designated Critical Habitat in New Mexico

Mammals

Six endangered and one threatened species are federally listed for New Mexico as summarized in Table 10.1.6-3. The black-footed ferret (*Mustela nigripes*), Canada lynx (*Lynx Canadensis*), and the Mexican wolf (*Canis lupus baileyi*) occur in northern New Mexico (USFWS, 2015d) . The New Mexico meadow jumping mouse (*Zapus hudsonius luteus*) occurs in north-central New Mexico. The jaguar (*Panthera onca*), lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*), and the Mexican long-nosed bat (*Leptonycteris nivalis*) occur in southwestern New Mexico. The Peñasco least chipmunk (*Tamias minimus atristriatus*) has been identified as a candidate species in New Mexico (USFWS, 2015d) . Information on the habitat, distribution, and threats to the survival and recovery of each of these species in New Mexico is provided below.

Table 10.1.6-3: Federally Listed Mammal Species of New Mexico

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in New Mexico	Habitat Description
Black-footed Ferret	*Mustela nigripes*	E	No	Native grasslands with healthy populations of prairie dogs. Found in Colfax and Taos Counties, in northern New Mexico.
Canada Lynx	*Lynx canadensis*	T	No	Subalpine spruce-fir forest areas. Found in 5 Counties in northern New Mexico.
Mexican Wolf	*Canis lupus bailey*	E, XP	No	Temperate forests, mountains, tundra, taiga, and grasslands. Found in the portion north of the centerline of Interstate Highway 40; in Catron, Grant, Hidalgo, and Sierra Counties in northern New Mexico.
Jaguar	*Panthera onca*	E	Yes, Hidalgo County.	Thornscrub, deserts, semidesert grasslands, oak woodlands, and pine forests. Found in Hidalgo County, in the southwestern corner of New Mexico.
Lesser Long-nosed Bat	*Leptonycteris curasoae yerbabuenae*	E	No	Caves and mines as day roosts and requires foraging areas with flowering columnar cactus or paniculate agave. Found in Hidalgo County, in the southwestern boot of New Mexico.
Mexican Long-nosed Bat	*Leptonycteris nivalis*	E	No	Upper desert scrub and pine-oak woodlands with cacti and agave present. Found in Grant and Hidalgo Counties, southwestern New Mexico.
New Mexico Meadow Jumping Mouse	*Zapus hudsonius luteus*	E	Yes, Lincoln National Forest, Santa Fe National Forest.	Dry soils with riparian vegetation. Found in 10 counties in north-central New Mexico.

[a] E = Endangered, T = Threatened, XP = Experimental Population, Non-Essential
Source: (USFWS, 2015d) (USFWS, 2015e)

Black-footed Ferret. The black-footed ferret is a member of the weasel family (*Mustelidae*). This species is characterized by a slender body with black feet, face mask and tipped tail. It ranges from 19 to 24 inches in length and 1.4 to 2.5 pounds (USFWS, 2013b). The ferret was first listed as endangered under early endangered species legislation in 1967 (32 FR 4001, March 11, 1967) and was incorporated into the ESA in 1973 (USFWS, 2015f). There is currently no critical habitat for this species (USFWS, 2013b).

Once historically populous and ranging across the grasslands of the western US, by 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. Based on 2001 USFWS population estimates, there were “more than 1,000 black-footed ferrets in the wild, and another 280 living in breeding facilities” (USFWS, 2010a). In New Mexico, it is found in Colfax and Taos Counties, in the northern part of the state (USFWS, 2015g).

Suitable habitat for the black-footed ferret consists of native grasslands inhabited by prairie dogs. The survival of black-footed ferrets is directly connected to prairie dog abundance and habitat, as prairie dog burrows are used for shelter as well as dens to rear their young. In addition, over 90 percent of the black-footed ferret’s diet is composed of prairie dogs. The primary causes for this species’ near extinction were the loss of habitat and prey resulting from conversion of prairies to agriculture or other uses, and prairie dog eradication programs (USFWS, 2010a), (USFWS, 2013c).

Canada Lynx. The Canada lynx is an average-sized cat (ranging from 30 to 35 inches long and 14 to 31 pounds) with “large, well-furred paws, long, black ear tufts, and a short, black-tipped tail” that separates it from a bobcat (*Lynx rufus*) (USFWS, 2013d). This cat inhabits boreal forests dominated by spruce and fir, and is skilled at hunting in deep snow. Their primary prey is the snowshoe hare (*Lepus americanus*) and as a result the abundance and survival of the Canada lynx is directly related to the density and health of regional snowshoe hare populations. Only a few places in the lower 48 states regularly support Canada lynx populations. Lynx were released in Colorado in 1999 and some of those animals regularly and frequently crossed the state boundary between Colorado and New Mexico. The habitats present in New Mexico are not believed capable of supporting a self-sustaining population, but may provide foraging habitat (USFWS, 2005a). This species was federally listed as threatened in 2000 (65 FR 16053 16086, March 24, 2000). In New Mexico, it is found in five counties in the northern portion of the state (USFWS, 2015h).

The Canada lynx was listed in 2000 primarily due to concerns with regard to habitat destruction and the need for more regulatory control and consistent guidance for forest management activities. This species travels back and forth between the U.S. and Canada, so contiguous habitat is important. In addition, snowshoe hare habitat is also important because of the direct link between snowshoe hare abundance and lynx abundance and survival. Incidental take of lynx from hunting or trapping is not indicated as a cause for low species densities, according to available data (USFWS, 2005a), (USFWS, 2013e).

Mexican Gray Wolf. The endangered Mexican gray wolf (*Canis lupus baileyi*) is the smallest and rarest gray wolf subspecies in North America. The Mexican gray wolf has a beige, gray, rust, and black colored coat with a rust-colored head. This subspecies weighs between 50 and 80 pounds, and stands between 28 and 32 inches tall (USFWS, 2006). The gray wolf was initially listed as endangered in 1976; in 2015, the Mexican gray wolf was separated from the gray wolf as a distinct subspecies and remained protected while the gray wolf was delisted due to recovery (80 FR 2487 2512, February 17, 2015). The Mexican gray wolf's historic range extended from central Mexico through Texas, New Mexico, Arizona, and northward (USFWS, 2006). There are approximately 300 individual Mexican gray wolves in captivity, found in 45 zoos and wildlife facilities in the U.S. and Mexico (USFWS, 2006). In 1998, three packs of Mexican gray wolves were released on public lands in Arizona and New Mexico, with the release of additional wolves annually; reintroduced wolves have dispersed from the primary recovery zone into the Gila National Forest (USFWS, 2006).

Mexican gray wolves are social animals, living in packs of five or six animals, with an adult pair, their pups, and older siblings. After pairing, Mexican gray wolves generally mate for life. Breeding occurs between late January and early March, and litters of four to six pups are born in April or May. Dens are often caves, enlarged burrows, underneath tree roots, or under rock ledges. Mexican gray wolves are carnivores, with a typical diet of deer and elk, but are also known to prey on javelina (skunk pig), rabbits, and other small mammals. (USFWS, 2013f)

Reasons for the Mexican gray wolf's decline include habitat loss and fragmentation[88], historic hunting for their meat and hides, and the shortage of prey animals (USFWS, 2013f). In times of a shortage of prey animals, Mexican gray wolves may hunt livestock, leading to a contentious relationship with farmers (USFWS, 2006) (USFWS, 2013f).

Jaguar. The jaguar is a species of large predatory cat native to North, Central, and South America. The large, yellow to black, spotted cat can grow up to 220 pounds as an adult (USFWS, 2012a). The jaguar was first listed as endangered by the USFWS in 1972 (37 FR 6476, March 30, 1972) and was incorporated into the ESA of 1973. Critical habitat was established for the species in 2014 (79 FR 12571 12654, March 5, 2014), in southeastern Arizona and southwestern New Mexico. In New Mexico, it is found in Hidalgo County, in the southwestern corner of the state (USFWS, 2015i).

Jaguar Photo credit: USFWS

The species typically ranges from Mexico to southern Brazil, but its range occasionally stretches into southern portions of Arizona, New Mexico, and Texas. In New Mexico, it has been observed in the Peloncillo Mountains near the Arizona border, and in the Animas Mountains in Hidalgo County. The jaguar is associated with a wide variety of habitats throughout its range. In Arizona and New Mexico, the species will use thornscrub, deserts, semidesert grasslands, oak woodlands, and pine forests. The rare individuals in New Mexico are likely associated with

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

larger populations in Mexico. Threats to this species' success in New Mexico include habitat destruction or alteration, illegal killing, border issues, and climate change. (USFWS, 2012a).

Lesser Long-nosed Bat. The lesser long-nosed bat is a yellow-brown to cinnamon gray bat, with a wingspan of approximately 10 inches and a total length of approximately 3 inches. The tongue is approximately the same length as the body, and it has a small noseleaf. The lesser long-nosed bat was federally listed as endangered in 1988 (53 FR 38456 38460, September 30, 1988), but was later down-listed to threatened in 2013 (78 FR 55046 55051, September 9, 2013). No critical habitat has been established for the subspecies. In New Mexico, it can be found in Hidalgo County, in the southwestern boot of the state (USFWS, 2016a).

The lesser long-nosed bat occupies caves and mines as day roosts and require foraging areas with flowering columnar cactus or paniculate[89] agave. It is adapted for arid areas, often found in desert scrub habitat in its U.S. range and in higher elevations of wooded mountains in its southern range. Populations in the southern U.S. and northern Mexico migrate south during the fall and return north in the spring. The primary threat to the subspecies is habitat destruction via removal of agaves and cactus, necessary for it to forage (USFWS, 1988a).

Mexican Long-nosed Bat. The Mexican long-nosed bat is grayish brown in color on its back, with paler shoulders and underparts. It has a long nose with a leaf-like projection on the end, medium sized ears, no tail, and a long and extendable tongue. The Mexican long-nosed bat was federally listed as endangered in 1988 (53 FR 38456 38460, September 30, 1988) (USFWS, 2015j). The natural range for this bat includes northern and central Mexico and southwestern Texas and New Mexico in areas of upper desert scrub and pine-oak woodlands. In New Mexico, it is found in the Animas, Peloncillo and Big Hatchet Mountains in Grant and Hidalgo Counties, in the southwestern corner of the state (NMDGF, 2014a) (USFWS, 2015j).

The Mexican long-nosed bat is migratory in the northern portion of its range, where it relies upon flowering cacti and paniculate agaves as its primary food source. It utilizes caves and rock fissures, hollow trees and manmade structures for day and night roost sites. Population decline and lack of habitat protection, including agave plants, were cited as primary reasons for listing. It is believed that agave and cactus species utilized by Mexican long-nosed bat may be dependent upon the bats for sexual reproduction (NatureServe, 2015).

New Mexico Meadow Jumping Mouse. The New Mexico meadow jumping mouse is a grayish-brown to yellowish-brown mouse with white undersides and is approximately 7 to 10 inches in total length. The species was federally listed as endangered in 2014 (79 FR 33119 33137, June 10, 2014) and critical habitat within New Mexico was designated in 2016. The range of this species includes portions of New Mexico, eastern Arizona, and southern Colorado. In New Mexico, it is found in 10 counties throughout the state. (USFWS, 2015k).

The New Mexico Meadow jumping mouse has specific requirements for habitat, nesting in dry soils with riparian vegetation. The jumping mouse is generally nocturnal, but during the summer

[89] Loosely branched.

the jumping mouse may also be seen during the day preparing for hibernation[90]. The jumping mouse hibernates about nine months out of the year, longer than most other mammals. Threats to the jumping mouse include specific changes to its habitat such as water shortages or flooding, wildfires, and grazing (USFWS, 2014b).

Reptiles

Three threatened reptile species are federally listed for New Mexico, as summarized in Table 10.1.6-4. Narrow-headed gartersnake (*Thamnophis rufipunctatus*), New Mexican ridge-nosed rattlesnake (*Crotalus willardi obscurus*), and the Northern Mexican gartersnake (*Thamnophis eques megalops*) occur in southwestern New Mexico (USFWS, 2015d). Information on the habitat, distribution, and threats to the survival and recovery of each of these species in New Mexico is provided below.

Table 10.1.6-4: Federally Listed Reptile Species of New Mexico

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in New Mexico	Habitat Description
Narrow-headed Gartersnake	*Thamnophis rufipunctatus*	T	No; Critical habitat was proposed in 2013.	Clear, rock-boulder strewn streams in the San Francisco and Gila River drainages in southwestern New Mexico.
New Mexican Ridge-nosed Rattlesnake	*Crotalus willardi obscurus*	T	Yes; West Fork, Bear, Indian, and Spring canyons in the Animas mountain range in Hidalgo County.	Pine-oak woodlands and pine forests between 5,000 and 8,500 feet of elevation in the Animas Mountain Range, southwestern New Mexico.
Northern Mexican Gartersnake	*Thamnophis eques megalops*	T	No; Critical habitat was proposed in 2013.	Ponds, cienegas, and the riparian forests of lowland rivers and upland streams, between 3,000 and 5,000 feet in elevation in Gila River and Mule Creek, southwestern New Mexico.

[a] T = Threatened
Source: (USFWS, 2015d)

Narrow-headed Gartersnake. The narrow-headed gartersnake is a small to medium size aquatic snake that is tan or gray-brown in overall color with brown, black, or reddish spots that become indistinct towards the tail (NMDGF, 2014b). The narrow-headed gartersnake was listed as threatened in 2014 (79 FR 38677 38746, July 8, 2014) and critical habitat was proposed in 2013. This species occurs in Arizona and New Mexico down to northern Mexico. In New Mexico, narrow-headed gartersnakes are known to occur only in the San Francisco and Gila River drainages in Catron, Grant, Hidalgo, and Sierra Counties in the southwestern portion of the state (USFWS, 2015m).

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

It inhabits clear, rock-boulder strewn streams. This snake is a habitat specialist, occurring only in shallow, swift-flowing rocky streams and rivers where it feeds almost exclusively on fish. The reduced distribution and low population densities, in conjunction with the habitat specificity, evolution of specific mechanisms for increased underwater visual and foraging capabilities, and a low species dispersal rate, has resulted in a high susceptibility of this species to environmental change. Declining populations of native fish and greater presence of competitor species and non-native prey, such as American bullfrog, are also considered to be significant in decline of this species at certain locations (NMDGF, 2014b).

New Mexican Ridge-nosed Rattlesnake. The New Mexican ridge-nosed rattlesnake is a small subspecies of ridge-nosed rattlesnake, typically growing to a maximum length of 26 inches. It has pale gray to gray-brown coloration marked with pale crossbars on the back, and is cream to white colored on the underside. The New Mexican subspecies was listed as threatened with critical habitat in the Animas Mountains of New Mexico in 1978 (43 FR 34476 34480, August 4, 2015). The subspecies is endemic to mountain ranges of southwestern New Mexico, southeastern Arizona, and northern Mexico. In New Mexico, it can be found in Hidalgo County, in the southwestern part of the state (USFWS, 2015n). In New Mexico, critical habitat includes West Fork, Bear, Indian, and Spring canyons in the Animas mountain range within Hidalgo County in the southwest corner of the state (USFWS, 1985a).

New Mexican ridge-nosed rattlesnake habitat consists of pine-oak woodlands and pine forests between 5,000 and 8,500 feet of elevation, along bottoms of steep, rocky canyons with intermittent streams or talus slopes. Threats to the subspecies includes habitat loss due to fire, livestock grazing, and watersheds degradation, as well as illegal collection and human contact (USFWS, 2015n)

Northern Mexican Gartersnake. The northern Mexican gartersnake is a subspecies of Mexican gartersnake native to watersheds of Arizona, New Mexico, and northern Mexico. It is an olive-colored snake with a dark stripe down its sides. The northern Mexican gartersnake is only distinguished from other gartersnakes of the southwest by the location of this stripe on its side. It is a medium-sized snake and grows to approximately 44 inches in length. The subspecies was federally listed as threatened in 2014 (79 FR 38677 38746, July 8, 2014) and critical habitat within New Mexico proposed in 2013 (USFWS, 2015o). In New Mexico, the subspecies occurs along the Gila River and Mule Creek within Catron, Grant, and Hidalgo Counties in the southwest portion of the state (USFWS, 2015o).

The northern Mexican gartersnake is found in ponds and riparian forests of lowland rivers and upland streams, typically between 130 to 8,497 feet in elevation. Threats to the species include habitat modification, reduction of prey availability, habitat fragmentation, and introduction of invasive predators such as bullfrogs, and increased competition from non-native species (USFWS, 2015o).

Amphibians

One endangered and one threatened amphibian species are federally listed for New Mexico as summarized in Table 10.1.6-5. The Jemez Mountains salamander (*Plethodon neomexicanus*) occurs in the Jemez Mountains of northern New Mexico. The Chiricahua leopard frog (*Rana chiricahuensis*) occurs in the mountains of west-central New Mexico, and the bootheel of southwestern New Mexico. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in New Mexico is provided below. (USFWS, 2015d)

Table 10.1.6-5: Federally Listed Amphibian Species of New Mexico

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in New Mexico	Habitat Description
Chiricahua Leopard Frog	*Rana chiricahuensis*	T	Yes; in Catron, Grant, Hidalgo, Sierra, and Socorro Counties.	Stock tanks and other manmade waters, as well as headwater streams and springs that do not have introduced predators. Found in 6 counties in the mountains of west-central New Mexico, and the bootheel of southwestern New Mexico.
Jemez Mountains Salamander	*Plethodon neomexicanus*	E	Yes; in Los Alamos, Rio Arriba, and Sandoval Counties.	Slopes on the rim of the collapsed volcanic crater in the Jemez Mountains, at an elevation between 7,200 and 9,500 feet, within mixed-conifer forest. It lives under logs, rocks, bark, and inside logs. Found in northern New Mexico, in the Jemez Mountains in Los Alamos, Rio Arriba, and Sandoval Counties.

[a] E = Endangered, T = Threatened
Source: (USFWS, 2015d)

Chiricahua Leopard Frog. The Chiricahua leopard frog is a medium sized leopard frog that reaches about 4.3 inches in length. It is green or brown colored with many small dark spots. It is distinguished from other leopard frogs by its salt and pepper pattern on the rear of the thigh, folds on the back and sides, stocky body proportions, high and upturned eyes, and rough skin on the back and sides. It also has a distinctive call that sounds like a snore, lasting 1 to 2 seconds. The Chiricahua leopard frog was federally listed as threatened in 2002 (67 FR 40790 40811, June 13, 2002) (USFWS, 2014c) (USFWS, 2015p). Critical habitat was designated in 2012 (77 FR 16324 16424, March 20, 2012) in Catron, Grant, Hidalgo, Sierra, and Socorro Counties, New Mexico (USFWS, 2012b).

Regionally, this species can be found in Arizona, New Mexico, and Mexico. In New Mexico, it is found in six counties in the mountains of the west-central part, as well as the bootheel of the southwestern part of the state (USFWS, 2014c) (USFWS, 2015p). Historically, it inhabited a variety of wetland habitats, but is now restricted to stock tanks and other manmade waters, as well as headwater streams and springs that do not have introduced predators. Threats to the Chiricahua leopard frog include predation by introduced predators, the introduced fungal skin disease chytridiomycosis, and habitat loss and degradation due to water diversions, groundwater pumping, poor livestock management, wild fire, mining, development, and environmental contamination (USFWS, 2014c).

Jemez Mountains Salamander. The Jemez Mountains salamander is a slender, long-bodied terrestrial salamander. Its back is dark brown in color, with occasional fine gold to brassy coloring with mottling on the back and sides, and a sooty gray colored underside. Its feet are webbed, and it breathes through its skin. The Jemez Mountains salamander was federally listed as endangered in 2013 (78 FR 55599 55627, September 10, 2013) with critical habitat designated in 2013 (78 FR 69569 69591, November 20, 2013) in Los Alamos, Rio Arriba, and Sandoval Counties. This species is only found in northern New Mexico, in the Jemez Mountains in Los Alamos, Rio Arriba, and Sandoval Counties (USFWS, 2013g) (USFWS, 2015q).

It inhabits slopes on the rim of the collapsed volcanic crater in the Jemez Mountains, at an elevation between 7,200 and 9,500 feet, within mixed-conifer forest. It lives under logs, rocks, bark, and inside logs. Threats to the Jemez Mountains salamander include habitat loss, degradation, and modification due to wildfires, fire suppression, forest and fire management, roads, trails, and habitat fragmentation, recreation, and climate change (USFWS, 2013h).

Birds

Two endangered and four threatened bird species are federally listed for New Mexico as summarized in Table 10.1.6-6 (USFWS, 2015d). The lesser prairie-chicken (*Tympanuchus pallidicinctus*) occurs in eastern New Mexico. The Mexican spotted owl (*Strix occidentalis lucida*) occurs in central and western New Mexico. The least tern (*Sterna antillarum*) occurs along the Pecos River in the Bitter Lake National Wildlife Refuge in New Mexico. The piping plover (*Charadrius melodus*), Southwestern willow flycatcher (*Empidonax traillii extimus*), and the yellow-billed cuckoo (*Coccyzus americanus*) occur throughout New Mexico. Table 10.1.6-6 also presents summary information for two Experimental Populations that occur in New Mexico, for the northern aplomando falcon (*Falco femoralis septentrionalis*) and the Whooping crane (*Grus americana*). The northern aplomando falcon occurs in southern New Mexico and the Whooping crane occurs in along the eastern border in the central part of New Mexico. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in New Mexico is provided below.

Table 10.1.6-6: Federally Listed Bird Species of New Mexico

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in New Mexico	Habitat Description
Least Tern	*Sterna antillarum*	E	No	Sandbars near rivers, reservoirs and other open water habitat along the Pecos River at the Bitter Lake National Wildlife Refuge in New Mexico.
Lesser Prairie-chicken	*Tympanuchus pallidicinctus*	T	No	Open, relatively flat rangeland in different stages of plant succession that includes a diversity of native, short- to mid-height grasses and wildflowers with low-growing shrubby cover. Found in 10 counties in eastern New Mexico.
Mexican Spotted Owl	*Strix occidentalis lucida*	T	Yes; 6 units in northwest New Mexico.	Dense, old-growth, multistoried, forest habitats in both canyons and in mountains. Found in 21 counties in central and western New Mexico.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in New Mexico	Habitat Description
Northern aplomado falcon	*Falco femoralis septentrionalis*	XP	No	Palm and oak savannahs, various desert grassland associations, and open pine woodlands – with open terrain with scattered trees, low ground cover, and nest sites. Found in 11 counties in southern New Mexico.
Piping Plover	*Charadrius melodus*	T	No	Open, sparsely vegetated beaches composed of sand or gravel on islands or shorelines of inland lakes or rivers. Found in 5 counties throughout New Mexico.
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E	Yes; along the middle Rio Grande and upper Gila River in 8 counties in New Mexico.	Riparian communities associated with rivers, lakes, swamps and other wetlands. Found in 20 counties throughout New Mexico.
Whooping Crane	*Grus americana*	XP	No	Wetland and other habitats, including marshes, lakes, ponds, wet meadows, rivers, and agricultural fields.
Yellow-billed Cuckoo	*Coccyzus americanus*	T	No; Critical habitat was proposed in 2014 along the Rio Grande.	Large, continuous blocks of riparian habitat of cottonwood and willow trees, or mesquite thorn scrub, typically near water. Found along the Rio Grande, Gila, San Francisco, and San Juan Rivers across 25 counties in New Mexico.

[a] E = Endangered, T = Threatened, XP = Experimental Population (non-essential)
Source: (USFWS, 2015d)

Least Tern. The least tern is the smallest member of the gull and tern family. The birds are approximately 9 inches in length. Unlike gulls, terns will dive into the water for small fish. The body of least terns is predominately gray and white in color, with black streaking on the head. Least terns have a forked tail and narrow pointed wings. Least terns less than a year old have less distinctive black streaking on the head and less of a forked tail (USFWS, 2015r). The species was federally listed as endangered in 1985 (50 FR 21784 21792, May 28, 1985). In New Mexico, it is found along the Pecos River at the Bitter Lake National Wildlife Refuge; it has been documented in 10 counties throughout the state (USFWS, 1990) (USFWS, 2015r).

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

Lesser Prairie-chicken. The lesser prairie-chicken is a medium-sized, grayish brown grouse of approximately 16 inches in length. It is marked with alternating brown and white bands and has tufts of elongated feathers on each side of its neck. The lesser prairie-chicken was federally listed as threatened in 2014 (79 FR 19973 20071, April 10, 2014) (Audubon Society, 2015), (USFWS, 2015s). Historically, the lesser prairie-chicken was found throughout the southern plains states of Texas, New Mexico, Oklahoma, Kansas and Colorado, but today, the species ranges in less than 16 percent of these grasslands (USFWS, 2014d). In New Mexico, it is known from the eastern portion of the state, where it has been documented in 10 counties (USFWS, 2015s).


Lesser prairie-chicken Photo Credit: USFWS

Lesser prairie-chicken habitat consists of open, relatively flat rangeland in different stages of plant succession that includes a diversity of native, short- to mid-height grasses and wildflowers interspersed with low-growing shrubby cover. In New Mexico, this includes shinnery oak/bluestem habitat dominated by sand bluestem, little bluestem, Indiangrass, switchgrass, buffalograss, sand dropseed, and sand sagebrush (USDA, 2011). 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).

Mexican Spotted Owl. The Mexican spotted owl is one of three subspecies of the spotted owl that is native to the mountainous regions of the southwestern U.S. It is characterized by its chestnut brown color, white and brown-spotted abdomen, and dark eyes. It has a brown tail with thin white bands and lacks ear tufts. The Mexican subspecies was federally listed as threatened in 1993 (58 FR 14248 14271, March 16, 1993) and afforded critical habitat in 2004 (69 FR 53182 53298, August 31, 2004). The subspecies is known from 21 counties in central and western New Mexico, and critical habitat has been designated within six unit locations in northwest New Mexico (USFWS, 2015u).

The Mexican spotted owl inhabits dense, old-growth, multistoried, forest habitats in both canyons and in mountains. The subspecies nests in large trees or in rock outcroppings. It uses a diverse array of habitats for foraging and roosting, and some undergo altitudinal migration during winter for nesting. The two primary threats for this species include the alteration of habitat due to timber harvesting and stand-replacing wildland fire (USFWS, 2012c).

Northern Aplomado Falcon. An Experimental Population of the northern aplomado falcon exists in southern New Mexico. Adults of the species are, "characterized by rufous (rust) underparts, a gray back, a long and banded tail, and a distinctive blanc and white facial pattern" (USFWS, 2016c). This subspecies of falcon, "ranges through most of South America," and was, "once considered common in its range within the U.S." but "populations declined rapidly after the 1930s. By the late 1950s, the northern aplomado falcon was considered extirpated in the U.S. and was designed an endangered species in 1986." (USFWS, 2007). The northern aplomado falcon was federally listed as endangered on February 25, 1986 (51 FR 6686, February 25, 1986). The subspecies is known to occur in 11 counties in southern New Mexico.

The northern aplomado falcon's "habitat is variable throughout the species range and includes palm and oak savannahs, various desert grassland associations, and open pine woodlands. Within these variations, the essential habitat elements appear to be open terrain with scattered trees, relatively low ground cover, an abundance of insects and small to medium-sized birds, and a supply of nest sites." (USFWS, 2016c). The species, "feed on a variety of prey, including birds, insects, rodents, small snakes, and lizards" and "appears to be non-migratory throughout its range." (USFWS, 2016c) "Disturbance at nest sites and destruction of habitat are threats to the species." (USFWS, 2016c)

Piping Plover. The endangered piping plover is a small, pale-colored shorebird with a short beak and black band across the forehead. It was listed as endangered in 1985 for the Great Lakes watershed of both the U.S. and Canada, and as threatened in the remainder of its range in the U.S., which includes the Northern Great Plains, Atlantic and Gulf Coasts, Puerto Rico, and the Virgin Islands (50 FR 50726 50734, December 11, 1985). In New Mexico, it can be found in five counties throughout the state (USFWS, 2015v).

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 wetlands in the Northern Great Plains. They feed on worms, fly larvae, beetles, crustaceans, and other marine macroinvertebrates. Current threats to this species include habitat loss and habitat degradation, human disturbance, pets, predation, flooding from coastal storms, and environmental contaminants (USFWS, 2015w) (USFWS, 2015x).

Southwestern Willow Flycatcher. The southwestern willow flycatcher is a subspecies of the willow flycatcher that is native to the southwestern U.S. and northern Mexico. It is a small grey-brown bird with a relatively large bill, white throat and a yellowish belly. It is typically 6 inches in length (including tail) and is characterized by its sharp whistling call. The southwestern willow flycatcher was federally listed as endangered in 1995 (60 FR 10695 10715, February 27, 1995) and afforded critical habitat in 2013 (78 FR 343 534, January 3, 2013). The subspecies is known from 20 counties in New Mexico (USFWS, 2015y), eight of which contain designated critical habitat, including areas along the middle Rio Grande and upper Gila River (USFWS, 2013j).

The southwestern willow flycatcher breeds in riparian communities associated with rivers, lakes, swamps and other wetlands. The species prefers dense, multistoried riparian vegetation and is typically associated with willow (*Salix* spp.) and/or tamarisk (*Tamarix* spp.). Threats to subspecies are primarily based on changes in riparian vegetation from damming of rivers and streams, livestock grazing, the establishment of invasive non-native plants and insects, a modified fire regime, and climate change. Other threats include parasitism from brown-headed cowbirds (*Molothrus ater*), disease, and habitat fragmentation (USFWS, 2002a) (USFWS, 2014e).

Whooping crane. The whooping crane, "occurs only in North America and is North America's tallest bird, with males approaching 1.5 m (5 ft.) when standing erect. The whooping crane adult plumage is snowy white except for black primaries, black or grayish alula (specialized feathers attached to the upper leading end of the wing), sparse black bristly feathers on the carmine crown and malar region (side of the head from the bill to the angle of the jaw), and a dark gray-black wedge-shaped patch on the nape. The common name 'whooping crane' probably originated from the loud, single-note vocalization given repeatedly by the birds when they are alarmed. Whooping cranes are a long-lived species; current estimates suggest a maximum longevity in the wild of at least 30 years." (USFWS, 2016d)

"The whooping crane breeds, migrates, winters, and forages in a variety of wetland and other habitats, including coastal marshes and estuaries, inland marshes, lakes, ponds, wet meadows and rivers, and agricultural fields. Bulrush is the dominant vegetation type in the potholes used for nesting, although cattail, sedge, musk-grass, and other aquatic plants are common. Nest sites are primarily located in shallow diatom ponds that contain bulrush. During migration, whooping cranes use a variety of habitats; however, wetland mosaics appear to be the most suitable. For feeding, whooping cranes primarily use shallow, seasonally and semi permanently flooded palustrine wetlands for roosting, and various cropland and emergent wetlands. Whooping cranes are omnivorous, probing the soil subsurface with their bills and taking foods from the soil surface or vegetation." (USFWS, 2016d)

Yellow-billed Cuckoo. The yellow-billed cuckoo is approximately 12 inches in length and weighs approximately 2 ounces. It is a shy, migrant bird that winters in South America and breeds in the U.S. Widely distributed across the U.S., the species has recently been divided into two distinct population segments (DPSs): western and eastern. The western DPS is found generally west of the Rocky Mountains and/or Pecos River (USFWS, 2013k). The western DPS was federally listed as threatened in 2014 (79 FR 59991 60038, October 3, 2014) (USFWS, 2015z). Critical habitat for the yellow-billed cuckoo was proposed in 2014 for central New Mexico along the Rio Grande (USFWS, 2015aa). Currently, the western yellow-billed cuckoo is known to breed in Arizona, California, Colorado, Idaho, New Mexico, Nevada, and Utah (Johnson, 2009). In New Mexico, the species is known along the Rio Grande, Gila, San Francisco, and San Juan Rivers across 25 counties (USFWS, 2013k).

Western yellow-billed cuckoos inhabit large, continuous blocks of riparian habitat of cottonwood (*Populus* spp.) and willow trees (*Salix* spp.) or mesquite (*Prosopis* spp.) thorn scrub, typically near water. The yellow-billed cuckoo breeds in forested areas with significant canopy cover (Johnson, 2009). Loss of suitable forested habitat along streams and rivers due to habitat fragmentation, invasion of invasive species, and conversion of land to other uses are considered the primary threats to this species (Johnson, 2009) (USFWS, 2015aa).

Fish

Nine endangered and five threatened fish species are federally listed for New Mexico as summarized in Table 10.1.6-7 (USFWS, 2015d). The Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), and the Zuni bluehead sucker (*Catostomus* *discobolus yarrowi*) occur in northwestern New Mexico. The Arkansas River shiner (*Notropis girardi*) occurs in eastern New Mexico. The beautiful shiner (*Cyprinella formosa*), Chihuahua chub (*Gila nigrescens*), Gila topminnow (*Poeciliopsis occidentalis*), Gila chub (*Gila intermedia*), Gila trout (*Oncorhynchus gilae*), headwater chub (*Gila nigra*), loach minnow (*Tiaroga cobitis*), roundtail chub (*Gila robusta*), and the spikedace (*Meda fulgida*) occur in southwestern New Mexico. The Pecos bluntnose shiner (*Notropis simus pecosensis*) and the Pecos gambusia (*Gambusia nobilis*) occur in southeastern New Mexico. The Rio Grande silvery minnow (*Hybognathus amarus*) occurs in central New Mexico. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in New Mexico is provided below.

Table 10.1.6-7: Federally Listed Fish Species of New Mexico

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in New Mexico	Habitat Description
Arkansas River Shiner	*Notropis girardi*	T	No	A shallow, braided channel with a primarily sandy bottom, where pools and riffles are also present. Found in the Canadian River downstream of Ute Reservoir and in lowermost reaches of Revuelto Creek in Quay County in eastern New Mexico.
Beautiful Shiner	*Cyprinella formosa*	T	No	Riffles and intermittent pools of small streams or rivers. Found in Grant and Luna Counties, in southwestern New Mexico.
Chihuahua Chub	*Gila nigrescens*	T	No; Critical habitat was proposed in 1980.	Deep pools bordered by undercut banks or overhanging vegetation in small to medium-sized streams. Found in the Mimbres River within the Guzman Basin in Grant County, southwestern New Mexico.
Colorado Pikeminnow	*Ptychocheilus lucius*	E/XN	Yes; in San Juan County.	Pools, deep runs, and eddies maintained by high spring flows. Found along the San Juan River in San Juan County in northwestern New Mexico.
Gila Topminnow	*Poeciliopsis occidentalis*	E	No	Prefers shallow, warm, slow moving, quiet waters. Found in Grant and Hidalgo Counties in southwestern New Mexico.
Gila Chub	*Gila intermedia*	E	Yes; Turkey Creek in the upper Gila River, Grant County.	A diverse range of aquatic habitats within smaller headwater streams, springs, or marshes, between 2,700 to 5,400 feet in elevation. Found in Grant County, southwestern New Mexico.
Gila Trout	*Oncorhynchus gilae*	T	No	Cool, clear, waterbodies with rocky substrates in pine or mixed-conifer forests above 5,400 feet in elevation. Found in the Gila River watershed in Catron, Grant, and Sierra Counties in southwestern New Mexico.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in New Mexico	Habitat Description
Loach Minnow	*Tiaroga cobitis*	E	Yes; in Catron, Grant, and Hidalgo Counties.	The bottoms of swift-moving mainstream rivers or tributaries, usually with rocky substrates, between approximately 2,300 and 8,200 feet in elevation. Found in Catron, Grant, and Hidalgo Counties, southwestern New Mexico.
Pecos Bluntnose Shiner	*Notropis simus pecosensis*	T	No; critical habitat proposed in Eddy, Chaves, and De Baca Counties.	Main channel areas with low-velocity water at depths of 6 to 12 inches and a sandy substrate. Found in the Pecos River in Chaves, DeBaca, and Eddy Counties, southeastern New Mexico.
Pecos Gambusia	*Gambusia nobilis*	E	No	Springheads and spring runs, or areas with abundant overhead cover, sedge covered marshes, and gypsum sinkholes, to depths of approximately 3 meters. Found in the Pecos River basin in Chaves and Eddy Counties, southeastern New Mexico.
Razorback Sucker	*Xyrauchen texanus*	E	Yes; the San Juan River Basin in New Mexico.	Deep runs, eddies, backwaters, and flooded environments in spring; runs and pools in shallow water associated with submerged sandbars in summer; and low-velocity runs, pools, and eddies in winter. Found in the San Juan River in San Juan County, northwestern New Mexico.
Rio Grande Silvery Minnow	*Hybognathus amarus*	E	Yes; on the middle Rio Grande from Cochiti Dam downstream to the crossing of the Atchison Topeka and Santa Fe Railroad near San Marcial.	Mainstream habitats where water depths are moderate and substrates are silt and sand. Found in the Rio Grande from Cochiti Pueblo downstream to the inflow of Elephant Butte Reservoir in 5 counties in central New Mexico.
Spikedace	*Meda fulgida*	E	Yes; in Catron, Grant, and Hidalgo Counties.	Moderate to large perennial streams, in shallow riffles and runs over sand, gravel, and cobble substrates with flowing current. Found in Catron, Grant, and Hidalgo Counties in southwestern New Mexico.
Zuni Bluehead Sucker	*Catostomus discobolus yarrowi*	E	Yes; in McKinley and Cibola Counties.	Streams with clean, perennial water over hard substrate like bedrock or boulders covered in algae. Found in the Zuni River watershed in Cibola, McKinley, and San Juan Counties in northwestern New Mexico.

[a] E = Endangered, T = Threatened, XN = Non-Essential Experimental Population
Source: (USFWS, 2015d)

Arkansas River Shiner. The Arkansas River shiner is a small minnow, measuring up to 2 inches in length. It 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, 2001a). The Arkansas River shiner was federally listed as threatened in 1998 (63 FR 64772 64799, November 23, 1998). Regionally, this species is found in Arkansas, Kansas, New Mexico, Oklahoma, and Texas. Critical habitat has been designated for the Arkansas River shiner in Kansas and Oklahoma, however, there is no critical habitat designated in New Mexico (70 FR 59808 59846, October 13, 2005). In New Mexico, this species is found in the Canadian River downstream of Ute Reservoir and in lowermost reaches of Revuelto Creek in Quay County in the eastern part of the state (NMDGF, 2013a).

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, 2001a).

Beautiful Shiner. The beautiful shiner is a small blue fish with bronze-orange coloration on its head and fins. The species grows up to 3.5 inches and has a distinctive compressed body (USFWS, 1995). The species was federally listed as threatened in 1984 (49 FR 34490 34497, August 31, 1984) with critical habitat designated in San Bernardino National Wildlife Refuge in Arizona. The beautiful shiner is endemic to the Rio Yaqui and Guzman Basin watersheds in northwestern Mexico, and parts of Arizona and New Mexico. In New Mexico, it is found in Grant and Luna Counties, in the southwestern part of the state (USFWS, 2015ab).

Within its range, the species inhabits riffles and intermittent pools of small streams or rivers. It is omnivorous, feeding mostly on drifting insects or plant material. It spends the majority of its time in the mid-water column, near but not within beds of plants along pond margins. Current threats to the species include drought, groundwater pumping, reduction in stream flow, and competition or predation from nonnative species (USFWS, 1995) (NMDGF, 2013b).

Chihuahua Chub. The Chihuahua chub is a dusky brown fish with a whitish underside, averaging approximately 5 to 6 inches in length (USFWS, 1986a). The species was federally listed as threatened in 1983 (48 FR 46053 46057, October 11, 1983) and critical habitat was proposed in 1980 (USFWS, 2016b). The Chihuahua chub is endemic to New Mexico where is occurs in the Mimbres River within the Guzman Basin in Grant County, southwest New Mexico (USFWS, 1986a).

Chihuahua chub habitat consists of deep pools bordered by undercut banks or overhanging vegetation in small to medium-sized streams. Threats to the species include loss of habitat due to flooding, channelization, and water quality degradation, as well as introduction of non-native species (NMDGF, 2014c).

Colorado Pikeminnow. The Colorado pikeminnow, also known as the Colorado squawfish, is the largest American minnow reaching up to 6 feet in length and weighing more than 80 pounds. The speckled greenish fish has an elongated body, long slender head, and teeth in its throat and gills, rather than jaws (USFWS, 2014f). The pikeminnow was listed as endangered in 1967 (32 FR 4001, March 11, 1967) and was incorporated into the USEPA of 1973 as an endangered species (16 U.S.C § 1531 et seq.). In 1994, the species was designated with critical habitat (59

FR 13374 13400, March 21, 1994) in Colorado, New Mexico, and Utah. Historically, the species was endemic throughout the Colorado River Basin, though today, populations occur only in portions of the Green River, upper Colorado River, and San Juan River, with experimental populations in the Salt and Verde rivers. In New Mexico, it is found along the San Juan River in San Juan County in the northwestern corner of the state (USFWS, 2015ac).

The Colorado pikeminnow migrates long distances, swimming hundreds of miles to and from spawning areas. Species habitat requirements include pools, deep runs, and eddies maintained by high spring flows. These high spring flows maintain channel and habitat diversity, flush sediments from spawning areas, rejuvenate food production, form gravel and cobble deposits used for spawning, and rejuvenate backwater nursery habitats. After hatching and emerging from spawning substrate, larvae drift downstream to nursery backwaters. Threats to the species include streamflow regulation, habitat modification, competition with and predation by nonnative fish species, and pesticides and pollutants (USFWS, 2002b).

Gila Topminnow. The Gila topminnow is the northernmost ranging species of the tropical *Poeciliopsis* genus, and native to the southwestern U.S. and northwestern Mexico. It is a small silver fish with dark spots across its body that grows to approximately 2 inches in length. The species was first listed as endangered under early endangered species legislation in 1967 (32 FR 4001, March 11, 1967) and was incorporated into the ESA in 1973 with no critical habitat (USFWS, 2015ad). Historically in New Mexico, the Gila topminnow was found in the San Francisco River at Frisco Hot Springs; however, this population was extirpated during the early 1960s. Reintroduction in the Gila River in the New Mexico Department of Game and Fish Red Rocks Wildlife Management Area was attempted in 1989 (NMDGF, 1999). Currently, Gila topminnow occurs in Arizona and in Grant and Hidalgo Counties in the southwestern portion of New Mexico (USFWS, 2015ad).

The species prefers shallow, warm, slow moving, quiet waters, although it can tolerate a variety of habitats. It is well adapted to its seasonally variable environment as it can burrow into mud and withstand several days out of water. Historically, the species likely would quickly repopulate seasonal waterways quickly after rain events. The primary threat to the species is habitat alteration. The species is also threatened by competition or predation from non-native species such as mosquitofish (*Gambusia affinis*) (USFWS, 1998).

Gila Chub. The Gila chub is a small minnow native to the Gila River watershed in the southwestern U.S. and northwestern Mexico. It is a dark colored fish with a light belly. Males and females grow to different sizes, with males rarely reaching 6 inches in length and females growing up to 8 inches in length (NMDGF, 1999) (USFWS, 2015ae). The species was federally listed as endangered in 2005 (70 FR 66664 66721, November 2, 2005) with critical habitat established, including Turkey Creek in the upper Gila River, Grant County, New Mexico (USFWS, 2005b). The Gila chub historically occupied many of the headwaters of the Gila River in Arizona, New Mexico, and Sonora, Mexico (NMDGF, 1999). In New Mexico, it can be found in Grant County, in the southwestern part of the state (USFWS, 2015ae).

The species typically is found in a diverse range of aquatic habitats within smaller headwater streams, springs, or marshes, between 2,700 to 5,400 feet in elevation. Its population size is naturally dynamic, expanding, and contracting with seasonal habitat availability. Threats to the species include habitat destruction, habitat alteration from livestock or reclamation projects, and competition or predation from non-native species such as crayfish (USFWS, 2015ae).

Gila Trout. The Gila trout is a species of trout endemic to cool streams of the Gila, San Francisco, Agua Fria, and Verde River watersheds in east and central Arizona and western New Mexico. The species is similar in size and appearance to the closely related Apache trout, although their range has very little overlap. It is distinguishable by its iridescent gold color (USFWS, 2003). The species was first listed as endangered under early endangered species legislation in 1967 (32 FR 4001, March 11, 1967) and was incorporated into the ESA in 1973. In 1987, the species was reclassified as threatened (52 FR 37424 37427, October 6, 1987). There is currently no critical habitat for the species (USFWS, 2015af). Within New Mexico, the Gila trout inhabit small headwater streams in sub-basins of the Gila River watershed in Catron, Grant, and Sierra Counties in the southwest portion of the state (NMDGF, 1999).

The Gila trout is found in cool, clear, waterbodies with rocky substrates in pine or mixed-conifer forests above 5,400 feet in elevation. Similarly to the Apache trout, the Gila trout is reliant on healthy riparian vegetation and, therefore, is impacted by local land management practices. Threats to the species include habitat destruction and alteration, severe fires, illegal fishing, disease, and competition or hybridization with non-native trout species (USFWS, 2003).

Loach Minnow. The loach minnow is a small, olive-colored minnow with an elongated body that is endemic to the Gila River watershed of Arizona, New Mexico, and Sonora, Mexico. The species is distinguished from other dace species by whitish spots present on its dorsal fins (NMDGF, 2014d). The loach minnow was federally listed as a threatened species in 1986 (51 FR 39468 39478, October 28, 1986) and was afforded critical habitat in 1994 (59 FR 10896 10898, March 8, 1994). In 2012, the species was relisted as endangered and afforded new critical habitat (77 FR 10810 10932, February 23, 2012). Within New Mexico, the species currently has critical habitat established in Catron, Grant, and Hidalgo Counties in the southwestern portion of the state (USFWS, 2015ag). The loach minnow historically ranged widely across the Gila River watershed, but is now limited to approximately 10 percent of its historic range. Current range includes portions of the Gila River and its tributaries, the San Francisco and Tularosa rivers and their tributaries, and the Blue River and its tributaries (NMDGF, 2014d). In New Mexico, it is found in Catron, Grant, and Hidalgo Counties, in the southwestern part of the state (USFWS, 2015ag).

Within its range, it is found along the bottoms of swift-moving mainstream rivers or tributaries, usually with rocky substrates, between approximately 2,300 and 8,200 feet in elevation. The current threats to this species include declining water levels, over-grazing by livestock and feral horses, river impoundments, and increased competition or predation from non-native species. (USFWS, 2015ag).

Pecos Bluntnose Shiner. The Pecos bluntnose shiner is a pallid gray to greenish-brown colored, moderately sized shiner with a robust body, blunt and rounded snout, and a large mouth that usually extends even with the pupil (USFWS, 1992). The species was federally listed as threatened in 1987 (52 FR 5295 5303, February 20, 1987), and had critical habitat proposed in the Pecos River in 1984 (49 FR 20031 20036, May 11, 1984). Current species range occurs in the Pecos River from the Ft. Sumner area southward to the inflow area of Brantley Reservoir (NMDGF, 1999) in Chaves, DeBaca, and Eddy Counties, southeastern New Mexico (USFWS, 2015ah).

Pecos bluntnose shiner habitat in the Pecos River is commonly found in main channel areas, with low-velocity water at depths of 6 to 12 inches, and a sandy substrate (NMDGF, 2013c). Threats to the species include stream alteration, introduction of non-native species, and pollution (USFWS, 1992).

Pecos Gambusia. Pecos gambusia is a small, light reddish-brown live-bearing fish with a flattened head and protruding lower jaw. The species was federally listed as endangered in 1970 (35 FR 16047 16048, October 13, 1970). The Pecos gambusia is endemic to springs and spring systems on the western slope of the Pecos River basin of southeastern New Mexico and western Texas. Introduced populations occur in isolated gypsum sinkholes on Bitter Lake National Wildlife Refuge and Salt Creek Wilderness Area in Chaves County, and Blue Springs in Eddy County (USFWS, 2015ai) (USFWS, 1983).

Pecos gambusia habit consists of springheads and spring runs, or areas with abundant overhead cover, sedge covered marshes, and gypsum sinkholes, to depths of approximately 3 meters. Threats to the species include loss of habitat (dewatering or diverting of springs) and introduction of non-native species, resulting in increased predation and competition (USFWS, 1983).

Razorback Sucker. The razorback sucker is a long, slender fish growing 39 inches in length and weighing up to 12 pounds. The species is marked with a dark head and dorsal fins with a yellowish white underbelly and fins (USFWS, 2014f). The razorback sucker was federally listed as endangered in 1991 (56 FR 54957 54967, October 23, 1991) and was given designated critical habitat in 1994 (59 FR 13374 13400, March 21, 1994), including the San Juan River Basin in New Mexico. Historically, the razorback sucker was widely distributed in warm-water reaches of larger rivers of the Colorado River Basin from Mexico to Wyoming; the species was known to occur in the San Juan and Gila drainages in New Mexico. Currently, the species exists only in the San Juan River in San Juan County in the northwest corner of the state due to species reintroduction (USFWS, 2015aj) (NMDGF, 2015f).

Razorback sucker Photo credit: USFWS

Habitats include features such as “deep runs, eddies, backwaters, and flooded environments in spring; runs and pools often in shallow water associated with submerged sandbars in summer; and low-velocity runs, pools, and eddies in winter. Spawning in rivers occurs over bars of cobble, gravel, and sand substrates during spring runoff at widely ranging flows and water temperatures” (USFWS, 2002c). Threats to the species include changes in streamflow, habitat, and introduction of competitive or predatory non-native fish species, and pesticides and pollutants (USFWS, 2014f).

Rio Grande Silvery Minnow. The Rio Grande Silvery Minnow is a greenish-yellow, fairly small, and relatively heavy-bodied silvery minnow with a rounded snout that overhangs the upper lip (NMDGF, 1999). The species was federally listed as endangered in New Mexico in 1994 (59 FR 36988 36995, July 20, 1994). In 1999, critical habitat was designated in New Mexico on the middle Rio Grande from Cochiti Dam downstream to the crossing of the Atchison Topeka and Santa Fe Railroad near San Marcial (64 FR 36274 36290, July 6, 1999). This species was historically abundant in the Rio Grande Basin and Pecos River, occurring from New Mexico to the Gulf of Mexico (USFWS, 1999). Current species range occurs in the Rio Grande from Cochiti Pueblo downstream to the inflow of Elephant Butte Reservoir (NMDGF, 1999) in five counties in central New Mexico (USFWS, 2015ak).

Rio Grande silvery minnow typically occupy mainstream habitats where water depths are moderate and substrates are silt and sand (NMDGF, 1999). Threats to the species include modification of stream discharge patterns and channel drying because of impoundments, water diversion for agriculture, and stream channelization (USFWS, 1999).

Spikedace. The spikedace is a small member of the minnow family, reaching less than 3 inches in length. The body is sleek and slender, with scales embedded deep in the skin. It has two spines on the top fin, and large eyes and mouth. The sides of the body are a bright silvery color with black specks, the back is olive-gray to brownish colored that is mottled with darker color, and the underside is white colored. During breeding season, males become brightly golden or brassy in color, especially on the head and bases of the fins (USFWS, 1991). The spikedace was federally listed as endangered in 1986 (51 FR 23769 23781, July 1, 1986), with critical habitat designated in 2012 (77 FR 10810 10932, February 23, 2012) in Catron, Grant, and Hidalgo Counties, New Mexico. Its historic range was throughout the Gila River Basin, however, the spikedace has been extirpated from most of this area. It is now found in the upper Gila River in New Mexico, and in the Aravaipa and Eagle creeks, and the upper Verde River in Arizona. In New Mexico, it is found in Catron, Grant, and Hidalgo Counties in the southwestern part of the state (USFWS, 2012d) (USFWS, 2015al).

The spikedace inhabits moderate to large perennial streams, in shallow riffles and runs over sand, gravel, and cobble substrates with flowing current. The main threats to the spikedace are habitat destruction and competition due to dams, water alteration, watershed decline, groundwater pumping, channelization, and the introduction of nonnative fish (USFWS, 1991) (USFWS, 2012d).

Zuni Bluehead Sucker. The Zuni bluehead sucker is a torpedo-shaped, slender fish growing up to 9 inches in length. Its mouth is on the underside of its snout, and it has a bluish colored head, silvery-tan to dark green colored back, and yellowish to silvery-white colored sides and abdomen. The adults are colored mottled slate-gray to almost black on the front half of the body, and cream-white on the back half. During spawning, the males develop coarse wart like bumps on the back fins and near the tail fin, as well as become black colored with a red horizontal band and a white abdomen (USFWS, 2014g). The Zuni bluehead sucker was federally listed as endangered in 2014 (79 FR 43131 43161, July 24, 2014). Critical habitat was designated in 2016 (USFWS, 2015am).

Regionally, this species is found in Arizona and New Mexico. In New Mexico, it can be found in the Zuni River watershed in Cibola, McKinley, and San Juan Counties in the northwestern part of the state (USFWS, 2014g) (USFWS, 2015am). It inhabits streams with clean, perennial water over hard substrate like bedrock or boulders covered in algae. Threats to the Zuni bluehead sucker include water withdrawal, sedimentation, impoundments, development, wildfires, livestock grazing, drought, and climate change (USFWS, 2014g).

Invertebrates

Eight endangered invertebrate species are federally listed for New Mexico as summarized in Table 10.1.6-8. The Alamosa springsnail (*Tryonia alamosae*), Chupadera springsnail (*Pyrgulopsis chupaderae*), Socorro springsnail (*Pyrgulopsis neomexicana*), and the Socorro isopod (*Thermosphaeroma thermophiles*) occur in central New Mexico. The Koster's springsnail (*Juturnia kosteri*), Noel's amphipod (*Gammarus desperatus*), Pecos assiminea snail (*Assiminea pecos*), Roswell springsnail (*Pyrgulopsis roswellensis*), occur in southeastern New Mexico. The Texas hornshell (*Popenaias popei*) has been identified as a candidate species in New Mexico. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in New Mexico is provided below. (USFWS, 2015d)

Table 10.1.6-8: Federally Listed Invertebrate Species of New Mexico

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in New Mexico	Habitat Description
Alamosa Springsnail	*Tryonia alamosae*	E	No	Thermal springheads and springruns that flow into Alamosa Creek. It needs fresh, flowing, thermally heated water, and thrives in slow current on gravel and among vegetation, where there is an organic film covering the substrate. Found in Socorro County, central New Mexico.
Chupadera Springsnail	*Pyrgulopsis chupaderae*	E	Yes; in 1.9 acres of private property in Socorro County.	Springs on hillsides where groundwater discharges flow through volcanic gravel that contains sand, mud, and aquatic plants. Found in the southeast end of the Chupadera Mountains in Socorro County, central New Mexico.
Koster's Springsnail	*Juturnia kosteri*	E	Yes; in Chaves County.	Soft substrates in slow to moderate current of springs and seeps. Found in Chaves County, southeastern New Mexico.
Noel's Amphipod	*Gammarus desperatus*	E	Yes; in Chaves County.	Under stones and in aquatic vegetation in shallow, cool, well-oxygenated waters of streams, ponds, ditches, and springs. Found in Chaves County, southeastern New Mexico.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in New Mexico	Habitat Description
Pecos Assiminea Snail	*Assiminea pecos*	E	Yes; in Chaves County.	Saturated, moist soil at the edges of streams or spring runs, and in wet mud or under mats of vegetation in 1 inch of flowing water. Found in Chaves County, southeastern New Mexico.
Roswell Springsnail	*Pyrgulopsis roswellensis*	E	Yes; in Chaves County.	Hard gypsum substrates in slow to moderate current of springs and seeps. Found in Chaves County, southeastern New Mexico.
Socorro Springsnail	*Pyrgulopsis neomexicana*	E	No	Small thermal springs. It needs fresh, flowing, thermally heated water, and thrives on rootlets and aquatic vegetation where there is an organic film covering the substrate. Found in Socorro County, central New Mexico.
Socorro Isopod	*Thermosphaeroma thermophilus*	E	No	Two concrete pools connected with a pipe, and the plumbing system of an abandoned bathhouse supplied with water from Sedillo Spring. Found in one spring located on private land in Socorro County, central New Mexico.

[a] E = Endangered
Source: (USFWS, 2015d)

Alamosa Springsnail. The Alamosa springsnail is a freshwater snail with a conical, thin, translucent shell that grows up to 0.1 inches long, with junction lines separating whorls on the shell. Its body color ranges from opaque black to gray, and the females have a longer shell than the males (USFWS, 1994a). The Alamosa springsnail was federally listed as endangered in 1991 (56 FR 49646 49649, September 30, 1991) with no critical habitat. This species is only found in Socorro County, central New Mexico (USFWS, 2015an).

It inhabits thermal springheads and springruns that flow into Alamosa Creek. It needs fresh, flowing, thermally heated water, and thrives in slow current on gravel and among vegetation, where there is an organic film covering the substrate. It feeds on algae and other materials that are in the organic film. Threats to the Alamosa springsnail include any activities that would reduce spring flow or its food source. These activities could include alterations to watersheds, springs, or associated runs, that could also alter the water temperature or quality (USFWS, 1994a).

Chupadera Springsnail. The Chupadera springsnail is a tiny freshwater snail, reaching 0.06 to 0.12 inches tall. It has a long, egg-shaped shell that is tan to brown in color and has a short spire. The head and body is black in color, including the eyes. It can be distinguished from the Socorro springsnail by its red-brown colored operculum[91] (NMDGF, 2013d) (USFWS, 2012e). The Chupadera springsnail was federally listed as endangered in 2012 (77 FR 41088 41106, July 12,

[91] A secreted plate that serves to close the opening of a gastropod mollusk's shell when the animal is retracted.

2012) and critical habitat was designated at time of listing in 1.9 acres of private property in Socorro County, New Mexico (USFWS, 2012e) (USFWS, 2015ao).

This species is only found in the southeast end of the Chupadera Mountains in Socorro County, central New Mexico. It inhabits springs on hillsides where groundwater discharges flow through volcanic gravel that contains sand, mud, and aquatic plants. Threats to the Chupadera springsnail include loss of spring flow, livestock grazing, spring modification, and drought due to climate change (USFWS, 2012e).

Koster's Springsnail. The Koster's springsnail is approximately 0.16 to 0.18 inches long, and has a pale tan colored shell that is conical in shape with twists (USFWS, 2005c). It was federally listed as endangered in 2005 (70 FR 46304 46333, August 9, 2005), and critical habitat redesignated in 2011 (76 FR 33036 33064, June 7, 2011) in Chaves County, New Mexico. This species is only found in Chaves County, southeastern New Mexico (USFWS, 2015ap).

It inhabits soft substrates in slow to moderate current of springs and seeps (USFWS, 2011). Threats to the Koster's springsnail include loss of spring flow, contaminants, and the introduction of nonnative species (USFWS, 2005c).

Noel's Amphipod. The Noel's amphipod is a small freshwater crustacean, sometimes called freshwater shrimp. It is brown-green in color with long, kidney-shaped eyes, and red bands along its body, and a red stripe on the back. It ranges from 0.33 to 0.58 inches long, with males growing larger than females (USFWS, 2005c). It was federally listed as endangered in 2005 (70 FR 46304 46333, August 9, 2005), and critical habitat redesignated in 2011 (76 FR 33036 33064, June 7, 2011) in Chaves County, New Mexico. This species is only found in Chaves County, southeastern New Mexico (USFWS, 2015aq).

It lives under stones and in aquatic vegetation in shallow, cool, well-oxygenated waters of streams, ponds, ditches, and springs. Threats to the Noel's amphipod include loss of spring flow, contaminants, and the introduction of nonnative species (USFWS, 2005c) (USFWS, 2011).

Pecos Assiminea Snail. The Pecos assiminea snail is 0.06 to 0.07 inches long, with a thin, almost transparent chestnut-brown colored shell that is conical with an oval opening (USFWS, 2005c). It was federally listed as endangered in 2005 (70 FR 46304 46333, August 9, 2005), and critical habitat redesignated in 2011 (76 FR 33036 33064, June 7, 2011) in Chaves County, New Mexico. Regionally, this species is found in New Mexico and Texas. In New Mexico, it is found in Chaves County, in the southeastern part of the state (USFWS, 2015ar).

It inhabits saturated, moist soil at the edges of streams or spring runs, and in wet mud or under mats of vegetation in 1 inch of flowing water. Threats to the Pecos assiminea snail include loss of spring flow, contaminants, and the introduction of nonnative species (USFWS, 2005c).

Roswell Springsnail. The Roswell springsnail is approximately 0.12 to 0.14 inches long with a tan colored, conical shell, and dark, amber colored operculum (USFWS, 2005c). It was federally listed as endangered in 2005 (70 FR 46304 46333, August 9, 2005), and critical habitat redesignated in 2011 (76 FR 33036 33064, June 7, 2011) in Chaves County, New Mexico. This species is only found in Chaves County, southeastern New Mexico (USFWS, 2015as).

It inhabits hard gypsum substrates in slow to moderate current of springs and seeps (USFWS, 2011). Threats to the Roswell springsnail include loss of spring flow, contaminants, and the introduction of nonnative species (USFWS, 2005c).

Socorro Springsnail. The Socorro springsnail is a freshwater snail with a long, conical, egg-shaped shell that is light tan in color, growing up to 0.1 inches in length. The body and head are dark gray to black in color, the internal callus[92] is reddish brown to amber in color, and the operculum is pale in color. The tentacles can be black or dark gray in color at the base, to pale gray in color at the tips (USFWS, 1994a). The Socorro springsnail was federally listed as endangered in 1991 (56 FR 49646 49649, September 30, 1991) with no critical habitat. This species is only found in Socorro County, central New Mexico (USFWS, 2015at).

It inhabits small thermal springs. It needs fresh, flowing, thermally heated water, and thrives on rootlets and aquatic vegetation where there is an organic film covering the substrate. It feeds on algae and other materials that are in the organic film. Threats to the Socorro springsnail include any activities that would reduce spring flow or its food source. These activities could include alterations to watersheds, springs, or associated runs, that could also alter the water temperature or quality (USFWS, 1994a).

Socorro Isopod. The Socorro isopod is a rare crustacean with a flattened body, seven pairs of legs, antennae on the head, and oar-like extensions on the last segment of the body. Males are approximately 0.3 inches in length, and females are approximately 0.2 inches in length (USFWS, 1982). The Socorro isopod was federally listed as endangered in 1978 (43 FR 12690 12691, March 27, 1978) (USFWS, 2015au).

This species can only be found in one spring located on private land in Socorro County, central New Mexico. It inhabits two concrete pools connected with a pipe, and the plumbing system of an abandoned bathhouse supplied with water from Sedillo Spring. Threats to the Socorro Isopod include loss of habitat due to drought, decreased spring discharge, or a change in water chemistry (USFWS, 2009b).

Plants

Seven endangered and six threatened plant species are federally listed for New Mexico as summarized in Table 10.1.6-9. The Holy Ghost ipomopsis (*Ipomopsis sancti-spiritus*) occurs in north-central New Mexico. The Knowlton's cactus (*Pediocactus knowltonii*), Mancos milk-vetch (*Astragalus humillimus*), Mesa Verde cactus (*Sclerocactus mesae-verdae*), and the Zuni fleabane (*Erigeron rhizomatus*) occur in northwestern New Mexico. The Sacramento Mountains thistle (*Cirsium vinaceum*), Sacramento prickly poppy (*Argemone pleiacantha* ssp. *pinnatisecta*), and the Sneed pincushion cactus (*Coryphantha sneedii* var. *sneedii*) occur in southern New Mexico. The Todsen's pennyroyal (*Hedeoma todsenii*) occurs in south-central New Mexico. The Gypsum wild-buckwheat (*Eriogonum gypsophilum*) and the Lee pincushion cactus (*Coryphantha sneedii* var. *leei*) occur in southeastern New Mexico. The Kuenzler hedgehog cactus (*Echinocereus fendleri* var. *kuenzleri*), and Pecos sunflower (*Helianthus paradoxus*) occur

[92] A thickened area of shell material.

in central and southeastern New Mexico. The Wright's marsh thistle (*Cirsium wrightii*) has been identified as a candidate species in New Mexico. Information on the habitat, distribution, and threats to the survival and recovery of each of these species in New Mexico is provided below. (USFWS, 2015d)

Table 10.1.6-9: Federally Listed Plant Species of New Mexico

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in New Mexico	Habitat Description
Gypsum Wild-buckwheat	*Eriogonum gypsophilum*	T	Yes; 130 acres of Eddy County.	Gravelly gypsum outcrops on north-facing slopes of hills covered with limestone. Found in Eddy County, southeastern New Mexico.
Holy Ghost Ipomopsis	*Ipomopsis sancti-spiritus*	E	No	Bare mineral soils on relatively dry, steep, west to southwest facing disturbed cut slopes of Forest Road 22 in an open ponderosa pine forest. Found in the southern Sangre de Cristo Mountains in San Miguel County, north-central New Mexico.
Knowlton's Cactus	*Pediocactus knowltonii*	E	No	Juniper woodlands, sage brush flats, and desert grasslands of San Juan County, northwestern New Mexico.
Kuenzler Hedgehog Cactus	*Echinocereus fendleri* var. *kuenzleri*	E	No	Gentle slopes in the cracks of limestone outcrops or in the shallow soils on the flat steps of hillsides in the lower edges of pinyon-juniper woodland. Found in Chaves, Eddy, Lincoln, and Otero Counties, central to southeastern New Mexico.
Lee Pincushion Cactus	*Coryphantha sneedii* var. *leei*	T	No	Semi-desert grassland on north-facing ledges on the Tansil Limestone Formation. Found in Eddy County, southeastern New Mexico.
Mancos Milk-vetch	*Astragalus humillimus*	E	No	Large, flat sheets of sandstone along the edges of bowl-like depressions and in cracks or fissures, on remote semi-arid sandstone rimrock ledges and mesa tops. Found in San Juan County, in the northwestern corner of New Mexico.
Mesa Verde Cactus	*Sclerocactus mesae-verdae*	T	No	High alkaline, gypsum-rich soils on the tops of hills or benches and slopes of hills. Found in San Juan County, northwestern New Mexico.
Pecos Sunflower	*Helianthus paradoxus*	T	Yes wherever it occurs in Chaves, Cibola, and Guadalupe Counties.	Wet, alkaline soils in spring seeps, wet meadows, streams, and edges of ponds. Found in five counties in central and southeastern New Mexico.
Sacramento Mountains Thistle	*Cirsium vinaceum*	T	No	Wet travertine deposits at alkaline springs and seeps, as well as saturated alkaline soils in the bottoms of valleys. Found in the Sacramento Mountains of Otero County, southern New Mexico.
Sacramento Prickly Poppy	*Argemone pleiacantha* ssp. *Pinnatisecta*	E	No	Arid canyon bottoms, dry terraces above riparian areas, and the edges of streams, springs, and seep areas. Found in the Sacramento Mountains of Otero County, southern New Mexico.
Sneed Pincushion Cactus	*Coryphantha sneedii* var. *sneedii*	E	No	Semi-desert grassland in restricted cracks and crevices in limestone cliffs and ledges. Found in Dona Ana and Eddy Counties, southern New Mexico.

Common Name	Scientific Name	Federal Status [a]	Critical Habitat in New Mexico	Habitat Description
Todsen's Pennyroyal	*Hedeoma todsenii*	E	Yes; wherever it occurs in Otero and Sierra Counties.	Gypsum-rich limestone soils on north-facing slopes in pinon-juniper woodland. Found in the San Andres and Sacramento mountains of south-central New Mexico, in Otero and Sierra Counties.
Zuni Fleabane	*Erigeron rhizomatus*	T	No	Fine textured clay hillsides with mid to low elevation mountain slopes derived from Chinle or Baca Formations. Found in Catron, Cibola, McKinley, and San Juan Counties, northwestern New Mexico.

[a] E = Endangered, T = Threatened,
Source: (USFWS, 2015d)

Gypsum Wild-buckwheat. The Gypsum wild-buckwheat is a woody stemmed perennial plant that grows in dense clumps to approximately 0.4 inches tall. It has dark green, thick, hairless leaves that are approximately 0.6 to 1 inch wide, usually wider than long, and turn bright red in the fall. The flowers are yellow, 0.04 to 0.08 inches long, and grow in a dense cluster from May to July (USFWS, 1984a). The Gypsum wild-buckwheat was federally listed as threatened in 1981 (46 FR 5730 5733, January 19, 1981) with critical habitat established at time of listing in 130 acres of Eddy County, New Mexico (USFWS, 1981).

This species can only be found in Eddy County, southeastern New Mexico (USFWS, 2015av). It inhabits gravelly gypsum outcrops on north-facing slopes of hills covered with limestone. The main threat to the Gypsum wild-buckwheat is habitat destruction due to off-road vehicle use, and trampling or grazing by cattle (USFWS, 1984a).

Holy Ghost Ipomopsis. The Holy Ghost ipomopsis is an herbaceous biennial that has one or a few stems that are 12 to 32 inches tall. The leaves are divided with sharp points at the end of each division. The pink flowers are tubular in shape, and have five spreading lobes (USFWS, 2002d). The Holy Ghost ipomopsis was federally listed as endangered in 1994 (59 FR 13836 13841, March 23, 1994) with no critical habitat designated.

This species is only found in the southern Sangre de Cristo Mountains in San Miguel County, north-central New Mexico (USFWS, 2002d) (USFWS, 2015aw). It inhabits bare mineral soils on relatively dry, steep, west to southwest facing disturbed cut slopes of Forest Road 22 in an open ponderosa pine forest. Threats to the Holy Ghost ipomopsis include its small population size, road maintenance, recreation, and forest fire (USFWS, 2002d).

Knowlton's Cactus. The Knowlton's cactus is a tiny, globe-shaped, light gray-green plant with solitary or clustered stems growing up to 2.2 inches tall and 1.2 inches wide. It has no central spines, and 18 to 24 white radial spines (USFWS, 1985b). The Knowlton's cactus was federally listed as endangered in 1979 (44 FR 62244 62246, October 29, 1979). Regionally, it is found in Colorado and New Mexico. In New Mexico, it can be found in San Juan County, in the northwestern part of the state (USFWS, 2015ax).

It inhabits juniper woodlands, sage brush flats, and desert grasslands of northwestern New Mexico and southwestern Colorado. Threats to the species include illegal harvesting by commercial vendors and private collectors, energy and utility corridor development, and rodent or rabbit predation (USFWS, 2010b).

Kuenzler Hedgehog Cactus. The Kuenzler hedgehog cactus is either single stemmed or branched, with short, conical stems about 6 inches long and 4 inches wide, with 9 to 12 ribs with spine clusters. The spines are white, soft, and have a chalky texture, with the longest spine on top. The magenta flowers are 4 inches long, and fruits are bright red when ripe (USFWS, 1985c). The Kuenzler hedgehog cactus was federally listed as endangered in 1979 (44 FR 61924 61927, October 26, 1979) with no critical habitat. This species can only be found in Chaves, Eddy, Lincoln, and Otero Counties, central to southeastern New Mexico (USFWS, 2015ay).

It inhabits gentle slopes in the cracks of limestone outcrops or in the shallow soils on the flat steps of hillsides in the lower edges of pinyon-juniper woodland. Threats to the Kuenzler hedgehog cactus include collection for private and commercial uses, road maintenance, development, and grazing by cattle (USFWS, 1985c).

Lee Pincushion Cactus. The Lee pincushion cactus is a small, many branched clumped cactus, often with “up to 100 or more” stems. Individual stems can be spherical to cylindrical or club-shaped, from 1 to 3 inches tall and up to slightly over 1 inch wide. About 40 to over 100 white spines (sometimes tipped with pink and brown) radiate from areoles at the tip of nipple-like tubercles, obscuring the stem. The spines slant from the top of the tubercle toward the main part of the stem. Flowers are up to a half inch in diameter, and are a dull medium brownish-pink color. Fruits are a usually grayish-green or brown-tinged green, club-shaped berry and up to a quarter-inch long. When ripe, they have a “prune-like odor” and may sometimes be slightly pinkish. (USFWS, 2015d)

The Lee pincushion cactus was federally listed as threatened in 1979 (44 FR 61554 61556, October 25, 1979) with no designated critical habitat. This species is only found in Eddy County, southeastern New Mexico (USFWS, 2015az). It inhabits semi-desert grassland on north-facing ledges on the Tansil Limestone Formation. The primary threat is that the small population sizes and limited distribution make this species vulnerable to commercial or individual collecting (USFWS, 1986b), although this pressure was more recently perceived to be less of a threat. Habitat loss to residential and commercial development, trampling by wildlife and livestock, fire, and habitat alteration due climate change are also threats (USFWS, 2015bb).

Mancos Milk-vetch. The Mancos milk-vetch is a small, tufted perennial shrub with spiny leaf stalks and leaves forming clumps approximately 12 inches across. The stems are up to 0.4 inches long, with leaves along their entire length. The leaves are 1.6 inches long and flowers are lavender to purplish in color and approximately 0.5 inches in length. The fruits are egg shaped, approximately 0.2 inches long and 0.1 inches wide, and produce four to nine seeds each (USFWS, 1989). The species was listed as threatened in 1985 (50 FR 26568 26572, June 27, 1985) with no critical habitat. This species is found in New Mexico and Colorado. In New Mexico, it can be found in San Juan County, in the northwestern corner of the state (USFWS, 2015bc).

It inhabits large, flat sheets of sandstone along the edges of bowl-like depressions and in cracks or fissures, on remote semi-arid sandstone rimrock ledges and mesa tops. Threats to the species include impacts to its habitat due to mineral or energy development of the San Juan Basin, or human collection of the plant (USFWS, 1989).

Mesa Verde Cactus. The Mesa Verde cactus is a smaller, globe shaped cactus with a stem of up to 3 inches tall. The spines are white, tan, straw, or gray in color. The plant blossoms cream to yellow colored flowers with green fruit that become brown when ripe and split open, producing black seeds. It has the ability to retract into the soil in periods of extended drought and is similar in many ways to the Wright fishhook cactus (*Sclerocactus wrightiae)* (USFWS, 1984b). The Mesa Verde cactus was federally listed as threatened in 1979 (44 FR 62471 62474, October 30, 1979). Regionally, this species is found in northwestern New Mexico and southwestern Colorado. In New Mexico, it can be found in San Juan County (USFWS, 2015bd).

It inhabits high alkaline, gypsum-rich soils on the tops of hills or benches and slopes of hills. Threats to the species include collection by cactus enthusiasts, habitat destruction, and isolated populations (USFWS, 1984b).

Pecos Sunflower. The Pecos sunflower is an annual herb in the sunflower family. Stems stand between 3 and 10 feet tall, and branch at the top, and like the leaves, are covered in short stiff hairs. Leaves are opposite on the lower stem, but alternate nearing the top. Leaves are lance-shaped, with 3 prominent veins, and are up 7 inches long and 3 inches wide. Flowering heads are 2 to 3 inches across, with bright yellow ray florets (the “petals) surrounding a dark purplish center (the disc florets). The fruit is a small sunflower seed (USFWS, 2005d). The Pecos sunflower was federally listed as threatened in 1999 (64 FR 56582 56590, October 20, 1999) and critical habitat was designated in 2008 (73 FR 17762 17807, 1 April 2008) in Chaves, Cibola, and Guadalupe Counties in New Mexico. Regionally, it is found in western Texas and throughout New Mexico. In New Mexico, it can be found in five counties in the central and southeastern portions of the state (USFWS, 2015be).

It inhabits wet, alkaline soils in spring seeps, wet meadows, streams, and edges of ponds. Threats to the Pecos sunflower include incompatible land use, habitat degradation and loss, and groundwater withdrawal (USFWS, 2005d).

Sacramento Mountains Thistle. The Sacramento Mountains thistle grows from 3.3 to 5.9 feet tall, with numerous ascending brown-purple colored branches. The leaves at the base are green, smooth, 12 to 20 inches long, up to 8 inches wide, with ragged edges, and divided almost to the middle rib, with slender yellow spines on the tips of the divisions. The bell-shaped, pink-purple flowers are 2 inches wide and almost 2 inches tall, forming at the ends of branches (USFWS, 1993). The Sacramento Mountains thistle was federally listed as threatened in 1987 (52 FR 22933 22936, June 16, 1987). This species is only found in the Sacramento Mountains of Otero County, southern New Mexico (USFWS, 2015bf).

It inhabits wet travertine[93] deposits at alkaline springs and seeps, as well as saturated alkaline soils in the bottoms of valleys. It often grows on steep slopes that are covered with dense patches of the thistle, in mixed conifer forests and open valleys. Threats to the Sacramento Mountains thistle include the need for a constant water supply, invasive plants competing for the same resources, livestock water use, and effects of climate change (USFWS, 2010c).

Sacramento Prickly Poppy. The Sacramento prickly poppy grows from 1.5 to 5 feet tall, and has 3 to 12 branching stems and blue-green colored leaves that are 4 to 6 inches long and have stout yellow spines. The large, showy flowers are white in color, have 6 petals that are 1.2 to 1.6 inches long and 3.5 inches wide, with orange stamens and a purple stigma. The small, round, black seeds are 0.1 inches in diameter, and the poppy has white-colored stem sap (USFWS, 1994b). The Sacramento prickly poppy was federally listed as endangered in 1989 (54 FR 35302 35305, August 24, 1989). This species is only found in the Sacramento Mountains of Otero County, southern New Mexico (USFWS, 2015bg).

It inhabits arid canyon bottoms, dry terraces above riparian areas, and the edges of streams, springs, and seep areas in steep rocky canyons between the pinyon/juniper zone of the Chihuahuan Desert Scrublands and Grasslands, as well as the lower edge of the ponderosa pine community of the Great Basin Conifer Woodlands. Threats to the Sacramento prickly poppy include water diversion, pipeline construction, road construction, drought, flooding, livestock grazing, off-road vehicle use, and a fungal disease (USFWS, 2015bh).

Sneed Pincushion Cactus. The Sneed pincushion cactus is a small, many branched clumped cactus, often with “up to 100 or more” stems. Individual stems can be spherical to cylindrical or club-shaped, from 1 to 3 inches tall and up to slightly over 1 inch wide. About 40 to over 100 white spines (sometimes tipped with pink and brown) radiate from areoles at the tip of nipple-like tubercles, obscuring the stem. The spines are spread parallel to the surface of the stem. Flowers are up to a half inch in diameter, and are pale to rose magenta in color. Fruits are a usually grayish-green or brown-tinged green, club-shaped berry and up to a quarter-inch long. When ripe they have a “prune-like odor” and may sometimes be slightly pinkish (USFWS, 1986b).

The Sneed pincushion cactus was federally listed as endangered in 1979 (44 FR 64741 64743, November 7, 1979) but no critical habitat has been proposed. Regionally, it is found in Texas and New Mexico. In New Mexico, it can be found in Dona Ana and Eddy Counties, in the southern part of the state (USFWS, 2015bi). It inhabits semi-desert grassland in restricted cracks and crevices in limestone cliffs and ledges. The primary threat is that the small population sizes and limited distribution make this species vulnerable to commercial or individual collecting (USFWS, 1986b), although this pressure was more recently perceived to be less of a threat. Habitat loss to residential and commercial development, trampling by wildlife and livestock, fire, d habitat alteration due climate change are also threats (USFWS, 2015bb).

[93] A mineral consisting of a massive usually layered calcium carbonate (as aragonite or calcite) formed by deposition from spring waters or especially from hot springs.

Todsen's Pennyroyal. The Todsen's pennyroyal is a perennial herb in the mint family that grows from 4 to 8 inches tall and has a woody base. The branches are slender and solitary, with opposite, lance-shaped leaves. The orange-red to yellow flowers grow alone in the tops of the upper leaves of the stems (USFWS, 2001b). The Todsen's pennyroyal was federally listed as threatened in 1981 (46 FR 5730 5733, January 19, 1981) with critical habitat established at time of listing wherever it occurs in Otero and Sierra Counties, New Mexico (USFWS, 1981).

This species can only be found in the San Andres and Sacramento mountains of south-central New Mexico, in Otero and Sierra Counties (USFWS, 2001b) (USFWS, 2015ba). It inhabits gypsum-rich limestone soils on north-facing slopes in pinon-juniper woodland. Threats to the Todsen's pennyroyal include its low population number, poor dispersal, fire, insect predation, and disease (USFWS, 2001b).

Zuni Fleabane. The threatened Zuni fleabane is an herbaceous perennial in the aster family. The Zuni fleabane grows stems ranging from 7 to 17 inches with a white or tinged with blue-violet flower at the top (USFWS, 1988b). The Zuni fleabane was federally listed as threatened in 1985 (50 FR 16680 16682, April 24, 1985). Regionally, it can be found in Arizona and New Mexico. In New Mexico, it is found in Catron, Cibola, McKinley, and San Juan Counties, in the northwestern part of the state (USFWS, 2015t).

It inhabits fine textured clay hillsides with mid to low elevation mountain slopes derived from Chinle or Baca Formations (USFWS, 1988b). The major threat to the survival of the Zuni fleabane is surface disturbance from the potential of uranium mines in the region, additionally habitat disturbance from cattle grazing and development (CPC, 2010).

10.1.7. Land Use, Recreation, and Airspace

10.1.7.1. Definition of the Resource

The following summarizes major land uses, recreational venues, and airspace considerations in New Mexico, 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, 2012b).

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 the following primary categories: semi-desert, forest and woodland, shrub and grassland, agricultural land, and developed land. 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, highlighting areas of recreational significance within three identified regions.

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

10.1.7.2. 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 New Mexico. However, most site-specific land use controls and requirements are governed by local county, city, and village laws and regulations. Furthermore, many land use controls and requirements are implemented and enforced under the umbrella of land use planning, often with the help and support of state authorities.

Because the Nation's airspace is governed by federal laws, there are no specific New Mexico state laws that would alter the existing conditions relating to airspace for this PEIS. Chapter 64 of the New Mexico Statutes addresses aviation (New Mexico Compilation Commission, 2015a).

10.1.7.3. Land Use and Ownership

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

Land Use

Table 10.1.7-1 identifies the major land uses by coverage type in New Mexico. Semi-Desert is comprised of the largest portion of land use with 38.7 percent of New Mexico's total land occupied by this category (Table 10.1.7-1 and Figure 10.1.7-1). Forest and woodland is the second largest area of land use with 29.7 percent of the total land area. Shrub and grassland is comprised of 26.6 percent of land. The fourth largest land use is agriculture, with 1.9 percent of New Mexico's land devoted to this use. Developed land accounts for approximately 0.7 percent of the total land area. Surface water accounts for 0.2 percent of the total land area. The remaining percentage of land includes public land and other land covers, shown in Figure 10.1.7-1, that are not associated with specific land uses (US Geological Survey 2012) (US Geological Survey 2014).

Table 10.1.7-1: Major Land Use Distribution by Coverage Type

Land Use	Square Miles	Percent of Land
Semi-Desert	46,949	38.7%
Forest and Woodland	35,999	29.7%
Shrub and Grassland	32,239	26.6%
Agricultural Land	2,322	1.9%
Developed Land	875	0.7%
Surface Water	306	0.2%
Public Land and other Land Covers	2,608	2.2%

Sources: (USGS, 2012c) (USGS, 2014k)

Semi-Desert

Semi-desert land can be found throughout the state, with most of these areas typically located at the lower elevations and valleys. The largest, most contiguous concentrations of semi-desert are located in the western and southwestern parts of the state (Figure 10.1.7-1). Although these areas are not developed, semi-desert land sustains multiple uses such as, oil and gas production, recreation, mineral development, rangeland for livestock, scientific study, and preservation of natural resources. More detail on these areas is provided under the Land Ownership heading in this section.

Forest and Woodland

Forest and woodland areas can be found throughout the state, mostly in the higher elevations. The largest concentrations of forest in New Mexico are located within five National Forests covering over 9.1 million acres managed by the USDA Forest Service (USGS, 2012c). Forest and woodland areas indirectly provide some public benefit, including forest products, wildlife habitat, jobs, scenic beauty, and outdoor recreation opportunities.

Shrub and Grassland

Shrub and grassland can be found throughout the state. Like semi-desert, most of these areas are typically located at the lower elevations and valleys. The largest, most contiguous concentrations of shrub and grassland are located in the eastern part of the state (Figure 10.1.7-1). Like semi-desert, shrub and grassland areas sustain multiple uses such as, oil and gas production, recreation, mineral development, rangeland for livestock, scientific study, and preservation of natural resources.

Agricultural Land

Agricultural land exists in most regions of the state, concentrated in river valleys or in areas where irrigation water is available (Figure 10.1.7-1). Approximately 1.9 percent of New Mexico's total land area is classified as agricultural land. In 2012, there were 24,721 farms in New Mexico and most were owned and operated by small, family businesses, with most farms less than 10 acres (USDA, 2012). Some of the state's largest agricultural uses include hay, sorghum, corn, pecans, and wheat. Other agricultural uses include livestock for dairy and meat, goats, sheep and hogs. For more information by county, access the USDA Census of Agriculture website:
http://www.agcensus.usda.gov/Publications/2012/Full_Report/Census_by_State/New_Mexico/.

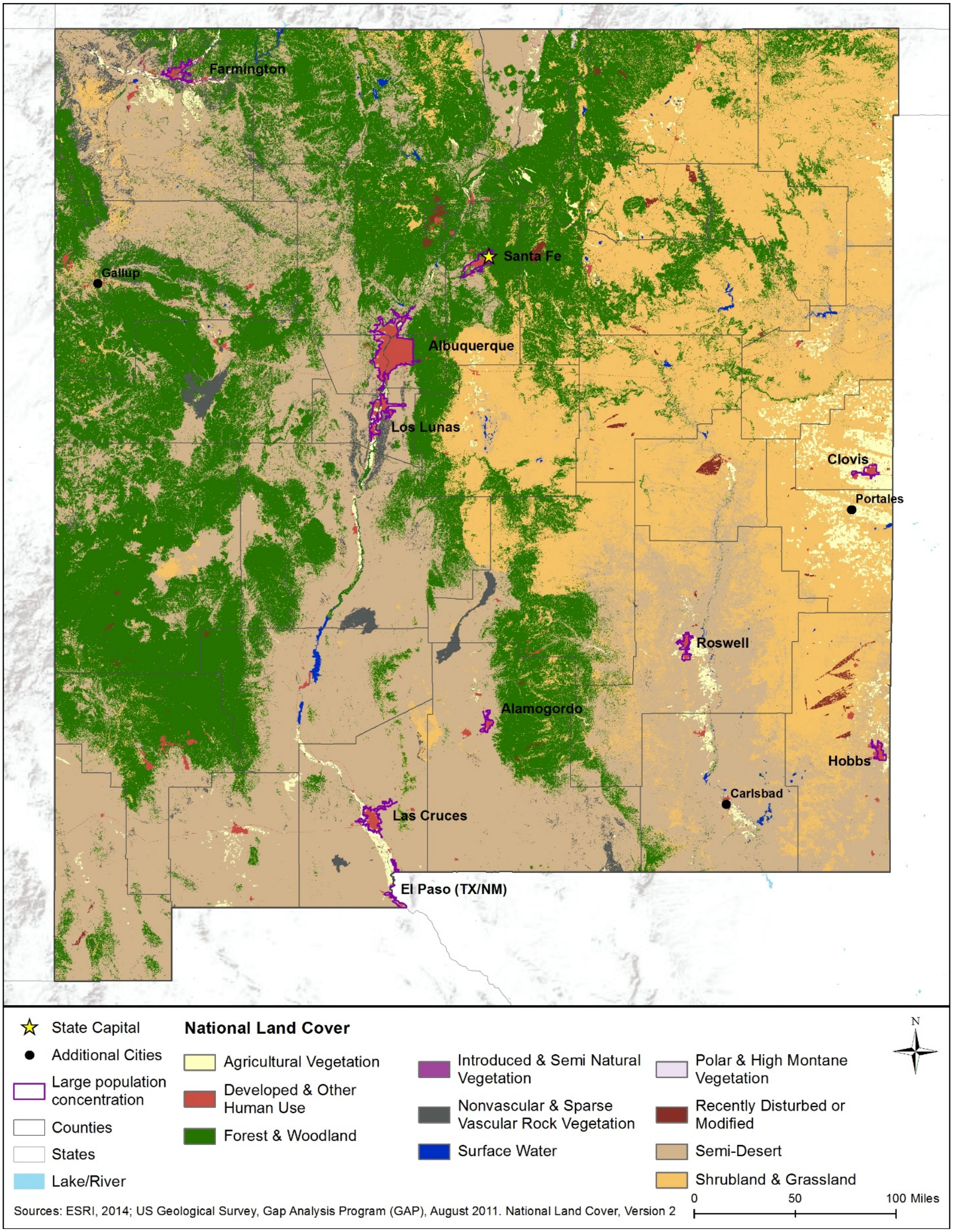

Figure 10.1.7-1: Major Land Use Distribution by Coverage Type

Developed Land

Developed land in New Mexico tends to be concentrated within major metropolitan areas and surrounding cities, towns, and suburbs (Figure 10.1.7-1). Although only 0.7 percent of New Mexico land is developed, these areas are highly utilized for residential, commercial, industrial, recreational, and government purposes. Table 10.1.7-2 lists the top five developed metropolitan areas within the state and their associated population estimates, and Figure 10.1.7-1 shows where these areas are located within the Developed land use category.

Table 10.1.7-2: Top Five Developed Metropolitan Areas

Metropolitan Area	Population Estimate
Albuquerque	741,318
Las Cruces	128,600
Santa Fe	89,284
Los Lunas	63,758
Farmington	53,049
Total Population of Metropolitan Areas	**1,076,009**
Total State Population	**2,085,572**

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

Land Ownership

Land ownership within New Mexico has been classified into four main categories: private, federal, state, and tribal (Table 10.1.7-3). [94]

Private Land

The majority of land in New Mexico is comprised of federal government, state government, and tribal lands (approximately 57 percent). Private land accounts for approximately 43 percent of the total land, with most of this falling under the land use categories of agricultural, shrub and grassland, forest and woodland, and developed (Figure 10.1.7-1). Highly developed, urban, 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.[95]

Federal Land

The federal government manages 40,958 square miles (33.6 percent) of New Mexico land with a variety of land types and uses, including national parks, monuments, historic sites, military bases, and national forests (Table 10.1.7-3). Seven federal agencies manage the majority of federal lands throughout the state (Table 10.1.7-3 and Figure 10.1.7-2). There may be other federal lands, but they are not shown on the map due to their small size relative to the entire state. (USGS, 2012c) (USGS, 2014k)

[94] 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 dataset 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.

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

Table 10.1.7-3: Federal Land in New Mexico

Agency	Square Miles	Representative Type
Department of Energy (DOE)	41.2	National Laboratory
Bureau of Reclamation	112.3	Reservoirs
USFWS	591.8	Wildlife Refuges, Wildlife Management Areas
National Park Service (NPS)	598.9	National Parks, National Monuments
Department of Defense (DoD)	3,979.4	Military Bases, Missile Ranges, Air Force Bases, USACE Recreation Areas
USFS	14,581.4	National Forests, Wilderness Areas
Bureau of Land Management (BLM)	21,080.4	Multiple Use, Mineral Development, Preservation, Recreation, Wilderness Areas
Total	**40,958.4**	

Sources: (USGS, 2012c) (USGS, 2014k)

- The DOE owns and manages 41.2 square miles for the Los Alamos National Laboratory;
- The Bureau of Reclamation owns and manages 112.3 square miles consisting of 10 reservoirs and recreation areas;
- The USFWS owns and manages 591.8 square miles consisting of the Maxwell National Wildlife Refuge (NWR), Las Vegas NWR, Sevilleta NWR, Bosque del Apache NWR, Bitter Lake NWR, and the San Andreas NWR;
- The NPS manages 598.9 square miles consisting of 15 NPS units and affiliated areas such as Bandelier National Monument, Capulin Volcano National Monument, White Sands National Monument, El Mapais National Monument, Chaco Culture National Historical Park, and the Carlsbad Caverns National Park (see 10.1.8, Visual Resources, for details);
- The DoD owns and manages 3,974.4 square miles comprised of the White Sands Missile Range, the Fort Bliss McGregor Range, the Fort Wingate Depot, the Melrose Air Force Range, the Cannon Air Force Base, and 7 USACE Recreation Areas;
- The USFS owns and manages 14,581.4 square miles consisting of the Carson NF, Santa Fe NF, Cibola NF, Lincoln NF, Gila NF, and the Apache NF; and
- The BLM owns and manages 21,080.4 square miles of land comprised of the Aztec Ruins National Monument, El Mapais National Conservation Area, Wilderness Areas, Areas of Critical Environmental Concern, mineral and energy leases, and recreation areas. (USGS, 2012c) (USGS, 2014k)

State Land[96]

The New Mexico state government owns approximately 14,357 square miles (12 percent of total land area) comprised of forests and woodlands, shrub and grassland, historic sites, state offices, educational facilities, and recreation areas. The New Mexico State Land Board manages the majority of these lands as State Trust Lands (Figure 10.1.7-4). Other agencies, such as the Department of Game and Fish and the Division of State Parks, manage preservation and recreation lands.

[96] State land use data for tables and narrative text were derived from specific state sources and may not correspond directly with USGS data that was used for developing maps and figures.

Table 10.1.7-4: State Land in New Mexico

Agency	Square Miles[a]	Representative Type
State Department of Land	0.98	No Data
Other State Land	12.06	Miscellaneous
Division of State Parks	129.34	State Parks and Recreation Areas
Department of Game and Fish	262.38	State Fish and Wildlife Areas
State Land Board	13,952.3	State Trust Lands

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

Tribal Land

The Bureau of Indian Affairs, along with individual tribes, manages 13,361 square miles, or 11 percent of the total land within New Mexico.[97] These lands are composed of 30 Indian Reservations, among 23 federally recognized tribes, currently located in the state (Table 10.1.7-5) (USGS, 2012c). For additional information regarding tribal land, see Section 10.1.11, Cultural Resources.

[97] Although the Bureau of Indian Affairs "manages" American Indian lands, the Bureau of Indian Affairs is different from other land management agencies as the lands are held in trust for sovereign nations.

Table 10.1.7-5: Indian Reservations and Other Land Holdings of New Mexico

Reservation Name	Square Miles
Southern Ute Reservation	0.16
Pojoaque Pueblo	21.2
San Juan Pueblo	26.86
Tesuque Pueblo	27.10
Picuris Pueblo	27.42
Nambe Pueblo	32.40
Sandia Pueblo	37.14
San Ildefonso Pueblo	44.06
Santa Clara Pueblo	76.99
San Felipe Pueblo	81.28
Cochiti Pueblo	81.94
Alamo Navajo Reservation	99.03
Navajo Reservation (Alamo)	99.05
Santo Domingo Pueblo	107.61
Canoncito (Navajo) Community	121.81
Navajo Reservation (Canoncito)	122.01
Santa Ana Pueblo	125.06
Jemez Pueblo	139.42
Taos Pueblo	153.63
Ute Mountain Reservation	163.17
Acoma Pueblo - Red Lake Purchase	179.12
Zia Pueblo	193.10
Isleta Pueblo	332.06
Acoma Pueblo	394.48
Navajo Reservation (Ramah)	449.14
Ramah (Navajo) Community	449.14
Zuni Reservation	640.07
Mescalero Apache Reservation	723.81
Laguna Pueblo	839.37
Jicarilla Apache Reservation	1,313.23
Navajo Reservation	6,259.97
Total	**13,360.83**

Sources: (USGS, 2012c) (USGS, 2014k)

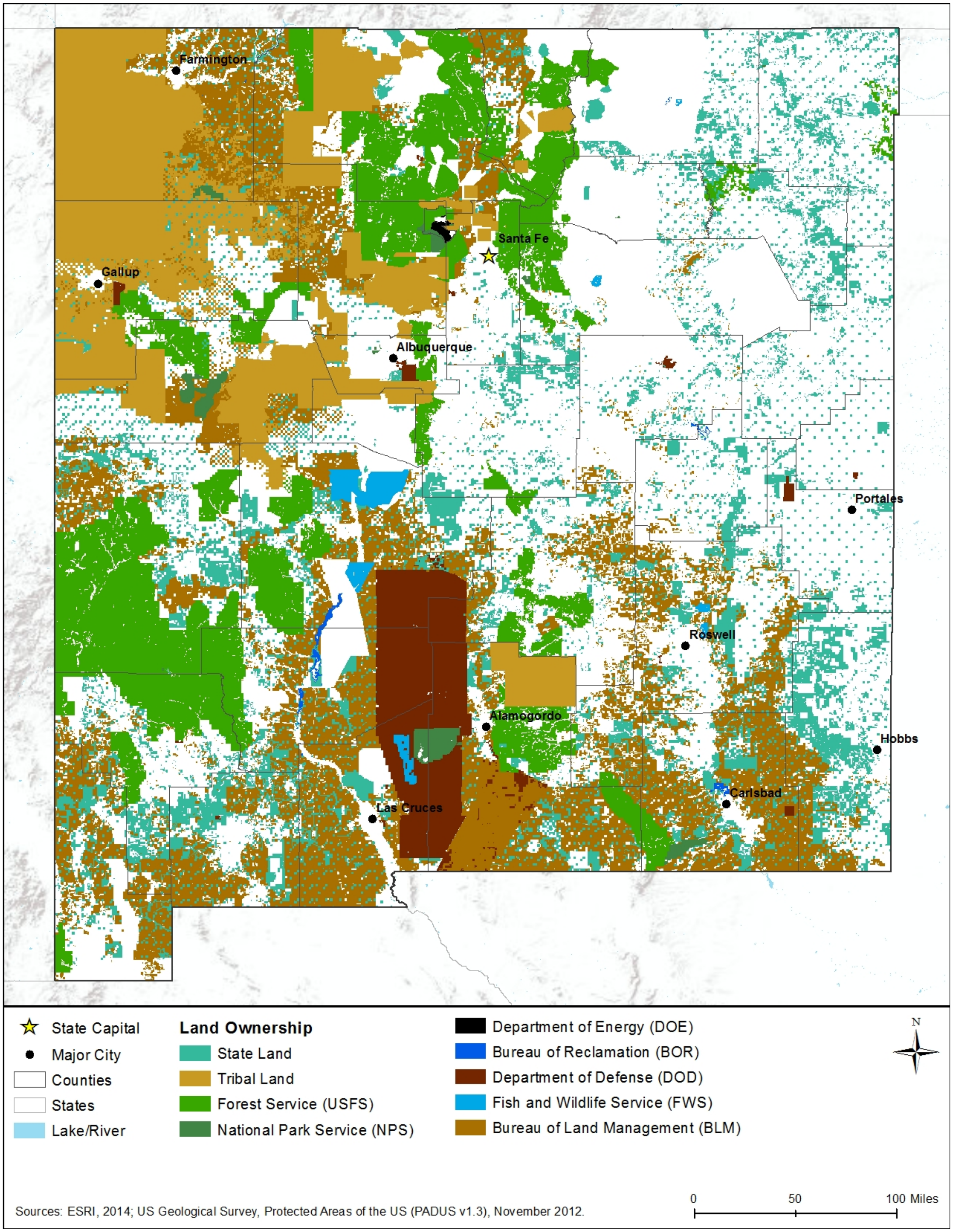

Figure 10.1.7-2: Land Ownership Distribution

10.1.7.4. Recreation

New Mexico's geography consists of deserts, mesas, and the Sangre de Cristo Mountains, with the Rio Grande running through the state. The BLM has more than fifty recreation areas within New Mexico specializing in hiking, rock climbing, horseback riding, and other trail use; camping and picnicking; fishing, swimming, boating, and other water activities; and licensed, seasonal hunting (Figure 10.1.7-3) (BLM, 2015a).[98] On the community level, towns, cities, and counties provide an assortment of indoor and outdoor recreational facilities, including athletic fields and courts, playgrounds, picnicking areas, and lake, river, or beach access points. Availability of community-level facilities is typically commensurate to the population's needs.

This section discusses recreational opportunities available at various locations throughout New Mexico. For information on visual resources, see Section 10.1.8, Visual Resources, and for information on the historical significance of locations, see Section 10.1.11, Cultural Resources.

Region 1

Region 1 is located in the northern part of the state, bordered by Arizona to the west, Colorado to the north, and Oklahoma to the east. The Chaco Culture National Historic Park has a nine-mile trail connecting popular areas, and backcountry trails to lesser-known areas: the park also hosts astronomy programs, solar viewing, and stargazing programs (NPS, 2015b).

The Carson National Forest is known for mountain scenery accessible by trails including the Pot Creek Interpretive Trail and the Devisadero Loop Trail. The Santa Fe National Forest is popular for white water rafting and access to pueblos, Spanish missions, and other ruins. Recreational activities within the forests include hiking, mountain biking, horseback riding, and other trail use; camping and picnicking; downhill and cross-country skiing, snowmobiling, and sledding; and fishing, and licensed, seasonal hunting. (USFS, 2015a) (USFS, 2015b)

Region 2

Region 2 cuts across central New Mexico, bordered to the west by Arizona and the east by Texas. The Manzano Mountains, Rio Grande Nature Center, and Sumner Lake State Parks have activities including hiking, birdwatching, horseback riding, and other trail activities; camping and picnicking; and boating and other water activities (New Mexico State Parks, 2015a) (New Mexico State Parks, 2015b) (New Mexico State Parks, 2015c).

The Cibola National Forest is known for the aerial Sandia Peak Tramway and the Four Seasons Visitor Center. Recreational activities within the forests include hiking, bicycling, horseback riding, and other trail use; camping and picnicking; and a variety of winter sports. (USFS, 2015c) (Recreation.gov, 2015)

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[98] 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 dataset that contains large quantities of information relevant to the Proposed Action. The data was queried to show the Primary Designation Type of area. To show these in the map, recognizable symbols (e.g., varying shades of green for National Parks and Forests) were used as PAD-US does not have a standard symbolization for recreational resources. The PADUS 1.3 geodatabase was downloaded in the summer of 2015, and used consistently throughout all these maps for each state and D.C.

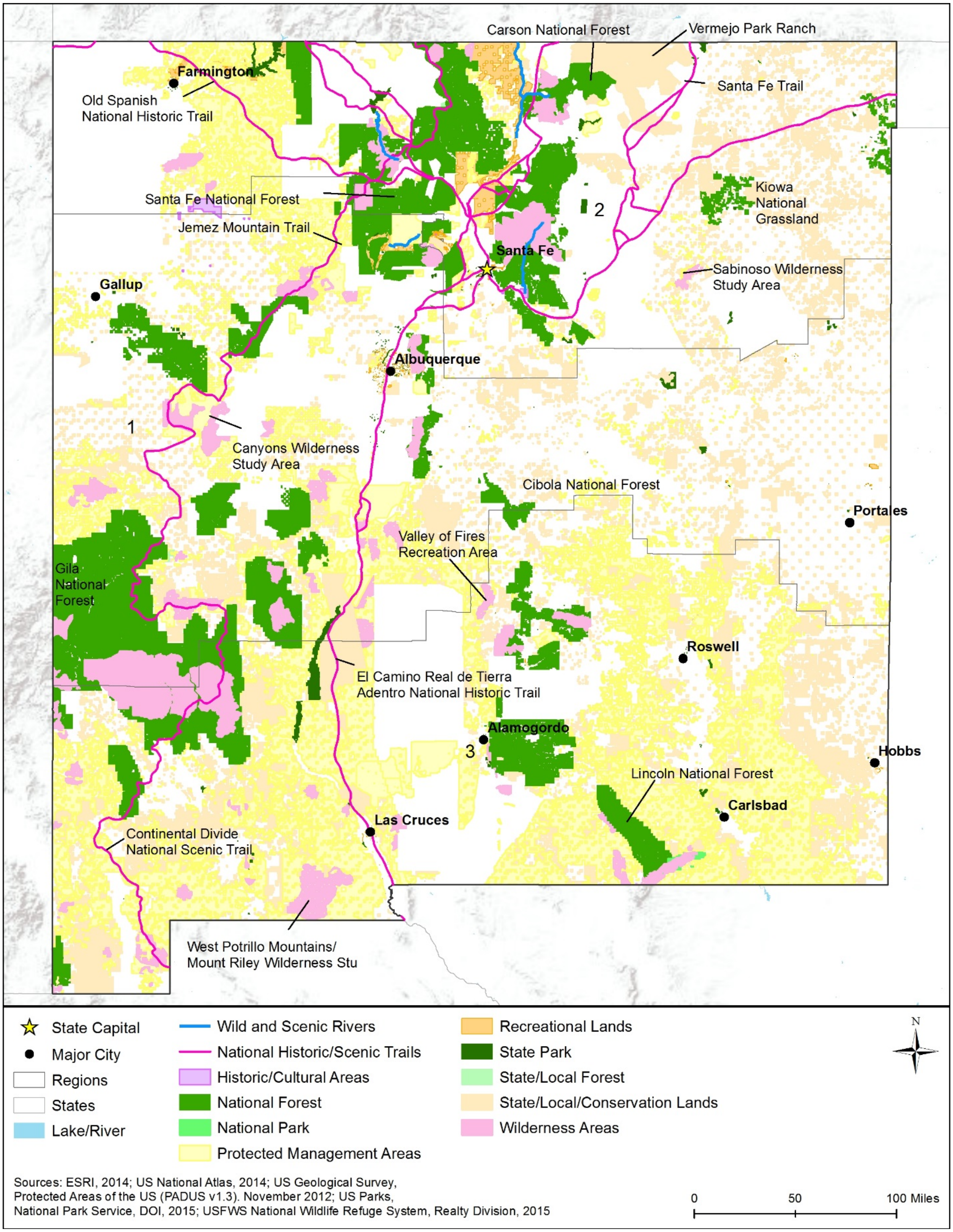

Figure 10.1.7-3: New Mexico Recreation Resources

Region 3

Region 3, in southern New Mexico, is bordered to the west by Arizona, the south by Mexico, and the south and east by Texas. The region includes the Carlsbad Caverns National Park, known for cave tours, bat flight watching programs, and stargazing (NPS, 2015c). The White Sands National Monument is the world's largest gypsum dunefield: hiking, camping, picnicking, and dune sledding are popular activities (NPS, 2015d).

The Gila National Forest is known for its horseback riding trails and connections to the Mogollon and Apache Indians. The Lincoln National Forest is popular for spelunking the karst caves found below the forest. Recreational activities within the forests include hiking, mountain biking, horseback riding, and other trail use; camping, rock-hounding, and picnicking; and fishing, and licensed, seasonal hunting. (USFS, 2015d) (USFS, 2015e)

10.1.7.5. Airspace

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

Airspace Categories

There are two categories of airspace or airspace areas:

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

Within each of these two categories, there are four types of airspace: controlled, uncontrolled, special use, and other airspace. The categories and types of airspace are dictated by the complexity or density of aircraft movements, the nature of the operations conducted within the airspace, the level of safety required, and the national and public interest. Figure 10.1.7-4 depicts the different classifications and dimensions for controlled airspace. Air Traffic Control (ATC)[99] service is based on the airspace classification (FAA, 2008).

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

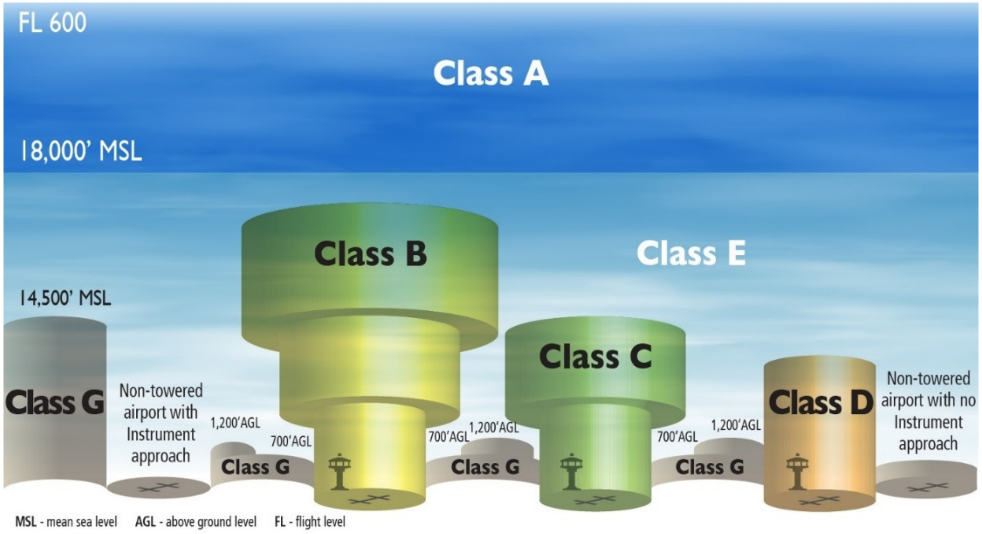

Figure 10.1.7-4: National Air Space Classification Profile

Source: Derived from (FAA, 2008)

Controlled Airspace

- **Class A:** Airspace from 18,000 feet to 60,000 feet Mean Sea Level (MSL)[100]. 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).[101]
- **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).

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

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 10.1.7-6).

Table 10.1.7-6: SUA Designations

SUA Type	Definition
Prohibited Areas	"Airspace of defined dimensions identified by an area on the surface of the earth within which the flight of aircraft is prohibited. Such areas are established for security or other reasons associated with the national welfare. These areas are published in the Federal Register and are depicted on aeronautical charts."
Restricted Areas	"Airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions. Activities within these areas must be confined because of their nature or limitations imposed upon aircraft operations that are not a part of those activities or both. Restricted areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Penetration of restricted areas without authorization from the using or controlling agency may be extremely hazardous to the aircraft and its occupants. Restricted areas are published in the Federal Register and constitute 14 CFR Part 73."
Warning Areas	"Airspace of defined dimensions, extending from three NM from the U.S. coast, which contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning areas is to warn non-participating pilots of the potential danger. A warning area may be located over domestic or international waters or both."
MOAs	"Airspace of defined vertical and lateral limits established for separating certain military activities (e.g., air combat maneuvers, air intercepts, testing, etc.) from IFR traffic. Whenever an MOA is in use, non-participating IFR traffic may be cleared through a MOA if IFR separation can be provided by ATC. Otherwise, ATC will reroute or restrict nonparticipating IFR traffic."
Alert Areas	"Depicted on aeronautical charts to inform non-participating pilots of areas that may contain a high volume of pilot training or an unusual type of aerial activity. Pilots should be particularly alert when flying in these areas. All activity within an alert area must be conducted in accordance with CFRs, without waiver, and pilots of participating aircraft and pilots transiting the area are responsible for collision avoidance."
Controlled Firing Areas (CFAs)	"Activities that, if not conducted in a controlled environment, could be hazardous to nonparticipating aircraft. The distinguishing feature of the CFA, as compared to other special use airspace, is that its activities are suspended immediately when spotter aircraft, radar, or ground lookout positions indicate an aircraft might be approaching the area. There is no need to chart CFAs since they do not cause a nonparticipating aircraft to change its flight path."
National Security Areas (NSA)	"Airspace of defined vertical and lateral dimensions established at locations where there is a requirement for increased security and safety of ground facilities. Pilots are requested to voluntarily avoid flying through the depicted NSA. When it is necessary to provide a greater level of security and safety, flight in NSAs may be temporarily prohibited by regulation under the provisions of 14 CFR Section 109.7. Regulatory prohibitions are issued by System Operations, System Operations Airspace and Aeronautical Information Manual (AIM) Office, Airspace and Rules, and disseminated via Notices to Airmen (NOTAM). Inquiries about NSAs should be directed to Airspace and Rules."

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

Other Airspace Areas

Other airspace areas, explained in Table 10.1.7-7, include Airport Advisory, Military Training Routes (MTRs), Temporary Flight Restrictions (TFRs), Parachute Jump Aircraft Operations, published Visual Flight Rules (VFR) and IFRs, and Terminal Radar Service Areas.

Table 10.1.7-7: 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 the State of Hawaii declared national disasters for humanitarian reasons. Only those TFRs annotated with an ending date and time of "permanent" are included in this Draft PEIS, since it indicates a longer, standing condition of the airspace. Other TFRs are typically a shorter duration of for a one-time specific event.
Parachute Jump Aircraft Operations	Parachute jump area procedures are in 14 CFR Part 105, while the U.S. parachute jump areas are contained in the regional Airport/Facility Directory.
Published VFRs and IRs	These are established routes for moving around and through complex airspace, like Class B airspace. VFRs are procedures used to conduct flights under visual conditions. IFRs are procedures used to conduct flights with instruments and meteorological conditions.
Terminal Radar Service Areas	Airspace areas that are not one of the established U.S. airspace classes. These areas provide additional radar services to pilots.

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

10.1.7.6. Aerial System Considerations

Unmanned Aerial Systems

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

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

Balloons

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

10.1.7.7. Obstructions to Airspace Considerations

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

- "Any construction or alteration exceeding 200 feet aboveground level;
- Any construction or alteration:
  - within 20,000 feet 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 feet;
  - within 10,000 feet 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 feet;
  - within 5,000 feet 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; and
- Any construction or alteration located on a public use airport or heliport regardless of height or location" (FAA, 2015e).

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

10.1.7.8. New Mexico Airspace

New Mexico Aviation is a division with the New Mexico Department of Transportation. "The Division provides planning and technical support in developing and maintaining the State's airports and other elements of the aviation system (NMDOT, 2015a)." Based on the New Mexico Airport System Plan, which documents the long term development of the State's airports, the objectives of the State and the Aviation Division is to "increase/enhance safety and security, preserve/protect investment in airports, accommodate existing and projected aviation demand, and support economic growth of the community" (NMDOT, 2011). There is one FAA FSDO in New Mexico located in Albuquerque (FAA, 2015c).

New Mexico airports are classified as those included in the State Aviation System Plan (SASP) and those that are not part of the SASP. The SASP addresses the strategic planning and future development for the State's airport system, as well as addressing key associated with their airports. (NASAO, 2015) Figure 10.1.7-5 presents the different aviation airports/facilities residing in New Mexico, while Figures 10.1.7-6 and 10.1.7-7 present the breakout by public and private airports/facilities. There are approximately 170 airports within New Mexico as presented in Table 10.1.7-8 and Figures 10.1.7-5 through 10.1.7-7 (USDOT, 2015a).

Table 10.1.7-8: Type and Number of New Mexico Airports/Facilities

Type of Airport or Facility	Public	Private
Airport	59	78
Heliport	4	28
Seaplane	1	0
Ultralight	0	1
Balloonport	0	0
Gliderport	0	0
Total	**63**	**107**

Source: (USDOT, 2015b)

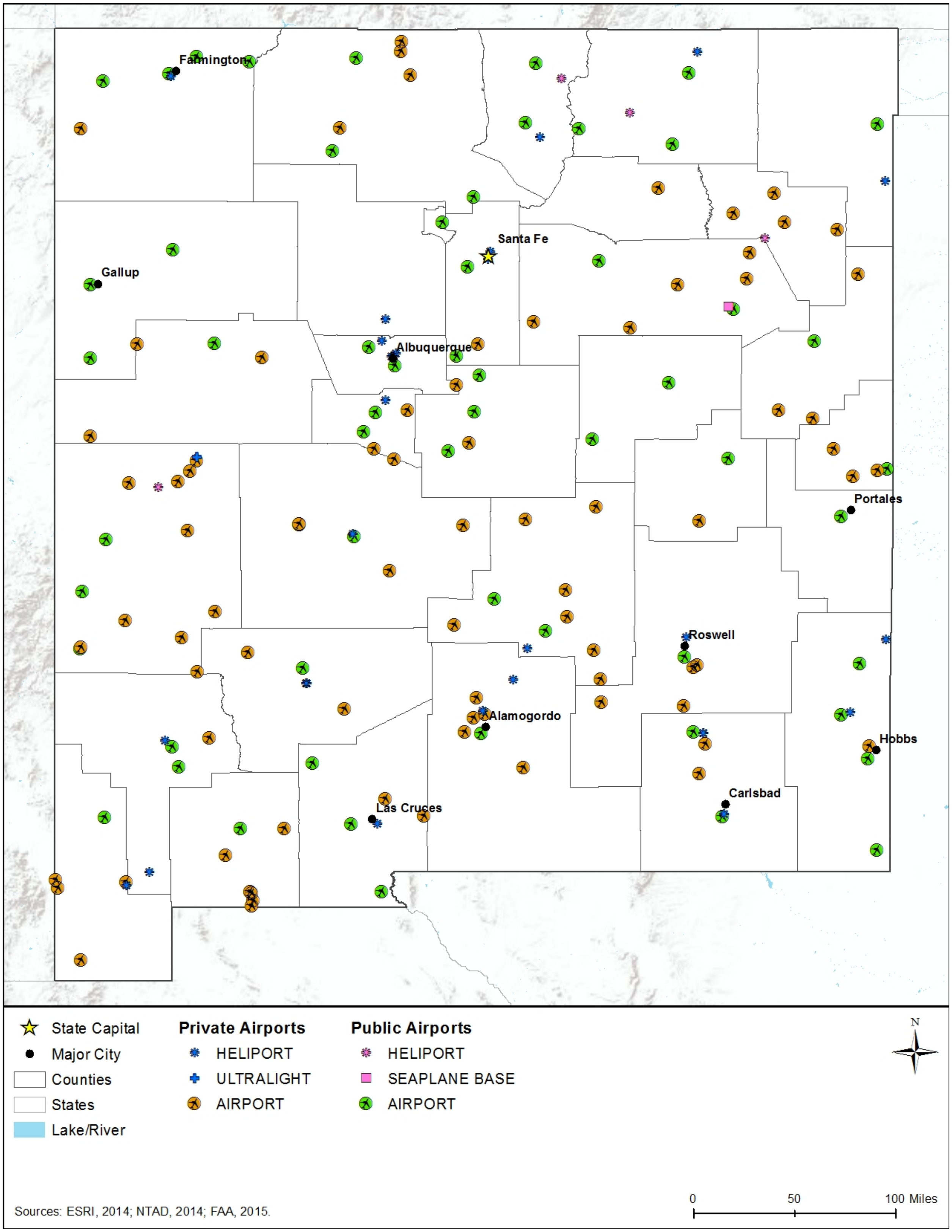

Figure 10.1.7-5: Composite of New Mexico Airports/Facilities

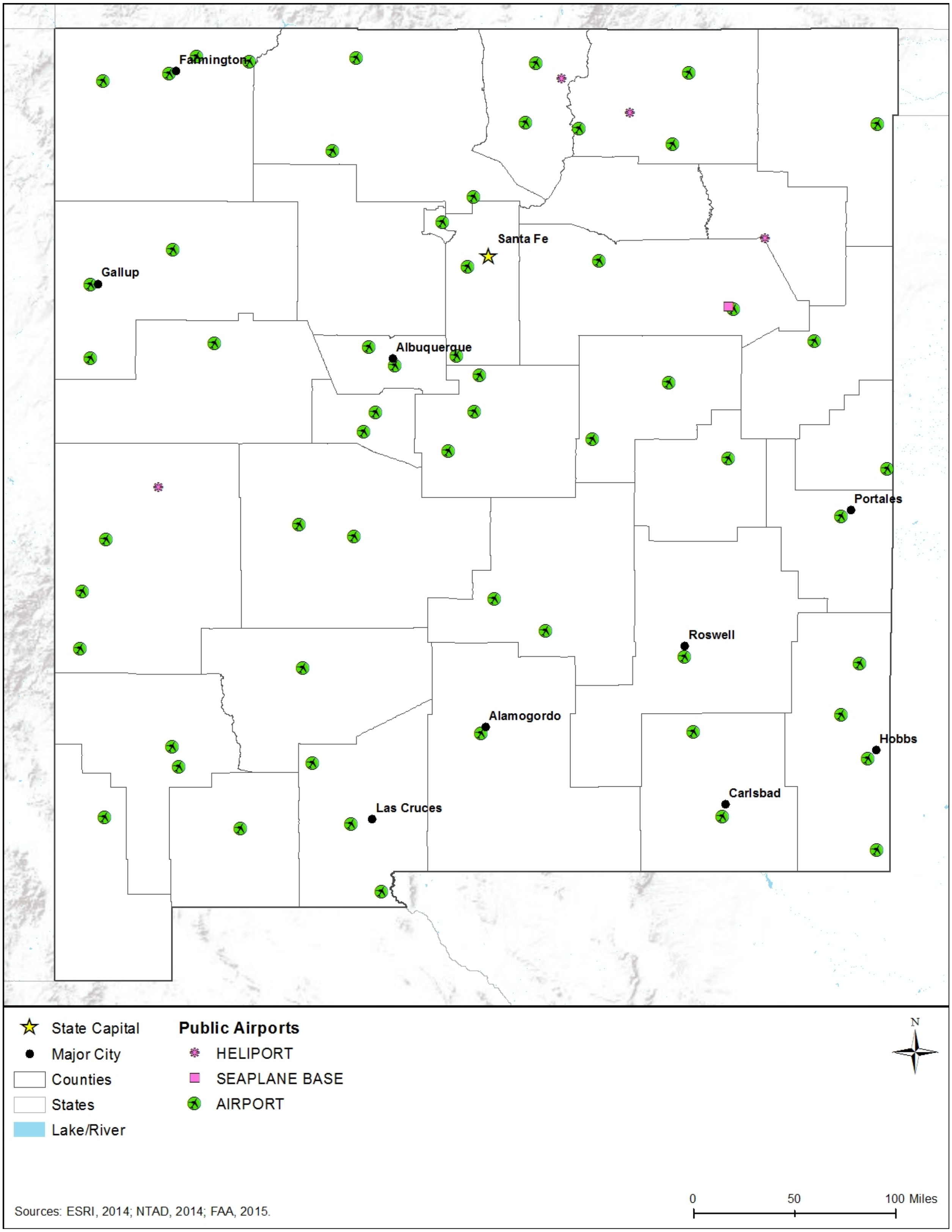

Figure 10.1.7-6: Public New Mexico Airports/Facilities

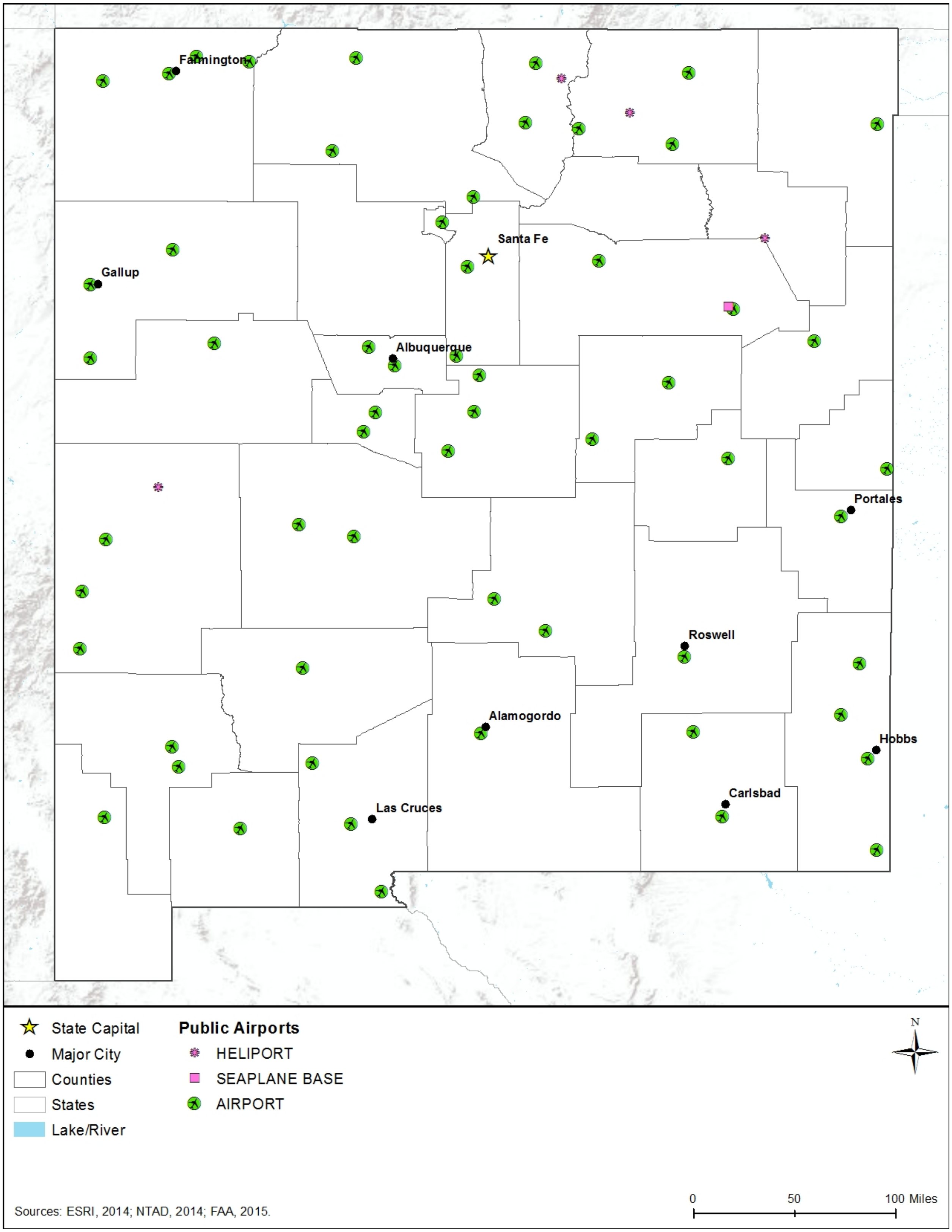

Figure 10.1.7-7: Private New Mexico Airports/Facilities

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

- One Class C –
  - Albuquerque International
- Six Class D –
  - Double Eagle II, Albuquerque
  - Cannon Air Force Base, Clovis
  - Farmington, Four Corners Regional
  - Lea County (Hobbs)
  - Roswell Industrial Air Center
  - Santa Fe County Municipal (FAA, 2015f)

SUAs (i.e., 29 restricted areas and twenty MOAs located in New Mexico are as follows:

- Los Alamos (Restricted) –
  - R-5101 – Surface to 12,000 feet MSL
- McGregor (Restricted) –
  - R-5103A – Surface to, but not including, FL 180
  - R-5103B – Surface to unlimited
  - R-5103C – Surface to unlimited
- Melrose (Restricted) –
  - R-5104A – Surface to, but not including, 18,000 feet MSL
  - R-5104B – 18,000 feet MSL to 23,000 feet MSL
  - R-5105 – Surface to 10,000 feet MSL
- White Sands Missile Range (Restricted) –
  - R-5107A – Surface to unlimited
  - R-5107B – Surface to unlimited
  - R-5107C – 9,000 feet MSL to unlimited
  - R-5107D – Surface to 22,000 feet MSL
  - R-5107E – Surface to unlimited
  - R-5107F – From FL 240 to FL 450
  - R-5107G – From FL 240 to FL 450
  - R-5107H – Surface to and including 9,000 feet MSL
  - R-5107J – Surface to and including 9,000 feet MSL
  - R-5107K – Surface to unlimited

   - R-5109A – From 24,000 feet MSL to unlimited
   - R-5109B – From 24,000 feet MSL to unlimited
- Elephant Butte (Restricted) –
   - R-5111A – 13,000 feet MSL to unlimited
   - R-5111B – Surface to 13,000 feet MSL
   - R-5111C – 13,000 feet MSL to unlimited
   - R-5111D – Surface to, but not including, 13,000 feet MSL
- Socorro (Restricted) –
   - R-5113 – Surface to 45,000 feet MSL
   - R-5119 – FL 350 to unlimited
- Deming (Restricted) –
   - R-5115 – Surface to 15,000 feet MSL
- Fort Wingate (Restricted) –
   - R-5117 – Surface to unlimited
   - R-5121 – FL 200 to unlimited
- Magdalena (Restricted) –
   - R-5123 – Surface to unlimited (FAA, 2015i)

The twenty MOAs for New Mexico are as follows:

- Beak –
   - A – 12,500 feet MSL to, but not including, FL 180
   - B – 12,500 feet MSL to, but not including, FL 180
   - C – 12,500 feet MSL to, but not including, FL 180
- Cato –
   - 13,500 feet MSL to, but not including, FL 180
- Taiban –
   - 500 feet aboveground level (AGL) to, but not including, 11,000 feet MSL
- Talon –
   - High – 12,500 feet MSL up to, but not including, FL 180
   - Low – 300 feet AGL up to, but not including, 12,500 feet MSL
- Mt. Dora –
   - East High – 11,000 feet MSL to, but not including, FL 180
   - East Low – 1,500 feet AGL to, but not including, 11,000 feet MSL
   - North High – 11,000 feet MSL to, but not including, FL 180

  - North Low – 1,500 feet AGL to, but not including, 11,000 feet MSL
  - West High – 11,000 feet MSL to, but not including, FL 180
  - West Low – 1,500 feet AGL to, but not including, 11,000 feet MSL
- Pecos –
  - North High – 11,000 feet MSL up to, but not including, FL 180
  - North Low – 500 feet AGL up to, but not including, 11,000 feet MSL
  - South – 500 feet AGL up to, but not including, FL 180
- Smitty –
  - 500 feet AGL to, but not including, 13,500 feet MSL; excluding the airspace below 1,600 feet AGL west of a line from lat. 34°18’47”N., long. 108°14’52”W.; to lat. 33°58’51”N., long. 108°13’14”W.; to lat. 33°52’01”N., long. 108°19’44”W.; to lat. 33°39’16”N., long. 108°23’17”W.
- Tombstone –
  - A – 500 feet AGL to, but not including, 14,500 feet MSL
  - B – 500 feet AGL to, but not including, 14,500 feet MSL
  - C – 14,500 feet MSL to, but not including, FL 180 (FAA, 2015i)

Texas State MOAs of Bronco 1 through 4, associated with the U.S. Air Force 27th Special Operations Wing of Cannon AFB New Mexico, extends into the lower eastern portion of the state (Bronco 1- 8,000 feet MSL to, but not including, FL 180; Bronco 2 – 10,000 feet MSL to, but not including, FL 180; Bronco 3 - 10,000 feet MSL to, but not including, FL 180; and Bronco 4 – 10,000 feet MSL to, but not including, FL 180. The Morenci MOA in Arizona State, associated with the 162nd Tactical Fighter Group of Tucson, extends into the lower western corner of the state. Altitude restrictions for the Morenci MOA are 1,500 feet AGL to, but not including, FL 180. The Reserve MOA of Arizona extends into the western portion of the state. Altitude restrictions for this MOA are 5,000 feet AGL to, but not including, FL 180. (FAA, 2015i)

The SUAs for New Mexico are presented in Figure 10.1.7-8. There are no TFRs (See Figure 10.1.7-8) (FAA, 2015h). MTRs in New Mexico, presented in Figure 10.1.7-9, consist of twelve Visual Routes, 28 Instrument Routes, and seven Slow Routes.

UAS Considerations

The NPS signed a policy memorandum on June 24, 2014 that “directs superintendents nationwide to prohibit launching, landing, or operating unmanned aircraft on lands or waters administered by the National Park Service” (NPS, 2014c). There are 15 national parks in New Mexico that must comply with this agency directive. (NPS, 2015e).

Obstructions to Airspace Considerations

Chapter 64-2-2 of the New Mexico aviation statutes speaks to obstructions: "To protect the lives and property of the users of the airport and the occupants of the territory adjacent to the airport, the joint airport zoning board may exercise those powers and duties granted legislative bodies under the Municipal Airport Zoning Law (3-39-16 to 3-39-26 NMSA 1978) in conformity with the provisions of the Municipal Airport Zoning Law or Sections 3-21-1, 3-21-2 and 3-21-5 through 3-21-11 NMSA 1978 insofar as it relates to compatible land use zoning around the airport. The area eligible for height, hazard and compatible land use zoning around the airport may not extend more than fifty thousand feet beyond any point on the perimeter of the area of land for the airport which is owned by the political subdivision which operates the airport." (New Mexico Compilation Commission, 2015b)

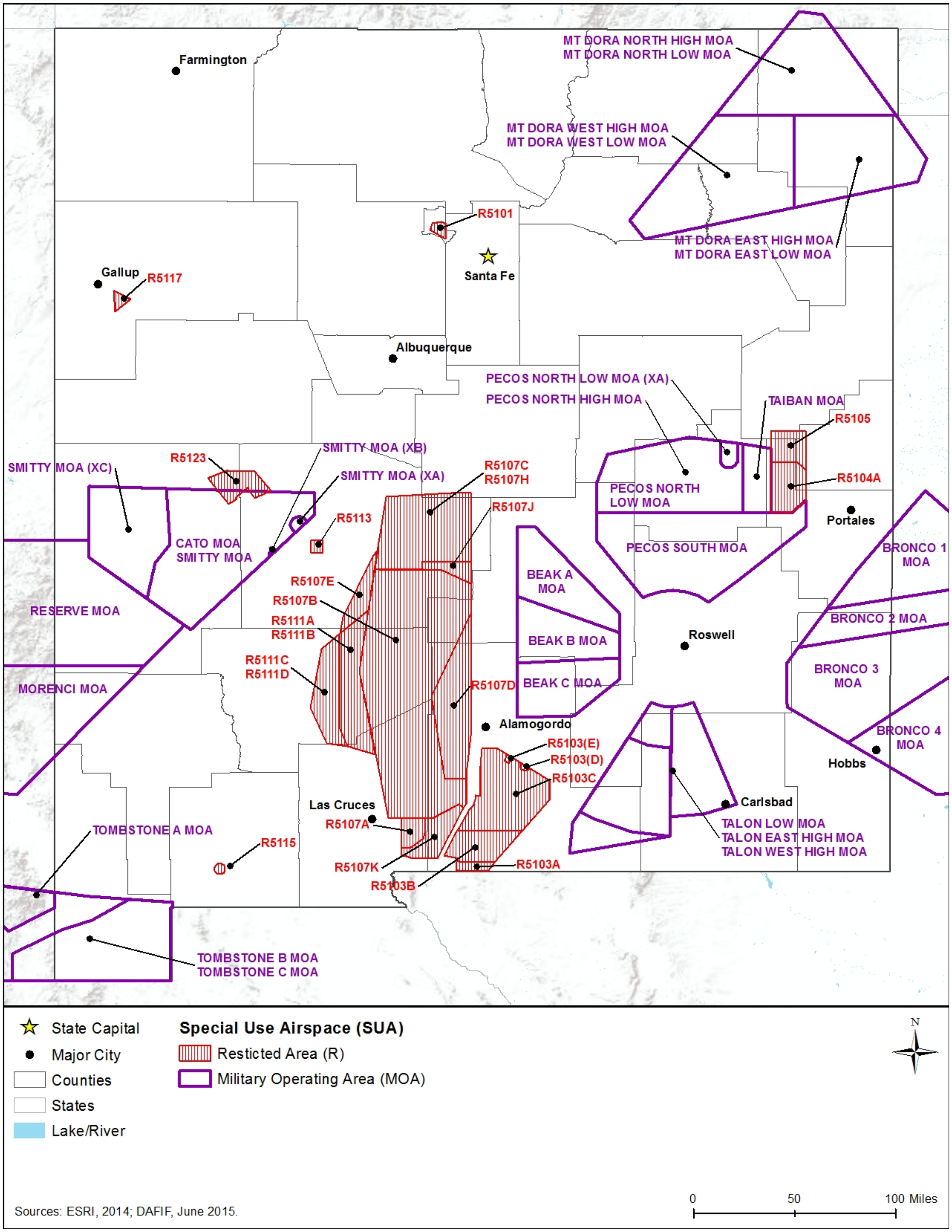

Figure 10.1.7-8: SUAs in New Mexico

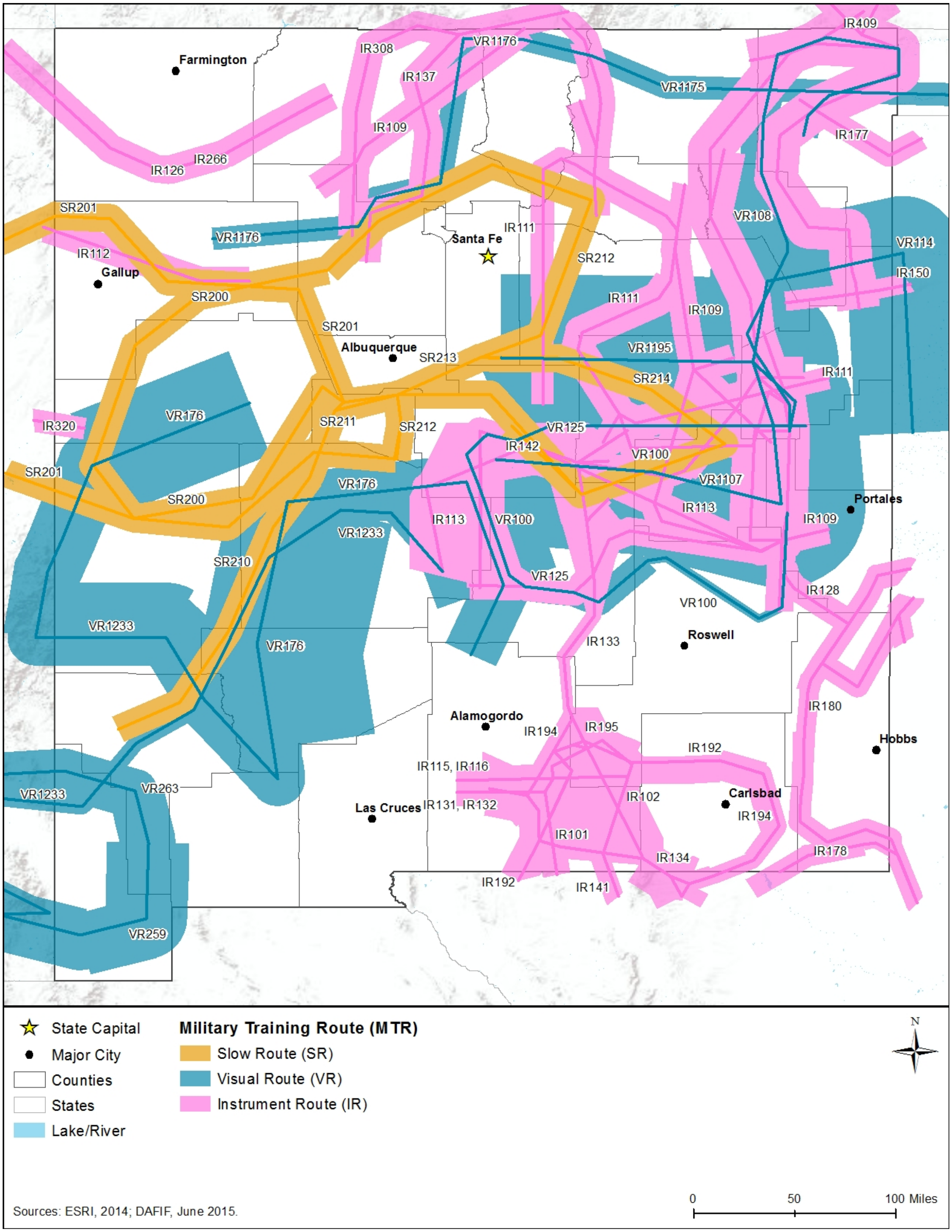

Figure 10.1.7-9: MTRs in New Mexico

10.1.8. Visual Resources

10.1.8.1. 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 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 BLM, "the visible physical features on a landscape (e.g., land, water, vegetation, animals, structures, and other features)" (BLM, 1984).

10.1.8.2. Specific Regulatory Considerations

Table 10.1.8-1 presents state and local laws and regulations that relate to visual resources.

Table 10.1.8-1: Relevant Visual Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
3-60A-10. Powers of municipality	Municipalities	"…to acquire real property that is appropriate for the preservation or restoration of historic sites; the beautification of urban land; the conservation of open spaces, natural resources and scenic areas…"
16-2-11. Acquisition of lands for park and recreational purposes; criteria.	State Parks Division	"Lands designated for acquisition or development as state parks or state recreational areas shall be those that: …preserve the most significant examples of New Mexico natural scenic landscape."
16-3-4. State trails system created; types of trails; planning.	State Parks Division	"There is created a "state trails system" composed of…state scenic trails" which are extended trails so located as to provide maximum potential for the appreciation of natural areas and for the conservation and enjoyment of the significant scenic, historic, natural, ecological, geological or cultural qualities of the areas through which such trails pass…"
16-4-1 through 8. El Rio Chama Scenic and Pastoral Act	State Game Commission	"To establish a scenic and pastoral river known as El Rio Chama."

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.

10.1.8.3. Character and Visual Quality of the Existing Landscape

New Mexico, known as the "Land of Enchantment" is the 5th largest state in the nation. The overall climate of the state is predominately dry, allowing for great visibility and expansive scenic vistas. The Southern Rocky Mountains reach in from the northern part of the state, divided by the Rio Grande River running from north to south. The remainder of the state varies from high, arid plateaus and mountain ranges, such as the Sangre de Christo Mountains, to the low Chihuahuan desert crossing the southern border. Water is scarce, resulting in many cities being located along the Rio Grande and Pecos Rivers, or along other smaller rivers and tributaries. The major cities are Albuquerque, along the Rio Grande River, and Santa Fe, located between the Rio Grande and Pecos Rivers. Scenery ranges from sand dunes, desert, scrubland, sandstone, and basalt cliffs to pine forests, steep mountains, deep canyons, and lush river valleys. The lowest point in the state is 2,842 feet at Red Bluff Reservoir, and the highest point is 13,163 Wheeler Peak in the Sangre de Christo Mountains. Culture and history of American Indians, Spanish, and U.S. pioneers are prevalent aspects of the state, influencing the “Southwestern” look and feel of the towns and landscape. (USGS, 2009; Encyclopaedia Britannica, 2015)

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

New Mexico has considered the management and protection of scenic resources in their parks, scenic byways, and trail planning (Table 10.1.8-1). Those policies allow for consideration and protection of visual resources in certain landscapes. While the state and many municipalities have some regulation of scenic and visual resources, not all scenic areas within the state have been identified or have policy or regulations for management or protection by the state. The areas listed below have additional management, significance, or protection through state or federal policy, as well as being identified as visually significant areas.

10.1.8.4. 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 10.1.8-1 shows a sample of areas that are included in the National Register of Historic Places (NRHP) that may be considered visually sensitive. In New Mexico, there are 1,133 NRHP listed sites, which include 46 National Historic Landmarks, seven National Monuments, and two National Historical Parks (NPS, 2015e). 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 historic properties and the visual resources therein (NPS 1995).

The BLM issued a 1997 Memorandum of Understanding with the Advisory Council on Historic Preservation and the National Conference of State Historic Preservation Officers regarding the manner in which BLM will meet its responsibilities under the National Historic Preservation Act (BLM, 2004). In addition, BLM is required to manage scenic resources under the Federal Land Policy and Management Act of 1976 (FLPMA) and Manuals 8100 and 8140 protecting cultural resources. BLM conducts visual resource inventories for all of the public lands they manage during their land use planning process, about every 10-15 years.

World Heritage Sites

Sites are designated World Heritage sites if they reflect "the world's cultural and natural diversity of outstanding universal value" (UNESCO, 2015a). To be included on the World Heritage List, sites must meet 1 of 10 criteria reflecting cultural, natural, or artistic significance (UNESCO, 2015b). World Heritage sites are diverse and range from archaeological remains, national parks, islands, buildings, city centers, and cities. The importance of World Heritage-designated properties can be attributed to cultural or natural qualities that may be considered visual resources or are visually sensitive at these sites. In New Mexico, Carlsbad Caverns National Park is designated a natural World Heritage site (Figure 10.1.8-1) (NPS, 2015f).

National Historic Landmarks

National Historic Landmarks (NHL) are defined as "nationally significant historic places designated by the U.S. Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States" (NPS, 2015g). In New Mexico, NHLs are comprised of "historic buildings, sites, structures, objects, and districts" (NPS, 2016a). Other types of historic properties include battlefields, American Indians historic sacred sites, and travel routes. 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 46 NHLs in New Mexico, which include a variety of historic structures but also include historic stopovers along travel routes and natural areas. The NHLs in New Mexico are:

- Abo
- Acoma Pueblo
- Bandelier CCC Historic District
- Barrio de Analco Historic District
- Big Bead Mesa
- Palace of the Governors
- Pecos Pueblo
- Puye Ruins
- Pyle, Ernie, House
- Quarai

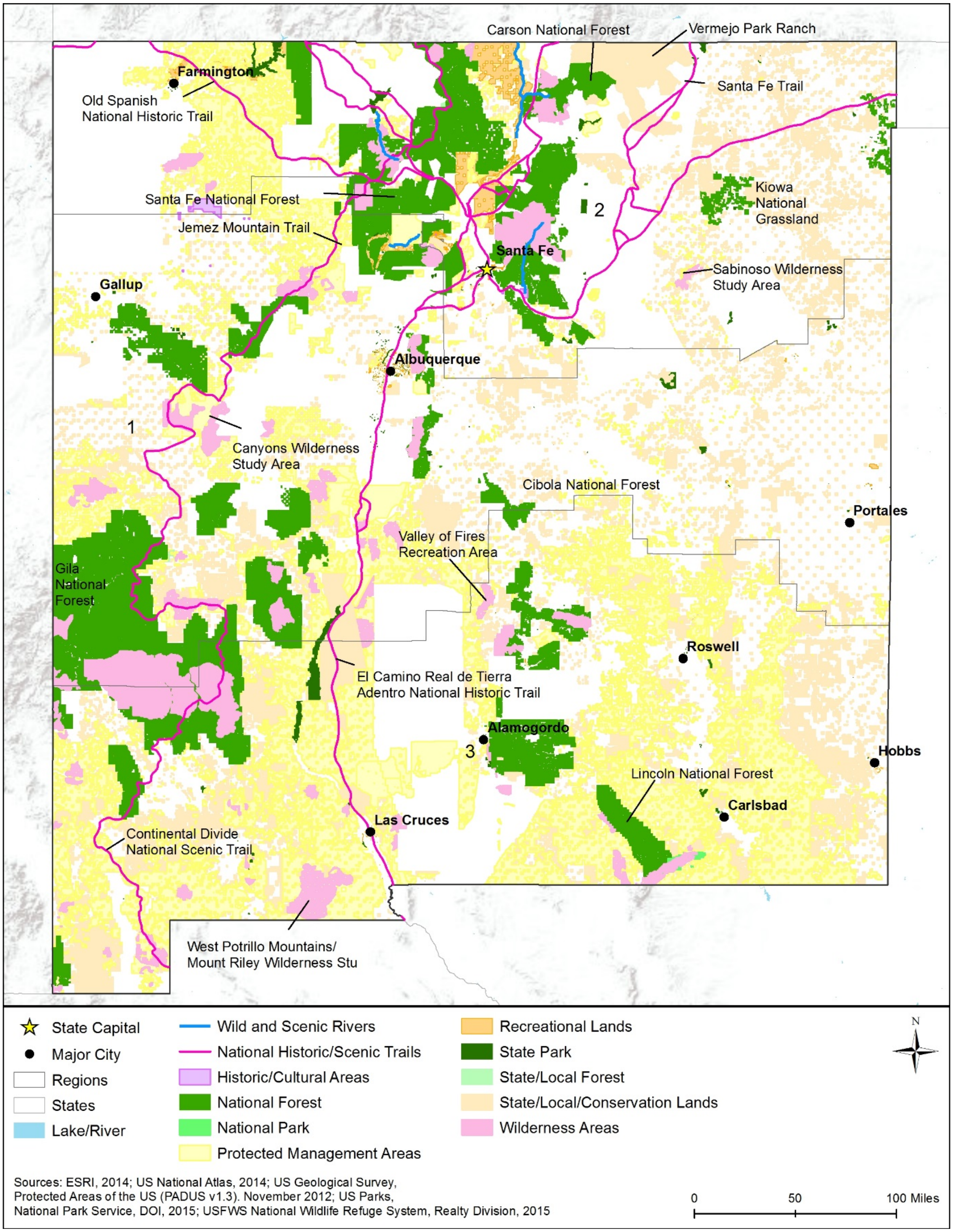

Figure 10.1.8-1: Representative Sample of Some Historic and Cultural Resources that May be Visually Sensitive

- Blackwater Draw, Formerly Known as Anderson Basin
- Blumenschein, Ernest L., House
- Carlsbad Irrigation Project
- Carson, Kit, House
- Denver and Rio Grande Railroad San Juan Extension (Cumbres and Toltec Scenic Railroad) Also in Colorado
- El Santuario De Chimayo
- Folsom Site
- Fort Bayard
- Glorieta Pass Battlefield
- Hawikuh
- Las Trampas Historic District
- Lincoln Historic District
- Los Alamos Scientific Laboratory
- Luhan, Mabel Dodge, House
- Manuelito Complex
- Mesilla Plaza
- National Park Service Region III Headquarters Building
- O'Keeffe, Georgia, Home and Studio
- Rabbit Ears
- Raton Pass (Also in Colorado)
- San Estevan del Rey Mission Church
- San Francisco de Assisi Mission Church
- San Gabriel de Yunque-Ouinge
- San Jose de Gracia Church;
- San José de Los Jémez Mission and Gíusewa Pueblo Site
- San Lazaro
- Sandia Cave
- Santa Fe Plaza
- Seton Village
- Taos Pueblo
- Trinity Site
- Village of Columbus and Camp Furlong
- Wagon Mound
- Watrous (La Junta)
- White Sands V-2 Launching Site
- Zuni-Cibola Complex

By comparison, there are over 2,500 NHLs in the United States (NPS, 2015g). Figure 10.1.8-1 provides a representative sample of some historic and cultural resources that may be visually sensitive. The scenic and visual resources of these landmarks and surrounding areas are managed for consistency with the historic resource and aesthetics of the landscape (NPS, 2015h).

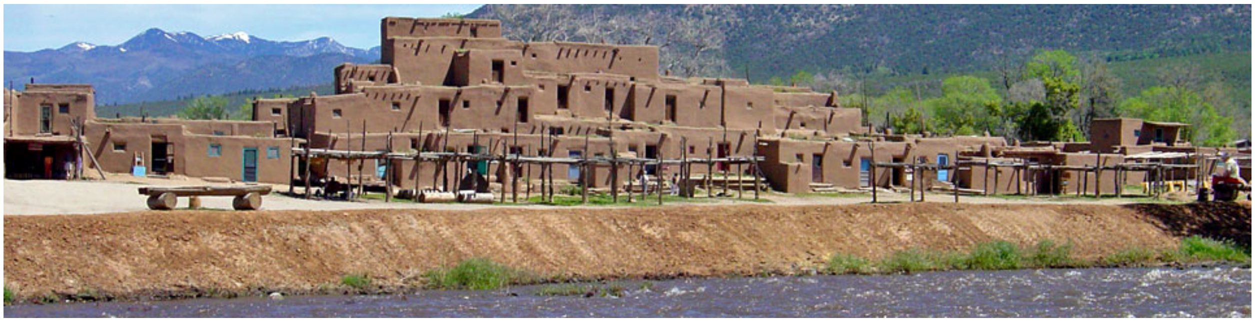

Figure 10.1.8-2: Taos Pueblo National Historic Landmark within the Northern Rio Grande National Heritage Area

Source: (NPS, 2015i)

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 New Mexico may contain scenic or aesthetic areas considered visual resources or visually sensitive. NHAs are not national parks or under NPS ownership, but the NPS does provide funding and support to the NHAs. New Mexico has one National Heritage Area, the Northern Rio Grande (Figure 10.1.8-1 and Figure 10.1.8-4) (NPS, 2012a). The Northern Rio Grande NHA is located along the banks of the Rio Grande River and represents an area inhabited by several American Indian tribes and Spanish colonists (NPS, 2015i).

National Historical Parks

There are three National Historical Parks located in New Mexico (Figure 10.1.8-1). National Historical Parks differ from National Monuments in that "the National Historical Park designation generally applies to historic parks that extend beyond single properties or buildings and requires an act of Congress" (NPS, 2015j).

Chaco Culture National Historical Park is a remote site containing ancient Puebloan structures. The landscape includes rocky buttes and cliffs, high desert, and ancient structures. (NPS, 2015k).

The Manhattan Project National Historical Park was recently established in November 2015 and represents a very different aspect of history, the development of nuclear weapons. This new park is in the city of Los Alamos and includes three sites within the surrounding hills of the town. (NPS, 2015l).

Pecos National Historical Park is a cultural site with remains from the Pecos and other American Indian tribes, as well as Spanish colonists. The site is located high in a pass between the Sangre de Christo Mountains and Glorieta mesa within mountain vistas and steep cliffs. (NPS, 2015j)

National Historic Trails

Designated under Section 5 of the National Trails System Act (16 USC 1241-1251, as amended), National 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" (Figure 10.1.8-3) (NPS, 2012b).

The 404 mile long El Camino Real de Tierra Adentro National Historic Trail preserves the ancient route used by American Indians, Spanish, other Europeans, and later Mexicans and Americans across Texas and New Mexico (NPS, 2015m).

The Old Spanish National Historic Trail connects Los Angeles, California to Santa Fe, New Mexico, crossing 2,700 miles through Arizona, California, Colorado, Nevada, New Mexico, and Utah (Figure 10.1.8-1) (NPS, 2015n).

The Santa Fe National Historic Trail crosses 1,203 miles through five states: Missouri, Kansas, Oklahoma, Colorado, and New Mexico. Historic ruts from wagons and livestock, stopovers, houses, and a range of landscapes are some of the visual resources of this historic trail. (NPS, 2015o)

Figure 10.1.8-3: View of the Rio Chama from the Old Spanish National Historic Trail

Source: (NPS, 2015p)

State Historic Sites

New Mexico features seven state historic sites featuring American Indian, Spanish, Civil War, and other historical structures and locations. The following sites highlight history and culture, as well as a variety of scenic resources including sandstone buttes and cliffs, mountain peaks, high desert, and river views (NMDCA, 2015):

- Coronado Historic Site
- El Camino Real Historic Trail Site
- Fort Selden Historic Site
- Fort Stanton Historic Site
- Fort Sumner Historic Site
- Jemez Historic Site
- Lincoln Historic Site

10.1.8.5. Parks and Recreation Areas

Parks and recreation areas include national parks, national monuments, BLM, USFS, or other public lands; state parks, forests, or trails; and other protected areas used for recreational activities. Public lands under federal ownership are subject to NEPA, and visual and aesthetic resources are considered in their NEPA analysis. Public lands, parks and recreation areas often contain scenic resources and are visited because of their associated visual or aesthetic qualities.

Figure 10.1.8-4 identifies parks and recreational resources that may be visually sensitive in New Mexico. [102]

State Parks

There are 35 state parks in New Mexico – a sampling may be found in Figure 10.1.8-4 (New Mexico State Parks, 2015d). The parks range from a city zoo and botanic gardens to remote rivers, canyons, mountains, creeks, forest, lakes, rocky buttes, and deserts.

- Bluewater Lake
- Bottomless Lakes
- Brantley Lake
- Caballo Lake
- Cerrillos Hills
- Cimarron Canyon
- City of Rocks
- Clayton Lake
- Conchas Lake
- Coyote Creek
- Eagle Nest Lake
- Elephant Butte Lake
- El Vado Lake
- Fenton Lake
- Heron Lake
- Hyde Memorial
- Leasburg Dam
- Living Desert Zoo and Gardens
- Manzano Mountains
- Mesilla Valley Bosque
- Morphy Lake
- Navajo Lake
- Oasis
- Oliver Lee Memorial
- Pancho Villa
- Percha Dam
- Rio Grande Nature Center
- Rockhound
- Santa Rosa Lake
- Storrie Lake
- Sugarite Canyon
- Sumner Lake
- Ute Lake
- Vietnam Veterans Memorial
- Villanueva

National Park Service

National Parks are managed by the 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 New Mexico, there are 15[103] officially designated national parks in addition to NPS affiliated areas, such as National Heritage Areas. There are 10 National Monuments, 1 National Park, 3 National Historical Parks, 3 National Historical Trails, 1 National Heritage Area, 1 National Preserve in New Mexico (Figure 10.1.8-4).

Carlsbad Cavern National Park is widely known for its hundreds of subterranean caves which are responsible for the Park's inclusion as a World Heritage Site. The 46,000 acres of lands above

[102] 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 dataset 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.

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

the caves contain a range of visual resources. There are 33,000 acres of designated wilderness, a protected area of northern Chihuahuan Desert ecosystem, mountain views, and rocky outcrops. (NPS, 2015q)

The National Monuments in New Mexico encompass many cultural sites representing the native inhabitants of the lands prior to Spanish and European settlement, as well as historic sites from the later settlers. The Monuments also represent the unique landforms and scenery within New Mexico such as sandstone cliffs, ancient volcanoes, and gypsum sand dunes. The following National Monuments within New Mexico contain a variety of visual resources throughout the state (NPS, 2014f):

- Aztec Ruins
- Bandelier
- Capulin Volcano
- El Malpais
- El Morro
- Fort Union
- Gila Cliff Dwellings
- Petroglyph
- Salinas Pueblo Missions
- White Sands

Figure 10.1.8-4: White Sands National Monument

Source: (NPS, 2015r)

Bureau of Land Management

The BLM manages 13.5 million acres throughout New Mexico (Figure 10.1.8-4) (BLM, 2015b). These lands are managed under a multiple use mandate (FLPMA) meaning that BLM must allow many uses of the lands, from recreation, to livestock grazing, forestry, wildlife habitat, and energy development (BLM, 2015c). The BLM uses their visual resources management system to “identify and evaluate scenic values to determine the appropriate levels of management.” Lands classified with high scenic values are assigned management that prevents or reduces impacts to the visual resources, protecting the scenic landscape (BLM, 2012). BLM lands with high scenic values are less likely to be developed or have the visual resources disturbed. Management varies among uses and resources, some areas, like lands adjacent to wild and scenic rivers, will be managed for high quality visual resources. Other areas, such as where energy development is occurring, may be managed for lower quality visual resources.

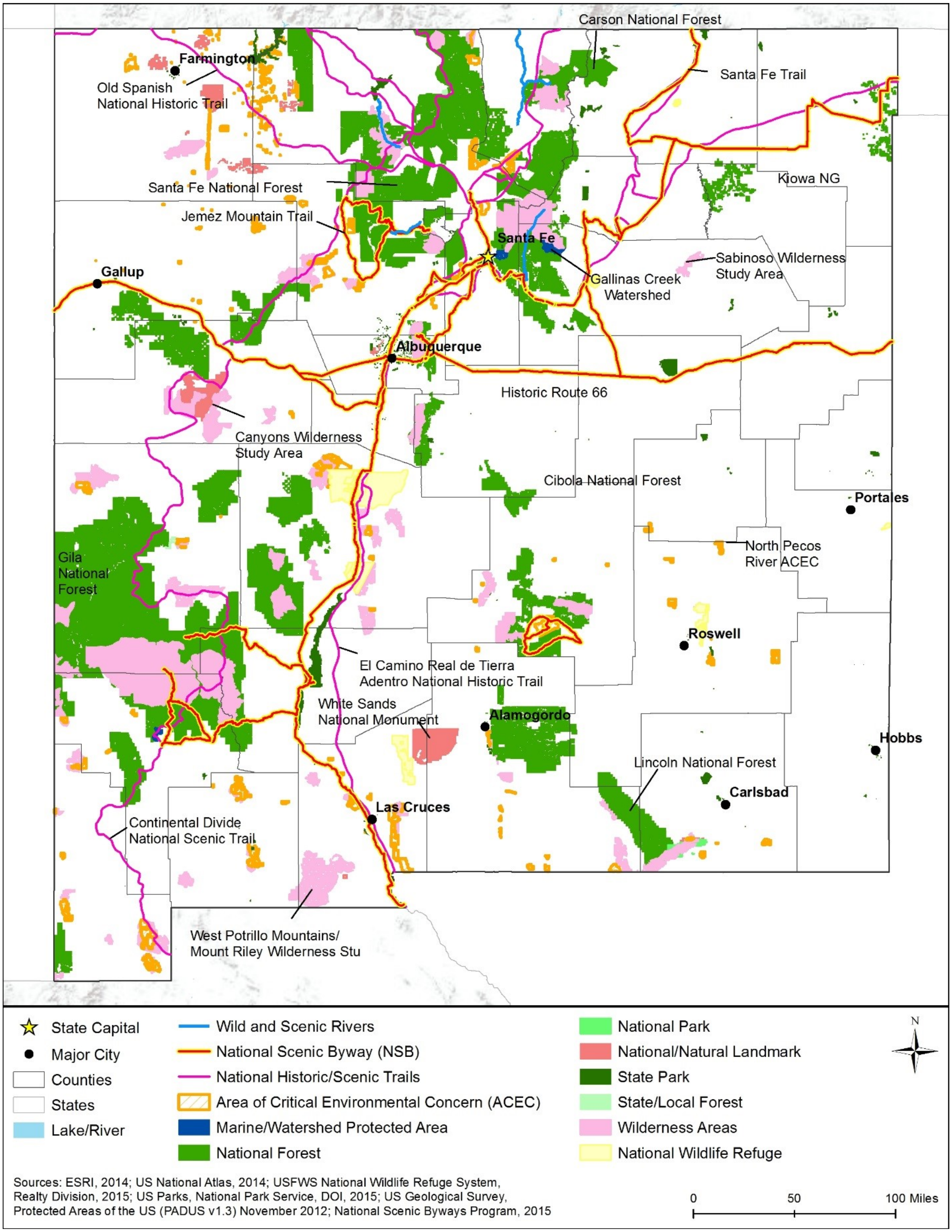

Figure 10.1.8-5: Natural Areas that May be Visually Significant

U.S. Forest Service

There are five National Forests in New Mexico (Table 10.1.8-2) covering over 9.1 million acres (USFS, 2013). The USFS conducts inventories of the forest lands and assigns scenic resource categories from which they manage for scenic and visual resources (USFS, 1995). The scenic inventories are conducted during their land and resource management planning process about every 10-15 years and used to manage the forest landscape and to protect areas of high scenic integrity (USFS, 1995).

Table 10.1.8-2: National Forests in New Mexico

Forest Name	Acres (million)	Scenic Resources
Carson	1.5	High mountain peaks, rocky buttes, forest, meadows, alpine landscape, valleys, streams, lakes
Cibola	1.6	Mountains, canyons, river, streams, steep cliffs, forests
Gila	3.3	Mountain peaks, desert lowlands, steep canyons, cliffs, rocky outcrops
Lincoln	1.1	High mountain peaks, forest, desert, steep cliffs, canyons, waterfalls,
Santa Fe	1.6	High mountain peaks, forest, lakes, rock outcrops
Total	**9.1**	

Source: (USFS, 2013; USFS, 2015f; USFS, 2015g; USFS, 1986; USFS, 2015h; USFS, 2015i)

Army Corps of Engineers Recreation Areas

There are seven USACE recreation areas within the state, Abiquiu Lake, Cochiti Lake, Conchas Lake, Galisteo Dam, Jemez Canyon Dam, Santa Rosa Lake, and Two Rivers Dam. (USACE, 2015). These reservoirs are specifically managed by the USACE for scenic and aesthetic qualities in their planning guidance in addition to managing risks for floods (USACE, 1997).

Bureau of Reclamation

The Bureau of Reclamation manages 10 reservoirs and recreation areas in New Mexico, most often in partnership with state and federal agencies (Figure 10.1.8-4). 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. (Bureau of Reclamation, 2015)

Federal and State Trails

There are 30 National Recreation Trails in New Mexico (Figure 10.1.8-4) (National Recreation Trails, 2015). "National Recreation Trails may be designated by the Secretary of Interior or the Secretary of Agriculture to recognize exemplary trails of local and regional significance in response to an application from the trail's managing agency or organization" (American Trails, 2015). In New Mexico, the 285.90 miles of trails are managed by several federal agencies or local governments. Table 10.1.8-3 identifies the trails and managing agency with trail length in miles.

Table 10.1.8-3: National Recreation Trails

Name and Managing Agency	Miles
Bandelier Backcountry (NPS)	30.00
Berg/Animas (City of Farmington)	4.00
Canones Creek (USFS)	12.50
Canyon Trail (USFWS)	2.20
Carlsbad Canyon (NPS)	3.00
Carolino Canyon Nature (City of Albuquerque)	0.25
Catwalk Trail (USFS)	1.35
Chupadera Wilderness Trail (USFWS)	9.50
Cienga Nature (USFS)	0.20
Columbine-Twining (USFS)	14.00
Dog Canyon (USFS)	4.20
Dripping Springs (BLM)	4.50
El Morro (NPS)	2.00
Fort Bayard Wood Haul (USFS)	11.50
Frijoles Canyon (NPS)	9.00
High Desert Trail System (McKinley County)	17.20
Jicarita Peak Trail (USFS)	23.00
Mount Taylor (USFS)	4.00
Organ Mountain (BLM)	10.00
Paseo del Bosque Bicycle (City of Albuquerque)	5.00
Paseo del Nordeste Bike (City of Albuquerque)	6.20
Rim Trail (USFS)	13.00
Rio Bonito Petroglyph (BLM)	1.40
Rio Grande (BLM)	12.00
Santa Cruz Lake (BLM)	6.40
Sawmill Brook (USFS)	8.50
Sierra Vista Trail (BLM)	29.00
South Boundary Trail #164 (USFS)	22.00
Tent Rocks Trail (BLM)	2.00
Winsor (USFS)	18.00
Total	**285.90**

Source: (National Recreation Trails, 2015)

10.1.8.6. 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 10.1.8-4 identifies natural areas that may have sensitive visual resources.

National Wilderness Areas

In 1964, Congress enacted the Wilderness Act of 1964 as "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. A designation as a National Wilderness Area is the highest level of conservation protection given by Congress to federal lands. This Act defined wilderness as land untouched by man and primarily affected only by the "forces of nature" and as that which "may also contain ecological, geological, or other features of scientific, education, scenic, or historical value" (NPS, 2015s). Over 106 million acres of federal public lands have been designated as wilderness areas in the United States. Of these federal lands, 25 percent are located in 47 national parks (44 million acres) and are part of National Park System. These designated wilderness areas are managed by the USFS, BLM, and USFWS (NPS, 2015s). In New Mexico, there are 26 designated wilderness areas covering over 1,600,000 acres (Figure 10.1.8-4) (Wilderness.net, 2015a). The following is a list of the designated wilderness in the state (Wilderness.net, 2015b):

- Aldo Leopold Wilderness
- Apache Kid Wilderness
- Bandelier Wilderness
- Bisti/De-Na-Zin Wilderness
- Blue Range Wilderness
- Bosque del Apache Wilderness
- Capitan Mountains Wilderness
- Carlsbad Caverns Wilderness
- Cebolla Wilderness
- Chama River Canyon Wilderness
- Columbine-Hondo Wilderness
- Cruces Basin Wilderness
- Dome Wilderness
- Gila Wilderness
- Latir Peak Wilderness
- Manzano Mountain Wilderness
- Ojito Wilderness
- Pecos Wilderness
- Sabinoso Wilderness
- Salt Creek Wilderness
- San Pedro Parks Wilderness
- Sandia Mountain Wilderness
- West Malpais Wilderness
- Wheeler Peak Wilderness
- White Mountain Wilderness
- Withington Wilderness

Rivers Designated as National or State Wild, Scenic or Recreational

New Mexico has 124.3 miles of rivers federally designated as wild, scenic, and recreational on the Jemez (East Fork), Pecos, Rio Chama, and Rio Grande Rivers (Figure 10.1.8-4) (National Wild and Scenic Rivers System, 2015a). National wild, scenic, or recreational rivers are those rivers designated by Congress or the Secretary of the Interior in accordance with the Wild and Scenic Rivers Act of 1968 (16 USC 1271-1287). The scenic resources of these rivers are protected by the federal designations.

- The east fork of the Jemez River has a total of 11.0 designated miles: 4.0 Wild, 5.0 Scenic, and 2.0 Recreational (National Wild and Scenic Rivers System, 2015b);
- The Pecos River has a total of 20.5 designated miles: 13.5 Wild and 7.0 Recreational (National Wild and Scenic Rivers System, 2015c);
- The Rio Chama has a total of 24.6 designated miles: 21.6 Wild and 3.0 Scenic (National Wild and Scenic Rivers System, 2015d);
- The Rio Grande has a total of 68.2 designated miles: 54.9 Wild, 12.5 Scenic, and 0.8 Recreational (National Wild and Scenic Rivers System, 2015e); and

The New Mexico legislature has also designated 30 miles of the Rio Chama as a state "Scenic and Pastoral River" (BLM, New Mexico State Office, 1986).

National Wildlife Refuges and State Wildlife Management Areas

There are eight National Wildlife Refuges in New Mexico (Figure 10.1.8-4). Many of these refuges are rivers, lakes, or wetlands and surrounding habitat; however, other refuges in this arid state are within native prairie and Chihuahuan desert, such as the Sevilleta National Wildlife Refuge. These refuges protect over 300,000 acres of habitat and the visual resources within and surrounding the refuges. (USFWS, 2013l)

Table 10.1.8-4: National Wildlife Refuges in New Mexico

National Wildlife Refuge	Acres
Bitter Lake	24,536[a]
Bosque del Apache	53,331[b]
Las Vegas	8,672[c]
Maxwell	3,700[d]
Rio Mora National Wildlife Refuge and Conservation Area (closed to the public)	4,600[e]
San Andres (closed to the public)	57,215[f]
Sevilleta	230,000[g]
Valle De Oro	570[h]
Total	**382,624**

[a] Source: (USFWS, 2012f)
[b] Source: (USFWS, 2014h)
[c] Source: (USFWS, 2013m)
[d] Source: (USFWS, 2012g)
[e] Source: (USFWS, 2013n)
[f] Source: (USFWS, 2013o)
[g] Source: (USFWS, 2012h)
[h] Source: (USFWS, 2013p)

Figure 10.1.8-6: Bitter Lake National Wildlife Refuge

Source: (USFWS, 2013q)

There are over 57 Wildlife Management Areas, Waterfowl Management Areas, and Fisheries Management Areas managed by the New Mexico Department of Game and Fish and the New Mexico State Game Commission to protect and conserve wildlife habitat. These areas contain protected habitat for plants and animals without disturbance from development and habitat loss. (NMDGF, 2015a)

National Natural Landmarks

There are 12 National Natural Landmarks (NNL) in New Mexico (NPS, 2015e). 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. The 12 NNLs in New Mexico cover over 260,000 acres owned by USFS, BLM, and USFWS, along with tribes and private landowners (Figure 10.1.8-4). Table 10.1.8-5 displays a list of NNLs, their size, and some of the scenic resources protected within these areas. (NPS, 2012c)

Table 10.1.8-5: National Natural Landmarks with Scenic Resources

National Natural Landmarks	Acres	Visual Resources
Bitter Lake Group	10,804	Sinkholes, lakes, grassland, wide-open vistas
Border Hills Structural Zone	1,858	Geologic features, hills, prairie, wide-open vistas
Bueyeros Shortgrass Plains	345	Native prairie, wide-open vistas
Fort Stanton Cave	983	Subterranean caves
Ghost Ranch	54	Paleontological features, rock outcrops
Grants Lava Flow	117,677	Volcanic features, forest
Kilbourne Hole	5,473	Volcanic features, buttes, grassland
Mathers Natural Area	377	Native prairie, wide-open vistas
Mescaleros Sands South Dune	3,208	Sand dunes
Ship Rock	20,683	Geologic feature, high desert, wide-open vistas
Torgac Cave	1	Subterranean cave
Valles Caldera	99,218	Volcanic caldera, streams, valleys, meadows, buttes
Total	**260,681**	

Source: (NPS, 2012c)

National Preserve

Valles Caldera is a unique location comprised of U.S. National Forest System land managed by the National Park Service (Figure 10.1.8-4). The 88,900 acre preserve is a dormant volcanic caldera filled with scenic resources such as lush valleys, streams, rock outcrops, forested domes, and grassy meadows (Figure 10.1.8-7). (Valles Caldera Trust, 2013)

Figure 10.1.8-7: Valles Caldera National Preserve and National Natural Landmark

Source: (NPS, 2012d)

10.1.8.7. Additional Areas

National and State Scenic Byways

There are 8 National Scenic Byways in New Mexico (USDOT, 2015c). National Scenic Byways are resources designated specifically for scenic or aesthetic areas or qualities which would be considered visual resources or visually sensitive. The National Scenic Byways Program is managed by the U.S. Department of Transportation, FHWA (USDOT, 2015d). The following National Scenic Byways all contain scenic vistas and resources.

- The Billy the Kid Trail spans 84.0 miles through New Mexico with mountain, forest, plain, and mountaintop vistas, along with cultural and historic sites (USDOT, 2015e).
- The El Camino Real travels 299.0 miles through New Mexico along the Rio Grande with mountain, river, lake, wetland, and forest views, along with cultural and historic sites (Figure 10.1.8-4) (USDOT, 2015f).
- The Geronimo Trail Scenic Byway travels 154.0 miles through New Mexico with mountain, forest, river, lake, butte, and mountaintop vistas, along with cultural and historic sites (USDOT, 2015g).
- Historic Route 66 travels 1,408.6 miles through Arizona, Illinois, New Mexico, and Oklahoma encompassing a variety of scenery including mountains, forests, plains, rivers, historic and cultural sites, and mountaintop vistas (USDOT, 2015h).
- Jemez Mountain Trail spans 163.0 miles through New Mexico highlighting geologic formations, mountains, forests, rivers, cultural and historic sites, and mountaintop vistas (USDOT, 2015i).
- The Santa Fe Trail crosses 565.0 miles through New Mexico and Colorado with mountain, forest, plains, river, and mountaintop vistas, along with cultural and historic sites (USDOT, 2015j).

- The Trail of the Mountain Spirits Scenic Byway travels 95.0 miles in southwestern New Mexico through mountains and forests; along rivers, valleys, canyons, and cliffs; with mountaintop vistas, and cultural and historic sites (USDOT, 2015k).
- The Turquoise Trail spans 62.0 miles between Santa Fe and Albuquerque through mountains, forests, canyons, high desert, and rock outcrops, along with cultural and historic sites (USDOT, 2015l).

Figure 10.1.8-8: Bosque del Apache National Wildlife Refuge seen from the El Camino Real National Scenic Byway

Source: (USDOT, 2015m)

The state of New Mexico manages 25 scenic byways, several are included in the National Scenic Byway program, while others are specific to the state of New Mexico. The scenic resources of the state byways are rich and varied, from deep, carved canyons and high mountain peaks, to desert, forest, rivers, sandstone pinnacles, colorful hills, cultural areas, and historic sites. The following is a list of state scenic byways in New Mexico (NMDOT, 2015b):

- Abo Pass Trail
- Billy the Kid National Scenic Byway
- Corrales Road Scenic Byway
- El Camino Real National Scenic Byway
- Enchanted Circle Scenic Byway
- Geronimo Trail National Scenic Byway
- Guadalupe Back Country Byway
- Jemez Mountain Trail National Scenic Byway
- La Frontera Del Llano
- Lake Valley Back Country Byway
- Quebradas Back Country Byway
- Route 66 National Scenic Byway
- Salt Missions Trail Byway
- Santa Fe National Forest Scenic Byway
- Santa Fe Trail National Scenic Byway
- Socorro Historical District Scenic Byway
- Sunspot Scenic Byway
- The High Road to Taos Byway
- Trail of the Ancients
- Trail of the Mountain Spirits National Scenic Byway

- Mesalands Scenic Byway
- Narrow Gauge Scenic Byway
- Puye Cliffs Scenic Byway
- Turquoise Trail National Scenic Byway
- Wild Rivers Back Country Byway.

10.1.9. Socioeconomics

10.1.9.1. 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)).[104] 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. 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.[105] This PEIS addresses environmental justice in a separate section (Section 10.1.10). This PEIS also addresses the following topics, sometimes included within socioeconomics, in separate sections: land use, recreation, and airspace (Section 10.1.7), infrastructure (10.1.1), and visual resources (Section 10.1.8).

Wherever possible, this section draws on nationwide datasets from federal sources such as the U.S. Census Bureau (Census Bureau) and U.S. Bureau of Labor Statistics (BLS). This ensures consistency of data and analyses across the states examined in this PEIS. In all cases, this section uses the most recent data available for each geography at the time of writing. At the county, state, region, and United States levels, the data are typically for 2013 or 2014. For smaller geographic areas, this section uses data from the Census Bureau's American Community Survey (ACS). The ACS is the Census Bureau's flagship demographic estimates program for

[104] See https://ceq.doe.gov/laws_and_executive_orders/the_nepa_statute.html.
[105] See https://www.gpo.gov/fdsys/pkg/FR-1994-02-16/html/94-3685.htm.

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)[106].

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.

10.1.9.2. 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.

10.1.9.3. Communities and Populations

This section discusses the population and major communities of New Mexico (NM) and it includes the following topics:

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

[106] 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. Additionally, the data contained in the FirstNet tables may incorporate data from multiple sources and may not be readily available in one table on the Census site.

Statewide Population and Population Growth

Table 10.1.9-1 presents the 2014 population and population density of New Mexico in comparison to the South region[107] and the nation. The estimated population of New Mexico in 2014 was 2,085,572. The population density was 17 persons per square mile (sq. mi.), which is substantially lower than the population density of both the region (114 persons/sq. mi.) and the nation (90 persons/sq. mi.). In 2014, New Mexico was the 36th largest state by population among the 50 states and the District of Columbia, fifth largest by land area, and had the 46th greatest population density (U.S. Census Bureau, 2015d; U.S. Census Bureau, 2015e).

Table 10.1.9-1: Land Area, Population, and Population Density of New Mexico

Geography	Land Area (sq. mi.)	Estimated Population 2014	Population Density 2014 (persons/sq. mi.)
New Mexico	121,298	2,085,572	17
South Region	914,471	104,109,977	114
United States	3,531,905	318,857,056	90

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

Population growth is an important subject for this PEIS given FirstNet's mission. Table 10.1.9-2 presents the population growth trends of New Mexico from 2000 to 2014 in comparison to the South region and the nation. The state's annual growth rate decreased substantially in the 2010 to 2014 period compared to 2000 to 2010, from 1.25 percent to 0.32 percent. The growth rate of New Mexico in the latter period was considerably lower than the growth rates of the region, at 1.14 percent, and the nation, at 0.81 percent.

Table 10.1.9-2: Recent Population Growth of New Mexico

Geography	Population			Numerical Population Change		Rate of Population Change (AARC)[a]	
	2000	2010	2014 (estimated)	2000 to 2010	2010 to 2014	2000 to 2010	2010 to 2014
New Mexico	1,819,046	2,059,179	2,085,572	240,133	26,393	1.25%	0.32%
South Region	86,516,862	99,487,696	104,109,977	12,970,834	4,622,281	1.41%	1.14%
United States	281,421,906	308,745,538	318,857,056	27,323,632	10,111,518	0.93%	0.81%

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

Demographers prepare future population projections using various population growth modeling methodologies. For this nationwide PEIS, it is important to use population projections that apply the same methodology across the nation. It is also useful to consider projections that use different methodologies, since no methodology is a perfect predictor of the future. The Census Bureau does not prepare population projections for the states. Therefore, Table 10.1.9-3 presents

[107] The South region is comprised of the states of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, New Mexico, Oklahoma, South Carolina, Tennessee, and Texas. Throughout the socioeconomics section, figures for the South 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 South region is the sum of the populations of all its states, divided by the sum of the land areas of all its states.

projections of the 2030 population from two sources that are national in scope and use different methodologies: the University of Virginia's Weldon Cooper Center for Public Service and ProximityOne, a private sector demographic and economic data, and analysis service. The table provides figures for numerical change, percentage change, and annual growth rate based on averaging the projections from the two sources. The average projection indicates New Mexico's population will increase by approximately 406,000 people, or 19.5 percent, from 2014 to 2030. This reflects an average annual projected growth rate of 1.12 percent, which is considerably higher than the growth rate from 2010 to 2014 (0.32 percent), but is slightly lower than the historical growth rate from 2000 to 2010 (1.25 percent). The projected growth rate of the state is higher than that of the region (0.97 percent) and the nation (0.80 percent). (U.S. Census Bureau, 2015d; ProximityOne, 2015; UVA Weldon Cooper Center, 2015)

Table 10.1.9-3: Projected Population Growth of New Mexico

Geography	Population 2014 (estimated)	Projected 2030 Population			Change Based on Average Projection		
		UVA Weldon Cooper Center Projection	Proximity One Projection	Average Projection	Numerical Change 2014 to 2030	Percent Change 2014 to 2030	Rate of Change (AARC)[a] 2014 to 2030
New Mexico	2,085,572	2,545,270	2,438,390	2,491,830	406,258	19.5%	1.12%
South Region	104,109,977	122,323,551	120,794,020	121,558,786	17,448,809	16.8%	0.97%
United States	318,857,056	360,978,449	363,686,916	362,332,683	43,475,627	13.6%	0.80%

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

Population Distribution and Communities

Figure 10.1.9-1 presents the distribution and relative density of the population of New Mexico. Each brown dot represents 500 people, and massing of dots indicates areas of higher population density – therefore, areas that are solid in color are particularly high in population density. The map uses ACS estimates based on samples taken from 2009 to 2013 (U.S. Census Bureau, 2015g).

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

Other groupings of brown dots on the map represent additional, but smaller, population concentrations. Dispersed dots indicate dispersed population across the less densely settled areas of the state. Outside of the population concentrations, much of the state is sparsely populated, with scattered smaller communities.

Table 10.1.9-4 provides the populations of the 10 largest population concentrations in New Mexico, based on the 2010 census. It also shows the changes in population for these areas between the 2000 and 2010 censuses.[108] In 2010, the largest population concentration by far was the Albuquerque area, which had 741,318 people. The state had no other population concentrations over 200,000. It had one area, the Las Cruces area, with a population between 100,000 and 200,000. The other eight areas had populations less than 100,000. The smallest of these 10 population concentrations was the New Mexico portion of the El Paso area, with a 2010 population of 30,712. The fastest growing area, by average annual rate of change from 2000 to 2010, was the Los Lunas area, with an annual growth rate of 5.85 percent. This area had a large increase in its Census Bureau area definition. The area expansion may have taken in some existing populations; thus, the growth rate may reflect this factor as well as organic growth (net in-migration and/or births exceeding deaths). Five other areas had growth rates over 1.00 percent, including the Albuquerque, El Paso (New Mexico portion), Hobbs, Las Cruces, and Santa Fe areas. The Alamogordo and Farmington areas experienced population declines during this period.

Table 10.1.9-4 also shows that the top 10 population concentrations in New Mexico accounted for 61.5 percent of the state's population in 2010. Further, population growth in the 10 areas from 2000 to 2010 amounted to 89.1 percent of the entire state's growth. These figures indicate that the populations within these 10 areas are growing at a faster rate than the population in the remainder of the state.

[108] 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.

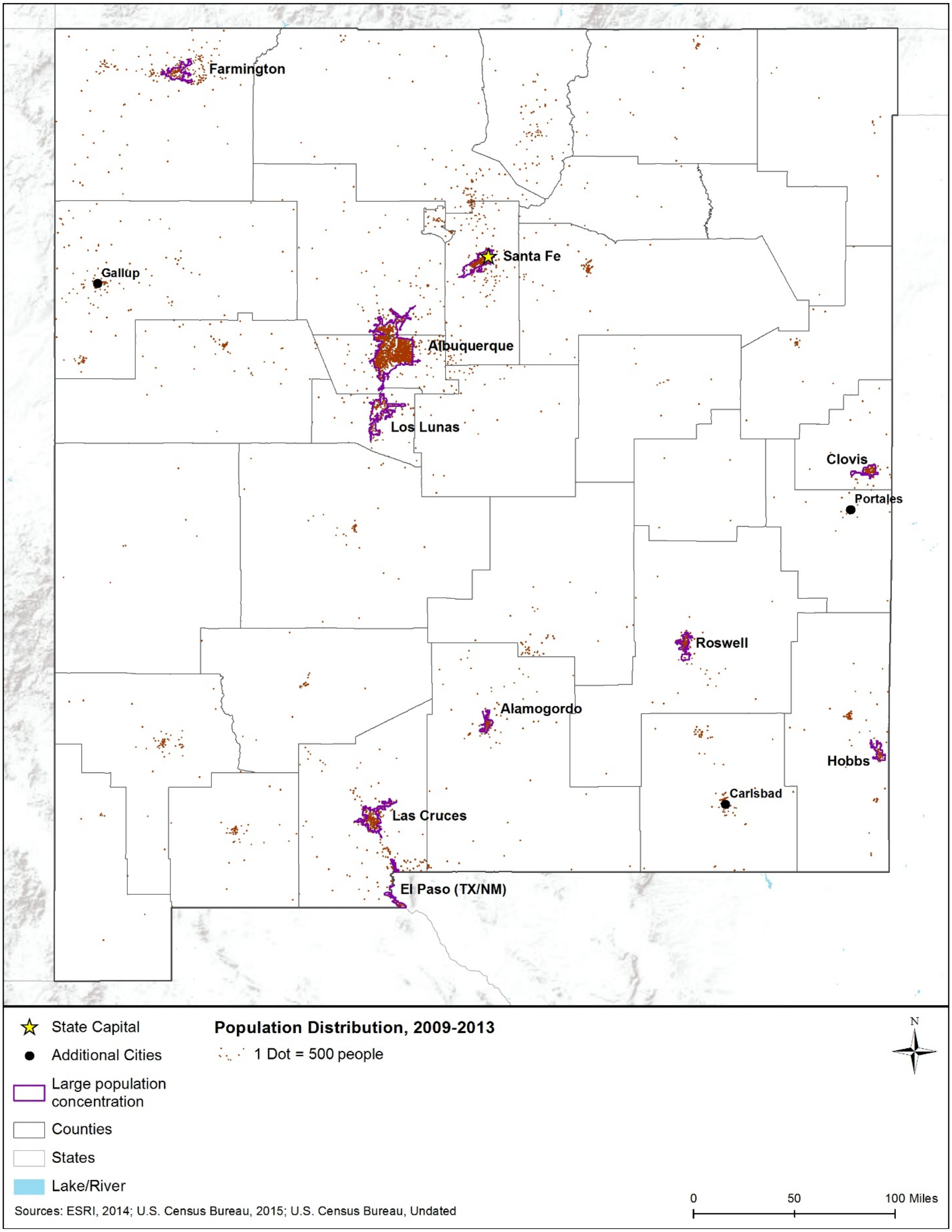

Figure 10.1.9-1: Population Distribution in New Mexico, 2009–2013

Table 10.1.9-4: Population of the 10 Largest Population Concentrations in New Mexico

Area	Population				Population Change 2000 to 2010	
	2000	**2010**	**2009–2013**	**Rank in 2010**	**Numerical Change**	**Rate (AARC)[a]**
Alamogordo	37,817	31,862	31,798	9	(5,955)	-1.70%
Albuquerque	598,191	741,318	748,886	1	143,127	2.17%
Clovis	38,388	41,570	42,076	7	3,182	0.80%
El Paso (TX/NM) (NM Portion)	26,336	30,712	31,032	10	4,376	1.55%
Farmington	53,294	53,049	52,473	5	(245)	-0.05%
Hobbs	30,783	36,696	37,249	8	5,913	1.77%
Las Cruces	104,186	128,600	132,305	2	24,414	2.13%
Los Lunas[b]	36,101	63,758	64,121	4	27,657	5.85%
Roswell	47,176	49,727	49,960	6	2,551	0.53%
Santa Fe	80,337	89,284	89,608	3	8,947	1.06%
Total for Top 10 Population Concentrations	**1,052,609**	**1,266,576**	**1,279,508**	**NA**	**213,967**	**1.87%**
New Mexico (statewide)	**1,819,046**	**2,059,179**	**2,069,706**	**NA**	**240,133**	**1.25%**
Top 10 Total as Percentage of State	**57.9%**	**61.5%**	**61.8%**	**NA**	**89.1%**	**NA**

[a] AARC = Average Annual Rate of Change (compound growth rate)
[b] The large population increase from 2000 to 2010 reflects a large change in the area definition for the Los Lunas urbanized area, from 36 sq. mi. in 2000 to 69 sq. mi. in 2010.
Sources: (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015i; U.S. Census Bureau, 2015j)

10.1.9.4. 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 10.1.1, Infrastructure. Project-level NEPA analyses may need to examine other institutions, depending on specific locations and specific types of actions.

Economic Activity

Table 10.1.9-5 compares several economic indicators for New Mexico to the South region and the nation. The table presents two indicators of income[109] – 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 10.1.9-5, the per capita income in New Mexico in 2013 ($23,334) was $1,677 lower than that of the region ($25,011), and $4,850 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 10.1.9-5 shows that in 2013, the MHI in New Mexico ($44,026) was $2,536 lower than that of the region ($46,562), and $8,224 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 10.1.9-5 compares the unemployment rate in New Mexico to the South region and the nation. In 2014, New Mexico's statewide unemployment rate of 6.5 percent was higher than the rates for the region (6.1 percent) and the nation (6.2 percent)[110].

Table 10.1.9-5: Selected Economic Indicators for New Mexico

Geography	Per Capita Income 2013	Median Household Income 2013	Average Annual Unemployment Rate 2014
New Mexico	$23,334	$44,026	6.5%
South Region	$25,011	$46,562	6.1%
United States	$28,184	$52,250	6.2%

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

Figure 10.1.9-2 and Figure 10.1.9-3 show how MHI in 2013 (U.S. Census Bureau, 2015k) and unemployment in 2014 (BLS, 2015b) varied by county across the state. These maps also incorporate the same population concentration data as Figure 10.1.9-1 (U.S. Census Bureau,

[109] 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, 2015n)

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

2012; U.S. Census Bureau, 2015h). Following these two maps, Table 10.1.9-6 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 New Mexico.

Figure 10.1.9-2 shows that only three counties in New Mexico had a MHI above the national median. Two of these counties were located north of Albuquerque and west of Santa Fe, and one was in the southeast corner of the state, where Hobbs is located. The remainder of the state had MHI levels below the national average, and approximately half the counties had very low MHI levels (below $37,092). Table 10.1.9-6 is consistent with those observations. It shows that MHI in the Albuquerque, Hobbs, and Santa Fe areas, and the Farmington area as well, was above the state average. MHI in all other population concentrations was below the state average. MHI was lowest (substantially lower than the state average) in the New Mexico portion of the El Paso area, which is also the smallest of the areas shown in the table.

Figure 10.1.9-3 presents variations in the 2014 unemployment rate across the state, by county. It shows that, in general, counties with unemployment rates below the national average (that is, better employment performance) were located in the eastern half of the state. Three counties in the Albuquerque and Santa Fe areas, in the north-central part of the state, also had relatively low unemployment rates. Counties with high unemployment rates were located in the western half of the state, and in areas east of Los Lunas, Albuquerque, and Santa Fe. When comparing unemployment in the population concentrations to the state average (Table 10.1.9-6), five areas had 2009–2013 unemployment rates that were higher than the state average. These areas were the Alamogordo, El Paso (New Mexico portion), Las Cruces, Los Lunas, and Santa Fe areas. The unemployment rate in the El Paso (New Mexico portion) area, at 15.1 percent, was substantially higher than the state average (9.7 percent).

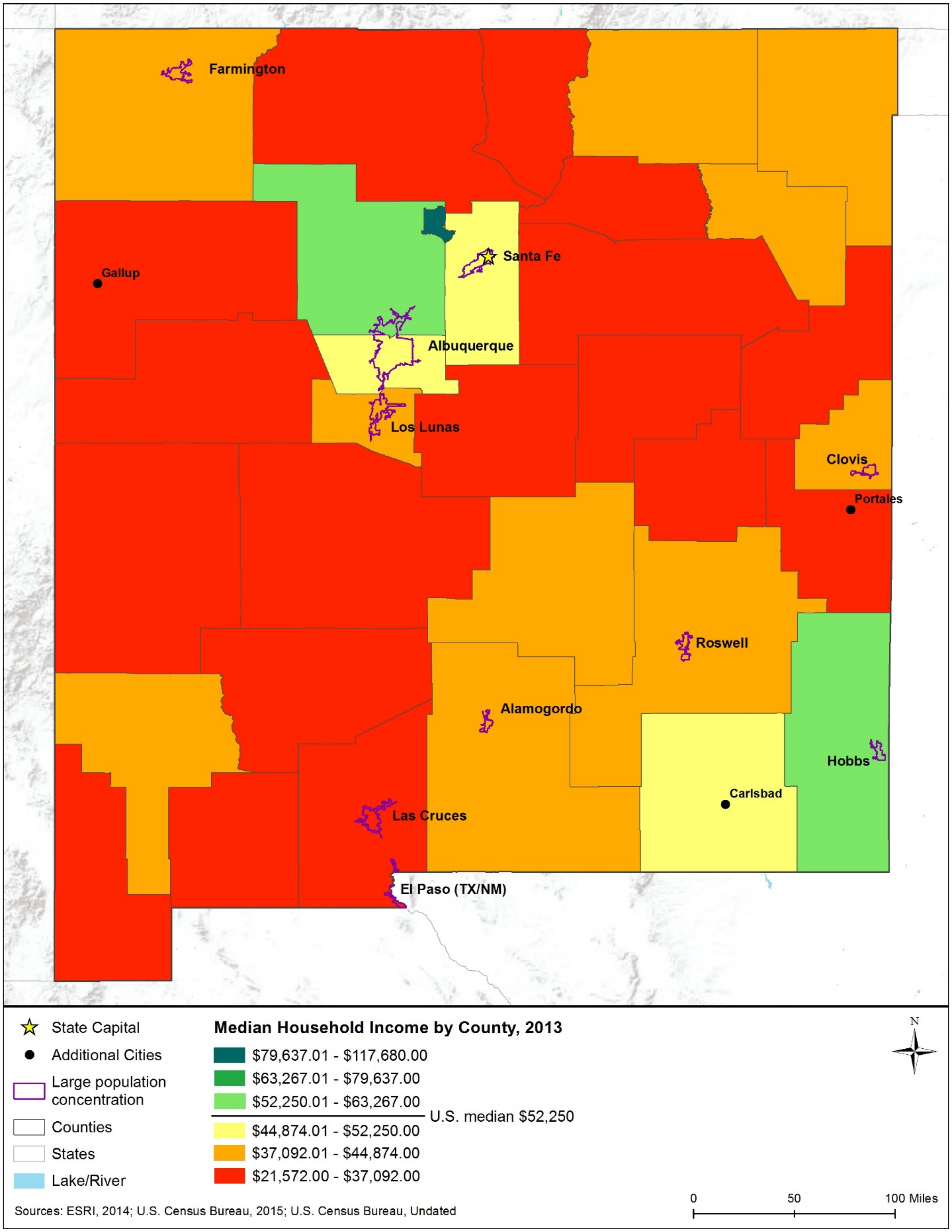

Figure 10.1.9-2: Median Household Income in New Mexico, by County, 2013

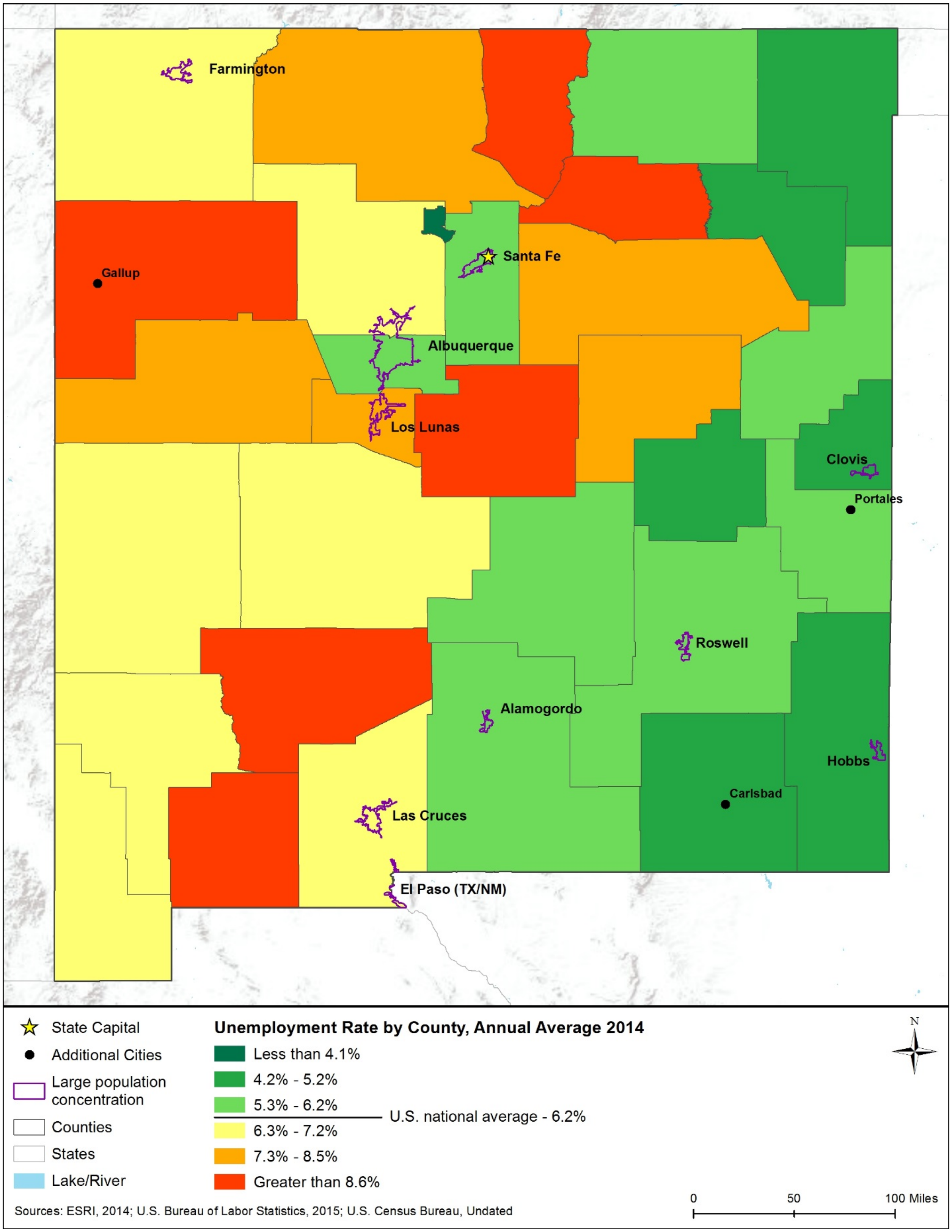

Figure 10.1.9-3: Unemployment Rates in New Mexico, by County, 2014

Table 10.1.9-6: Selected Economic Indicators for the 10 Largest Population Concentrations in New Mexico, 2009–2013

Area	Median Household Income	Average Annual Unemployment Rate
Alamogordo	$43,571	11.6%
Albuquerque	$49,524	8.4%
Clovis	$39,071	8.7%
El Paso (TX/NM) (NM Portion)	$27,744	15.1%
Farmington	$52,442	6.6%
Hobbs	$49,907	9.0%
Las Cruces	$40,424	12.2%
Los Lunas	$42,863	12.3%
Roswell	$36,991	7.8%
Santa Fe	$47,955	10.1%
New Mexico (statewide)	$44,927	9.7%

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

Detailed employment data provide useful insights into the nature of a local, state, or national economy. Table 10.1.9-7 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 considerably lower in New Mexico than in the South region and the nation. The percentage of government workers was considerably higher in the state than in the region and nation. Self-employed workers were a slightly higher percentage in the state compared to the region and nation.

By industry, New Mexico has a mixed economic base and some notable figures in the table are as follows. New Mexico in 2013 had a considerably lower percentage (more than two percentage points) of persons working in "manufacturing" than did the region or the nation. It also had a considerably lower percentage of workers in the "finance and insurance, and real estate and rental and leasing" than the nation. In comparison to the region and nation, New Mexico had a considerably higher percentage of workers in the "agriculture, forestry, fishing and hunting, and mining" industry, and the "public administration" industry. It also had a considerably higher percentage of workers in the "educational services, and health care and social assistance" industry than the region.

Table 10.1.9-7: Employment by Class of Worker and by Industry, 2013

Class of Worker and Industry	New Mexico	South Region	United States
Civilian Employed Population 16 Years and Over	872,487	45,145,155	145,128,676
Percentage by Class of Worker			
Private wage and salary workers	70.1%	79.4%	79.7%
Government workers	22.7%	14.5%	14.1%

Class of Worker and Industry	New Mexico	South Region	United States
Self-employed in own not incorporated business workers	6.8%	5.9%	6.0%
Unpaid family workers	0.4%	0.2%	0.2%
Percentage by Industry			
Agriculture, forestry, fishing and hunting, and mining	4.3%	2.4%	2.0%
Construction	6.8%	6.9%	6.2%
Manufacturing	5.2%	9.9%	10.5%
Wholesale trade	2.0%	2.8%	2.7%
Retail trade	10.9%	12.1%	11.6%
Transportation and warehousing, and utilities	4.7%	5.2%	4.9%
Information	1.6%	1.9%	2.1%
Finance and insurance, and real estate and rental and leasing	4.4%	6.3%	6.6%
Professional, scientific, management, administrative, and waste management services	11.0%	10.5%	11.1%
Educational services, and health care and social assistance	24.4%	22.0%	23.0%
Arts, entertainment, and recreation, and accommodation and food services	11.2%	9.9%	9.7%
Other services, except public administration	5.3%	5.2%	5.0%
Public administration	8.3%	4.8%	4.7%

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

Table 10.1.9-8 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 10.1.9-7.

Table 10.1.9-8: Employment by Selected Industries for the 10 Largest Population Concentrations in New Mexico, 2009–2013

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Alamogordo	8.8%	2.3%	0.7%	7.5%
Albuquerque	6.7%	3.7%	2.1%	13.1%
Clovis	9.1%	7.9%	1.6%	6.7%
El Paso (TX/NM) (NM Portion)	8.2%	5.5%	2.8%	6.3%
Farmington	5.6%	6.8%	1.9%	6.6%
Hobbs	9.4%	7.1%	1.6%	6.7%
Las Cruces	6.3%	3.2%	2.0%	8.4%
Los Lunas	9.0%	6.8%	1.3%	8.0%
Roswell	5.7%	4.6%	0.5%	5.6%

Area	Construction	Transportation and Warehousing, and Utilities	Information	Professional, Scientific, Management, Administrative and Waste Management Services
Santa Fe	6.4%	3.0%	1.3%	15.5%
New Mexico (statewide)	7.1%	4.5%	1.7%	10.8%

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

Housing

The housing stock is an important socioeconomic component of communities. The type, availability, and cost of housing in an area reflect economic conditions and affect quality of life. Table 10.1.9-9 compares New Mexico to the South region and nation on several common housing indicators.

As shown in Table 10.1.9-9, in 2013, New Mexico had a lower percentage of housing units that were occupied (83.2 percent) than the region (85.2 percent) or nation (87.6 percent). Of the occupied units, New Mexico had a higher percentage of owner-occupied units (67.9 percent) than the region (64.6 percent) or nation (63.5 percent). The percentage of detached single-unit housing (also known as single-family homes) in New Mexico in 2013 (64.7 percent) was higher than in the region (63.8 percent) and nation (61.5 percent). The homeowner vacancy rate in New Mexico (3.0 percent) was higher than the rates for the region (2.2 percent) and the nation (1.9 percent). This rate reflects "vacant units that are 'for sale only'" (U.S. Census Bureau, 2015n). The vacancy rate among rental units was higher in New Mexico (9.0 percent) than in the region (8.5 percent) or nation (6.5 percent).

Table 10.1.9-9: Selected Housing Indicators for New Mexico, 2013

Geography	Total Housing Units	Housing Occupancy & Tenure				Units in Structure
		Occupied Housing	Owner-Occupied	Homeowner Vacancy Rate	Rental Vacancy Rate	1-Unit, Detached
New Mexico	905,134	83.2%	67.9%	3.0%	9.0%	64.7%
South Region	44,126,724	85.2%	64.6%	2.2%	8.5%	63.8%
United States	132,808,137	87.6%	63.5%	1.9%	6.5%	61.5%

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

Table 10.1.9-10 provides housing indicators for the largest population concentrations in the state by 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 10.1.9-10: Selected Housing Indicators for the 10 Largest Population Concentrations in New Mexico, 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
Alamogordo	14,635	87.2%	61.2%	2.5%	3.1%	69.5%
Albuquerque	316,574	92.6%	64.5%	1.8%	6.8%	66.4%
Clovis	17,217	89.4%	58.4%	4.5%	6.8%	73.9%
El Paso (TX/NM) (NM Portion)	9,423	92.7%	65.5%	0.5%	3.5%	52.8%
Farmington	20,055	87.1%	69.7%	2.3%	12.5%	58.8%
Hobbs	14,411	85.3%	67.5%	2.6%	14.5%	67.2%
Las Cruces	54,131	90.7%	61.2%	2.5%	7.7%	57.7%
Los Lunas	25,126	89.8%	79.1%	2.4%	9.4%	60.3%
Roswell	20,260	90.1%	63.0%	2.3%	6.8%	75.5%
Santa Fe	44,505	86.6%	61.9%	2.5%	6.9%	56.1%
New Mexico (statewide)	902,302	84.4%	68.7%	2.3%	8.2%	64.7%

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

Property Values

Property values have important relationships to both the wealth and affordability of communities. Table 10.1.9-11 provides indicators of residential property values for New Mexico and compares these values to values for the South 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, 2015n).

Table 10.1.9-11: Residential Property Values in New Mexico, 2013

Geography	Median Value of Owner-Occupied Units
New Mexico	$159,200
South Region	$137,752
United States	$173,900

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

Table 10.1.9-12 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 Santa Fe area had a median value that was considerably higher than the state median value ($261,300 compared to $160,000). The Albuquerque ($184,100) and Farmington ($168,800) areas also had median property values higher than the state value. All other population concentrations had property values below the state value. The lowest values were in the same two areas – El Paso (New Mexico portion) and Roswell – that had the lowest median household incomes (Table 10.1.9-6). The median values in these two areas (both approximately $90,000) were substantially lower than the state value.

Table 10.1.9-12: Residential Property Values for the 10 Largest Population Concentrations in New Mexico, 2009–2013

Area	Median Value of Owner-Occupied Units
Alamogordo	$112,400
Albuquerque	$184,100
Clovis	$122,100
El Paso (TX/NM) (NM Portion)	$89,200
Farmington	$168,800
Hobbs	$102,800
Las Cruces	$151,600
Los Lunas	$134,700
Roswell	$93,300
Santa Fe	$261,300
New Mexico (statewide)	$160,000

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

Government Revenues

State and local governments obtain revenues from many sources. Table 10.1.9-13 presents total and selected state and local government revenue sources as reported by the Census Bureau's 2012 Census of Governments. It provides both total dollar figures (in millions of dollars) and figures per capita (in dollars), based on total population for each geography. The per capita figures are particularly useful in comparing the importance of certain revenue sources in the state relative to other states in the region and the nation. State and local governments may obtain some additional revenues related to telecommunications infrastructure.

General and selective sales taxes may change, reflecting expenditures during system development and maintenance. 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).

Table 10.1.9-13 shows that the New Mexico state government received more total revenue in 2012 on a per capita basis than its counterpart governments in the region and nation. Conversely, New Mexico's local governments received less total revenue than did their counterparts in the region and nation. The New Mexico state government had higher levels per capita of intergovernmental revenue[111] from the federal government, while the state's local governments had roughly similar revenue levels from this source compared to their counterparts regionally and nationally. The New Mexico state government obtained higher levels of property taxes per capita than state governments in the region, but lower levels than those governments in the nation. Local governments in New Mexico obtained considerably less revenue from property taxes compared to counterparts in both the region and nation. General sales taxes were higher on a per capita basis for New Mexico state and local governments, compared to their counterparts in the region and nation. Selective sales taxes, and public utility taxes specifically, were lower on a per capita basis for New Mexico state and local governments than for those governments in the region and nation. Per capita individual and corporate income tax revenues for the New Mexico state government were higher than revenues for state governments in the region, and were lower than or similar to revenues for state governments in the nation. Local governments in New Mexico obtained no revenues from individual or corporate income taxes.

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

Table 10.1.9-13: State and Local Government Revenues, Selected Sources, 2012

Type of Revenue	New Mexico		Region		United States	
	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount	State Govt. Amount	Local Govt. Amount
Total Revenue ($M)	$15,196	$8,390	$524,374	$449,683	$1,907,027	$1,615,194
Per capita	$7,286	$4,023	$5,148	$4,414	$6,075	$5,145
Intergovernmental from Federal ($M)	$5,171	$448	$160,706	$18,171	$514,139	$70,360
Per capita	$2,480	$215	$1,578	$178	$1,638	$224
Intergovernmental from State ($M)	$0	$3,669	$0	$115,088	$0	$469,147
Per capita	$0	$1,759	$0	$1,130	$0	$1,495
Intergovernmental from Local ($M)	$182	$0	$2,815	$0	$19,518	$0
Per capita	$87	$0	$28	$0	$62	$0
Property Taxes ($M)	$60	$1,365	$2,073	$109,687	$13,111	$432,989
Per capita	$29	$654	$20	$1,077	$42	$1,379
General Sales Taxes ($M)	$1,991	$938	$82,651	$25,836	$245,446	$69,350
Per capita	$954	$450	$811	$254	$782	$221
Selective Sales Taxes ($M)	$663	$99	$41,447	$9,394	$133,098	$28,553
Per capita	$318	$48	$407	$92	$424	$91
Public Utilities Taxes ($M)	$27	$57	$5,101	$4,745	$14,564	$14,105
Per capita	$13	$27	$50	$47	$46	$45
Individual Income Taxes ($M)	$1,150	$0	$38,637	$1,226	$280,693	$26,642
Per capita	$552	$0	$379	$12	$894	$85
Corporate Income Taxes ($M)	$281	$0	$8,099	$114	$41,821	$7,210
Per capita	$135	$0	$80	$1	$133	$23

Sources: (U.S. Census Bureau, 2015s; U.S. Census Bureau, 2015t)
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. Bureau of the Census 2006).
Note: This table does not include all sources of government revenue. Summation of the specific source rows does not equal total revenue.

10.1.10. Environmental Justice

10.1.10.1. Definition of the Resource

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, issued in 1994, sets out principles of environmental justice and requirements that federal agencies should follow to comply with the EO (see Section 10.8.11).[112] 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" (Executive Office of the President, 1994). Under the EO, each federal agency must "make achieving environmental justice part of its mission by identifying and addressing, as

[112] See https://www.epa.gov/laws-regulations/summary-executive-order-12898-federal-actions-address-environmental-justice.

appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations" (USEPA, 2016b). In response to the EO, the Department of Commerce developed an Environmental Justice Strategy in 1995, and published an updated strategy in 2013 (USDOC, 2013b).

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, 2015i) offers guidance on Environmental Justice issues and provides an "environmental justice screening and mapping tool," EJSCREEN (USEPA, 2015j).

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).

10.1.10.2. Specific Regulatory Considerations

NMED has defined environmental justice as "the fair treatment and meaningful opportunities for involvement of all New Mexicans regarding the development and enforcement of environmental laws and regulations, and Section 1.8, Overview of Relevant Federal Laws and Executive Orders." (NMED, 2015n)

As a result of public input received during a series of outreach sessions held during 2004, Governor Bill Richardson signed the New Mexico Environmental Justice Executive Order (#2205-056) in November 2005. This order created the Environmental Justice Task Force, a multi-agency advisory group that makes recommendations to state agencies regarding environmental justice issues. (NMED, 2015n)

Since 2005, New Mexico has increased its community outreach efforts and public participation in permitting processes. (NMED, 2015n)

10.1.10.3. Environmental Setting: Minority and Low-Income Populations

Table 10.1.10-1 presents 2013 data on the composition of New Mexico's population by race and by Hispanic origin. The state's population has a considerably higher percentage of individuals who identify as American Indian/Alaska Native (9.1 percent) than the populations of the South region (0.9 percent) and the nation (0.8 percent). New Mexico also has a higher percentage of individuals identifying as Some Other Race (8.9 percent) compared to the region (3.3 percent) and the nation (4.7 percent). The state's population of persons identifying as Black/African American (2.0 percent) is considerably smaller than that of the region (18.4 percent) or the nation (12.6 percent), and its population identifying as Asian (1.4 percent) is somewhat smaller than that of the region (2.6 percent) and nation (5.1 percent). The state's population of persons identifying as White (75.3 percent) is somewhat larger than that of the South region (72.3 percent) and the nation (73.7 percent).

The percentage of the population in New Mexico that identifies as Hispanic (47.3 percent) is considerably larger than in the South region (18.8 percent) and the nation (17.1 percent). Hispanic origin is a different category than race; persons of any race may identify as also being of Hispanic origin.

The category All Minorities consists of all persons who consider themselves Hispanic or of any race other than White. New Mexico's All Minorities population percentage (60.7 percent) is considerably higher than that of the South region (42.3 percent) or the nation (37.6 percent).

Table 10.1.10-2 presents the percentage of the population living in poverty in 2013, for the state, region, and nation. The figure for New Mexico (21.9 percent) is considerably higher than that for both the South region (18.2 percent) and the nation (15.8 percent).

Table 10.1.10-1: Population by Race and Hispanic Status, 2013

Geography	Total Population (estimated)	Race							Hispanic	All Minorities
		White	Black/ African Am	Am. Indian/ Alaska Native	Asian	Native Hawaiian /Pacific Islander	Some Other Race	Two or More Races		
New Mexico	2,085,287	75.3%	2.0%	9.1%	1.4%	0.1%	8.9%	3.3%	47.3%	60.7%
South Region	102,853,019	72.3%	18.4%	0.9%	2.6%	0.1%	3.3%	2.4%	18.8%	42.3%
United States	316,128,839	73.7%	12.6%	0.8%	5.1%	0.2%	4.7%	3.0%	17.1%	37.6%

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

"All Minorities" is defined as all persons who consider themselves Hispanic or of any race other than White. Because some Hispanics identify as both Hispanic and of a non-White race, "All Minorities" is less than the sum of Hispanics and non-White races.

Table 10.1.10-2: Percentage of Population (Individuals) in Poverty, 2013

Geography	Percent Below Poverty Level
New Mexico	21.9%
South Region	18.2%
United States	15.8%

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

10.1.10.4. 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 10.1.10-1 visually portrays the results of the environmental justice population screening analysis for New Mexico. The analysis used block group data from the Census Bureau's American Community Survey 2009-2013 5-Year Estimates (U.S. Census Bureau, 2015g; U.S. Census Bureau, 2015w; U.S. Census Bureau, 2015x; U.S. Census Bureau, 2015y) and Census Bureau urban classification data (U.S. Census Bureau, 2012; U.S. Census Bureau, 2015h)

Figure 10.1.10-1 shows that a large proportion of New Mexico has high potential for environmental justice populations. High potential areas are somewhat more prevalent in the northwest and north-central portions of the state, and along its southern border. They occur both within and outside of the 10 largest population concentrations. The distribution of areas with Moderate or low potential for environmental justice populations is also somewhat uneven across the state; these areas are more prevalent in the southern and eastern portions of the state.

It is important to understand how the data behind Figure 10.1.10-1 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 10.1.10-1 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, Environmental Justice Methodology, 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 or significant according to the significance criteria, and "appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group" (CEQ, 1997). The Environmental Consequences section (Section 10.2) addresses the potential for disproportionately high and adverse environmental or human health impacts on environmental justice populations.

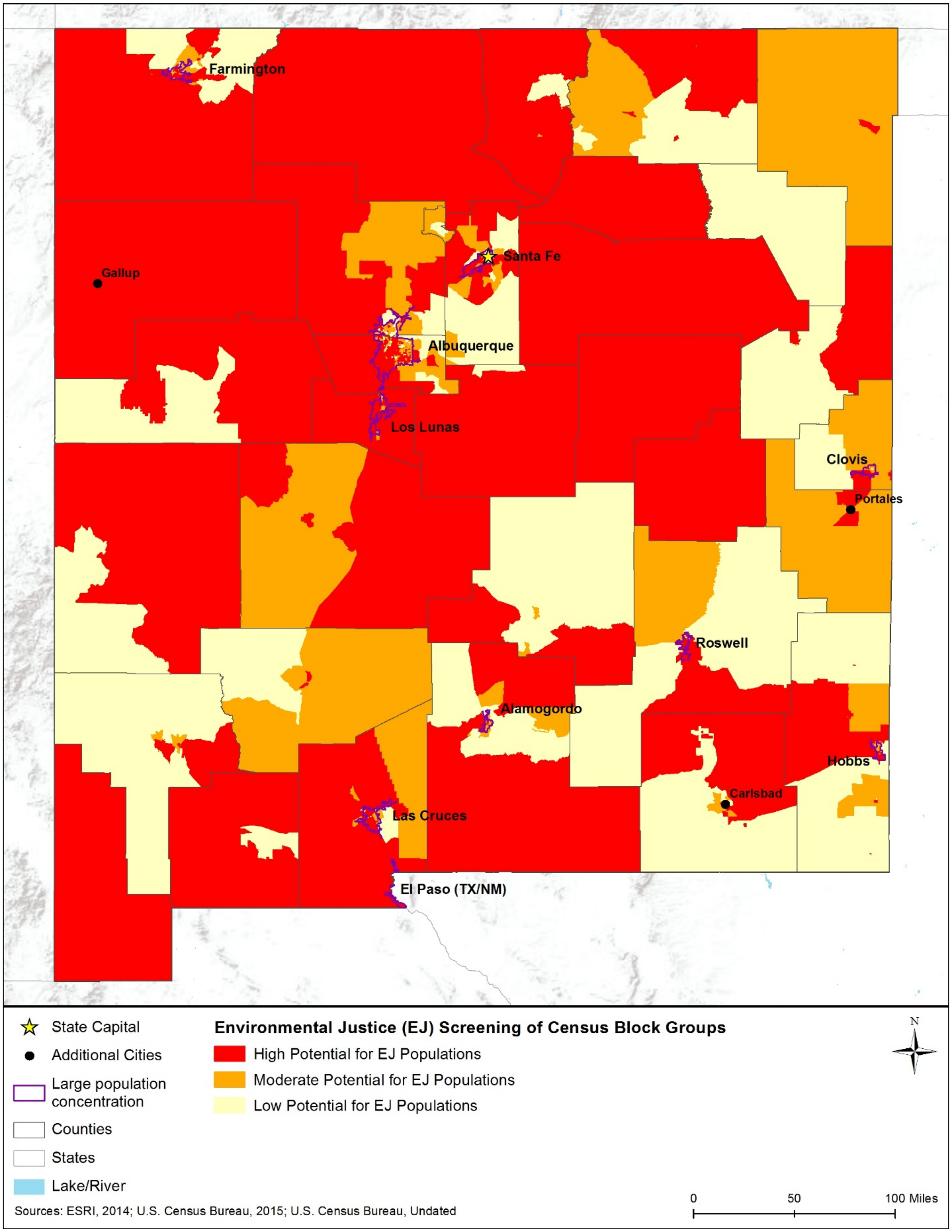

Figure 10.1.10-1: Potential for Environmental Justice Populations in New Mexico, 2009-2013

10.1.11. Cultural Resources

10.1.11.1. Definition of Resource

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

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

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

- Statutory language and implementing regulations for Section 106 of the NHPA, as amended, formerly 16 USC 470a(d)(6)(A) (now 54 USC 306131(b)) and 36 CFR 800.16(l)(1);
- Statutory language and Implementing regulations for the Archaeological Resources Protection Act of 1979 (ARPA), 16 U.S.C. 470cc(c) and 43 CFR 7.3(a);
- Statutory language and implementing regulations for the Native American Graves Protection and Repatriation Act (NAGPRA), 25 U.S.C. 3001(3)(D) and 43 CFR 10.2(d);
- NPS's program support of public and private efforts to identify, evaluate, and protect America's historic and archeological resources (NPS, 2016b); and
- Advisory Council on Historic Preservation's (ACHP) guidance for protection and preservation of sites and artifacts with traditional religious and cultural importance to Indian tribes or Native Hawaiian organizations (Advisory Council on Historic Preservation, 2004).

10.1.11.2. 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.

New Mexico has a state law, with associated regulations that is similar to the NHPA or NEPA. 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 10.1.11-1: Relevant New Mexico Cultural Resources Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Cultural Properties Act (Sections 18-6 through 18-6-23, NMSA 1978)	New Mexico State Historic Preservation Office (SHPO)	This Act mirrors the NHPA for state actions, requiring state agencies to consult with SHPO regarding potential impacts to historic properties.

10.1.11.3. Cultural and Natural Setting

Human beings have inhabited the New Mexico region for more than 12,000 years (NMOSH, 2015a). They ancestors of the earliest inhabitants are believed to have crossed the land bridge at the Bering Strait during the last ice age as they followed the migrations of the mammoth, bison, and other large game. The majority of evidence of the region's early human habitation comes from the study of prehistoric and historic archaeological sites. Various state parks within New Mexico assist in the preservation of more than 300 listed on the National Register of Historic Places (NRHP). As shown in Figure 10.1.3-1 in the Geology section for New Mexico, the state falls inside the Central Lowland Physiographic areas of North America (Gibbon, 1998).

Archaeological evidence in New Mexico is primarily found on or near the ground surface. However, due to natural factors some sites have been buried beneath several layers of sediment or organic materials such as floodplain deposits found along streams and rivers or peat deposits in wetlands. These alluvial deposits can range from 1 to 10 feet below the current ground surface, with older sites in the deeper sediments

The following sections examine New Mexico's prehistory (approximately 9500 B.C. to A.D. 1600) and historic period. Section 10.1.11.4 provides an overview of this initial human habitation in New Mexico and the cultural development before European contact. Section 10.1.11.5 discusses the federally recognized American Indian tribes with a cultural affiliation to the state. Section 10.1.11.6 presents a current list of significant archaeological sites in New Mexico and the resources the state and the federal government use to ensure their protection. Section 10.1.11.7 discusses the history of the state, and Section 10.1.11.8 describes the architecture of New Mexico.

10.1.11.4. Prehistoric Setting

Archaeologists divide New Mexico's prehistory into four periods: The Paleoindian (9500 - 5500 B.C.), the Archaic (5500 B.C. - A.D. 400), the Basketmaker (A.D. 400 - 700), and the Pueblo (A.D. 700 - 1600). The following timeline (Figure 10.1.11-1) provides a guideline to New Mexico's prehistoric habitation. New Mexico is one of the Four Corner[113] states that contain an impressive array of Southwestern archaeological sites. Evidence of New Mexico's prehistoric occupation is prevalent primarily in the Southeastern corner and the Northwestern corners of the state. As each occupation is roughly defined and identified by the styles of the time, the archaeological evidence of these four periods includes a range of artifacts that are uniquely identifiable to each occupation.

[113] Four corner states refers to the region of the United States consisting of the southwestern corner of Colorado, southeastern corner of Utah, northeastern corner of Arizona, and northwestern corner of New Mexico.

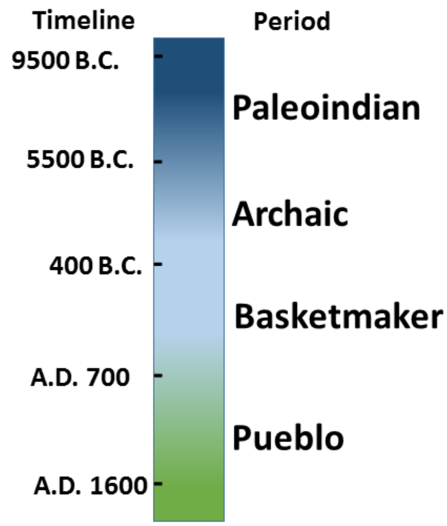

Figure 10.1.11-1: Timeline of Prehistoric Human Occupation

Sources: (Cameron & Lekson, 1997) (Cordell, 1979)

Paleoindian Period (9500 – 5500 B.C.)

The Paleoindian Period represents the earliest period of human habitation in New Mexico. People at this time were primarily hunter-gatherer nomads following the migratory patterns of the mammoth, bison, and other large land mammals. Cultural remains for this period primarily include large spear points called Clovis points and smaller, more distinctive lanceolate points (Cordell, 1979). Studies show that similar projectile points had a widespread use across the continents of northeastern Asia, the Arabian Peninsula, and Spain prior to human arrival into North America (Charpentier, Inizan, & Feblot-Augustins, 2002). These earliest Paleoindian points occurring in North America were first found by archaeologists in New Mexico, and are named after their respective discovery locations (NMSHPO, 2016).

The Blackwater Draw archaeological site in the eastern plains of New Mexico is an early Paleoindian site and was listed as a National Historic Monument in 1961. Evidence that "hunters armed with atlatls, darts and spears" ambushed a watering mammoth at this freshwater pond has made this a notable archeological site (Sanchez, Spude, & Gomez, 2013). At this site, among a number of artifacts, archaeologists have found a retouched flake-dressing tool and cylindrical tapered bone fore-shafts from darts or spears that may have been attached to the end of a spear or to a toggle device. Clovis points also occur as surface finds in northeastern New Mexico, and have been consistently dated to the relatively 9500 and 9000 B.C. period, which represent the earliest well-documented Paleoindian manifestation in the Southwest (Cordell, 1979).

The later part of the Paleoindian Period, also referred to as the Folsom Period, is distinguishable by the smaller and more distinctive lanceolate point. These points are fluted on both sides for the length of the point, and are generally convex (Cordell, 1979). Lanceolate points are the earliest points refined by pressure flaking techniques.

Archaic Period (5500 – 400 B.C.)

Bison and other large mammals remained a major source of the diet of early Archaic Period inhabitants of New Mexico, although the Archaic Period is generally referred to as a transitional period where the beginnings of a more sedentary culture began to emerge. As temperatures warmed, herd animals moved out of the area and human populations had to rely on the subsistence of smaller game and foraged plants (Cameron & Lekson, 1997). Archaic populations were partially nomadic hunter-gatherers with seasonal camps in such areas as the heads of canyons or near springs. By the Late Archaic Period, populations may have begun using base camps and traveling to special seasonal use camps.

Archaeologists have found remains of temporary structures dating toward the later part of the Archaic Period. These mud, brush, and grass structures were made on a partially excavated dirt floor (Cameron & Lekson, 1997). Diversified tools have been discovered at these sites, including plant-processing tools such as the mortar and pestle and other milling implements. As horticulture was introduced and expanded, these tools aided in the processing of plant materials that could otherwise not be eaten. These tools were ideal for seasonal camps, as they were easy to replicate when relocating to a new area. However, this accessibility has also created problems for current researchers attempting to study the Archaic Period and differentiate from artifacts left by later occupiers. According to Cordell, "loci which were used for hunting or plant processing by Archaic Period groups were also, apparently, often revisited by later Pueblo groups" and will often contain assemblages of both Archaic and Puebloan remains (Cordell, 1979).

Cebolla Mesa, in the northern part of New Mexico on the east side of the Taos Plateau, has been found to contain assemblages of artifacts dating to the Late Archaic. Sixty-six sites have been recorded in the area, ten of which contained Archaic Period assemblages of stone tools, such as projectile points, and manos (grinding stones) (Boyer & Moore, 2001).

Basketmaker Period (400 B.C. – A.D. 700)

The Basketmaker Period is uniquely identifiable by the elaborate, handwoven baskets that were created during this time. Many researchers divide this period into three sub-periods: Basketmaker Sub-Periods I, II, and III. During this period, there was an increase in sedentary villages, greater reliance on horticulture, and the cultural remains are more easily found due to the concentration of population in the villages. The Basketmaker name was derived from the abundance of basketry found in habitation sites, cave storage cisterns, and burials sites (Capace, 2000).

Very little is known of the Basketmaker Sub-Period I people. Archaeologists believe that the Basketmaker Sub-Period I population was period of transition from the Archaic Period and may have still been partially nomadic. There is some debate as to the end of the Archaic Period and the beginning of the Basketmaker Sub-Period I in New Mexico and elsewhere. In some cases, the two terms have been used interchangeably to discuss the transition into the Basketmaker Sub-Period II. (Capace, 2000)

The Basketmaker Sub-Period II people excelled in weaving. Their baskets were found "to be woven so tightly they could hold water and be used for cooking (when heated stones were dropped in the water-filled baskets)" (Sanchez, Spude, & Gomez, 2013). They created decorative woven bags, coiled baskets, and sandals. Their fibers were woven from materials that included Indian hemp (*Apocynum cannabinum*), yucca, juniper bark fiber, as well as human and animal hair (Capace, 2000). Much of the information about the Basketmaker Sub-Period II population comes from rock shelter and cave habitations, with a particular focus on the San Juan basin in northwestern New Mexico, where the arid climate caused the artifacts and other organic remains to be "preserved in a state of extreme dryness" (Capace, 2000). During this phase of the Basketmaker Period, people began cultivating beans, squash, and a smaller, soft variety of maize. Throughout this period, crude, unfired versions of pottery were being utilized; it was not until the Basketmaker Sub-Period III that the advent of fired ceramics became widespread.

During the Basketmaker Sub-Period III, people began settling into the first permanent dwellings and creating storage spaces for caches of resources, which permitted increase in population. The pit-houses that made up these permanent dwellings were circular in design, partially dug into the ground (between 3 to 6 feet), and between 10 to 20 feet across. The dwellings were built of interwoven reeds and grass for the sidewalls, and roof supported by timbers that made up the framework (Sanchez, Spude, & Gomez, 2013). Basketmaker Sub-Period III also saw the introduction of great kivas, which were large, communal structures generally at large sites. These structures were constructed like pit-houses but large enough to hold many people (Cameron & Lekson, 1997). This phase in the Basketmaker culture also introduced a broad-scale use of fired pottery, the bow and arrow, and more varieties of corn.

Evidence of the Basketmaker Sub-Period III site is clearly represented at the North Ponil 1 site, which is on a valley floor against the outcrops of the Poison Canyon formation in northwestern New Mexico. At this site, "several varieties of fire-pits, underground bottle-shaped cists, roasting ovens of various sizes, a broad activity area, at least two shallow pit-houses and a large, dense scatter of fire-cracked rock" are represented along with plain pot sherds, open end trough metates, and grinding slabs (Cordell, 1979). This site represents the emergence of full-scale communal villages and represents the end of the nomadic culture.

Pueblo Period (A.D. 700 – 1600)

The Pueblo Period — so named by the Spaniards who found large numbers of people living in compact communities — was a time of large increases in populations, village sizes, and agricultural production. Similar to the Basketmaker Period, the Pueblo Period is subdivided into phases.

Pueblo Phases I and II are termed Developmental. Pueblo Phase III is generally known as the Classic phase. Pueblo Phase IV has been called Regressive (because contact with the Spanish hampered the potential progress of indigenous cultures). Pueblo Phase V is the Historic phase and pertains to modern Pueblo people (Miller, 1940).

During Pueblo Phase I, inhabitants shifted from dugout, round pit-houses to aboveground rectangular, earthen, or masonry structures. Professor A.E. Douglass, an astronomer of the University of Arizona, discovered that the dates of these structures could be determined by analyzing the tree rings of wooden beams taken from the ruins of old buildings in New Mexico and Arizona, thus determining the phase during which each structure was built and becoming the father of the science of dendrochronology (Miller, 1940). Throughout this phase, these crude masonry structures were single-story, unit-style buildings consisting of a curved row of 6 to 10 units. Evidence of these structures is primarily in eastern New Mexico. Pueblo Phase I phase also saw the introduction of more sophisticated ceramic manufacturing techniques; pottery began to be slipped, polished, corrugated, incised, and tempered with finer materials (Miller, 1940).

One of the more intriguing developments to come out of Pueblo Phase II is a culture group referred to as the Chaco. During this time, people began the construction of large, elaborate structures in the area known as Chaco Canyon, an area of extremely arid climate with little possibility of farming. An example of this “Chaco Phenomenon,” as it has come to be known, is the ruin of Pueblo Bonito; one of the earliest Chacoan Great Houses. Pueblo Bonito is a massive, two-story pueblo with unusually thick walls and more than 800 large rooms built in a single large arc shape. Chaco Canyon, with its large Great Houses came to become the center of the ancestral Pueblo world during this phase of the Pueblo Period. (Cameron & Lekson, 1997).

Pueblo Phase III saw a shift toward the accumulation of wealth and goods as opposed to sustainable resources. This phase is considered the Classic Pueblo stage in which agricultural practices were at their height. Terracing and gridded fields with new irrigation methods such as channeling rivers and streams became common practice. Pueblos were built with multi-story houses. Additional changes and improvements to ceramics were made with the introduction of a variety of colors and designs. Trade routes were well established and wealth was displayed “in turquoise, shells, quartz, wood and stone beads, gorgets, bracelets, pendants, mosaics, and other forms of jewelry as well as in pottery” (Miller, 1940). A heavy drought marked the end of this classic phase of the Pueblo Period as a drop in the supply of water lead to the abandonment of the entire northwest corner of New Mexico (the “Four Corners” area) in favor of areas more suitable for sustaining large populations.

While Pueblo Phase IV, the last phase before sustained European contact, may be considered the Regressive phase, in various portions of New Mexico, it may have been the period of highest cultural achievement (Miller, 1940). In general, Pueblo Phase IV people retained the style of material culture from Pueblo Phase III. Polychrome and glazed paint wares became much more abundant, replacing the heavily ornamental pottery of the previous phase.

Horse, donkey, cattle, sheep goat, pig, and poultry were introduced by the Spanish to the culture in the later part of Pueblo Phase IV. After leaving the Four Corners area during Pueblo Phase III phase, populations became more concentrated in the Zuni and central Rio Grande areas of New Mexico. Throughout this period, dry-farming techniques became useful to sustain agriculture in the arid climates of Zuni (Sanchez, Spude, & Gomez, 2013).

In the Rio Grande area, Arroyo Hondo, a site at the base of a mountain pass, is an example of a fortified habitation due to the frequent access by the neighboring Plains raiders. Arroyo Hondo was a large multi-story village constructed with minimal entrances around an enclosed plaza (Cameron & Lekson, 1997). Other villages in the area fortified themselves using a wall to separate the trading grounds from the main pueblo structures (Sanchez, Spude, & Gomez, 2013).

Pueblo Phase V, the Historic phase, is marked by the sustained interaction with the Spanish through the sixteenth century. Evidence of Spanish influence is observed in the remains of the Salinas Pueblo Missions near Mountainair. As the Spanish attempted to convert the indigenous people to Catholicism, they constructed missions in Pueblo communities to extend their influence. Sites such as Abo (part of Salinas Pueblo), which at the time of Spanish arrival was a thriving Pueblo community, is marked by the establishment of a convento[114] inside a pueblo room containing a circular Kiva. The design of this religious structure, which adapted Spanish Christian to Puebloan characteristics, may have aided in early conversions of Puebloan populations by bridging cultural traits (NPS, 2015t).

10.1.11.5. Federally Recognized Tribes of New Mexico

According to the Bureau of Indian Affairs and the National Conference of State Legislators, there are 23 federally recognized tribes in New Mexico (Table 10.1.11-2) with three tribes crossing state borders (NCSL, 2015).

Table 10.1.11-2: Federally Recognized Tribes in New Mexico

Jicarilla Apache Nation of the Jicarilla Apache Reservation	Sandia Pueblo
Mescalero Apache Tribe of the Mescalero Apache Reservation	Santa Ana Pueblo
Acoma Pueblo	Santa Clara Pueblo
Cochiti Pueblo	Santo Domingo Pueblo
Jemez Pueblo	Taos Pueblo
Isleta Pueblo	Tesuque Pueblo
Laguna Pueblo	Zia Pueblo
Nambe Pueblo	Zuni Tribe of the Zuni Reservation
Picuris Pueblo	Ute Mountain Tribe (Colorado, New Mexico and Utah)
Pojoaque Pueblo	Navajo Nation (Arizona, New Mexico and Utah)
San Felipe Pueblo	San Juan Pueblo (Now known as the Ohkay Owingeh)
San Ildefonso Pueblo	

[114] Gathering area for religious ceremonies.

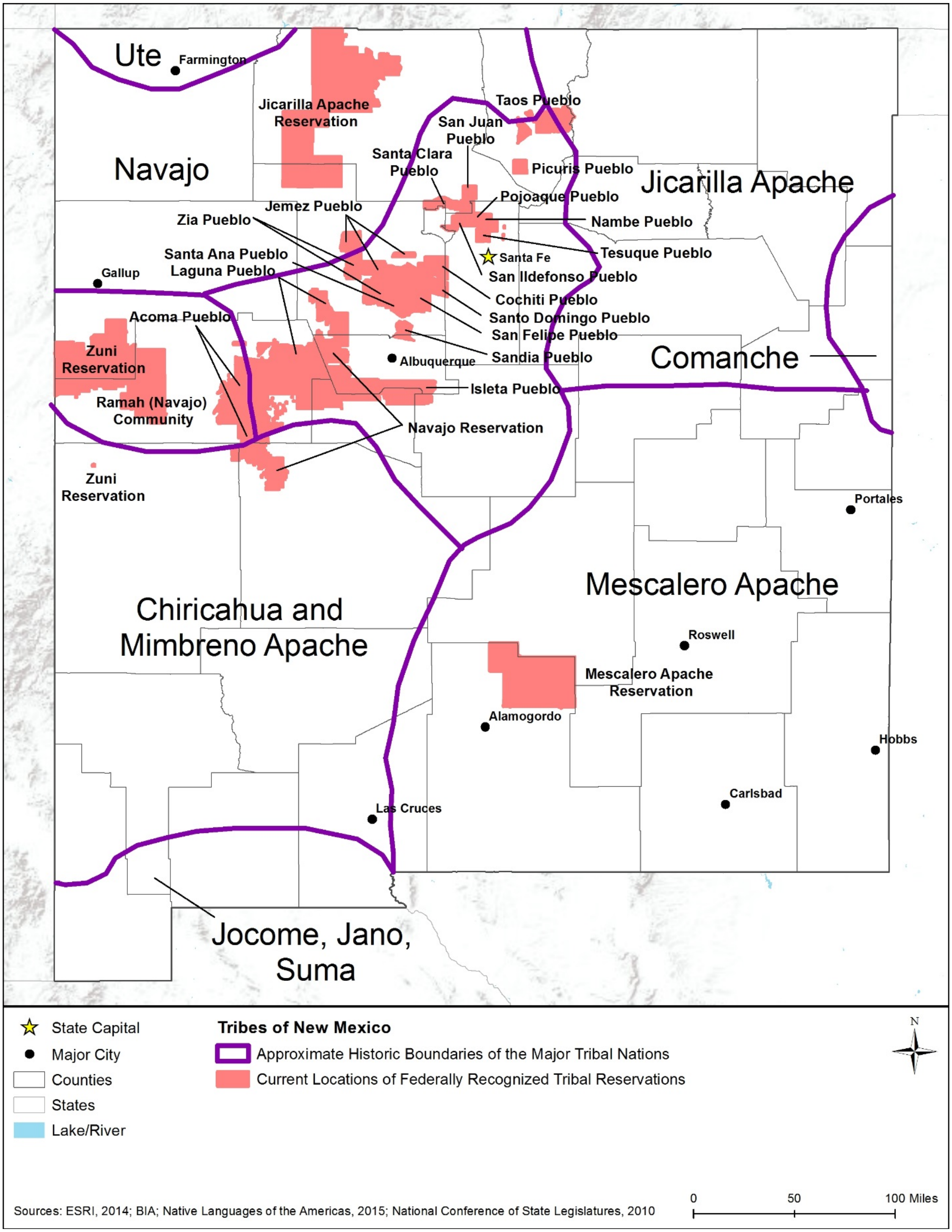

Figure 10.1.11-2: Federally Recognized Tribes in New Mexico

10.1.11.6. Significant Archaeological Sites of New Mexico

As previously mentioned in Section 10.1.11.3 there are more than 300 archaeological sites in New Mexico listed on the NRHP. Table 10.1.11-3 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/ (National Park Service 2015).

New Mexico State Cultural Resources Database and Tools

New Mexico State Historic Preservation Office (NMSHPO)

The State Historic Preservation Office, which is part of the New Mexico Department of Cultural Affairs, works to preserve the cultural resources of New Mexico. The office is responsible for overseeing preservation programs and maintaining a significant amount of historical resources. A list of all NRHP nominations is available on the SHPO website (http://www.nmhistoricpreservation.org/) for public review, as well as nomination forms and documents for future nominations. (NMSHPO, 2012).

New Mexico Office of Archaeological Studies (OAS)

The Office of Archaeological Studies, which is also part of the New Mexico Department of Cultural Affairs, works to preserve the cultural resources of New Mexico. The office is responsible for conducting research projects throughout New Mexico. The OAS mission is to identify, interpret, and disseminate information about prehistoric and historic sites. An inventory of New Mexico archaeological site reports is available on the OAS website (http://www.nmarchaeology.org/). (New Mexico Office of Archaeological Studies, 2012)

University of New Mexico – Office of Contract Archaeology (OCA)

The University of New Mexico, in partnership with the Maxwell Museum of Anthropology, conducts large-scale, interdisciplinary cultural resource studies with scientifically based management solutions. The office manages projects and maintains contracts with the government and with the private sector. (The University of New Mexico, 2016)

Archaeological Society of New Mexico (ASNM)

The Archaeological Society of New Mexico is a statewide organization that encourages the study and preservation of New Mexico's multi-cultural heritage. The goal of ASNM is to spread awareness of prehistoric and historic sites through the distribution of information via publications. Information on becoming an affiliate of ASNM is available at http://newmexico-archaeology.org. (Archaeological Society of New Mexico, 2016)

Table 10.1.11-3: Archaeological Sites on the National Register of Historic Places in New Mexico

Closest City	Site Name	Type of Site
Abiquiu	Abiquiu Mesa Grid Gardens	Prehistoric
Abiquiu	Santa Rosa de Lima de Abiquiu	Historic
Abiquiu	Tsama Pueblo	Prehistoric
Albuquerque	Las Imagines Archeological District--Albuquerque West Mesa Escarpment	Historic, Historic - Aboriginal, Prehistoric
Albuquerque	Petroglyph National Monument	Prehistoric
Albuquerque	Piedras Marcadas Pueblo (LA 290)	Prehistoric
Albuquerque	Rancho de Carnue Site	Historic, Prehistoric
Albuquerque	Pueblo of Santo Domingo (Kiua)	Historic
Animas	Alamo Hueco Site	Prehistoric
Animas	Archeological Site No. LA 54021	Prehistoric
Animas	Archeological Site No. LA 54042	Prehistoric
Animas	Archeological Site No. LA 54049	Prehistoric
Animas	Archeological Site No. LA 54050	Prehistoric
Animas	Box Canyon Site	Prehistoric
Animas	Brushy Creek Ruin	Prehistoric
Animas	Clanton Draw Site	Prehistoric
Animas	Culberson Ruin	Prehistoric
Animas	Double Adobe Creek Site	Prehistoric
Animas	Fortress--Stewart Ranch Site	Prehistoric
Animas	Hoskins Site	Prehistoric
Animas	Joyce Well Site	Prehistoric
Animas	Little Site	Prehistoric
Animas	Lunch Box Site	Prehistoric
Animas	Metate Ruin	Prehistoric
Animas	Pendleton Ruin	Prehistoric
Animas	Pigpen Creek Site	Prehistoric
Animas	Saddle Bronc--Battleground Site	Prehistoric
Animas	Sycamore Well Site	Prehistoric
Animas	Timberlake Ruin--Walnut Creek Site	Prehistoric
Anton Chico	Anton Chico de Abajo Historic District	Historic
Bernalillo	Jemez Pueblo	Historic - Aboriginal
Bernalillo	Kuaua Ruin	Historic - Aboriginal, Prehistoric
Bernalillo	Sandia Cave	Prehistoric
Bernalillo	Zia Pueblo	Historic, Prehistoric
Bingham	Archeological Site No. LA 1069	Prehistoric
Bingham	Archeological Site No. LA 1070	Prehistoric
Bingham	Archeological Site No. LA 1071	Prehistoric
Bingham	Archeological Site No. LA 1072	Prehistoric

Closest City	Site Name	Type of Site
Bingham	Archeological Site No. LA 1073	Prehistoric
Bingham	Archeological Site No. LA 1074	Prehistoric
Bingham	Archeological Site No. LA 1075	Prehistoric
Bingham	Archeological Site No. LA 1076	Prehistoric
Bingham	Archeological Site No. LA 1181	Prehistoric
Bingham	Archeological Site No. LA 1201	Prehistoric
Blanco	Frances Canyon Ruin	Historic - Aboriginal
Bloomfield	Halfway House Archeological Site	Prehistoric
Bloomfield	Twin Angels Archeological Site	Prehistoric
Budaghers	Espinaso Ridge Pueblo	Prehistoric
Budaghers	Pueblo Tuerto	Prehistoric
Canones	Tsiping	Historic - Aboriginal
Capitan	Fort Stanton	Historic - Aboriginal
Capitan	Fort Stanton Historic District (Boundary Increase)	Historic - Aboriginal
Capitan	Wizard’s Roost	Historic - Aboriginal
Capitan	San Marcos Pueblo	Historic, Prehistoric
Carlsbad	Painted Grotto	Prehistoric
Casa Salazar	Big Bead Mesa	Historic - Aboriginal
Chupadera	Seco Ruin	Prehistoric
Cimarron	Ring Place, The	Historic
Cliff	Woodrow Ruin	Historic - Aboriginal
Clovis	Anderson Basin	Prehistoric
Colonias	Colonias de San Jose Historic District	Historic
Colonias	La Placita De Abajo District	Historic
Coyote	Forest Service Site No. AR-03-10-01-374	Prehistoric
Coyote	Forest Service Site No. AR-03-10-01-390	Prehistoric
Crownpoint	Casa de Estrella Archeological Site	Prehistoric
Crownpoint	Dalton Pass Archeological Site	Prehistoric
Crownpoint	Greenlee Archeological Site	Prehistoric
Crownpoint	Haystack Archeological District	Historic - Aboriginal
Crownpoint	Upper Kin Klizhin Archeological Site	Prehistoric
Datil	Ake Site	Prehistoric
Deming	Upton Site	Prehistoric
Dulce	Vicenti Site	Prehistoric
Elephant Butte	Fort McRae	Historic, Military
Espanola	Chupaderos Canyon Small Structural Site	Prehistoric
Espanola	Chupaderos Mesa Village	Prehistoric
Espanola	Guaja Water/Soil Control Site	Prehistoric
Espanola	Corral Canyon Pueblo Site	Prehistoric
Espanola	Corral Mesa Cavate Pueblo Site	Prehistoric
Espanola	Ku-ouinge	Prehistoric
Espanola	Puye Ruins	Prehistoric

Closest City	Site Name	Type of Site
Espanola	San Gabriel de Yungue-Ouinge	Historic, Historic - Aboriginal
Espanola	Santa Clara Pueblo	Historic
Farmington	Crow Canyon Archeological District	Historic - Aboriginal, Prehistoric
Farmington	Christmas Tree Ruin (LA 11097)	Historic - Aboriginal
Farmington	Cottonwood Divide Site (LA 55829)	Historic - Aboriginal
Farmington	East Side Rincon Site	Prehistoric
Farmington	Gallegos Wash Archeological District	Prehistoric
Farmington	Hadlock’s Crow Canyon No. 1 (LA 55830)	Historic - Aboriginal
Farmington	Jaquez Site Ruin	Prehistoric
Farmington	Mesa Prieta Site (LA 11251)	Historic - Aboriginal
Farmington	Salmon Ruin	Prehistoric
Farmington	Simon Canyon (LA 5047)	Historic - Aboriginal
Farmington	Star Rock Refuge (LA 55838)	Historic - Aboriginal
Folsom	Folsom Site	Prehistoric
Fort Sumner	Fort Sumner Ruins	Historic, Military
Fort Wingate	Fort Wingate Archeological Site	Prehistoric
Fruitland	Archeological Site OCA-CGP-56	Prehistoric
Fruitland	Site No. OCA-CGP-54-1	Historic - Aboriginal
Fruitland	Site OCA-CGP-605	Prehistoric
Gallup	Halona Pueblo	Historic - Aboriginal
Gladstone	Santa Fe Trail--Segment West of Point of Rocks	Historic
Gran Quivira	Salinas Pueblo Missions National Monument	Historic - Aboriginal
Grants	Dittert Site	Prehistoric
Grants	Candelaria Pueblo	Prehistoric
Guadalupe	Guadalupe Ruin	Prehistoric
Hernandez	Leaf Water Pueblo(LA 300)	Prehistoric
High Rolls	Fresnal Shelter	Prehistoric
Hobbs	Laguna Plata Archeological District	Prehistoric
Horse Springs	Bat Cave	Prehistoric
Jemez Spring	San Juan Mesa Ruin	Historic - Aboriginal, Prehistoric
Jemez Springs	Amoxiumqua Site (FS-530, LA481)	Historic - Aboriginal, Prehistoric
Jemez Springs	Archeological Site FS-18, LA-5920	Historic - Aboriginal, Prehistoric
Jemez Springs	Archeological Site FS-199, LA-135	Historic - Aboriginal, Prehistoric
Jemez Springs	Archeological Site FS-3	Historic - Aboriginal, Prehistoric
Jemez Springs	Archeological Site FS-535, LA-385	Historic - Aboriginal, Prehistoric
Jemez Springs	Archeological Site FS-554, LA-386	Historic - Aboriginal, Prehistoric

Closest City	Site Name	Type of Site
Jemez Springs	Archeological Site FS-574	Historic - Aboriginal, Prehistoric
Jemez Springs	Archeological Site FS-575	Historic - Aboriginal, Prehistoric
Jemez Springs	Archeological Site FS-580, LA-137	Historic - Aboriginal, Prehistoric
Jemez Springs	Archeological Site FS-647, LA-128	Historic - Aboriginal, Prehistoric
Jemez Springs	Archeological Site FS-688	Historic - Aboriginal, Prehistoric
Jemez Springs	Archeological Site FS-689, LA-403	Historic - Aboriginal, Prehistoric
Jemez Springs	Archeological Site FS-8	Historic - Aboriginal, Prehistoric
Jemez Springs	Archeological Site No. AR-03-10-03-620	Historic - Aboriginal, Prehistoric
Jemez Springs	Astialakwa Archeological District (FS-360, LA-1825)	Historic - Aboriginal, Prehistoric
Jemez Springs	Boletsakwa Site (FS-2, LA-136)	Historic - Aboriginal, Prehistoric
Jemez Springs	Borrego Mesa Agricultural Site	Prehistoric
Jemez Springs	Forest Service Archeological Site No. FS-7	Historic - Aboriginal, Prehistoric
Jemez Springs	Guacamayo Site (FS0572, LA-189)	Prehistoric
Jemez Springs	Hanakwa Site (FS-578)	Historic - Aboriginal, Prehistoric
Jemez Springs	Holiday Mesa Logging Camp	Historic
Jemez Springs	Hot Springs Pueblo (FS-505, Bj-73)	Historic - Aboriginal, Prehistoric
Jemez Springs	Jemez Cave	Historic - Aboriginal
Jemez Springs	Kiashita Site	Historic - Aboriginal, Prehistoric
Jemez Springs	Kiatsukwa Site (FS-31 and 504, LA-132 and 133)	Historic - Aboriginal, Prehistoric
Jemez Springs	Kwastiyukwa Site (FS-11, LA-482)	Historic - Aboriginal, Prehistoric
Jemez Springs	Nanishagi Site (FS-320, LA-541)	Historic - Aboriginal, Prehistoric
Jemez Springs	Patokwa Site (FS-5, LA-96)	Historic - Aboriginal, Prehistoric
Jemez Springs	Pejunkwa Site (FS-571, LA-130)	Historic - Aboriginal, Prehistoric
Jemez Springs	Tostaskwinu Site (FS-579, LA-479)	Historic - Aboriginal, Prehistoric
Jemez Springs	Tovakwa Site	Historic - Aboriginal
Jemez Springs	Unshagi Site (FS-337, LA-123)	Historic - Aboriginal, Prehistoric

Closest City	Site Name	Type of Site
Jemez Springs	Virgin Canyon Logging Camp No. 1	Historic
Jemez Springs	Virgin Mesa Logging Camp No. 1	Historic
Jemez Springs	Virgin Mesa Logging Camp No. 2	Historic
Jemez Springs	Virgin Mesa Logging Camp No. 3	Historic
Jemez Springs	Virgin Mesa Rock Art Site	Prehistoric
Jemez Springs	Wabakwa Site (FS-400, LA-478)	Historic - Aboriginal, Prehistoric
Jemez Springs	Wahajhamka (FS-573)	Historic - Aboriginal, Prehistoric
La Bajada	La Bajada Mesa Agricultural Site	Prehistoric
La Plata	Morris' No. 41 Archeological District	Prehistoric
Las Cruces	Fort Fillmore	Historic, Military
Lincoln	Archeological Site LA 12151	Historic, Prehistoric
Lincoln	Archeological Site LA 12153	Historic, Prehistoric
Lincoln	Archeological Site LA 12155	Historic
Lincoln	Archeological Site LA 61201	Historic
Lincoln	Archeological Site LA 61202	Historic
Lincoln	Archeological Site LA 61204	Prehistoric
Lincoln	Archeological Site LA 61206	Historic
Lincoln	Archeological Site LA 61208	Historic
Lincoln	Archeological Site LA 61210	Historic
Lincoln	Archeological Site LA 61211	Historic
Lincoln	Feather Cave	Historic - Aboriginal, Prehistoric
Llaves	Archeological Site No. AR-03-10-02-357	Prehistoric
Llaves	Castles of the Chama (AR-03-10-01-216)	Prehistoric
Llaves	Nogales Cliff House (AR-03-10-02-124)	Prehistoric
Llaves	Rattlesnake Ridge Site	Prehistoric
Los Alamos	Guaje Site	Historic - Aboriginal
Magdalena	Gallinas Springs Ruin	Prehistoric
Manuelito	Manuelito Complex	Prehistoric
Mayhill	Hay Canyon Logging Camp	Historic
Mimbres	Mattocks Site	Historic - Aboriginal
Nogal	Mesa Ranger Station Site	Prehistoric
Nogal	Nogal Mesa Kiva Site	Prehistoric
Nogal	Nogal Mesa Site	Prehistoric
Ojo Caliente	Hupobi-ouinge	Prehistoric
Ojo Caliente	Ponsipa'akeri	Prehistoric
Ojo Caliente	Posi-ouinge	Prehistoric
Ojo Caliente	Howiri-ouinge	Prehistoric
Pecos	Valencia Ranch Historic Archaeological District	Historic, Prehistoric
Placitas	San Jose de las Huertas	Historic
Pojoaque	Bouquet, Jean, Historic/Archeological District	Historic - Aboriginal

Closest City	Site Name	Type of Site
Prewitt	Andrews Archeological District	Prehistoric
Pueblo Pintado	Archeological Site # LA 15278 (Reservoir Site; CM 100)	Prehistoric
Pueblo Pintado	Archeological Site # LA 45,780	Prehistoric
Pueblo Pintado	Archeological Site # LA 45,781	Prehistoric
Pueblo Pintado	Archeological Site # LA 45,782	Prehistoric
Pueblo Pintado	Archeological Site # LA 45,784	Prehistoric
Pueblo Pintado	Archeological Site # LA 45,785	Prehistoric
Pueblo Pintado	Archeological Site # LA 45,786	Prehistoric
Pueblo Pintado	Archeological Site # LA 45,789	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,000	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,001	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,013 (CM101)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,014 (CM 102)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,015 (CM 102A)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,016 (CM 103)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,017 (CM 104)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,018	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,019 (CM 105)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,020 (CM 106)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,021	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,022 (CM 107)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,023 (CM 118)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,024 (CM 108)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,025 (CM 109)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,026 (CM 110)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,027 (CM 111)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,028 (CM 112)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,030 (CM 114)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,031 (CM 115)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,033 (CM 117)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,034	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,035	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,036	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,037	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,038	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,044	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,071 (CM 148)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,072 (CM 94)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,074 (CM 181)	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,077	Prehistoric
Pueblo Pintado	Archeological Site # LA 50,080	Prehistoric

Closest City	Site Name	Type of Site
Queen	Archeological Site No. AR 03-08-03-195	Historic - Aboriginal, Prehistoric
Queen	Archeological Site No. AR-03-08-03-232	Historic - Aboriginal, Prehistoric
Queen	Dark Canyon Apache Rancheria--Military Battle Site	Historic - Aboriginal
Queen	LA 157206--White Oaks Pictograph Site	Prehistoric
Queen	LA 158783--Ambush Site	Prehistoric
Queen	LA 162411--Lost Again Shelter	Prehistoric
Queen	LA 64908--Ambush Two Hands Shelter	Prehistoric
Queen	LA 71921--Horse Well Shelters	Prehistoric
Queen	Last Chance Canyon Apache--Cavalry Battle Site	Historic - Aboriginal, Prehistoric
Queen	Archeological Site No. AR-03-08-03-128	Historic, Prehistoric
Radium Springs	Camino Real--San Diego North South Section	Historic
Radium Springs	Summerford Mountain Archeological District	Prehistoric
Raton	Clifton House Site	Historic
Red Hill	Mogollon Pueblo	Prehistoric
Rincon	Camino Real--Rincon Arroyo--Perrillo Section	Historic
Rincon	Camino Real--San Diego South	Historic
Rowe	Rowe Pueblo	Prehistoric
San Juan	Wheaton-Smith Site	Historic - Aboriginal
San Lorenzo	Janss Site	Historic - Aboriginal
San Mateo	San Mateo Archeological Site	Prehistoric
Santa Fe	Cochiti Pueblo	Historic - Aboriginal, Prehistoric
Santa Fe	Arroyo Hondo Pueblo	Prehistoric
Santa Fe	Fort Marcy Ruins	Military
Santa Fe	San Lazaro	Historic, Historic - Aboriginal, Prehistoric
Santa Fe	San Juan Pueblo	Historic - Aboriginal
Seven Lakes	Bee Burrow Archeological District	Prehistoric
Silver City	Gila Cliff Dwellings National Monument	Historic - Aboriginal, Prehistoric
Socorro	San Felipe Pueblo Ruin	Prehistoric
Socorro	Teypama Piro Site	Historic, Historic - Aboriginal
Tejon Grant	Tonque Pueblo	Historic - Aboriginal
Thoreau	Chaco Culture National Historical Park	Historic - Aboriginal
Tierra Amarilla	Adolfo Canyon Site (LA 5665)	Historic - Aboriginal
Tierra Amarilla	Boulder Fortress (LA 55828)	Historic - Aboriginal
Tierra Amarilla	Cabresto Mesa Tower Complex (LA 2138)	Historic - Aboriginal
Tierra Amarilla	Cagle’s Site (LA 55826)	Historic - Aboriginal
Tierra Amarilla	Canyon View Ruin (LA 55827)	Historic - Aboriginal
Tierra Amarilla	Casa Mesa Diablo (LA 11100)	Historic - Aboriginal

Closest City	Site Name	Type of Site
Tierra Amarilla	Citadel, The (LA 55828)	Historic - Aboriginal
Tierra Amarilla	Compressor Station Ruin (LA 5658)	Historic - Aboriginal
Tierra Amarilla	Crevice Ruin (LA 13218)	Historic - Aboriginal
Tierra Amarilla	Crow Canyon Site (LA 20219)	Historic - Aboriginal
Tierra Amarilla	Delgadito Pueblito (LA 5649)	Historic - Aboriginal
Tierra Amarilla	Foothold Ruin (LA 9073)	Historic - Aboriginal
Tierra Amarilla	Frances Canyon Ruin (LA 2135) (Boundary Increase)	Historic - Aboriginal
Tierra Amarilla	Gomez Canyon Ruin (LA 55831)	Historic - Aboriginal
Tierra Amarilla	Gomez Point Site (LA 58832)	Historic - Aboriginal
Tierra Amarilla	Gould Pass Ruin (LA 5659)	Historic - Aboriginal
Tierra Amarilla	Hill Road Ruin (LA 55833)	Historic - Aboriginal
Tierra Amarilla	Hooded Fireplace Ruin (LA 5662)	Historic - Aboriginal
Tierra Amarilla	Kin Naa daa (Maize House) (LA 1872)	Historic - Aboriginal
Tierra Amarilla	Kin Yazhi (Little House) (LA 2433)	Historic - Aboriginal
Tierra Amarilla	Largo School Ruin (LA 5657)	Historic - Aboriginal
Tierra Amarilla	Old Fort (LA 1869)	Historic - Aboriginal
Tierra Amarilla	Overlook Site (LA 10732)	Historic - Aboriginal
Tierra Amarilla	Pointed Butte Ruin (LA 10733)	Historic - Aboriginal
Tierra Amarilla	Pork Chop Pass Site (LA 5661)	Historic - Aboriginal
Tierra Amarilla	Pueblito Canyon Ruin (LA 1684)	Historic - Aboriginal
Tierra Amarilla	Pueblito East Ruin (LA 55834)	Military
Tierra Amarilla	Ridge Top House (LA 6287)	Historic - Aboriginal
Tierra Amarilla	Rincon Largo Ruin (LA 2436 and LA 2435)	Historic - Aboriginal
Tierra Amarilla	Rincon Rockshelter (LA 55835)	Historic - Aboriginal
Tierra Amarilla	Romine Canyon Ruin (LA 55836)	Historic - Aboriginal
Tierra Amarilla	Shaft House (LA 5660)	Historic - Aboriginal
Tierra Amarilla	Split Rock Ruin (LA 5664)	Historic - Aboriginal
Tierra Amarilla	Tapicito Ruin (LA 2298)	Historic - Aboriginal
Tierra Amarilla	Three Corn Ruin (LA 1871)	Historic - Aboriginal
Tierra Amarilla	Tower of the Standing God (LA 55839)	Historic - Aboriginal
Tierra Amarilla	Truby’s Tower (LA 2434)	Historic - Aboriginal
Tierra Amarilla	Unreachable Rockshelter (LA 55841)	Historic - Aboriginal
Tierra Amarilla	Wall, The (LA 55840)	Historic - Aboriginal
Tierrra Amarilla	Adams Canyon Site (LA 55824)	Historic - Aboriginal
Tierrra Amarilla	Garcia Canyon Pueblito (LA 36608)	Historic - Aboriginal
Tijeras	Tijeras Pueblo Archeological Site	Prehistoric
Timberon	Archeological Site No. AR-03-08-02-409	Historic - Aboriginal, Prehistoric
Timberson	Archeological Site No. AR-03-08-02-415	Historic, Prehistoric
Tome	El Cerro Tome Site	Historic, Historic - Aboriginal, Prehistoric
Tome	Los Ojuelos (The Springs)	Historic, Historic - Aboriginal, Prehistoric

Closest City	Site Name	Type of Site
Truth or Consequences	Archeological Site No. LA1119	Prehistoric
Truth or Consequences	Archeological Site No. LA49016	Prehistoric
Truth or Consequences	Archeological Site No. LA49030	Prehistoric
Truth or Consequences	Archeological Site No. LA50548	Prehistoric
Truth or Consequences	Archeological Site No. LA517	Prehistoric
Truth or Consequences	Chambers Canyon Site (LA49028)	Prehistoric
Truth or Consequences	Horse Island Site (LA48996)	Prehistoric
Truth or Consequences	Kettle Top Butte Site (LA48995)	Prehistoric
Truth or Consequences	Longbottom Canyon Site (LA49033)	Prehistoric
Truth or Consequences	Monticello Point Archeological District	Prehistoric
Truth or Consequences	Palomas Narrows North (LA38755)	Prehistoric
Truth or Consequences	Palomas Narrows South (LA49007)	Prehistoric
Tyrone	Burro Springs Site	Historic - Aboriginal
Velarde	Mesa Prieta Petroglyphs	Historic, Historic - Aboriginal, Prehistoric
White Oaks	Archeological Site No. AR-03-08-01-051	Prehistoric
White Oaks	Archeological Site No. AR-03-08-01-052	Prehistoric
White Oaks	Funston Site No. AR-03-08-01-046	Prehistoric
White Rock	Pajarito Springs Site	Prehistoric
White Rock	White Rock Canyon	Historic, Historic - Aboriginal, Prehistoric
White Rock	White Rock Canyon (Boundary Increase)	Historic, Historic - Aboriginal, Prehistoric
White Rock	Navawi	Prehistoric
Zuni	Peggy’s Pueblo	Prehistoric
Zuni	Zuni-Cibola Complex	Historic - Aboriginal, Prehistoric

Source: (NPS, 2014e)

10.1.11.7. Historic Context

The first European exploration of present day New Mexico occurred in 1536--1539 when Alvar Nunez Cabeza de Vaca, Alonso de Castillo, Andres Dorantes, a Franciscan monk named Fray Marcos de Niza, and his slave, a Moor named Estabanico Estevanico the Moor—all, survivors of the ill-fated Panfilo de Narvaez expedition to Florida in 1528—wandered through present-day New Mexico from Texas before reaching other Spaniards in Culiacan, Mexico. This was followed by expedition in 1539 led by a Franciscan priest, Marcos de Niza, with Estavanico the Moor as his guide, which was authorized by Mexico’s Viceroy, Antonio de Mendoza, ventured into the region into search for of gold. Other Spanish expeditions, such as that of Francisco Vazquez de Coronado in 1540, continued to occur during the 16th century, and in 1610, the capital of New Mexico was moved from San Gabriel de del Yunque- Owinge Ouinge to Santa Fe where it remains today. In 1680, the Pueblo Revolt began among the American Indian populations in New Mexico and drove Spanish settlers from the area until they were able to reestablish control in the early 1690s. During the 17th and 18th centuries, the primary means of transportation between Mexico City and Santa Fe was "The Royal Road of the Interior," or El Camino Real de Tierra Adentro (NMDCA, 2012). This road is the oldest wagon route in North America, and remains visible today (NRHP, 2011). Additional exploration of the region occurred during the 18th century (NMDCA, 2012).

In 1810, led by a Catholic priest, Miguel Hidalgo y Costilla, residents of Mexico began to revolt against Spanish colonial control, and finally succeeded in winning their independence in 1821. Mexico ruled New Mexico until 1848, when it came under the control of the Unites States following the conclusion of the Mexican-American War. Organized as a territory in 1850 following the settlement of claims by Texas and the final addition of land through the Gadsden Purchase of 1853, Anglo-American exploration and trade in New Mexico, once forbidden under Spain, was now encouraged. The Santa Fe Trail linked St. Louis to Santa Fe, and facilitated trade and immigration during the 19th century (NMDCA, 2012).

Following the Mexican-American War, American forts were established in the region to protect settlers from Indian attacks (NMDCA, 2012). During the Civil War, Albuquerque and Santa Fe were captured; however, Confederate forces were halted in their westward march at the Battle of Glorieta Pass (NMDCA, 2012). In 1879, the first passenger train reached New Mexico, and would soon expand service to further portions of the territory (NMOSH, 2015b). Mining became an important industry during the late 19th century, with the railroads facilitating the growth of the mining industry and mining settlements (NMDCA, 2012).

New Mexico became a state on January 6, 1912, being the 47th state to join the Union (NMOSH, 2015c). New Mexico continued to be involved in farming and ranching during the early 20th century, with new lands becoming available through land reclamation projects, such as the Elephant Butte Dam (NMDCA, 2012) (NMOSH, 2015c). Like most of the United States, New Mexico suffered during the Great Depression, with close to half of the population unemployed. New Deal projects were used to curb unemployment, with World War II (WWII) ultimately helping boost the state's economy (NMDCA, 2012).

During WWII, "rough terrain afforded a safely isolated and remote location for significant and top secret military work…including the development of the Atomic Bomb. This strong military presence has expanded over the years at military facilities such as Los Alamos National Laboratory, Sandia National Laboratory, and White Sands Missile Range" (NMDCA, 2012). Following WWII, suburban development was common around larger cities like Santa Fe, Albuquerque, and Silver City (NMDCA, 2012).

New Mexico has 1,133 NRHP listed sites, as well as 46 National Historic Landmarks (NHL) (NPS, 2014f) (NPS, 2015e). New Mexico contains one National Heritage Area, the Northern Rio Grande National Heritage Area (NPS, 2015u). Figure 10.1.11-3 shows the location of NRHP sites within New Mexico.

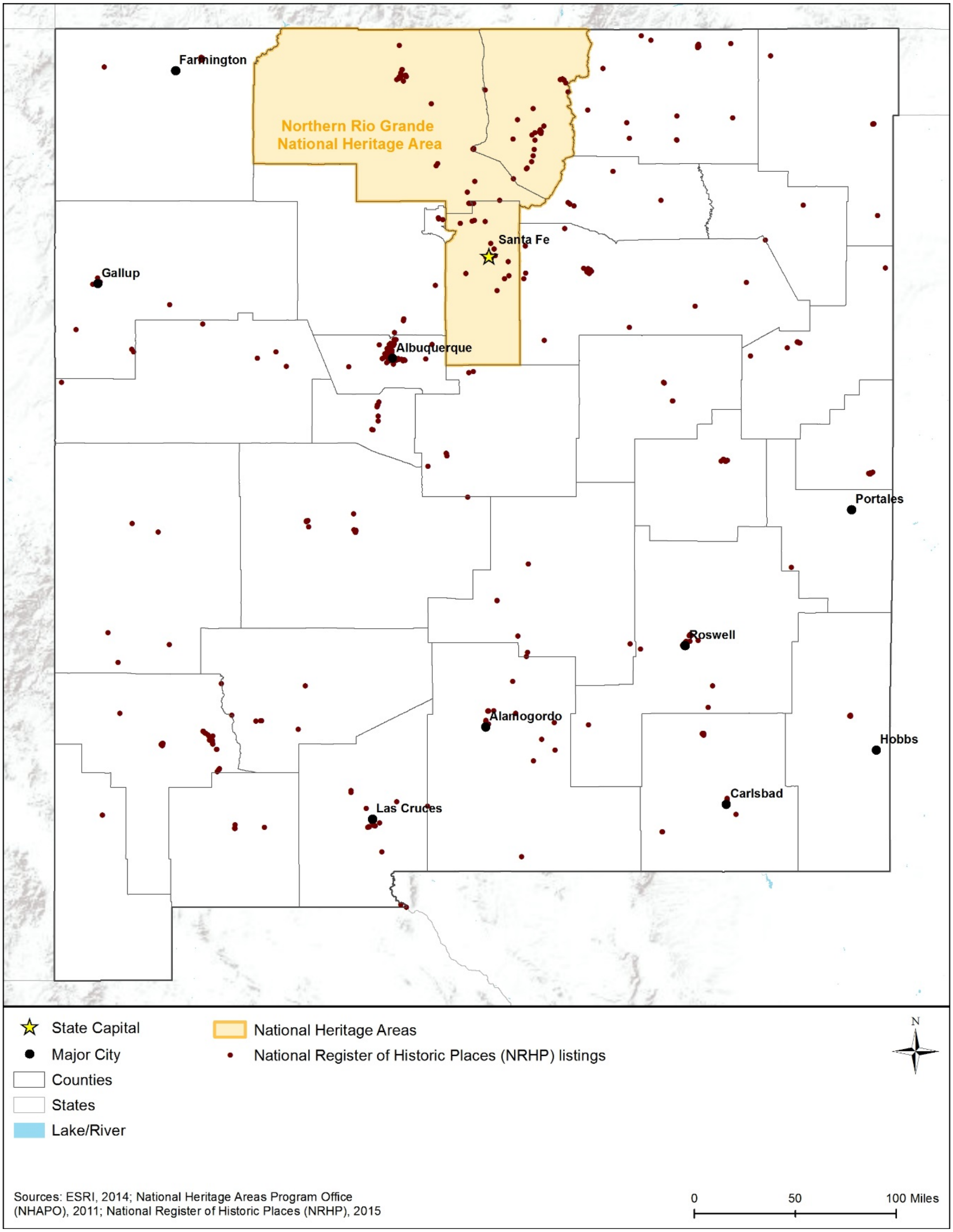

Figure 10.1.11-3: National Heritage Area (NHA) and National Register of Historic Places (NRHP) Sites in New Mexico

10.1.11.8. Architectural Context

Early European architecture in New Mexico was built by the Spanish beginning in the 16th and 17th centuries. Protohistoric pueblo structures also remain today, dating from the late 1400s through the 1500s, evidencing how the indigenous population lived before during and immediately after the contact period. Traditional Spanish styles were introduced at this time, including concepts of formal town layout and community design. During the 17th century, "Spanish Colonial and Pueblo cultures…melded to create an enduring legacy of architecture, community organization, and cultural landscapes" (NMDCA, 2012). One of the oldest remaining historic resources from this time is El Camino Real de Tierra Adentro, of which remnants can still be seen on the landscape today (NRHP, 2011).

During the short period of Mexican control, which lasted only from when Mexico won independence from Spain in 1821 through the conclusion of the Mexican-American War in 1848, architecture remained largely the same. Spanish colonial traditions were continued, and structures were commonly constructed of adobe and sunbaked sod. The Severino Martinez House, which is a casa-corral plan hacienda near Taos, is an example of what was built in 1804 while Mexico controlled the area (NMDCA, 2012). The Santa Fe Trail, which connected St. Louis and Santa Fe, was heavily traveled during this time and remnants, such as wagon ruts, are still visible (NRHP, 1994).

After New Mexico became a United States territory in 1850, military outposts were established to protect settlers. "These forts were built of adobe in the regional 'vernacular' design. However, milled lumber and fired bricks soon became standard construction materials after the Army brought the first sawmill and commercial brick kilns to New Mexico" (NMDCA, 2012). The Territorial-style became common for newly constructed buildings and is "characterized by adobe load-bearing walls, flat roofs and high parapets capped by brick. Milled lumber was used to create sash windows, and architectural details that emulated elements of Greek Revival architecture, popular at that time" (NMDCA, 2012).

During the second half of the 19th century, ranching and farming activities continued to dominate New Mexico. Examples of these buildings remain on the landscape today and are common on historic ranches. With the arrival of the railroad, New Mexico experienced an influx of new building materials and styles. Late 19th century styles like "Italianate, Queen Anne, Second Empire, and Classic Revival…were widely adopted in the territory" (NMDCA, 2012).

Many large irrigation projects were undertaken during the early 20th century in an attempt to open more land to settlement (NMDCA, 2012). In Engle, the Elephant Butte Dam (1916) became the world's second largest dam related to irrigation at the time of its construction (NMOSH, 2015c). During the Great Depression, a variety of New Deal programs employed New Mexico residents who were unemployed to construct schools, community centers, post offices, courthouses, armories, and other civic improvements (NRHP, 1996).

Pueblo Revival styles became popular during the early 20th century, and have come to dominate cities like Santa Fe. Starting in the early 20th century, Santa Fe made a conscious push to begin remaking the city into a large collection of pueblo buildings; these have now become historic themselves (Page & Mason, 2004). During the latter part of the 20th century, continued suburban growth has continued to be the "hallmark of the era, including Casa Solana in Santa Fe, Monte Vista, and College View in north-central Albuquerque and Silver Heights in Silver City." (NMDCA, 2012).

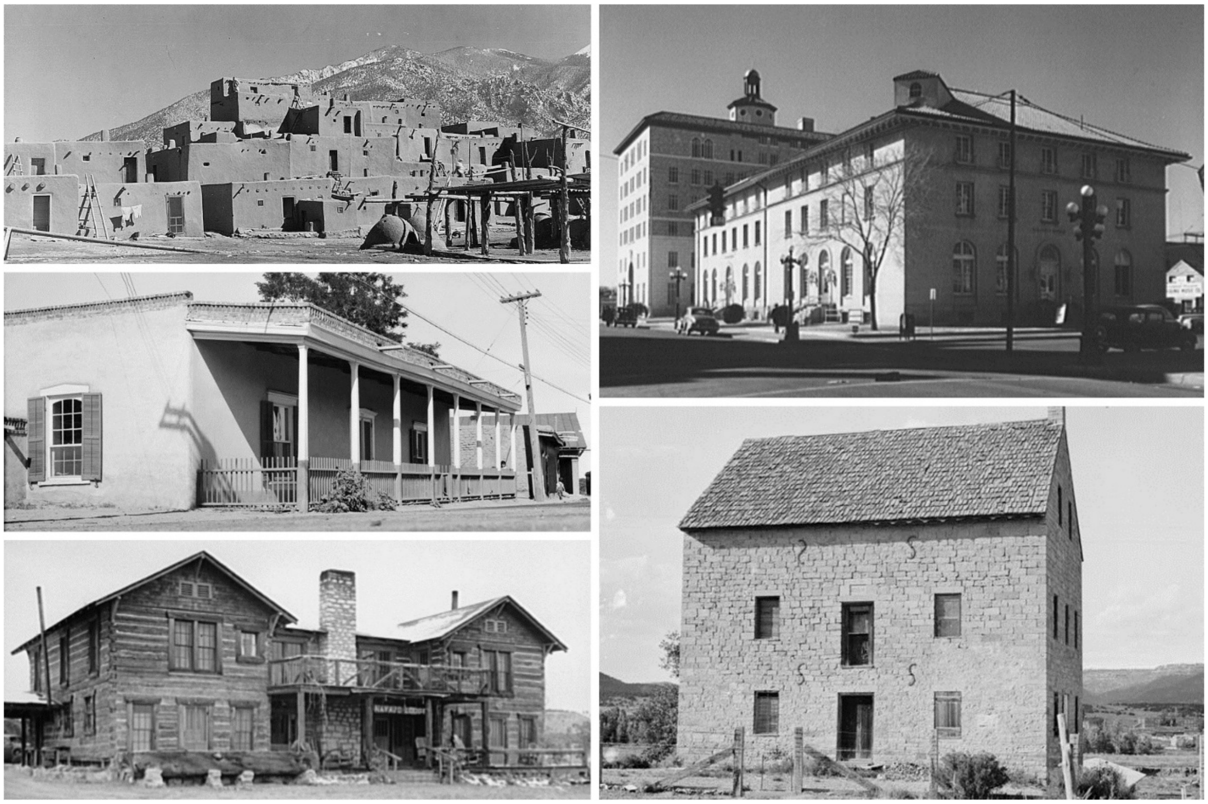

Figure 10.1.11-4: Representative Architectural Styles of New Mexico

- Top Left – Taos Pueblo (Taos, NM) – (Rothstein, 1936)
- Middle Left – Borrego House (Santa Fe, NM) – (Historic American Buildings Survey, 1933a)
- Bottom Left – Navajo Lodge (Datil, NM) – (Lee, 1940)
- Top Right – Post Office and Federal Building (Albuquerque, NM) – (Collier, 1943)
- Bottom Right – Old Aztec Mill (Cimarron, NM) – (Historic American Buildings Survey, 1933b)

10.1.12. Air Quality

10.1.12.1. Definition of the Resource

The type and amount of pollutants emitted into the atmosphere, the size, and topography[115] of the area, and the prevailing weather and climate conditions determines the air quality in a geographic area. The levels of pollutants and pollutant concentrations in the atmosphere are typically expressed in units of parts per million (ppm)[116] or micrograms per cubic meter ($\mu g/m^3$) determined over various periods of time (averaging time).[117] This section discusses the existing air quality in New Mexico. USEPA designates areas within the United States as attainment,[118] nonattainment,[119] maintenance,[120] or unclassifiable[121] depending on the concentration of air pollution relative to ambient air quality standards. Information is presented regarding national and state ambient air quality standards and nonattainment areas that would be potentially more sensitive to impacts from implementation of the Proposed Action or alternatives.

The New Mexico Environment Department (NMED) Air Quality Bureau (AQB) has authority over air quality in all areas of New Mexico except Bernalillo County and Tribal Lands. The Albuquerque Environmental Health Department - Air Quality Program (AEHD-AQP) regulates businesses located in Bernalillo County and the USEPA regulates air quality issues on Tribal Lands.

10.1.12.2. Specific Regulatory Considerations

National and State Ambient Air Quality Standards

The Clean Air Act (CAA) establishes National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: Carbon monoxide (CO), lead, oxides of nitrogen (NO_X), particulate matter ($PM_{2.5}$ and PM_{10}), ozone (O_3), and oxides of sulfur (SO_X). The NAAQS establish various standards, either primary[122] or secondary,[123] for each pollutant with varying averaging times. Standards with short averaging times (e.g., 1-hour, 8-hour, and 24-hour) were developed to prevent the acute health effects from short-term exposure at high concentrations. Longer

[115] Topography: The unique features and shapes of the land (e.g., valleys and mountains).
[116] Equivalent to 1 milligram per liter (mg/L).
[117] Averaging Time: “The period over which data are averaged and used to verify proper operation of the pollution control approach or compliance with the emissions limitation or standard” (USEPA, 2015k).
[118] Attainment areas: Any area that meets the national primary or secondary ambient air quality standard for the pollutant (USEPA, 2015l).
[119] Nonattainment areas: Any area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for the pollutant (USEPA, 2015l).
[120] Maintenance areas: An area that was previously nonattainment, but has met the national primary or secondary ambient air quality standards for the pollutant, and has been designated as attainment (USEPA, 2015l).
[121] Unclassifiable areas: Any area that cannot be classified on the basis of available information as meeting the national primary or secondary air quality standard for a pollutant (USEPA, 2015l).
[122] Primary standard: The primary standard is set to provide public health protection, including protecting the health of sensitive populations such as asthmatics, children, and the elderly (USEPA, 2014c).
[123] Secondary standards: The secondary standard is set to provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings (USEPA, 2014c).

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, Air Quality.

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, Air Quality, presents a list of federally regulated HAPs.

In conjunction with the federal NAAQS, New Mexico maintains its own air quality standards, the New Mexico Ambient Air Quality Standards (NM AAQS). Table 10.1.12-1 presents an overview of the NM AAQS as defined by NMED AQB.

Table 10.1.12-1: New Mexico Ambient Air Quality Standards (NM AAQS)

Pollutant	Averaging Time	Primary Standard		Secondary Standard		Notes
		μg/m^3	ppm	μg/m^3	ppm	
CO	8-hour	-	8.7	-	-	Maximum allowable concentration
	1-hour	-	13.1	-	-	Maximum allowable concentration
NO_2	24-hour	-	0.10	-	-	Maximum allowable concentration
	Annual	-	0.05	-	-	Maximum allowable concentration
Total Suspended Particulates	24-hour	150		-	-	Average
	7-day	110		-	-	Average
	30-day	90		-	-	Average
	Annual	60		-	-	Annual geometric mean
SO_2 (except for within 3.5 miles of the Chino Mines Company smelter furnace stack at Hurley)	24-hour	-	0.10	-	-	Average
	Annual	-	0.02	-	-	Annual arithmetic average
SO_2 (Within 3.5 miles of the Chino Mines Company smelter furnace stack at Hurley)	24- hour	-	0.14	-	-	Average, not to be exceeded more than once per year
	3-hour	-	0.50	-	-	Average, not to be exceeded more than once per year
	Annual	-	0.03	-	-	Annual arithmetic average
H_2S	1-hour	-	0.01	-	-	For the state, except the Pecos-Permian Basin Intrastate Air Quality Control Region. Not to be exceeded more than once per year.
	½-hour	-	0.10	-	-	For the Pecos-Permian Basin Intrastate Air Quality Control Region

Pollutant	Averaging Time	Primary Standard		Secondary Standard		Notes
		$\mu g/m^3$	ppm	$\mu g/m^3$	ppm	
	½-hour	-	0.03	-	-	For within corporate limits of municipalities within the Pecos-Permian Basin Intrastate Air Quality Control Region
	½-hour	-	0.03	-	-	For within five miles of the corporate limits of municipalities having a population of greater than twenty thousand and within the Pecos-Permian Basin Intrastate Air Quality Control Region
Total Reduced Sulfur	½-hour	-	0.003	-	-	For the state, except the Pecos-Permian Basin Intrastate Air Quality Control Region except for hydrogen sulfide
	½-hour	-	0.01	-	-	For the Pecos-Permian Basin Intrastate Air Quality Control Region, except for hydrogen sulfide
	½-hour	-	0.003	-	-	For within corporate limits of municipalities within the Pecos-Permian Basin Intrastate Air Quality Control Region, except for hydrogen sulfide
	½-hour	-	0.003	-	-	For within five miles of the corporate limits of municipalities having a population of greater than twenty thousand and within the Pecos-Permian Basin Intrastate Air Quality Control Region, except for hydrogen sulfide

Source: (NMED AQB, 2006)

Title V Operating Permits/State Operating Permits

New Mexico 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, 2015m). The overall goal of the Title V program is to “reduce violations of air pollution laws and improve enforcement of those laws” (USEPA, 2015m). New Mexico Administrative Code (NMAC) 20.2.70.200 (Part 70 Sources) describes the applicability of Title V operating permits. New Mexico 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 10.1.12-2). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014a).

Table 10.1.12-2: Major Air Pollutant Source Thresholds

Pollutant	TPY
Any Criteria Pollutant[a]	100
Single Hazardous Air Pollutant (HAP)	10
Total/Cumulative HAPs	25

[a] Sources in nonattainment areas will have lower thresholds for some criteria pollutants depending on the classification of the nonattainment area.
Source: (USEPA, 2014b)

Exempt Activities

NMAC 20.2.72.202.B (Construction Permits, Exemptions) lists exemptions from construction and are not to be used for Potential to emit calculations for Title V permitting. The following emissions sources and activities are exempt:

- "Fuel burning equipment which is used solely for heating buildings for personal comfort or for producing hot water for personal use and which:
    - Uses gaseous fuel and has a design rate less than or equal to five (5) million BTU per hour; or
    - Uses distillate oil (not including waste oil) and has a design rate less than or equal to one (1) million BTU per hour…
- …Standby generators which are:
    - Operated only during the unavoidable loss of commercial utility power;
    - Operated less than 500 hours per year; and
    - Either are:
        - The only source of air emissions at the site; or
        - Accompanied by sufficient record keeping to verify that the standby generator is operated less than 500 hours per year…
- …Any emissions unit, operation, or activity that has a potential emission rate of no more than one-half (1/2) ton per year of any pollutant for which a National or New Mexico Ambient Air Quality Standard has been set or one-half (1/2) ton per year of any VOC. Multiple emissions units, operations, and activities that perform identical or similar functions shall be combined in determining the applicability of this exemption…" (NMED AQB, 2001).

In addition, sources that are located on Indian tribal jurisdiction are exempt from obtaining a Part 70 permit through NMED, however will have to go through the tribal authority. (NMED AQB, 2011)

Temporary Emissions Sources Permits

NMED AQB does not have separate temporary emissions permitting as both portable and temporary sources are required to obtain construction and operation permits per stationary guidelines (NMED AQB, 2002). However, the NMED AQB can issue permits for temporary and portable sources allowing them to relocate without obtaining permit modifications (NMED AQB, 2011). All activities should review applicable stationary source requirements, or contact the NMED AQB for additional assistance.

State Preconstruction Permits

NMED AQB requires stationary sources that have the potential to emit greater than 10 pounds per hour or 25 TPY of any regulated air contaminant for which there is a NAAQS or NM AAQS to obtain a construction permit prior to commencing construction. Portable and temporary installations are not exempt from this requirement and must review applicable construction requirements prior to installation at a site. (NMED AQB, 2002)

General Conformity

Established under Section 106(c)(4) of the CAA, “the General Conformity Rule ensures that the actions taken by federal agencies in nonattainment and maintenance areas do not interfere with a state’s plans to meet national standards for air quality” outlined in the state implementation plan (SIP) (USEPA, 2013a).An action in designated nonattainment and maintenance areas would be evaluated for the emission of those particular pollutants under the General Conformity Rule through an applicability analysis. Pursuant to Title 40 CFR 93.153(d)(2) and (e), Federal actions “in response to emergencies which are typically commenced on the order of hours or days after the emergency” and actions “which are part of part of a continuing response to emergency or disaster” that are taken up to 6 months after beginning response activities, will be exempt from any conformity determinations (GPO, 2010).

The estimated pollutant emissions are compared to *de minimis*[124] levels. These values are the minimum thresholds for which a conformity determination must be performed (see Table 10.1.12-3). As a result, lower *de minimis* thresholds for VOCs and NO_2 could apply depending on the attainment status of a county.

[124] 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.”

Table 10.1.12-3: *De Minimis* Levels

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

Source: (GPO, 2010)

If an action does not result in an emissions increase above the *de minimis* levels in Table 10.1.12-3, then a conformity determination is not required. If the applicability analysis shows that the total direct and indirect emissions are above the *de minimis* levels in Table 10.1.12-3, then the action must undergo a conformity determination. The federal agency must first show that the action would meet all SIP control requirements and that any new emissions would not cause a new violation of the NAAQS. To demonstrate conformity[125], the agency would have to fulfill one or more of the following:

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

State Implementation Plan Requirements

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

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

codified under 40 CFR Part 52 Subpart GG. A list of all SIP actions for all six criteria pollutants can be found on NMED at AQBhttps://www.env.nm.gov/aqb/Control_Strat/sip/new_mexico_state_implementation_.html.

10.1.12.3. Specific Regulatory Considerations for the Albuquerque Environmental Health Department - Air Quality Program (AEHD-AQP)

National and State Ambient Air Quality Standards

The Albuquerque Environmental Health Department - Air Quality Program (AEHD-AQP) monitors and regulates Albuquerque and Bernalillo County air quality. In conjunction with the federal NAAQS, AEHD-AQP maintains its own air quality standards as defined by the Albuquerque - Bernalillo County Air Quality Control Board (ABC-AQCB) Title 20, Chapter 11, Part 8 (Ambient Air Quality Standards). The AEHD-AQP are the same as the New Mexico Ambient Air Quality Standards, with the exception of hydrogen sulfide and total reduced sulfur, which are the same, as shown in Table 10.1.12-1 (ABC-AQCB, 2009).

Title V Operating Permits/State Operating Permits

AEHD-AQP 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, 2013b). The overall goal of the Title V program is to "reduce violations of air pollution laws and improve enforcement of those laws" (USEPA, 2013b). ABC-AQCB NMAC Title 20, Chapter 11, Part 42 (Operating Permits) describes the applicability of Title V operating permits. AEHD-AQP regulations 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 10.1.12-2). The permit issued to a facility contains both state and federal portions and incorporates a reporting schedule (USEPA, 2014b).

Exempt Activities

AEHD-AQP does not explicitly exempt any source from obtaining a permit. All activities should review applicable stationary source requirements, or contact the AEHD-AQP for additional assistance. In addition, sources that are located on Indian tribal jurisdiction are exempt from obtaining a Part 70 permit through AEHD-AQP, however will have to go through the tribal authority. (ABC-AQCB, 2013)

Temporary Emissions Sources Permits

AEHD-AQP does not have separate temporary emissions permitting as both portable, temporary sources are required to obtain construction, and operation permits as per stationary guidelines. All activities should review applicable stationary source requirements, or contact the AEHD-AQP for additional assistance. (ABC-AQCB, 2014)

State Preconstruction Permits

AEHD-AQP requires stationary sources that have the potential to emit greater than 10 pounds per hour or 25 TPY of any regulated air contaminant for which there is a NAAQS or NM AAQS to obtain a construction permit prior to commencing construction. Portable and temporary installations are not exempt from this requirement and must review applicable construction requirements prior to installation at a site. Source that are located on Indian tribal jurisdiction are exempt from obtaining a construction permit through AEHD-AQP, however will have to go through the tribal authority.

"The following activities may be commenced or changed without a permit or permit modification under 20.11.41 NMAC if the emissions and activities are not subject to any requirement under a local board regulation, the New Mexico Air Quality Control Act, NMSA 1978, NSPS or NESHAP:

- …Use of portable support equipment such as power generation equipment, compressors, heaters, air conditioning and lighting equipment used for activities that include, but are not limited to maintenance and repair if the equipment is used fewer than 12 consecutive months at the same location and the equipment does not directly support an otherwise regulated portable stationary source (such as a screening plant, sand and gravel processing equipment, hot mix asphalt plant, concrete plant or soil vapor extraction system)…" (ABC-AQCB, 2014).

Also, "an applicant for a permit is not required to obtain a permit for the following new or modified sources and activities at a facility, but is required to report the following on permit application forms available from the department: fuel burning equipment that is used solely for heating buildings for personal comfort or for producing hot water for personal use and that: (a) uses gaseous fuel and has a design rate of five million BTU per hour or less; or (b) uses distillate oil, but not including waste oil, and has a design rate of one million BTU per hour or less." (ABC-AQCB, 2014)

Registration and Fugitive Dust

Registration is required for all emissions sources with exception to sources that are located on Indian lands where the AEHD-AQP does not have jurisdiction or sources that the AEHD-AQP exempts from this requirement. (ABC-AQCB, 2001)

Under NMAC 20.11.20 (Fugitive Dust Control) land disturbance activities that will disturb three-quarter of an acre or more must do one of the following:

- Obtain a fugitive dust control programmatic permit pursuant to 20.11.20.13 NMAC or
- Obtain a fugitive dust control construction permit pursuant to 20.22.20.14 NMAC. (ABC-AQCB, 2008)

General Conformity

The AEHD-AQP follows the federal General Conformity regulations and do not maintain their own. See section 10.1.12.2 for a general discussion of the Federal General Conformity regulations.

State Implementation Plan Requirements

The AEHD-AQP SIP is composed of many related actions to ensure ambient air concentrations of the six criteria pollutants comply with the NAAQS. AEHD-AQP's SIP is a conglomeration of separate actions taken for each of the pollutants. All of AEHD-AQP's SIP actions are codified under 40 CFR Part 52 Subpart GG (under New Mexico's). A list of all SIP actions for all six criteria pollutants can be found on USEPA's website (https://www.cabq.gov/airquality/air-quality-control-board/state-implementation-plans-sip).

10.1.12.4. 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 10.1.12-1 and Table 10.1.12-4 present the current nonattainment areas in New Mexico as of January 30, 2015. Table 10.1.12-4 contains the nonattainment status of each criteria pollutant for New Mexico. 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 listed are in effect. Figure 10.1.12-1 does not differentiate between standards for the same pollutant. Additionally, given that particulate matter is the criteria pollutant of concern, PM_{10} and $PM_{2.5}$ merge in the figure to count as a single pollutant.

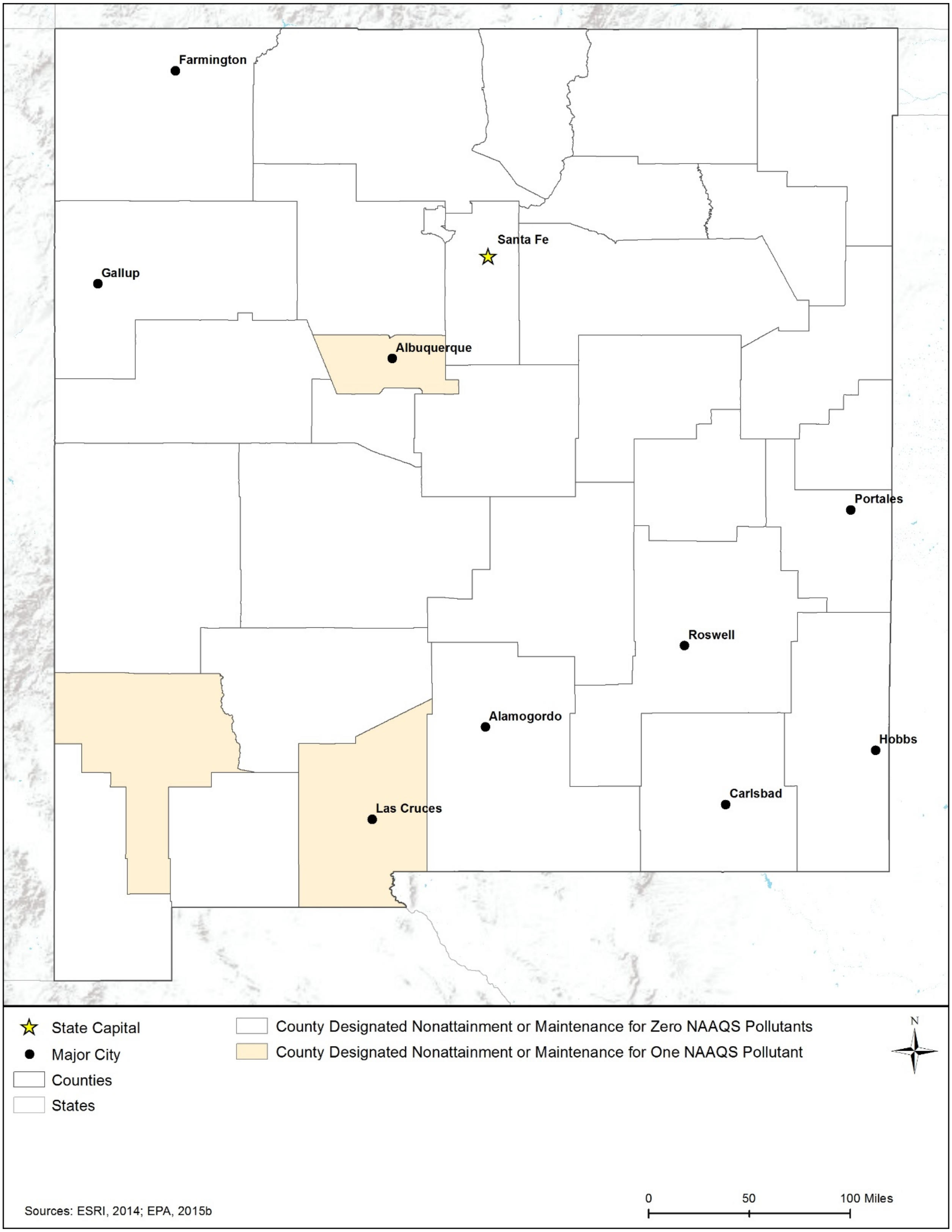

Figure 10.1.12-1: Nonattainment and Maintenance Counties in New Mexico

Table 10.1.12-4: New Mexico Nonattainment and Maintenance Areas by Pollutant Standard and County

County	Pollutant and Year USEPA Implanted 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
Bernalillo	M										
Dona Ana					X-4						
Grant										M	

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
Source: (USEPA, 2015n)

Air Quality Monitoring and Reporting

The NMED AQB measures air pollutants at 21 sites across the state as part of the National Air Monitoring Stations Network and the State and Local Air Monitoring Stations Network. Annual New Mexico State Ambient Air Quality Reports are prepared, containing pollutant data summarized by region. NMED AQB reports real-time pollution levels of NO_2, O_3, particulate matter (PM_{10} and $PM_{2.5}$), and SO_2 on their website at https://www.env.nm.gov/aqb/documents/2015_AnnualNetworkReview.pdf. (NMED AQB, 2015).

Air Quality Control Regions

USEPA classified all land in the United States as a Class I, Class II, or Class III Federal Air Quality Control Region (AQCR) (42 U.S.C. § 7470). These are different from the air quality classification levels defined in Table 10.1.12-1 as part of the NM AAQS. 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[126] of a Class I area. "The EPA's policy is that FLMs should be notified by the Regional Office about any project that is within 100 kilometers of a Class I area. For sources having the capability to affect air quality at greater distances, notification should also be considered for Class I areas beyond 100 kilometers" (Page, 2012).

[126] The memorandum and associated guidance use kilometers. 100 kilometers is equal to about 62 miles.

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

New Mexico contains nine 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 (USEPA, 1992). Arizona has four, Colorado has three and Texas has one Class I area where the 100-kilometer buffer intersects a few New Mexico counties. Any PSD-applicable action within these counties would require FLMs notification from the appropriate Regional Office. Figure 10.1.12-2 provides a map of New Mexico highlighting all relevant Class I areas and all areas within the 100-kilometer radiuses. The numbers next to each of the highlighted Class I areas in Figure 10.1.12-2 correspond to the numbers and Class I areas listed in Table 10.1.12-5.

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

Table 10.1.12-5: Relevant Federal Class I Areas

#[a]	Area	Acreage	State
1	Wheeler Peak Wilderness	6,027	NM
2	San Pedro Parks Wilderness	41,132	NM
3	Bandelier Wilderness	23,267	NM
4	Pecos Wilderness	167,416	NM
5	Gila Wilderness	433,690	NM
6	Bosque del Apache (Chupadera Unit)	80,850	NM
	Bosque del Apache (Indian Well Unit)		
	Bosque del Apache (Little San Pascual Unit)		
7	White Mountain Wilderness	31,171	NM
8	Salt Creek Wilderness	8,500	NM
9	Carlsbad Caverns NP	46,435	NM
10	Guadalupe Mountains NP	76,292	TX
11	Chiricahua NM Wilderness-Designated Wilderness	9,440	AZ
	Chiricahua NM Wilderness-Designated Wilderness		
	Chiricahua NM Wilderness-Designated Wilderness		
	Chiricahua NM Wilderness-Not Studied		
	Chiricahua Wilderness	18,000	AZ
12	Petrified Forest NP	93,493	AZ
13	Mount Baldy Wilderness	6,975	AZ
14	Great Sand Dunes Wilderness-NP	33,450	CO
15	Mesa Verde NP	51,488	CO
16	Weminuche Wilderness	400,907	CO

[a] The numbers correspond to the shaded regions in Figure 10.1.12-2.
Source: (USEPA, 2012a)

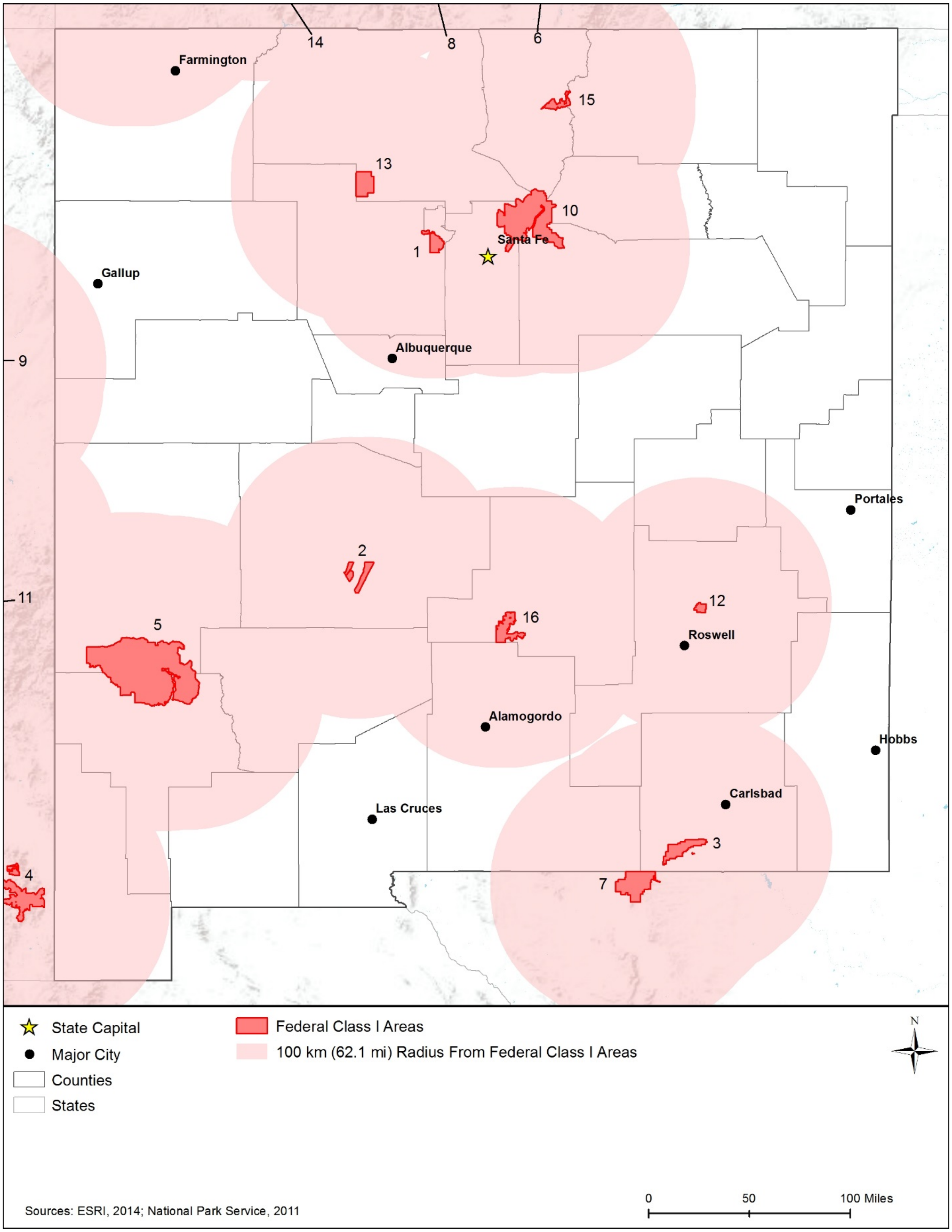

Figure 10.1.12-2: Federal Class I Areas With Implications for New Mexico

10.1.13. Noise

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

10.1.13.1. 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, 2015g). The A-weighted scale, denoted as dBA, approximates the range of human hearing by filtering out lower frequency noises, which are not as damaging as the higher frequencies. The dBA scale is used in most noise ordinances and standards (OSHA, 2016a).

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 10.1.13-1 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.

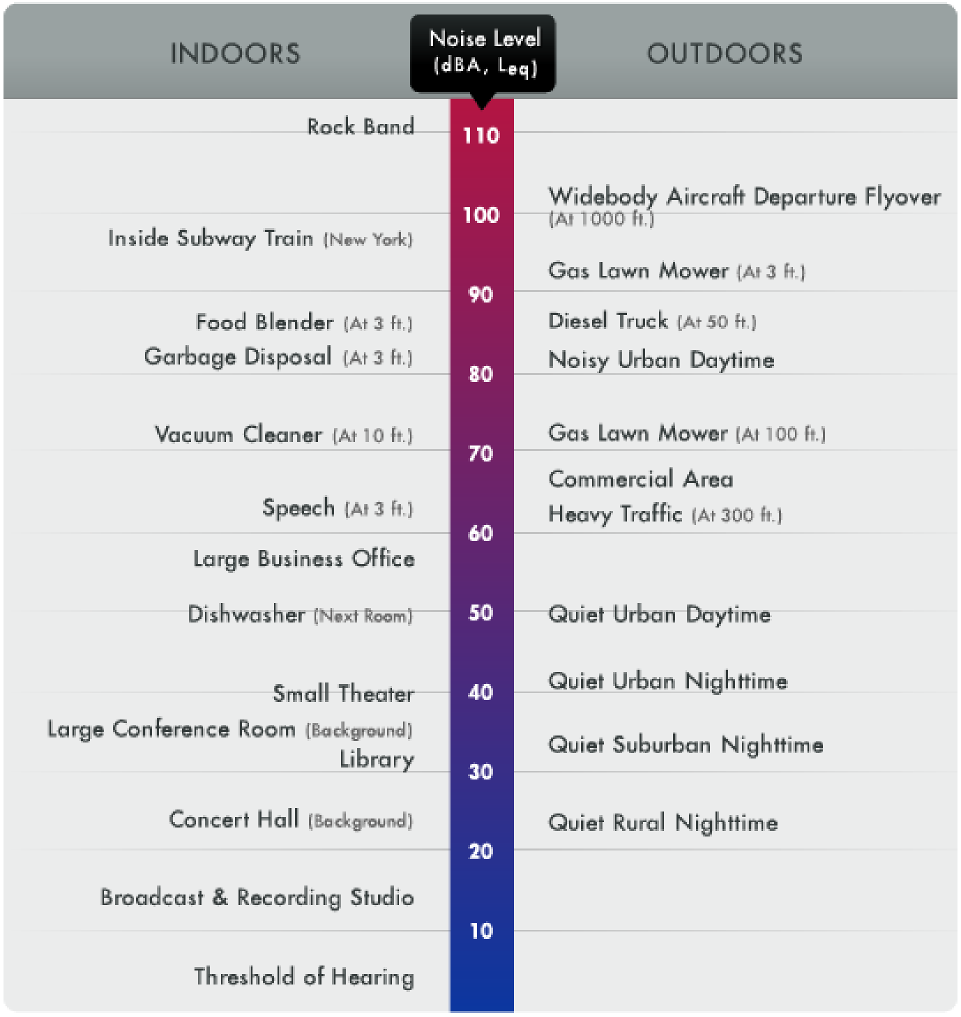

Figure 10.1.13-1: Sound Levels of Typical Sounds

Leq: Equivalent Continuous Sound Level
Source: (Sacramento County Airport System, 2015)
Prepared by: Booz Allen Hamilton

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

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

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

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

10.1.13.2. 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.

New Mexico does have state-wide noise regulations. However, they deal with various restrictions on motor vehicle noise levels, such as horns and mufflers, that would be applied to vehicles used under the Proposed Action regardless of whether or not the action occurs. Many cities and towns may have additional local noise ordinances to manage community noise levels. The noise limits specified in such ordinances are typically applied to define noise sources and specify a maximum permissible noise level. Large cities and towns, such as Albuquerque, 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).

10.1.13.3. Environmental Setting: Ambient Noise

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. The population of New Mexico can choose to live and interact in areas that are large cities, rural communities, and national and state parks. Figure 10.1.13-1 illustrates noise values for typical community settings and events that are representative of what the population of New Mexico may experience on a day-to-day basis. These noise levels represent a wide range and are not specific to New Mexico. As such, this section describes the areas where the population of New Mexico can potentially be exposed to higher than average noise levels.

- **Urban Environments:** Urban areas are likely to have higher noise levels on a daily basis due to highway traffic (70 to 90 dBA), construction noise (90 to 120 dBA), and outdoor conversations (e.g., small/large groups of people) (60 to 90 dBA) (USDOI, 2008). The areas that are likely to have the highest ambient noise levels in the state are in and around Albuquerque.
- **Airports:** Areas surrounding airports tend to be more sensitive to noise due to aircraft operations that occur throughout the day. A jet engine aircraft can produce between 130 to 160 dBA in its direct proximity (FAA, 2007). However, commercial aircraft are most likely to emit noise levels between 70 to 100 dBA depending of the type of aircraft and associated engine (FAA, 2012). This noise will be perceived differently based on the altitude of the aircraft and its distance to the point of measurement. Airport operations are primarily arrivals and departures of commercial aircraft, but based on the type of airport, can include

touch-and-go operations that are typical of general aviation airports and military airfields. The location of most commercial airports are in the proximity of urban communities; therefore, aircraft operations (arrivals/departures) can result in noise exposure in the surrounding areas to be at higher levels with the potential for increased noise levels during peak operation times (early morning and evenings), when there is an increase in air traffic. The noise levels in areas surrounding commercial airports can have significantly higher ambient noise levels than in other areas. In New Mexico, Albuquerque International Sunport (ABQ) has 130,002 annual operations (FAA, 2015j). These operations result in increased ambient noise levels in the surrounding communities. See Section 10.1.1, Public Safety Infrastructure, and Figure 10.1.7-7 for more information about airports in the state.

- **Highways:** Communities near major highways also experience higher than average noise levels when compared to areas that are not in close proximity to a highway (FHWA, 2015d). There are a number of major highways within the state that may contribute to higher ambient noise levels for residents living in those areas. The major highways in the state tend to have higher than average ambient noise levels on nearby receptors, ranging from 52 to 75 dBA (FHWA, 2015d). See Section 10.1.1, Public Safety Infrastructure, and Figure 10.1.1-1 for more information about the major highways in the state.
- **Railways:** Like highways, railways tend to have higher than average ambient noise levels for residents living in close proximity (FTA, 2006). Railroad operations can produce noise ranging from 70 dBA for an idling locomotive to 115 dBA when the locomotive engineer rings the horn while approaching a crossing (FRA, 2015). New Mexico has multiple rail corridors with high levels of commercial and commuter rail traffic. These major rail corridors include lines that extend mainly from Albuquerque, Santa Fe, and Las Cruces to other cities in New Mexico, Texas, Arizona, and Colorado, such as the Union Pacific Railroad and the Burlington Northern & Santa Fe Railroad. There are also a number of other rail corridors that join these major rail lines and connect with other cities (NMDOT, 2016). See Section 10.1.1, Public Safety Infrastructure, and Figure 10.1.1-1 for more information about rail corridors in the state.
- **National and State Parks:** 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. These areas typically have lower noise levels, as low as 30 to 40 dBA (NPS, 2014g). New Mexico has 15 national parks and 12 National Natural Landmarks (NPS, 2014f). Visitors to these areas expect lower ambient noise conditions than the surrounding urban areas. See Section 10.1.8, Visual Resources for more information about national and state parks for New Mexico.

10.1.13.4. Sensitive Noise Receptors

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

(BLM, 2014). Most cities, towns, and villages in New Mexico have at least one school, church, or park, in addition to likely having other noise-sensitive receptors. There are most likely thousands of sensitive receptors throughout the state of New Mexico.

10.1.14. Climate Change

10.1.14.1. 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),[128] which equalizes for the different global warming potential of each type of GHG. Where this document references emissions of CO_2 only, the units will be in million metric tons (MMT) CO_2. Where the document references emissions of multiple GHGs, the units are in MMT CO_2e.

The IPCC reports that "global concentrations of these four GHGs have increased significantly since 1750" with "Atmospheric concentrations of CO_2 increased from 280 parts per million (ppm) of carbon in 1750 to 379 ppm of carbon in 2005" (IPCC, 2007). The atmospheric concentration of CH_4 and N_2O have increased from pre-industrial values of about 715 and 270 parts per billion (ppb) to 1774 and 319 ppb, respectively, in 2005 (IPCC, 2007). In addition, the IPCC reports that human activities are causing an increase in various hydrocarbons from near-zero pre-industrial concentrations (IPCC, 2007).

Both the GHG emissions effects of the Proposed Action and Alternatives, and the relationships of climate change effects to the Proposed Action and Alternatives, are considered in this PEIS (see 10.2, Environmental Consequences). Existing climate conditions in the project area are described first by state and sub-region, where appropriate, and then by future projected climate scenarios. The discussion focuses on the following climate change impacts: 1) temperature; 2) precipitation; and 3) severe weather events (including flooding, drought, and severe thunderstorms).

[128] CO_2e refers to Carbon Dioxide Equivalent, "A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as million metric tons of carbon dioxide equivalents ($MMTCO_2e$). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP. $MMTCO_{2e}$ = (million metric tons of a gas) * (GWP of the gas)" (USEPA 2015).

10.1.14.2. Specific Regulatory Considerations

The pertinent federal laws relevant to the protection and management of climate change are summarized in Appendix C, Environmental Laws and Regulations. New Mexico has established goals and regulations to reduce GHG emissions to combat climate change. As shown in Table 10.1.14-1, three key state laws/regulations are the primary policy drivers on climate change preparedness and GHG emissions.

Table 10.1.14-1: Relevant New Mexico Climate Change Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
Executive Order 2005-033: Establishing the New Mexico Climate Change Action Council and the New Mexico Climate Change Advisory Group (CCAG)	State of New Mexico	Executive Order 2005-033 was signed on June 5, 2005, which established the New Mexico Climate Change Action Council and the New Mexico Climate Change Advisory Group (CCAG). The Climate Change Action Group reviewed and provided recommendations to the Governor's office regarding climate change policy. The Council was chaired by the Secretary of the Environment and will had representatives from the Departments of Agriculture; Economic Development; Energy, Mining, and Natural Resources; General Services; Health; Indian Affairs; and Transportation. The State Engineer, Director of Game and Fish, and the Governor's Advisor on Energy and Environment also served on the Council. Drawing on its own expertise and the perspectives of the CCAG members, the Advisory Group found meaningful solutions that fit New Mexico's unique needs and circumstances.
2006-069: New Mexico Climate Change Action	State of New Mexico	Executive Order 2006-069 was signed on December 28, 2006, and established a Climate Change Action Implementation Team, under the direction of the Clean Energy Development Council, whose advisory responsibility is to ensure that the directives of this EO to address climate change in various ways are implemented. Some actions include adopting a GHG emissions registry and reporting mechanism; creating a state clean standard; and regulating recycling in government buildings among many others.
Executive Order 2009-047: Establishing New Mexico as a Leader in Addressing Climate Change	State of New Mexico	Executive Order 2009-047 was signed on December 4, 2009, and directs new emission reduction strategies to address climate change in New Mexico and builds on actions to implement from EO 2006-069.

10.1.14.3. New Mexico Greenhouse Gas Emissions

Estimates of New Mexico's total GHG emissions vary. The DOE's Energy Information Agency (EIA) collects and disseminates national-level emissions data on other GHGs such as CH_4 and nitrous oxide (NO_2), but not at the state level (EIA, 2015c). The USEPA also collects and disseminates national-level GHG emissions data, but by economic sector, not by state (USEPA, 2015o). 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, New Mexico emitted a total of 54.2 MMT of CO_2 in 2013. The electric power sector was the largest emitter at 28.9 percent of total emissions, including all emissions from coal and 33 percent of the natural gas emissions (Table 10.1.14-2) (EIA, 2015d). Annual emissions between 1980 and 2013 are presented in Figure 10.1.14-2. Between 1980 and 2006, New Mexico's CO_2 emissions increased intermittently to a maximum of 59.6 MMT before beginning an intermittent decline to their current levels. Coal dominates the emissions profile throughout this time period, and the proportion of total emissions of coal, petroleum products, and natural gas has not changed significantly as overall emissions rose and fell (EIA, 2015e). New Mexico was ranked 12th in per-capita energy-related GHG emissions in 2011 (EIA, 2014b), but was ranked 36th in total CO_2 emissions in 2013 (EIA, 2015f).

Table 10.1.14-2: New Mexico CO_2 Emissions from Fossil Fuels by Fuel Type and Source, 2012

Fuel Type (MMT)		Source (MMT)	
Coal	24.2	Residential	2.3
Petroleum Products	16.2	Commercial	1.4
Natural Gas	13.4	Industrial	8.4
		Transportation	13.3
		Electric Power	28.2
TOTAL	**53.9**	**TOTAL**	**53.9**

Source: (EIA, 2015g)

The New Mexico Environment Department prepared a 2000 to 2007 greenhouse gas emission inventory in 2010 (New Mexico Environment Department, 2010). The report includes estimates for GHG emissions in 1990, 2000, and 2007. GHG emissions were estimated at 65.3 MMT CO_2e in 1990, 77.0 MMT CO_2e in 2000, and 76.2 MMT CO_2e in 2007. The majority of New Mexico's GHG emissions is CO_2 resulting from fossil fuel combustion for electricity. Other GHGs emitted in New Mexico are CH_4, NO_2, with small quantities of hydrofluorocarbons (HFCs), sulfur hexafluoride (SF_6) and perfluorocarbons (PFCs) (New Mexico Environment Department, 2010).

GHG emissions broke down across sectors in 2007 with 42 percent from the electric power sector, 22 percent from the fossil fuel industry, 20 percent from transportation (with an increasing proportion from diesel fuel), and the remainder attributed to other sectors such as agriculture, non-fossil fuel industries, and waste management (New Mexico Environment Department, 2010). Electricity in New Mexico is generated from natural gas and coal with a growing percentage from wind and solar (EIA, 2015h). New Mexico is home to three of the largest oil fields in the nation and produces four percent of the nation's crude, as well as four percent of the natural gas. Production is on the rise due to new horizontal drilling technology

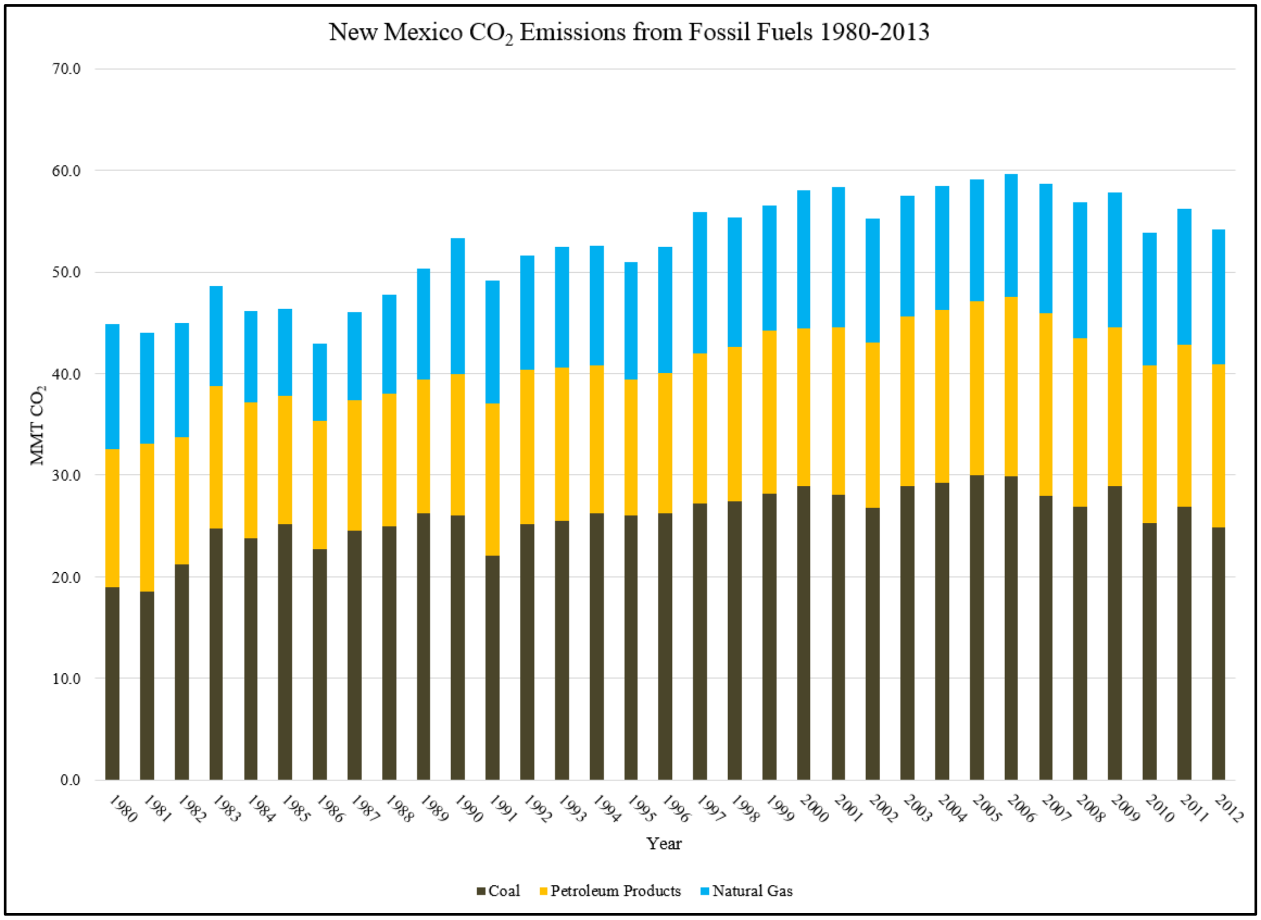

Figure 10.1.14-1: New Mexico CO_2 Emissions from Fossil Fuels by Fuel Type 1980-2013

Source: (EIA, 2015g)

and oil recovery techniques (EIA, 2015h). New Mexico is a significant producer and exporter of natural gas. There are four coal mines in New Mexico that produce coal for nearby power plants. Because California is adapting new air quality regulations, electricity generation from coal will likely continue decline along with coal emissions.

10.1.14.4. Environmental Setting: Existing Climate

The National Weather Service defines climate as the "reoccurring average weather found in any particular place" (NWS, 2011a). The widely-accepted division of the world into major climate categories is referred to as the Köppen-Geiger climate classification system. Climates within this system are classified based "upon general temperature profiles related to latitude" (NWS, 2011a). The first letter in each climate classification details the climate group. The Köppen-Geiger system further divides climates into smaller sub-categories based on precipitation and temperature patterns. The secondary level of classification details the seasonal precipitation, degree of aridity, and presence or absence of ice. The tertiary levels distinguish different monthly characteristics (NWS, 2011b).

The majority of New Mexico is classified within the climate group B. Climates classified as B are dry climates, “in large continental regions of the mid-latitudes often surrounded by mountains” (NWS, 2011a). “The most obvious climatic feature of this climate is that potential evaporation and transpiration exceed precipitation” (NWS, 2011a). Although the majority of the state is classified within climate group B, areas of northern New Mexico are classified 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). New Mexico has three sub-climate categories, which are described below in the following paragraphs.

Bsk – The Köppen-Geiger climate classification system classifies the majority of New Mexico 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)

BWk – The Köppen-Geiger climate classification system classifies areas of southern and southwestern New Mexico as (BWk). Climates classified as (BWk) are mid-latitude deserts, with mean annual temperatures that are less than 64 °F and are too dry to support most plant life. Evaporation in (BWk) climates “exceeds precipitation on average but is less than half potential evaporation” (NWS, 2011b). Winters in (BWk) climates zones typically experience “below freezing temperature” (NWS, 2011b) (GLOBE SCRC, 2015)

Dfa – The Köppen-Geiger climate classification system classifies areas of northern New Mexico 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)

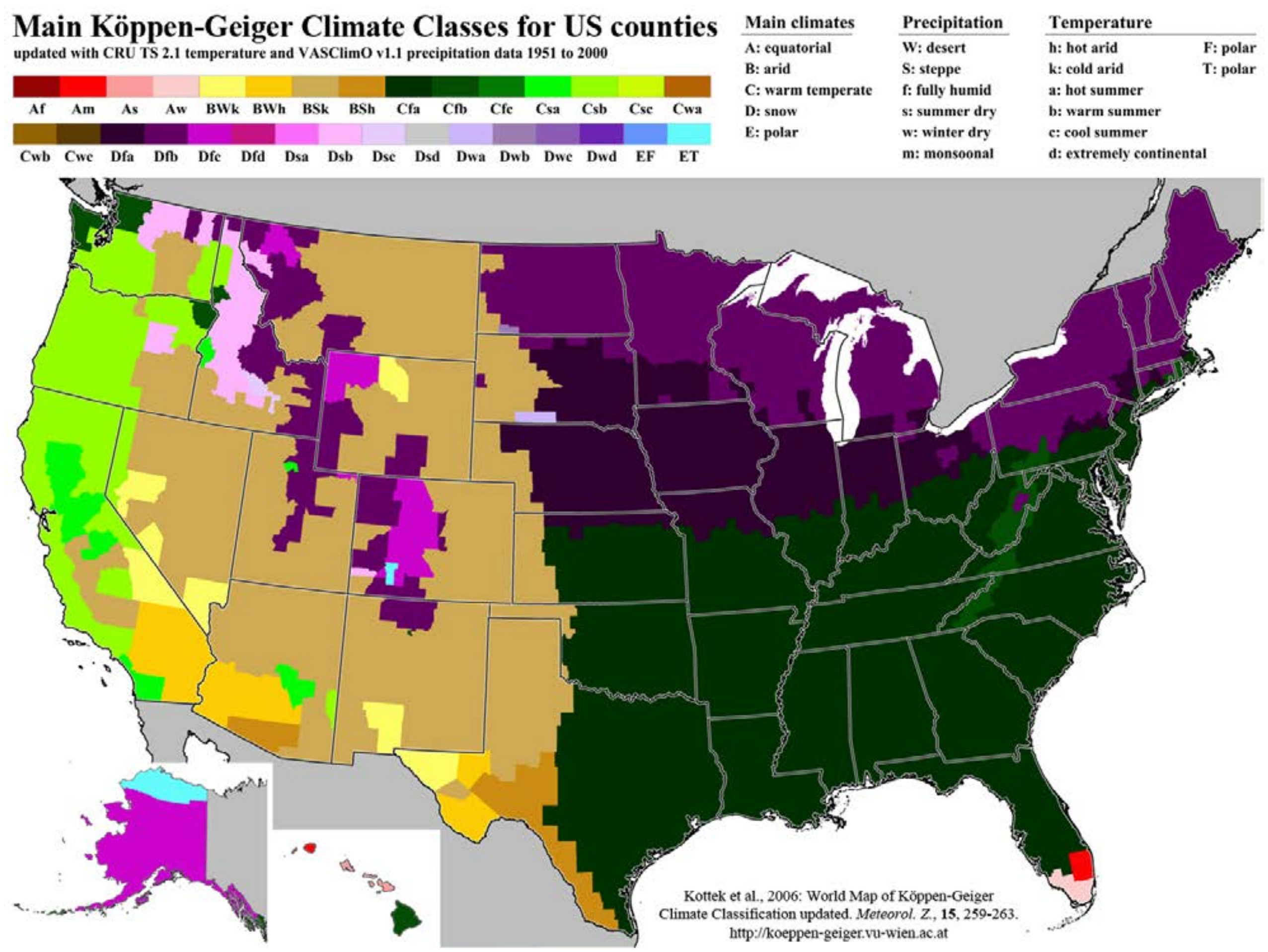

Figure 10.1.14-2: Köppen-Geiger Climate Classes for U.S. Counties

Source: (Kottek, 2006)

Air Temperature

Elevations in New Mexico "range from 2,817 feet in the south along the Pecos over to the top of Wheeler Peak at 13,161 feet high in the Sangre de Cristo Mountains" (DuBois, 2015). Regions in the south, with low elevations and desert-like climates are generally hot during summer months, with mild winter temperatures. Average annual temperatures in New Mexico range from approximately 64 °F in the southeast to 40 °F or lower in the north. Maximum average temperatures in the southeastern areas of the state can reach 110 °F, while areas of higher elevation reach a maximum of 80 °F. During winter months, temperatures commonly drop to below zero in higher elevations, while remaining in the teens in lower elevations. January is New Mexico's coldest month, with average daytime temperatures ranging from approximately 55 °F in the south and central valley to approximately 35 °F in the north. The highest temperature to occur in New Mexico was on June 27, 1994 with a record high of 122 °F (SCEC, 2015). The lowest temperature to occur in New Mexico was on February 1, 1951 with a record low of negative 50 °F (SCEC, 2015). (DuBois, 2015) (New Mexico State University, 2015)

Precipitation

Statewide, average rainfall is approximately 13.9 inches. In New Mexico, areas of higher elevations receive the highest amounts of precipitation during the year, with areas such as Sangre de Cristo, San Juan, San Pedro, and Mogollon Mountains receiving an average of 45 inches per year (DuBois, 2015). In central valley, south central, and northwestern regions of the state, average rainfall totals are minimal by comparison, with many of these areas considered the driest in the state. On average, these drier areas receive less than 10 inches of precipitation annually. In Newcomb, located in norther western New Mexico, annual average rainfall totals are approximately 5.97 inches (1971 through 1990 precipitation normals). (DuBois, 2015)

The majority of precipitation throughout the state is received during the summer monsoon season, as air masses travel from the Pacific Ocean, Gulf of California, and Gulf of Mexico into the state. “Thunderstorms in summer can cause short but intense rainfall and can be highly localized” (DuBois, 2015). The greatest 24-hour precipitation accumulation to occur in the state was on March 18, 1955 with a total of 11.28 inches in Lake Maloya (SCEC, 2015). (DuBois, 2015)

Snowfall in New Mexico is also highly variable, with average annual totals ranging from “less than an inch at the south to more than 100 inches at Northern Mountains stations” (DuBois, 2015). In Red River specifically, average annual snowfall is approximately 147 inches (1906 through 2008 snowfall normals). In the highest mountains in northern New Mexico, snowfall totals can even exceed 300 inches. In low-lying, desert-like climate in New Mexico, measureable snowfall is extremely rare. The greatest 24-hour snowfall accumulation to occur in the state was on February 3, 1964 with a total of 42 inches in Kelly Ranch (SCEC, 2015). (DuBois, 2015)

Severe Weather Events

Generally, widespread floods do not occur in New Mexico. If floods do occur, they are localized and associated with heavy summertime thunderstorms. Thunderstorms occur an average of 40 times a year in the south and an average of 70 times in the northeast. Due to the state’s rough terrain and sparse vegetation, heavy rainfall most often leads to runoff and flash flooding. Floods in New Mexico can also occur due to rapid or excessive snowmelt. Occasionally, thunderstorms in New Mexico are associated with severe hailstorms. The greatest hail frequency occurs east of Los Alamos. (New Mexico State University, 2015)

New Mexico’s wettest year on record was 1941, with a statewide precipitation total of 27.06 inches; by comparison, the long-term statewide annual average is approximately 13.65 inches. This extreme precipitation, in combination with tropical storm remnants from September, caused 26 fatalities and over $2 million in damages. More recently, in July 2008, another significant flooding event occurred due to remnants of Hurricane Dolly and associated precipitation. In total, over 500 buildings were damages, 200 homes were either damaged or destroyed, and over $25 million in damages occurred. Only one death was reported. (NWS, 2015a)

“Severe weather in the form or tornadoes are most frequent from May to August when moist air masses from the Gulf of Mexico move inland and encroach the eastern part of the state” (DuBois, 2015). The majority of tornadoes in southern New Mexico occur during summer months, from June until August. On average, nine tornadoes occur in New Mexico each year. New Mexico’s deadliest tornado occurred in 1930 near Wagon Mound. In total, three people died, 19 were injured, and over $150,000 in property damages. In 1964, another destructive tornado occurred, causing one death, eight injuries, and over $450,000 in property damages. (New Mexico State University, 2015)

Overall, average wind speeds throughout the state are moderate. During spring months, high intensity windstorms are common, with winds reaching up to 90 miles per hour (mph). High intensity windstorms are most common along mountain ranges and on ridge tops. High winds “generally predominate from the southeast in summer and from the west in winter, but local surface wind directions will vary greatly because of local topography and mountain and valley breezes” (New Mexico State University, 2015). (DuBois, 2015) (New Mexico State University, 2015)

10.1.15. Human Health and Safety

10.1.15.1. Definition of the Resource

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

The health and safety issues reviewed in this section include occupational safety for telecommunications workers, contaminated sites, and manmade or natural disaster sites. This section does not evaluate the health and safety risks associated with radio frequency (RF) radiation or vehicle traffic. Vehicle traffic and the transportation of hazardous materials and wastes are evaluated in Section 10.1.1, Infrastructure.

10.1.15.2. Specific Regulatory Considerations

Federal organizations, such as OSHA, USEPA, the U.S. Department of Health and Human Services, and others protect human health and the environment. In New Mexico, this resource area is regulated by the NMED, which includes the New Mexico Occupational Health and Safety Bureau. Federal OSH regulations apply to workers through either OSHA, or stricter state-specific plans that must be approved by OSHA. New Mexico's Occupational Safety and Health Bureau (New Mexico OSHB) State Plan is an OSHA-approved "State Plan," which covers private and public sector employers. New Mexico OSHB incorporates all federal OSHA regulations by reference and has unique regulations for State and Local government firefighting, convenience stores, field sanitation, and short-handed hoe operators (OSHA, 2015a). Occupational safety and health regulations are enforced at the state level by New Mexico OSHA compliance officers and at the federal level by OSHA. Public health is regulated by the New Mexico Department of Health (NMDH).

Federal laws relevant to protecting occupational and public health and safety are summarized in Appendix C, Environmental Laws and Regulations, and Section 1.8, Overview of Relevant Federal Laws and Executive Orders. Table 10.1.15-1 below summarizes the major New Mexico laws relevant to the state's occupational health and safety, hazardous materials, and hazardous waste management programs.

Table 10.1.15-1: Relevant New Mexico Human Health and Safety Laws and Regulations

State Law/Regulation	Regulatory Agency	Applicability
New Mexico Administrative Code (NMAC): Title 10, Chapter 6, Part 2	New Mexico Department of Public Safety	Outlines requirements for Enhanced 911 services, including public safety answering points, dispatch operations, and training requirements for telecommunications workers.
NMAC: Title 10, Chapter 20	New Mexico Department of Homeland Security and Emergency Management	Specifies requirements of the New Mexico Hazardous Materials and Emergency Response Plan and Procedures Manual. The manual provides roles and responsibilities of private and public parties during a declared hazardous materials emergency.
NMAC: Title 11, Chapter 5	NMED; Occupational Health and Safety Bureau	Specifies the general and industry specific requirements to protect worker safety.
NMAC: Title 19, Chapter 7, Part 2	New Mexico Energy, Minerals and Natural Resources Department (EMNRD)	Provides for the protection of public health and safety through the effective safeguarding of mine surface openings and other hazards at inactive mines.
NMAC: Title 20, Chapter 3	NMED; Environmental Improvement Board	Outlines requirements to protect the general public and occupationally exposed individuals from radioactive materials, including naturally occurring radioactive materials found in the oil and gas industry.
NMAC: Title 20, Chapter 5	NMED; Environmental Improvement Board	Regulations for the operation, maintenance, and spill response for aboveground and underground petroleum storage tanks.

10.1.15.3. Environmental Setting: Existing Telecommunication Sites

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

Working from height, overhead work, and slips, trips, or falls – At tower and building-mount sites, workers regularly climb structures using fixed ladders or step bolts to heights up to 2,000 feet above the ground's surface (OSHA, 2015b). In addition to tower climbing hazards, telecommunication workers have restricted workspace on rooftops or work from bucket trucks parked on uneven ground. Cumulatively, these conditions present fall and injury hazards to telecommunication workers, and the general public who may be observing the work or transiting the area (IFC, 2007).

Trenches and confined spaces – In rare cases, FirstNet deployment, operation, and maintenance activities may involve work in trenches or confined spaces. Installation and maintenance of underground utilities in urban areas or utility manholes[129] are examples of when confined space work is necessary. Installation of telecommunications activities involves laying conduit and limited trenching (generally 6 to 12 inches in width). Confined space work can involve poor atmospheric conditions, requiring ventilation and rescue equipment. Additionally, when inside a confined space, worker movement is restricted and may prevent a rapid escape or interfere with proper work posture and ergonomics.

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

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

Optical fiber safety – Optical fiber cable installation and repair presents additional risks to telecommunications workers, including potential eye or tissue damage, through ingestion,

[129] 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.

inhalation, or other contact with glass fiber shards. The shards are generated during termination and splicing activities, and can penetrate exposed skin (IFC, 2007). Additionally, fusion splicing (to join optical fibers) in confined spaces or other environments with the potential for flammable gas accumulation presents risk of fire or explosion (Fiber Optic Association, 2010).

Noise – Sources of excess noise at telecommunication sites include heavy equipment operation, electrical power generators and other small engine equipment, air compressors, electrical and pneumatic power tools, and road vehicles, such a diesel engine work trucks. The cumulative noise environment has the potential to exceed the OSHA acceptable level of 85dB per 8-hour time weighted average (see Section 10.1.13, 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.

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 be a greater health risk than the primary hazardous material (e.g., diesel fuel). Furthermore, the use of hazardous materials creates down-stream potential to generate hazardous waste. 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.

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

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

Telecommunication Worker Occupational Health and Safety

The U.S. Department of Labor, Bureau of Labor Statistics (BLS) uses established industry and occupational codes to classify telecommunications workers. For industry classifications, BLS uses the North American Industry Classification System (NAICS) codes, which identify the telecommunications industry (NAICS code 517XX) as being within the information industry (NAICS code 51). For occupational classifications, BLS uses the Standard Occupational Classification (SOC) system to identify workers as belonging to one of 840 occupations. Telecommunications occupations are identified as either telecommunication equipment installers or 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 1,290 telecommunication equipment installers and repairers, and 430 telecommunication line installers and repairers (Figure 10.1.15-1) working in New Mexico (BLS, 2015c). In 2013, the most recent year data are available, New Mexico had 1.1 cases of nonfatal occupational injuries or illnesses in the telecommunications industry per 100 full-time workers (BLS, 2013a). By comparison, there were 1.9 nonfatal occupational injury cases nationwide in both 2012 and 2013 per 100 full-time workers in the telecommunications industry (BLS, 2013b).

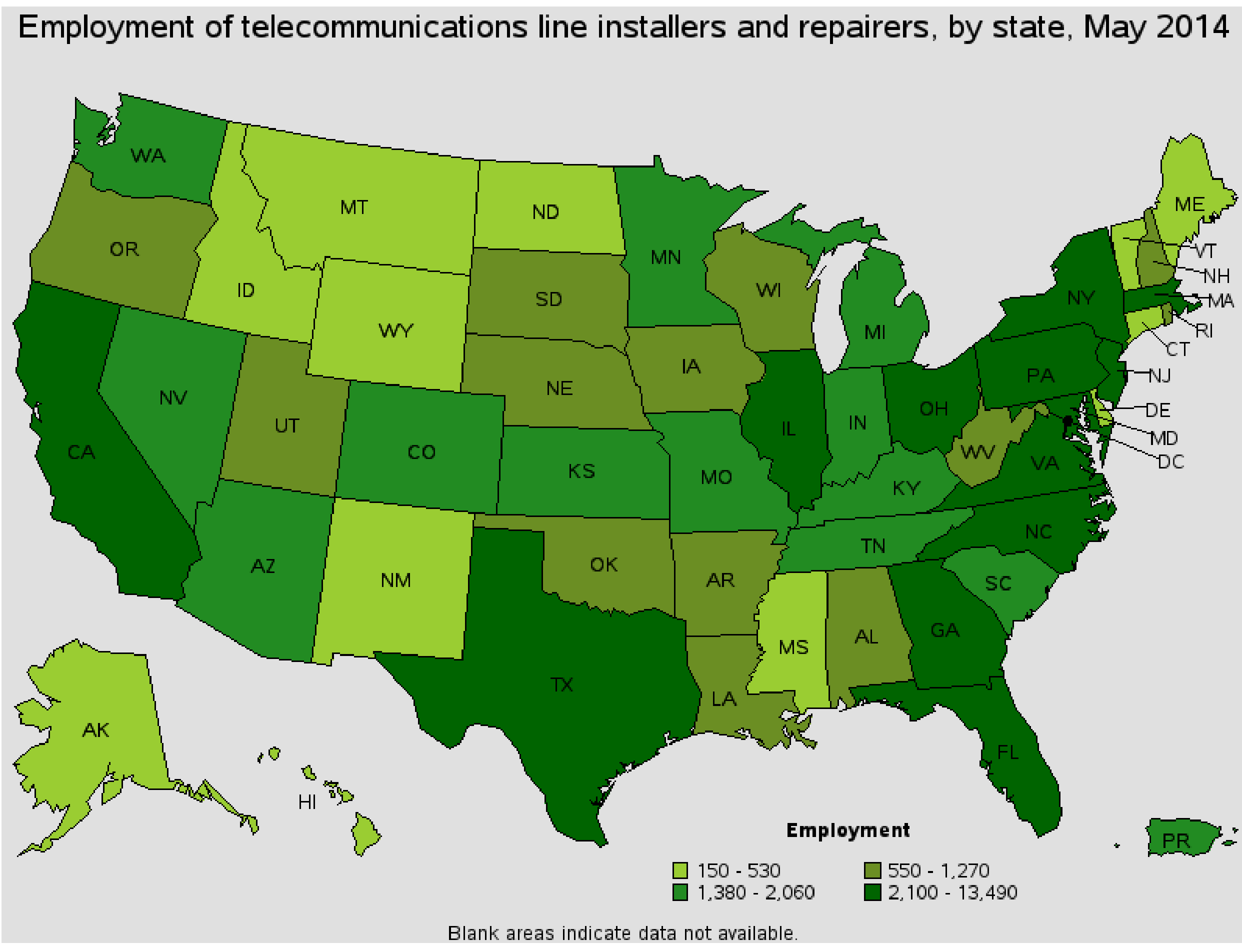

Figure 10.1.15-1: Number of Telecommunication Line Installers and Repairers Employed per State, May 2014

Source: (BLS, 2015d)

Nationwide in 2013, there were 18 fatalities reported across the telecommunications industry (5 due to violence and other injuries by persons or animals; 3 due to transportation incidents; and 7 due to slips, trips, or falls), with an hours-based fatal injury rate of 7.9 per 100,000 full-time equivalent workers (BLS, 2013c). This represents 45 percent of the broader information industry fatalities (40 total), and less than 1 percent of total occupational fatalities (4,585 total). New Mexico has not had any fatalities in the telecommunications industry or telecommunications occupations since 2003, when data were first reported. By comparison, within the broader installation, maintenance, and repair occupations (SOC code 49-0000), there were 37 fatalities in New Mexico between 2003 and 2014, with the highest fatality year being 2006, with 8 fatalities (BLS, 2015e).

Public Health and Safety

The general public is unlikely to encounter occupational hazards at telecommunication sites due to limited access. The New Mexico Department of Health (NMDH) collects environmental and public health data through the New Mexico Indicator-Based Information System (IBIS) portal (NMDH, 2015). The same data are reported with more specificity at the federal level through the Centers for Disease Control and Prevention (CDC) Wide-ranging Online Data for Epidemiologic Research (WONDER). While the WONDER database cannot be searched for cases specific to telecommunication sites, many available injury categories are consistent with risks present at telecommunication sites. For example, in New Mexico, between 1999 and 2013, there were 98 fatalities due to a fall from, out of, or through a building or structure, and 12 fatalities due to being caught, crushed, jammed or pinched in or between objects (CDC, 2015a). Among the general public, trespassers entering telecommunication sites would be at the greatest risk for exposure to health and safety hazards.

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

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

Contaminated property is typically classified by the federal environmental remediation or cleanup programs that govern them, such as sites administered through the Superfund Program[130] 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

[130] 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).

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.

New Mexico's Superfund Oversight Section administers the Superfund Program, and is managed under the NMED Ground Water Quality Bureau (NMED, 2015o). As of October 2015, New Mexico had 23 RCRA Corrective Action sites,[131] 107 brownfield sites, and 15 proposed or final Superfund/NPL sites (USEPA, 2015p). Based on a November 2015 search of USEPA's Cleanups in My Community (CIMC) database, there are zero Superfund sites in New Mexico where contamination has been detected at an unsafe level, or a reasonable human exposure risk exists (USEPA, 2015q). NMED also maintains a database of State Cleanup Site that tracks existing environmental cleanup activities throughout the state. According to the database of cleanup sites, as of August 2015, New Mexico has 131 cleanup sites; 26 of the sites are located in Chaves County (includes City of Roswell), 24 are located in Doña Ana County (includes Las Cruces), and 23 are located in Bernallio County (includes City of Albuquerque) (NMED, 2015p).

Brownfield sites in New Mexico may enroll in a variety of programs managed by the NDEM Ground Water Quality Bureau, including Brownfields Assessment Grants, Assessment Coalitions, Brownfield Revolving Loan Fund Grants, and Brownfields Cleanup Grants (NMED, 2015q). One example of a state brownfield site is the historic Luna Lodge, along Route 66 in Albuquerque, NM, which contained lead and asbestos. NMED awarded a $50,000 grant through the Brownfields Revolving Loan Fund to rehabilitate the lodge into apartments for previously homeless persons with special needs and disabilities. (NMED, 2013)

Uranium mining and milling activity in New Mexico presents unique health and safety hazards to the general public and potentially to occupational workers installing infrastructure on contaminated land. Uranium extraction produces mill tailings, a radioactive ore residue containing heavy metals and radium that presents radiation exposure through airborne decay products or in water supplies. These tailings were occasionally used as aggregate or other residential building materials, presenting additional risk of lung cancer and kidney failure to inhabitants. Between 1944 and 1986, the federal government and the commercial industry extracted nearly 4 million tons of uranium ore within the Navajo Nation across New Mexico, Utah, and Arizona. Across New Mexico today, there are more than 500 abandoned uranium mines on Navajo lands. USEPA, the Bureau of Indian Affairs, and other associated agencies have developed a Five-Year Plan to address uranium contamination in the Navajo Nation. (USDOE, 2014) In 2006, the USEPA compiled over 4,000 federal, state, and Tribal uranium mine records to identify potential problem areas. However, the location of many uranium sites remains unknown since uranium was not always the primary mined material, and abandoned mines may not have been assessed for potential radioactive hazards such as tailings. (USEPA, 2006)

[131] Data gathered using USEPA's Cleanups in My Community (CIMC) search on November 23, 2015, for all sites in New Mexico, where cleanup type equals 'RCRA Hazardous Waste – Corrective Action,' and excludes sites where cleanup phase equals 'Construction Complete' (i.e., no longer active). (USEPA, 2013d)

In New Mexico, the NMED Environmental Improvement Board regulates uranium mills and associated radioactive material disposal, and includes the Radiation Technical Advisory Council that advises NMED on technical matters relating to radiation (NMED, 2015r). The Draft Five-Year Plan for former uranium mills in New Mexico plans to transition regulatory oversight from the USNRC to the DOE by 2020 (USEPA, 2015r). Although assessment, cleanup, and health studies are ongoing in New Mexico, actions already taken include prioritizing mine sites for cleanup, demolishing contaminated structures, and providing financial compensation to impacted residents (USDOE, 2014). One example of a New Mexico uranium mill is the Homestake Mining Company (HMC) site (Figure 10.1.15-3), approximately 5.5 miles north of Milan, NM (Cibola County). The mill closed in 1990, leaving behind 22 million tons of mill tailings. Currently, the U.S. Nuclear Regulatory Commission (USNRC), in coordination with USEPA and NMED, regulates cleanup activities at the HMC site under the Uranium Mill Tailings Radiation Control Act of 1978. (USACE, 2010)

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 EPCRA of 1986. The Toxic Release Inventory database is a measure of the industrial nature of an area and the over-all chemical use, and can be used to track trends in releases over time. The “releases” do not necessarily equate to chemical exposure by humans or necessarily constitute to quantifiable health risks because the releases include all wastes generated by a facility – the majority of which are disposed of via managed, regulated processes that minimize human exposure and related health risks (e.g., in properly permitted landfills or through recycling facilities). As of November 2015, New Mexico has 85 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, New Mexico released 25.9 million pounds of toxic chemicals through onsite and offsite disposal, transfer, or other releases, largely from the surface impoundment and landfill industries. This accounted for 0.63 percent of total nationwide TRI releases, ranking New Mexico 49 out of 56 U.S. states and territories (USEPA, 2015s).

Another USEPA program is the NPDES, which regulates the quality of stormwater and sewer discharge from industrial and manufacturing facilities. Permitted discharge facilities are potential sources of toxic constituents that are harmful to human health or the environment. As of November 2, 2015, New Mexico had 36 permitted major discharge facilities registered with the USEPA Integrated Compliance Information System (USEPA, 2015t).

The National Institutes of Health (NIH), U.S. National Library of Medicine, provides an online mapping tool called TOXMAP, which allows users to “visually explore data from the USEPA’s TRI and Superfund Program” (NIH, 2015). Figure 10.1.15-2 provides an overview of potentially hazardous sites in New Mexico.

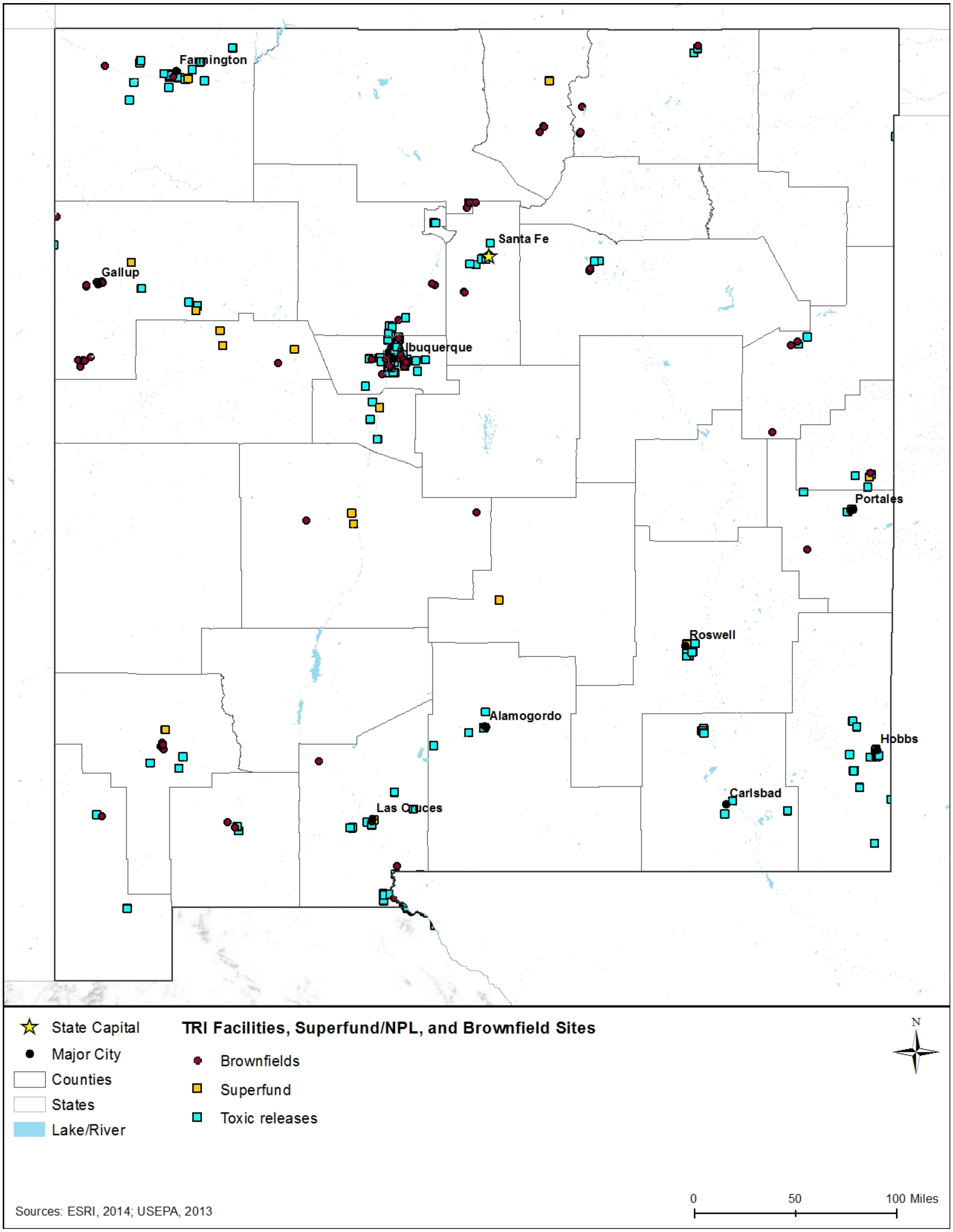

Figure 10.1.15-2: TOXMAP Superfund/NPL and TRI Facilities in New Mexico (2015)

Telecommunication Worker Occupational Health and Safety

Telecommunications sites may be on or near contaminated land, industrial discharge facilities, or mines. 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 November 2015, there are 131 USEPA-regulated telecommunications sites in New Mexico (USEPA, 2015u). These sites are regulated under one or more environmental programs including NPDES compliance, Superfund/NPL status, and TRI releases.

According to BLS data, New Mexico has not had any fatalities from exposure to "harmful substances or environments" within the telecommunications industry or telecommunications occupations since 2003, when data are first available (BLS, 2015e). By comparison, the Bureau of Labor Statistics reported three fatalities in 2011 and three preliminary[132] fatalities 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, 2014).

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 would then inadvertently ingest or absorb the contaminant when using that source of water for drinking, cooking, bathing, and swimming. By trespassing on a restricted property, a trespasser may come in contact with contaminated soil or surface water, or by inhaling harmful vapors. The New Mexico Department of Health (NMDH), Environmental Public Health Tracking website provides public health data resulting from exposure to environmental contamination (NMDH, 2014).

The NMDH partners with the CDC as part of the Environmental Public Health Tracking (EPHT) Network to provide health assessments and consultations that identify and assess human exposure risks at contaminated sites. Public health assessments, consultations, and advisories for documented hazardous waste sites are publicly available through the NMDH EPHT website (NMDH, 2014). At the federal level, the CDC National EPHT Program provides health, exposure, and hazard information, including known chemical contaminants, chronic diseases,

[132] 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).

and conditions based on geography. As of 2015, New Mexico had no injuries or fatalities due to reported acute toxic substance release incidents (CDC, 2015b).

10.1.15.5. Abandoned Mine Lands at or near Telecommunications Sites

Spotlight on New Mexico Superfund Sites: Homestake Mining Company

The Homestake Mining Company (HMC) site is a former uranium mill, 5.5 miles north of Milan, NM (Cibola County). HMC operated from 1958 until 1990, and left two expansive piles of mill tailings at the site. The larger pile covered more than 175 acres and was 100 feet thick, while the smaller pile covered 40 acres and was 25 feet thick. In total, more than 22 million tons of unremediated mill tailings were left on open ground, exposed to precipitation and wind (USACE, 2010).

In 1983, the HMC site was added to the NPL after a 1977 state-approved groundwater restoration program identified contamination from metals and radioneucleotides. The contamination was so severe that USEPA and HMC signed a Consent Decree in December 1983, requiring HMC to provide alternative drinking water for surrounding residents for 10 years (USACE, 2010). HMC has installed several groundwater treatment units at the site, and more than 200 groundwater monitoring wells have been sampled as part of the extensive onsite and offsite groundwater monitoring network (USEPA, 2015v).

Groundwater contamination from arsenic, molybdenum, nitrates, selenium, sulfate, and uranium is still present, with selenium and uranium detected at concentrations above the maximum contaminant level in 22 of the 34 private drinking water wells in the study area. Many residents have been connected to municipal water supplies with only five residents still relying on a private well as their primary drinking water source. (ATSDR, 2009)

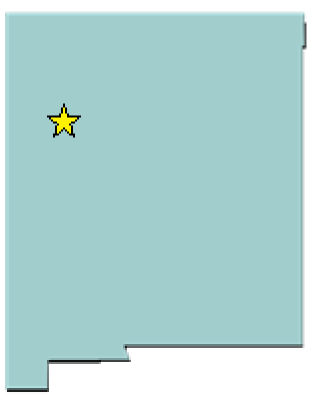


Figure 10.1.15-3: Residential Gamma Radiation Sampling using Baby Buggy-Mounted Gamma Radiation Detector near HMC

Source: (USEPA, 2010).

Another health and safety hazard in New Mexico includes surface and subterranean mines. In 2015, the New Mexico mining industry ranked 15th for non-fuel minerals (primarily copper, potash, sand and gravel, Portland cement, and salt), generating a value of $1.76B (USGS, 2016a). Mining activities occur in 30 of 33 New Mexico counties, with the majority (64 percent) being aggregate mines (New Mexico EMNRD, 2014a). Additional resources mined in New Mexico include metal ore, uranium, stone, precious metals, and gems. As of 2013, New Mexico had 211 active mines with the highest concentration in Eddy County (New Mexico EMNRD, 2014b). That same year, New Mexico had four active coalmining operations (one underground and three surface) (EIA, 2013). Health and safety hazards at active mines and abandoned mine lands (AML) include falling into open shafts, cave-ins from unstable rock and decayed support, deadly gases and lack of oxygen inside the mine, unused explosives and toxic chemicals, horizontal and vertical openings, high walls, and open pits (BLM, 2015d).

In New Mexico, the Energy, Minerals, and Natural Resource Department (EMNRD), Mining and Minerals Division (MMD) administers the Abandoned Mine Land Program. As of 2015, the MMD estimates there to be roughly 15,000 abandoned mine features in New Mexico (New Mexico EMNRD, 2015). Mine features include shallow pits, mineshafts, waste piles, or other residual mine components. Since the enactment of the Mining Act Reclamation Program in 1993, some 538 mines have received state permits (New Mexico EMNRD, 2014a). According to the U.S. Department of the Interior, BLM, Abandoned Mine Lands inventory, New Mexico has over 600 known abandoned hardrock mines, including uranium mines, with 2,500 mine features that potentially present a public safety risk (BLM, 2015e). Figure 10.1.15-4 shows the distribution of High Priority (Priority 1, 2 and adjacent Priority 3) AMLs in New Mexico, 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 November 2015, New Mexico had 139 Priority 1 and 2 AMLs, with 119 unfunded problem areas (USDOI, Office of Surface Mining Reclamation and Enforcement, 2015a).

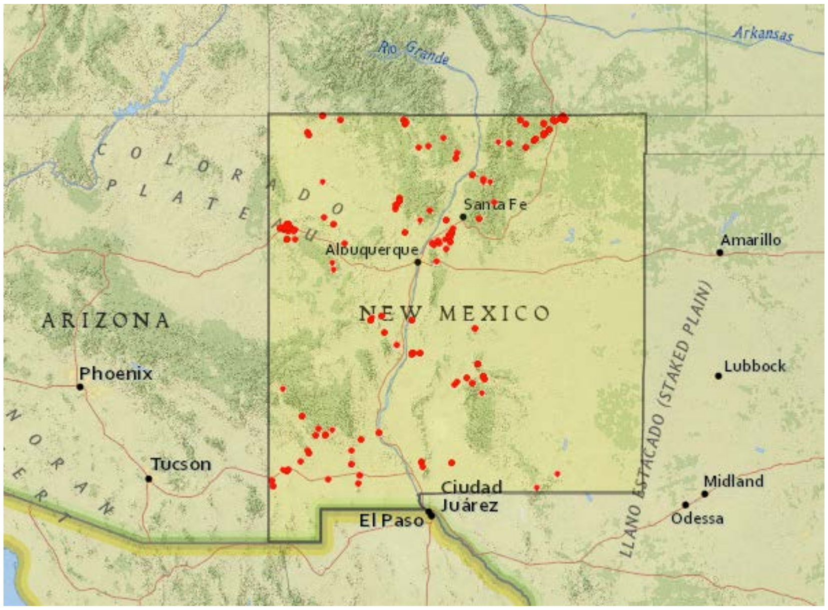

Figure 10.1.15-4 High Priority Abandoned Mine Lands in New Mexico (2015)

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

Telecommunication Worker Occupational Health and Safety

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

Public Health and Safety

Subterranean mines present additional health and safety risks to the general public, by generating toxic combustible gases, which can penetrate the surface through ground fractures, potentially seeping into residential structures. Additionally, mine fires can consume enough sub-surface material, that risk of subsidence increases. As a result, AMLs and coalmine fires in particular, can result in evacuations of entire communities (USDOI, Office of Surface Mining Reclamation and Enforcement, 2015c).

10.1.15.6. Natural & Manmade Disaster Sites

Natural and manmade disaster events can create health and safety risks, as well as present unique hazards, to telecommunication workers and the general public. Telecommunications, including public safety communications, can be unavailable (temporarily or permanently) during disaster events. Examples of manmade disasters are train derailments, refinery fires, or other incident involving the release of hazardous constituents. A common example of a natural disaster is flooding. Floodwaters damage transportation infrastructure (roads, railways, etc.) and utility lines (sewer, water, electric power, broadband, natural gas lines, etc.). Floodwaters are often contaminated by hazardous chemicals and sanitary wastes, which can cause headaches, skin rashes, dizziness, nausea, excitability, weakness, fatigue, and disease to exposed workers (OSHA, 2003). In New Mexico, natural or manmade disasters could result in an uncontrolled release of radioactive material from abandoned uranium mines and mills, increasing potential risk to health and safety.

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, and falls. During natural and manmade disasters, access to the telecommunication sites can be obstructed by debris.

Telecommunication Worker Occupational Health and Safety

Telecommunication workers are often called upon to provide support to natural and manmade disaster response efforts because of the critical need to restore and maintain telecommunication capabilities. The need to enter disaster areas as part of the initial recovery effort exposes telecommunication workers to elevated risks because chemical, biological, and physical hazards have not been fully 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, the NMEH 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 64 NRC-reported incidents for New Mexico in 2015 with known causes, 2 incidents were attributed to natural disaster (natural phenomenon), while 62 were attributed to manmade disasters (equipment failure and operator error). For example, during a thunderstorm in August 2015, a lightning strike hit an amine pump system (removes acid gases from raw natural gas) at a facility resulting in the release of 1,040 pounds of nitrogen oxide and 55 pounds of nitrogen dioxide into the air (USCG, 2015). Such incidents present unique, hazardous challenges to telecommunication workers responding during natural or manmade 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, New Mexico reported 3 weather-related fatalities (2 due to drowning and 1 due to lightning) and 10 injuries. By comparison, 384 weather-related fatalities and 2,203 injuries were reported nationwide the same year. (NWS, 2015b). 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, New Mexico reported 3 weather-related fatalities (2 due to drowning and 1 due to lightning) and 10 injuries. By comparison, 384 weather-related fatalities and 2,203 injuries were reported nationwide the same year (NWS, 2015b).

Spotlight on New Mexico Natural Disaster Sites: Little Bear Wild Fire

On June 4, 2012, a lightning strike in the White Mountains Wilderness Area ignited the "Little Bear Wild Fire," which burned more than 44,300 acres of land (Figure 10.1.15-5). The federal government and the State of New Mexico owned the majority of the impacted property; however, the fire also burned more than 8,500 acres of private land and 352 acres of Mescalero Tribal land, destroying 242 homes (McCaffrey, Stidham, & Brenkert-Smith, 2013). The fire caused widespread evacuations, road closures, and destruction of aboveground utility infrastructure (i.e., burned and downed telephone and power lines), totaling $100M (Derr, 2012).

On June 9, the fire burned through the region's primary communication lines, disabling the Internet, landlines, and cell phone service within 30 miles of the fire. First responders were forced to communicate via radio and face-to-face until an emergency replacement line could be installed through the Mescalero Apache Reservation. (USDA, 2013)

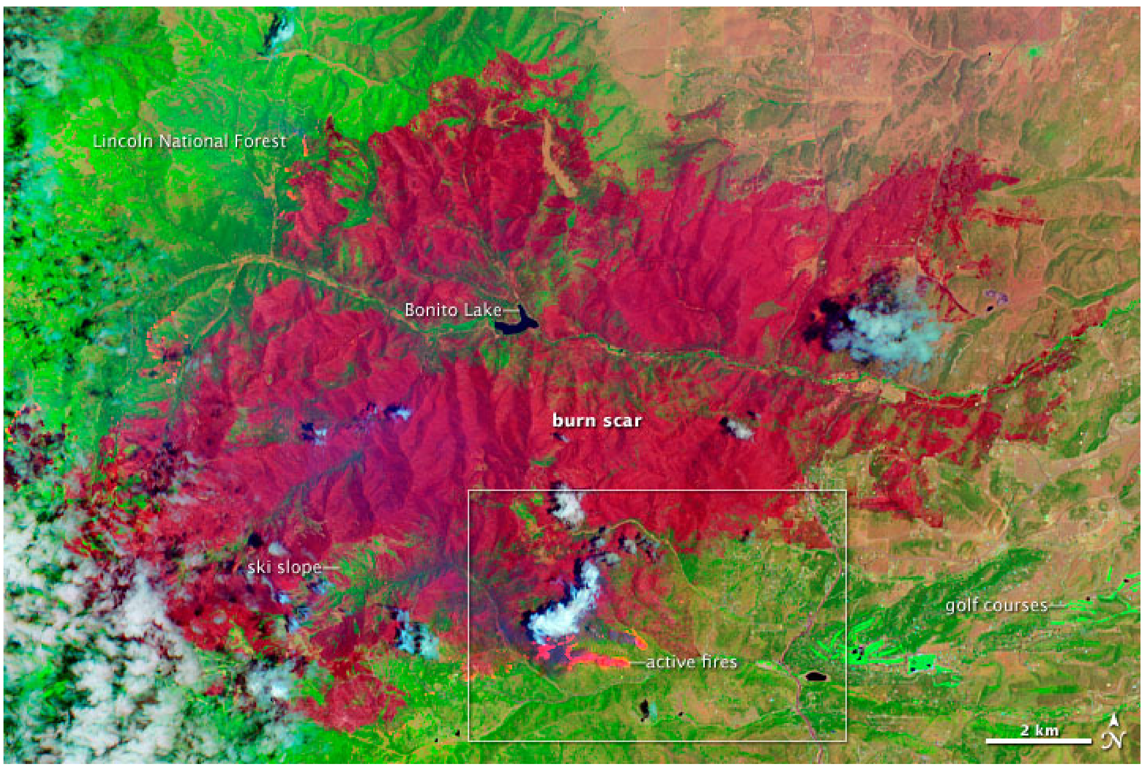

Figure 10.1.15-5: False-Color Image Depicting Burn Scar (dark red) and Active Fires (orange-red) on June 12, 2015 from Little Bear Wild Fire

Source: (NASA, 2012)

10.2. 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 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.

At the programmatic level, the categories of impacts have been 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 Alternative provides a comparison to describe the effects of environmental resources of the existing conditions to the proposed Alternatives.

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

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

10.2.1. Infrastructure

10.2.1.1. Introduction

This section describes potential impacts to infrastructure in New Mexico associated with construction, deployment, and operation of the Proposed Action and Alternatives. Chapter 16, Best Management Practices (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.

10.2.1.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on infrastructure were evaluated using the significance criteria presented in Table 10.2.1-1. As described in Section 10.2, 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 10.2.1-1: 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

10.2.1.3. Description of Environmental Concerns

Transportation System Capacity and Safety

The primary concerns for transportation system capacity and safety related to FirstNet activities would primarily occur during the construction phases of deployment. Depending on the exact site locations and placement of new assets in the field, temporary impacts on traffic congestion, railway use, airport or harbor operations, or use of other transportation corridors could occur if site locations were near or adjacent to roadways and other transportation corridors, requiring temporary closures (lane closures on roadways, for example). Coordination would be necessary with the cognizant transportation authority (i.e., departments of transportation, airport authorities, railway companies, and harbormasters) to ensure proper deployment. Based on the impact significance criteria presented in Table 10.2.1-1, such impacts would be less than significant at the programmatic level due to the temporary nature of deployment activities, even if impacts would be realized at one or more isolated locations. These impacts would be noticeable during the deployment phase, but would be short-term, with no anticipated impacts continuing into the operational phase, unless any large-scale maintenance would become necessary during operations.

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

The capacity of local health, public safety, and emergency response services would experience less than significant impacts at the programmatic level during construction or operation phases. During deployment and system optimization, existing services would likely remain operational in a redundant manner ensuring continued operations and availability of services to the public. The only potential impact would be extremely rare, 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 10.2.1-1, potential negative impacts would be less than significant at the programmatic level. 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 10.2.1-1, any potential impacts would be less than significant at the programmatic level 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 at the programmatic level 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 likely be using a different spectrum for communications. FirstNet has exclusive rights to use of the assigned spectrum, and only designated public safety organizations would be authorized to connect to FirstNet's network. Depending on the use patterns of FirstNet's spectrum, such spectrum use may be over-built or under-utilized.[133] Anticipated impacts would be less than significant at the programmatic level due to the limited extent and temporary nature of the deployment.

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

The activities proposed by FirstNet would have less than significant impacts at the programmatic level 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.

10.2.1.4. Potential Impacts of the Preferred Alternative

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

[133] 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.

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 at the programmatic level 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)[134], 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 at the programmatic level as the activity would be temporary and minor.
    - New Build – Aerial Fiber Optic Plant: Installation of a new aerial fiber optic plant could impact new telecommunications infrastructure through the installation of new, or replacement of existing telecommunications poles.
    - Collocation on Existing Aerial Fiber Optic Plant: Similar to new build activities (above), collocation on existing aerial fiber optic plant could include installation of new or replacement towers requiring ground disturbance.
    - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact infrastructure resources because there would be no local infrastructure to impact. However, impacts to infrastructure resources could potentially occur as result of the construction of landings and/or facilities on shores or the banks of water bodies that accept the submarine cable, depending on the exact site location and proximity to existing infrastructure.
    - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment such as small boxes or huts, or access roads could potentially impact infrastructure. Impacts could include disruption of service in transportation corridors, disruption of service to telecommunications infrastructure, or other temporary impacts.
- 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

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

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 such as minor disruptions in services. As a result of collocation of equipment, the potential addition of power units, structural hardening, and physical security measures could potentially have beneficial impacts on existing infrastructure assets, depending on the site-specific plans.
- Deployable Technologies: Deployable technologies such as COWs, COLTs, and SOWs are comprised of cellular base stations, sometimes with expandable antenna masts, and generators that connect to utility power cables. Connecting the generators to utility power cables has the potential to disrupt electric power utility systems or cause power outages; however, this is expected to be temporary and minor. Some staging or landing areas (depending on the type of technology) could require minor construction and maintenance within public road ROWs and utility corridors, heavy equipment movement, and minor excavation and paving near public roads, which have the potential to impact transportation capacity and safety as these activities could increase transportation congestion and delays. Implementation of deployable technologies could result in potential impacts to infrastructure resources in terms of infrastructure expansion, if deployment requires paving of previously unpaved surfaces or other new infrastructure build to accommodate the deployable technology. Also, beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events. Where deployable technologies would be implemented on existing paved surfaces and the acceptable load on those paved surfaces is not exceeded, or where aerial deployable technologies may be launched or recovered from existing paved surfaces, it is anticipated that there would be no impacts to infrastructure resources because there would be no disturbance of the natural or built environment.

In general, the abovementioned activities could potentially impact infrastructure resources in different ways, resulting in both potentially negative and potentially positive impacts. Potential negative impacts to infrastructure associated with deployment could include temporary disruption of various types of transportation corridors, temporary impacts on existing or new telecommunications sites, and more permanent impacts on utilities, if new infrastructure required tie-in the electric grid. These impacts are expected to be less than significant at the programmatic level as the deployment activities will likely be of short duration (generally a few hours to a few months depending on the activity), would be regionally based around the on-going phase of deployment, and minor. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts. Positive impacts to infrastructure resources may result from the expansion of public safety and commercial telecommunications capacity and an improvement in public safety telecommunications coverage, system resiliency, response times, and system redundancy.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in potential impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to infrastructure associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if further construction related activities are required along public road and utility ROWs, increased traffic congestion, current telecommunication system interruption, and utility interruptions could occur. These potential impacts would be expected to be minor and temporary as explained above.

Numerous beneficial impacts would be associated with operation of the NPSBN. The new system is intended to result in substantial improvements in public safety response times and the ability to communicate effectively with and between public safety entities, and would also likely result in substantial improvements in level of service and communications capabilities. Operation of the NPSBN is intended to involve high-speed data capabilities, location information, images, and eventually streaming video, which would likely significantly improve communications and the ability of the public safety community to effectively engage and respond. The NPSBN is also intended to have a higher level of redundancy and resiliency than current commercial networks to support the public safety community effectively, even in events of extreme demand. This improvement in the level of resiliency and redundancy is intended to increase the reliability of systems, communications, and level of service, and also minimize disruptions and misinformation resulting from limited or disrupted service. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.1.5. Alternatives Impact Assessment

The following section assesses potential impacts to infrastructure associated with the Deployable Technologies Alternative and the No Action Alternative.[135]

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

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 at the programmatic level to infrastructure even if deployment requires expansion of infrastructure, such as paving of previously unpaved surfaces or other new infrastructure built to support deployment. This is primarily due to the small amount of paving or new infrastructure that might have to be constructed to accommodate the deployables. The site-specific location of deployment would need to be considered, and any local infrastructure assets (transportation, telecommunications, or utilities) would need to be considered, planned for, and managed accordingly to try and avoid any negative impacts to such resources. Beneficial impacts could be realized, as deployable technologies are used when other infrastructure is impaired in some way; so deployable technologies could provide continuity of service during emergency events. These impacts are expected to be less than significant at the programmatic level. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to infrastructure resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment, as part of routine maintenance or inspection occurs off an established access road or utility ROW, or if additional maintenance-related construction activities occur within public road and utility ROWs, less than significant impacts would still likely still occur to transportation systems or utility services due to the limited amount of new infrastructure needed to accommodate the deployables. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated deployment or installation 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 10.1.1, Infrastructure. The state also would not realize positive, beneficial impacts to infrastructure resources described above.

10.2.2. Soils

10.2.2.1. Introduction

This section describes potential impacts to soil resources in New Mexico associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.2.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on soil resources were evaluated using the significance criteria presented in Table 10.2.2-1. As described in Section 10.2, 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 10.2.2-1 Impact Significance Rating Criteria for Soils

Type of Effect	Effect Characteristics	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

10.2.2.3. Description of Environmental Concerns

Soil Erosion

Soil erosion is an environmental concern for 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 New Mexico and other states with similar geography and weather patterns is the erosion of construction site soils to natural waterways, where the sediment could impair water and habitat quality, and potentially affect aquatic plants and animals (NRCS, 2000). Areas exist in New Mexico that have steep slopes (i.e., greater than 20 percent) or where the erosion potential is medium to high, including locations with Albolls, Aquerts, Aquolls, and Usterts (see Section 10.1.2.4, Soil Suborders, and Figure 10.1.2-2).

Based on the impact significance criteria presented in Table 10.2.2-1, building of some of FirstNet's network deployment sites could cause potentially significant erosion at locations with highly erodible soil and steep grades. For the majority of projects, impacts to soils would be expected to be less than significant at the programmatic level given the short-term and temporary duration of the activities. Furthermore, deployment sites that are large-scale or adjacent to other construction sites (i.e., cumulatively large-scale sites) could result in long-term erosion that might not be reversed for several years.

To the extent practicable, FirstNet would attempt to minimize ground disturbing construction in areas with high erosion potential due to steep slopes or soil type. Where construction is required in areas with a high erosion potential, FirstNet could implement BMPs and mitigation measures, where practicable and feasible, to avoid or minimize impacts, and minimize the periods when exposed soil is open to precipitation and wind (see Chapter 16).

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 10.2.2-1, and due to the relatively small-scale (less than 1 acre) of most FirstNet project sites, as well as the implementation of BMPs and mitigation measures (Chapter 16), minimal topsoil mixing is anticipated.

Soil Compaction and Rutting

Soil compaction and rutting at construction sites could involve heavy land clearing equipment such as bulldozers and backhoes, trenchers and directional drill rigs to install buried fiber, and cranes to install towers and aerial infrastructure. Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (see Section 10.1.2.4, Soil Suborders). Heavy equipment could cause perceptible compaction and rutting of susceptible soils, particularly. BMPs and mitigation measures could help avoid or minimize potential impacts.

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Soils with the highest potential for compaction or rutting were identified by using the STATSGO2 database (see Section 10.1.2.4, Soil Suborders). The most compaction susceptible soils in New Mexico are Albolls, Aquerts, Aquolls, and Userts, hydric soils and with poor drainage conditions. These soils are found in about 2.24 percent of New Mexico,[136] throughout the state (see Figure 10.1.2-2). The potential for compaction or rutting impact would be generally low at FirstNet network deployment sites where other soil types predominate.

Based on impact significance criteria presented in Table 10.2.2-1, the risk of soil compaction and rutting resulting from FirstNet deployment activities would be less than significant at the programmatic level due to the extent of susceptible soils in the state.

10.2.2.4. 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, at the programmatic level, 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 handholes, pulling vaults, junction boxes, huts, and POP structures would not impact soil resources because it would not produce perceptible changes to soil resources.
    - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber would be conducted electronically through existing infrastructure, with no impacts to soil resources. If physical access is required to light dark fiber, it would be through existing hand holes, pulling vaults, junction boxes, huts, and similar existing structures.

[136] This percentage was calculated by dividing the acres of soils that fall within the suborders listed above by the total soil land cover for the state.

- 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.

Activities with the Potential to Have Impacts

Implementation of the Preferred Alternatives could include potential deployment-related impacts to soil resources resulting from ground disturbance activities, including soil erosion, topsoil mixing, and soil compaction and rutting. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to soil resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures that require ground disturbance. Impacts from fiber optic plant installation and structure construction, as well as associated grading and restoration of the disturbed ground when construction is completed, could result in soil erosion, topsoil mixing, or soil compaction and rutting.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and replacement/upgrading of existing poles and structures could potentially impact soil resources resulting from ground disturbance for pole/structure installation (soil erosion and topsoil mixing), and heavy equipment use from bucket trucks operating on existing gravel, or dirt roads (soil compaction and rutting). Potential impacts to soils are anticipated to be small-scale and short-term.
  - Collocation on Existing Aerial Fiber Optic Plant: Topsoil removal, soil excavation, and excavated material placement during the replacement of poles and structural hardening could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in soil compaction and rutting.
  - New Build – Submarine Fiber Optic Plant: Installation of fiber optic plants in or near bodies of water could potentially impact soil resources at and near the landings and/or facilities on shores or the banks of water bodies that accept the 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.

- 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 are needed, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to soil resources could occur, including soil erosion and topsoil mixing, as well as soil compaction and rutting associated with heavy equipment use.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to soil resources depending on the technology and location for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could result in soil compaction and rutting if deployed in unpaved areas. Where technologies such as COWs, COLTs, and SOWs are deployed on existing paved surfaces, there would be no impacts to soil resources because there would be no ground disturbance.

In general, the abovementioned activities could potentially involve land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads, and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to soil resources associated with deployment of this infrastructure could include soil erosion, topsoil mixing, or soil compaction and rutting. These impacts are expected to be less significant as the activity would likely be short term, localized to the deployment locations, and would return to normal conditions as soon as revegetation occurs, often by the next growing season. It is expected that heavy equipment would utilize existing roadways and utility rights-of-way for deployment activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described earlier, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be no impacts to soil resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections because there would be no ground disturbance. . If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors, or if the acceptable load of the surface is exceeded, soil compaction and rutting impacts could result as explained above. The impacts are expected to be less than significant at the programmatic level due to the temporary nature and small-scale of operations activities with the potential to create impacts. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.2.5. 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 at the programmatic level, regardless of whether the deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to soils could occur on paved surfaces if the acceptable load of the surface is exceeded. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in soil erosion and topsoil mixing. Heavy equipment use associated with these activities may result in soil compaction and rutting. In addition, implementation of deployable technologies themselves could also result in soil compaction and rutting if deployed in unpaved areas. However, these potential impacts are expected to be less than significant due to the small scale and short term nature of the deployment. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to soil resources associated with routine inspections of the deployable assets, assuming that the same access roads used for deployment are also used for inspections because there would be no ground disturbance. 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 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to soil resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.2, Soils.

10.2.3. Geology

10.2.3.1. Introduction

This section describes potential impacts to New Mexico geology resources associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.3.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on geology resources were evaluated using the significance criteria presented in Table 10.2.3-1. As described in Section 10.2, 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 10.2.3-1: Impact Significance Rating Criteria for Geology

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

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMP and Mitigation Measures Incorporated	Less than Significant	No Impact
	Geographic Extent	Areas with known paleontological resources are highly prevalent within the state/territory.		Areas with known paleontological resources occur within the state/territory, but may be avoidable.	Areas with known paleontological resources do not occur within the state/territory.
	Duration or Frequency	NA		NA	NA
Surface Geology, Bedrock, Topography, Physiography, and Geomorphology	Magnitude or Intensity	Substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes.	Effect that is potentially significant, but with mitigation is less than significant.	Minor degradation or alteration of surface geology, bedrock, topography that do not result in measurable changes in physiographic characteristics or geomorphological processes.	No degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphologic processes.
	Geographic Extent	State/territory		State/territory.	NA
	Duration or Frequency	Permanent or long-term changes to characteristics and processes.		Temporary degradation or alteration of resources that is limited to the construction and deployment phase.	NA

NA= Not Applicable

10.2.3.3. Description of Environmental Concerns

Environmental concerns regarding geology can be viewed as two distinct types, those that would potentially provide impacts to the project, such as seismic hazards, landslides, and volcanic activity, and those that would be impacts from the project, such as land subsidence, and effects on mineral and fossil fuel resources, paleontological resources, surface geology, bedrock, topography, physiography, and geomorphology. These concerns and their impacts on geology are discussed below.

Seismic Hazard

As discussed in Section 10.1.3.8 (Figure 10.1.3-4), while New Mexico is not subject to frequent significant (greater than magnitude 6.0 on the Richter scale[137]) earthquakes, portions of the state are susceptible to moderate (greater than 4.5) earthquakes. Areas of greatest seismicity in New Mexico are concentrated in the central and north-central portions of the state, near Albuquerque and Santa Fe. Based on the impact significance criteria presented in Table 10.2.3-1, seismic impacts from deployment or operation of the Proposed Action would have no impact on seismic activity; however, seismic impacts to the Proposed Action could be potentially significant if First Net's deployment locations were within high-risk earthquake hazard zones. Given the potential for minor to moderate earthquakes in parts of New Mexico, some amount of infrastructure be subject to earthquake hazards. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Volcanic Activity

Volcanoes were considered but not analyzed for New Mexico, as they do not occur in New Mexico; 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 10.1.3.8 (Figure 10.1.3-5), the majority of New Mexico is at low to moderate risk of experiencing landslide events. The highest potential for landslides in New Mexico is found in northern portions of the state that have slopes greater than ten degrees. Heavy rainfall events could trigger dormant landslides. Based on the impact significance criteria presented in Table 10.2.3-1, potential impacts to landslides from deployment or operation of the Proposed Action would have less than significant impacts at the programmatic level as it is likely that the project would attempt, as practicable and feasible, to avoid areas that are prone to landslides; however, landslide impacts to the Proposed Action could be potentially significant if

[137] 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)

FirstNet's deployment locations were within areas in which landslides are highly prevalent. To the extent practicable, FirstNet would avoid deployment in areas that are susceptible to landslide events. However, given that most of the state is susceptible to landslides, some amount of infrastructure be subject to landslide hazards. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Land Subsidence

Equipment that is exposed to land subsidence, such as sinkholes created by karst topography or mine collapse, is subject to misalignment, alteration, or, in extreme cases, destruction. Significant long-term land subsidence, due to factors such as aquifer compaction, in coastal areas could lead to relative sea level rise[138] and inundation of equipment. All of these activities could result in connectivity loss.

As discussed in Section 10.1.3.8 and shown in Figure 10.1.3-6, portions of New Mexico are vulnerable to land subsidence due to collapsible soils (Love, 2015) and karst[139] topography. Based on the impact significance criteria presented in Table 10.2.3-1, potential impacts to land subsidence from deployment or operation of the Proposed Action would have less than significant impacts at the programmatic level; however, subsidence impacts to the Proposed Action could be potentially significant to the Proposed Action if FirstNet's deployment locations were within areas at high risk to karst topography or mining areas. To the extent practicable, FirstNet would avoid deployment in known areas of collapsible soils and karst topography. Equipment that is exposed to land subsidence, such as sinkholes created by karst topography is subject to misalignment, alteration, or, in extreme cases, destruction. All of these activities could result in connectivity loss. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Mineral and Fossil Fuel Resource Impacts

Equipment deployment near mineral and fossil fuel resources is 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 10.2.3-1, impacts to mineral and fossil fuel resources is unlikely as the Proposed Action could only be potentially significant if FirstNet's deployment locations were to cause severe, widespread, observable impacts to mineral and/or fossil fuel resources. To the extent practicable, FirstNet would avoid construction in areas where these resources exist. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

[138] Relative Sea Level Rise: "[Sea level rise that] includes the combined movement of both water and land. Even if sea level was constant, there could be changes in relative sea level. For example, a rising land surface would produce a relative fall in sea level, whereas a sinking land surface would produce a relative rise in sea level." (U.S. Geological Survey, 2015)

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

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 10.2.3-1, impacts to paleontological resources could be potentially significant if FirstNet's buildout/deployment locations were to cause impacts to paleontological resources. As discussed in Section 10.1.3.7, fossils are abundant throughout parts of New Mexico. 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 paleontological resources should be considered on a site-by-site basis, and BMPs and mitigation measures could further help avoid or minimize the potential impacts. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Surface Geology, Bedrock, Topography, Physiography, and Geomorphology

Equipment installation and construction activities that require modification or removal of the surrounding terrain could cause irreparable damage to that area's geology, topography, physiography, or geomorphology. Based on the impact significance criteria presented in Table 10.2.3-1, impacts could be potentially significant if FirstNet's deployment were to cause substantial and measurable degradation or alteration of surface geology, bedrock, topography, physiographic characteristics, or geomorphological processes. Construction activities related to the Proposed Action and Alternatives are likely to be minor and less than significant as the proposed activities are not likely to require removal of significant volumes of terrain and any rock ripping would likely occur in discrete locations and would be unlikely to result in large-scale changes to the geologic, topographic, or physiographic characteristics. When ground disturbance is required, BMPs and mitigation measures could be implemented to help avoid or minimize the potential impacts. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.3.4. 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 points of presence POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to geologic resources due to associated ground disturbance, such as impacts to fuel and mineral resources or paleontological resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - New Build – Aerial Fiber Optic Plant: Installation of new utility poles, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in

locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.

- Collocation on Existing Aerial Fiber Optic Plant: Replacement of utility poles and structural hardening, and associated use of heavy equipment during construction, could result in potential impacts to geologic resources due to associated ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
- New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water is not expected to impact geologic resources including marine paleontological resources. However, where landings and/or facilities for submarine cable are installed at locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require ground disturbance in locations that are susceptible to geologic hazards (e.g., land subsidence, landslides, or earthquakes), it is possible that they could be affected by that hazard.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to geologic resources. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the installation of new wireless towers and associated structures or access roads could result in erosion or disturbance of geologic resources. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in ground disturbance. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to geologic resources could occur due to ground disturbance. Where equipment is installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that equipment could be affected by that hazard.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to geologic resources depending on the technology and location proposed for deployment. Potential impacts may result if deployment of vehicles (i.e., SOWs, COWs, COLTs, or UAVs) occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas

(depending on the type of technology) may require land/vegetation clearing, excavation, and paving. Where deployable technologies would be implemented on existing paved surfaces, there would be no impacts to/from geologic resources because there would be no ground disturbance and mobile technologies could be moved to avoid geologic hazards.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: In most cases, the installation of permanent equipment on existing structures, adding equipment to satellites launches for other purposes, or the use of portable devices that use satellite technology would not impact geologic resources because those activities would not require ground disturbance. However, where equipment is permanently installed in locations that are susceptible to landslides, earthquakes, and other geologic hazards, it is possible that they could be affected by that hazard. The use of portable satellite-enabled devices would not impact geologic resources nor would it be affected by geologic hazards because there would be no ground disturbance nor any impact to the built or natural environment.

In general, the abovementioned activities could potentially involve ground disturbance resulting from land/vegetation clearing, topsoil removal, excavation, excavated material placement, trenching or directional boring, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to geological resources associated with deployment could result in incidental removal of bedrock or mineral resources, or adverse impacts to installed equipment resulting from geologic hazards (e.g., seismic hazards, landslides, and land subsidence). Specific FirstNet projects are likely to be small-scale; correspondingly, disturbance to geologic resources for those types of projects with the potential to impact geologic resources is also expected to be small-scale as a result, these potential impacts are expected to be less than significant. For the same reason, impacts to deployment from geologic hazards are likely to be less than significant as well. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no impacts to geology associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections because there would be no ground disturbance.

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 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.3.5. 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 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

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

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 subject to increased seismic activity, landslides, and land subsidence. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to geologic resources (or from geologic hazards) as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.3, Geology.

10.2.4. Water Resources

10.2.4.1. Introduction

This section describes potential impacts to water resources in New Mexico associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.4.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on water resources were evaluated using the significance criteria presented in Table 10.2.4-1. As described in Section 10.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 10.2.4-1: Impact Significance Rating Criteria for Water Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Water Quality (groundwater and surface water) - sedimentation, pollutants, nutrients, water temperature	Magnitude or Intensity	Groundwater contamination creating a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer; local construction sediment water quality violation, or otherwise substantially degrade water quality; water degradation poses a threat to the human environment, biodiversity, or ecological integrity. Violation of various regulations including: CWA, SDWA.	Effect that is potentially significant, but with mitigation is less than significant.	Potential impacts to water quality, but potential effects to water quality would be below regulatory limits and would naturally balance back to baseline conditions.	No changes to water quality; no change in sedimentation or water temperature, or the presence of water pollutants or nutrients.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Impact is temporary, lasting no more than six months.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Floodplain degradation[a]	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

[a] 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). (See http://www.archives.gov/federal-register/codification/executive-order/11988.html and https://www.federalregister.gov/articles/2015/02/04/2015-02379/establishing-a-federal-flood-risk-management-standard-and-a-process-for-further-soliciting-and).
NA = Not Applicable

10.2.4.3. Description of Environmental Concerns

Potential Water Quality Impacts

Water quality impaired waterbodies are those waters that have been identified as not supporting their appropriate uses. Projects in watersheds of impaired waters may be subject to heightened permitting requirements. For example, the CWA requires states to assess and report on the quality of waters in their state. Section 303(d) of the CWA requires states to identify impaired waters. For these impaired waters, states must consider the development of a Total Maximum Daily Load (TMDL) or other strategy to reduce the input of the specific pollutant(s) restricting waterbody uses, in order to restore and protect such uses.

Over 90 percent of the state's assessed lakes, reservoirs, and ponds are impaired due to various contaminants, such as mercury and polychlorinated biphenyls (USEPA, 2015d). Elevated concentrations of these contaminants have resulted in fish consumption advisories for various lakes and reservoirs, such as the Conchas Lake (NMED, 2014b). Approximately 65 percent of New Mexico's rivers and streams are impaired. Designated uses include aquatic life, domestic water supply, irrigation, livestock watering, recreating, and wildlife habitat. NMED has found that temperature, nutrients, pathogens are the three most common causes of water quality impairments in New Mexico's rivers and streams (USEPA, 2015d). Generally, the water quality of New Mexico's aquifers is suitable for drinking and daily water needs (NMED, 2014a).

Deployment activities could contribute pollutants in a number of ways but the primary likely manner is increased sediment in surface waters. Vegetation removal on site exposes soils to rain and wind that could increase erosion. Impacts to water quality may occur from post construction vegetation management, such as herbicides, that may leach into groundwater or move to surface waters through soil erosion or runoff, spray drift, or inadvertent direct overspray. Fuel, oil, and other lubricants from equipment could contaminate groundwater and surface waters if carried in runoff. Other water quality impacts could include changes in temperature, water volume flows, 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 New Mexico 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 could reduce potential impacts to surface water quality.

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

Therefore, based on the impact significance criteria presented in Table 10.2.4-1, water quality impacts would likely be less than significant at the programmatic level and could be further reduced if BMPs and mitigation measures were to be incorporated where practicable and feasible.

During implementation of the Proposed Action and Alternatives, there is the potential to encounter shallow groundwater due to clearing and grading activities, shallow excavation, or relocation of utility lines. This is unlikely, as trenching is not expected to exceed a 48-inch depth. However, groundwater contamination may exist in areas directly within or near the project area. If trenching[140] 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 New Mexico dewatering requirements. Any groundwater extracted during dewatering activities, or subject to the terms of a dewatering permit, may be required to be treated prior to discharge or disposed of at a wastewater treatment facility.

Due to average thickness of most New Mexico aquifers, there is little potential for groundwater contamination within a watershed or multiple watersheds. Thus, it is unlikely that the majority of FirstNet's deployment locations would result in a drinking quality violation, or otherwise substantially degrade groundwater quality or aquifer, and based on the impact significance criteria presented in Table 10.2.4-1, there would likely be less than significant impacts at the programmatic level on groundwater quality within most of the state.

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 flood. Some projects may be outside of a floodplain, but still be in an area with known flooding history.

Based on the impact significance criteria presented in Table 10.2.4-1, floodplain degradation impacts would be potentially less than significant at the programmatic level since the majority of FirstNet's likely deployment activities, on the watershed or subwatershed level, would use minimal fill, would not substantially increase impervious surfaces, structures would not impede

[140] Telecommunications activities involve laying conduit, with minimal trenching. Trenching activities would likely be at a minimal depth (less than 36 inches) and width (6 to 12 inches).

or redirect flood flows or impact floodplain hydrology, and would not occur during flood events with the exception of deployable technologies which may be deployed in response to an emergency. Additionally, any effects would be temporary, lasting no more than one season or water year,[141] or occur only during an emergency.

Examples of activities that would have less than significant impacts at the programmatic level include:

- Construction of any structure in the 500-year floodplain but is built above base flood elevation pursuant to floodplain management regulations;
- Land uses that include pervious surfaces such as gravel parking lots;
- Land uses that do not change the flow of water or drainage patterns; and
- Limited clearing or grading activities.

Implementation of BMPs and mitigation measures could reduce the risk of additional impacts to floodplain degradation (see Chapter 16).

Drainage Pattern Alteration

Flooding and erosion from land disturbance could changes 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 10.2.4-1, 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 at the programmatic level.

Example of projects that could have minor changes to the drainage patterns include:

- Land uses with pervious surfaces that create limited storm water runoff;
- Where storm water is contained on site and does not flow to or impact surface waterbodies offsite on other properties;
- Activities designed so that the amount of storm water generated before construction is the same as afterwards; and
- Activities designed using low impact development techniques for storm water.

[141] A water year is defined as “the 12-month period October 1, for any given year through September 30, of the following year. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months.” (USGS, 2016c).

Since the proposed activities would not substantially alter drainage patterns in ways that alter the course of a stream or river; create a substantial and measurable increase in the rate and amount of surface water; or change the hydrologic regime; and any effects would be short-term; impacts to drainage patterns would be less than significant at the programmatic level; 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 10.2.4-1. 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; and
- Minor clearing or grading activities.

Since the proposed activities would not likely alter flow characteristics or change the hydrologic regime, impacts would be less than significant impacts to flow alteration. BMPs, mitigation measures, and avoidance could be implemented to further reduce any impacts.

Changes in Groundwater or Aquifer Characteristics

As described in Section 10.1.4.7, approximately 78 percent of New Mexican residents depend on groundwater for drinking water. Groundwater makes up nearly 50 percent of the total water annually withdrawn for all uses in New Mexico, including agriculture and industry, and is the only practicable source of water in many areas of the state. Generally, the water quality of New Mexico's aquifers is suitable for drinking and daily water needs. (NMED, 2014a) 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 be unlikely to cause significant impacts to water quality due to the expected small volume of these materials. 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; and
- Storage of petroleum or chemical products.

Private and public water supplies often use groundwater as a water source. To maintain a sustainable system, the amount of water withdrawn from these groundwater sources must be balanced with the amount of water returned to the groundwater source (groundwater recharge).

Deployment activities should be less than significant at the programmatic level since they would not substantially deplete supplies of potable groundwater, as any construction dewatering would be short-term. It is likely that areas that utilize groundwater for potable water purposes, would be avoided. According to Table 10.2.4-1, potentially significant impacts to groundwater or aquifer characteristics would only occur if actions resulted in substantial and measurable changes in groundwater or aquifer characteristics, including volume, timing, duration, and frequency of groundwater flow, and other changes to the groundwater hydrologic regime on a watershed or within multiple watersheds that is ongoing and permanent. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.4.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to water resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to potentially significant impacts depending on the deployment scenario or site-specific conditions. The impact on the water resources that could be affected would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource’s current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, 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 help avoid or minimize potential impacts.

- New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would impact water resources from a short-term increase in suspended solids in the water. Site-specific impact assessment could be required to shoreline environments prior to installation to fully assess potential impacts to lake or river coastal environments.
- New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Ground disturbance activities could cause impacts to water quality from increased suspended solids; groundwater impacts from trenching activities are not expected. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
- Collocation on Existing Aerial Fiber Optic Plant*:* Replacement of poles or structural hardening could result in ground disturbance that could cause impacts to water quality from increased suspended solids.
- Installation of Optical Transmission or Centralized Transmission Equipment*:* If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to water resources.

- Wireless Projects
  - New Wireless Communication Towers*:* Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security lighting, electrical feeds, and concrete foundations and pads) or access roads could result in potential direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites. The amount of impact depends on the land area affected, installation technique, and location. Trenching would not be expected to occur near or below the existing water table (depth to water). Implementing BMPs and mitigation measures could reduce impact intensity. If a new roadway were built, additional impervious surface would not be expected to impact water resources or the overall amount of runoff and nonpoint pollution.
  - Deployable Technologies*:* Implementation of land-based deployable technologies could result in potential impacts to water resources if deployment involves movement of equipment through streams, occurs in riparian or floodplain areas, occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require

land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites or deployment in unpaved areas. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in indirect impacts on water quality if fuels leak into surface or groundwater. Where deployable technologies would be implemented on existing paved surfaces, or where aerial and vehicular deployable technologies may be used on existing paved surfaces, it is anticipated that there would be no impacts to water resources because there would be no ground disturbance.

- Deployment of drones, balloons, blimps, or piloted aircraft could have indirect impacts on water quality if fuels spill or other chemicals seep into ground or surface waters. In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to water resources associated with deployment of this infrastructure could include water quality impacts, but are expected to be less than significant due to the small-scale of individual activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) 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 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities, and are expected to have no impacts as there would be no ground disturbing activity and it is likely routine maintenance activities would be conducted along exiting roads and utility rights-of-way. 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 ongoing potential impacts to surface and groundwater quality from routine operations and maintenance application of herbicides to control vegetation are not expected. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.4.5. 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 at the programmatic level to water resources if those activities occurred on paved surfaces. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving, however, these activities would be isolated and short-term, and would likely return to baseline conditions once revegetation was complete. Additionally, project activities could result in direct and indirect impacts to water quality from a temporary increase in the amount of suspended solids running off construction sites and from fuels leaking into surface or groundwater. However, spills from vehicles or machinery used during deployment tend to be associated with re-fueling operations, and as such, would likely be a few gallons or less in volume and would likely be easily contained or cleaned up, and therefore would have less than significant impacts at the programmatic level. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Deployable Technologies Alternative would consist of routine maintenance and inspection of the deployable technologies. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The water resources impacts would depend on the watershed, duration (chronic or short-term) and frequency (many years or a few months) the resource would be used, and the water resource’s current use (sole source for drinking water, considered exceptional value for recreation, or provides critical habitat for a species).

It is anticipated that there would be no impacts to water resources associated with routine inspections of the Deployable Technologies Alternative, assuming that the same access roads used for deployment are also used for inspections. If usage of heavy equipment as part of routine maintenance or inspections occurs off of established access roads or corridors and near waterbodies, the resulting ground disturbance could increase sedimentation in waterbodies, potentially impacting water quality. It is assumed that routine maintenance would not include operation of vehicles or equipment in waterbodies. Finally, if ground-based deployable technologies are parked and operated with air conditioning for extended periods of time, the condensation water from the air conditioner could result in soil erosion that could potentially impact waterbodies if the deployables are located adjacent to waterbodies, however, due to the limited and temporary nature of the deployable activities, it is anticipated that these potential impacts would be less than significant. Site maintenance, including mowing or herbicides, may result in less than significant effects to water quality, due to the small-scale of expected FirstNet activities in any particular location. In addition, the presence of new access roads could increase the overall amount of impervious surface in the area, and increase runoff effects on water resources, as explained above. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to 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 10.1.4, Water Resources.

10.2.5. Wetlands

10.2.5.1. Introduction

This section describes potential impacts to wetlands in New Mexico associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.5.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on wetlands were evaluated using the significance criteria presented in Table 10.2.5-1. As described in Section 10.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 10.2.5-1: 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[a] or Intensity	Substantial loss of high-quality wetlands (e.g., those that provide critical habitat for sensitive or listed species, are rare or a high-quality example of a wetland type, are not fragmented, support a wide variety of species, etc.); violations of Section 404 of the CWA.	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands (e.g., not rare or unique, that have low productivity and species diversity, and those that are already impaired or impacted by human activity).	No direct loss of wetlands.
	Geographic Extent/Context	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA
	Duration or Frequency	Chronic and long term changes not likely to be reversed over several years or seasons.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA
Other direct effects: vegetation clearing; ground disturbance; direct hydrologic changes (flooding or draining); direct soil changes; water quality degradation (spills or sedimentation)	Magnitude or Intensity	Substantial and measurable changes to hydrological regime of the wetland impacting salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands.	Effect that is potentially significant, but with mitigation is less than significant.	Impacts to lower quality wetlands affecting the hydrological regime including salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality; introduction and establishment of invasive species to high quality wetlands.	No direct impacts to wetlands affecting vegetation, hydrology, soils, or water quality.
	Geographic Extent	Watershed level, and/or within multiple watersheds.		Watershed or subwatershed level.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	Long-term or permanent alteration that is not restored within 2 growing seasons, or ever.		Periodic and/or temporary loss reversed over 1-2 growing seasons with or without active restoration.	NA
Indirect Effects: [b] Change in Function(s)[c] 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

[a] "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.
[b] 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.
[c] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, T/E species habitat, biodiversity, recreational/social value.
NA= Not Applicable

10.2.5.3. 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 at the programmatic level given the amount of land disturbance associated with the project locations (generally less than an acre) and the short time-frame of deployment activities. Additionally, all site-specific locations will be subject to an environmental review to help ensure environmental concerns are addressed. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures (see Chapter 16).

Of the 1 million acres of wetlands that existed in New Mexico in the early 1800s, there are approximately 300,000 acres remaining (USFWS, 2014a) (NMED, 2014a) (FGDC, 2013). The main type of wetland is palustrine (freshwater) wetlands found on river and lake floodplains across the state, as shown in Section 10.1.5, Figure 10.1.5-1. As discussed in Section 10.1.5.4, Wetlands, New Mexico's Water Quality Standards establish designated uses for waterbodies, which include all waters of the U.S., set criteria to protect those uses, and establish provisions to preserve water quality. Outstanding Natural Resource Waters (ONRWs) receive additional protection to ensure that the biological, chemical, and physical integrity of all New Mexico wetlands are adequately protected. Designation protects wetlands from degradation by human activities that may occur in wilderness wetlands. (NMED, 2015l) Wetlands that are considered ONRWs in New Mexico include approximately 6,000 acres of wetlands in USFS Wilderness Areas (NMED, 2015l). Based on the impact significance criteria presented in Table 10.2.5-1, the deployment activities would most likely have less than significant direct impacts on wetlands. Additionally, the deployment activities would not violate applicable federal, state, or local regulations.

Potential Other Direct Effects

Other 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, other direct impacts would not result in a loss of total wetland acreage. Changes, for example, could include conversion of a forested wetland system to a non-forested state through chemical, mechanical, or hydrologic manipulation; altered hydrologic conditions (increases or decreases) such as storm water discharges or water withdrawals that alter the functions of the wetlands.

Based on the impact significance criteria presented in Table 10.2.5-1, construction-related deployment activities that result in long-term or permanent, substantial, and measurable changes to hydrological regime of the wetland (i.e., changes in salinity, pollutants, nutrients, biodiversity, ecological integrity, or water quality) may cause potentially significant impacts. In addition, introduction and establishment of invasive species to high quality wetlands within a watershed or multiple watersheds are potentially significant. Other direct effects to wetlands would be less than significant at the programmatic level 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. 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 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Examples of activities that could have other direct effects to wetlands in New Mexico include:

- *Vegetation Clearing:* removing existing vegetation by clearing forest and herbaceous vegetation during construction activities, grading, seeding, and mulching. Clearing and grading may include increased soil erosion and a decrease in the available habitat for wildlife.
- *Ground Disturbance:* Increased amounts of storm water runoff in wetlands 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, such as the acidic conditions of bogs and alkaline conditions of fens.

- *Water Quality Degradation (spills or sedimentation)*: The loss of wetlands results in a depletion of water quality both in the wetland and downstream. Filtering of pollutants by wetlands is an important function and benefit. High levels of suspended solids (sedimentation) could reduce light penetration, dissolved oxygen, and overall wetland productivity. Toxic materials in runoff could interfere with the biological processes of wetland plants, resulting in impaired growth, mortality, and changes in plant communities.

Indirect Effects:[142] Changes in Function(s)[143] or Change in Wetland Type

Indirect effects to wetlands could include change in wetland function or conversion of a resource to another type (i.e., wetland to an open body of water). The construction of curb and gutter systems diverts surface runoff and could cause flooding or wetlands to dry out, depending on the direction of diversion. Indirect effects to high- and low-quality wetlands would be less than significant at the programmatic level 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. To minimize any potential impacts to wetlands, BMPs and mitigation measures would be implemented in compliance with any issued federal, state, and local permits. Potential wetlands impacts could be further reduced by implementing BMPs and mitigation measures, as practicable and feasible (see Chapter 16).

- *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.

[142] Indirect effects are those resulting from direct effects, but they occur elsewhere in space and/or time. Includes indirect hydrologic effects (wetting or drying) that in turn alters wetland function or type.
[143] Wetland functions include hydrologic, ecological, geomorphic, and social functions typically assessed for wetlands as part of USACE compensatory mitigation planning. Typical functions assessed may include flood attenuation, bank stabilization, water quality, organic matter input/transport, nutrient processing, wildlife habitat, T/E species habitat, biodiversity, recreational/social value.

- *Wildlife Habitat:* Impacts on wetland hydrology and water quality affect wetland vegetation. While flooding could harm some wetland plant species, it promotes others. Shifts in plant communities because of hydrologic changes could have impacts on the preferred food supply and animal cover.
- *Recreational Value:* Wetlands provide recreation opportunities for people, such as hiking, bird watching, and photography.
- *Groundwater Recharge:* Wetlands retain water, allowing time for surface waters to infiltrate into soils and replenish groundwater.

According the significant criteria defined in Table 10.2.5-1, 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 at the programmatic level. Since the majority of wetlands in New Mexico are not considered high quality, deployment activities could have less than significant indirect impacts at the programmatic level on wetlands in the state. In areas of the state with high quality wetlands, there could be potentially significant impacts at the project level that would be analyzed on a case-by-case basis. If avoidance were not possible, BMPs and mitigation measures would help to mitigate impacts. 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 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.5.4. Potential Impacts of the Preferred Alternative

The following section assesses potential impacts associated with implementation of the Preferred Alternative, including deployment and operation activities. To determine the magnitude of potential impacts of site-specific activities, wetland delineations would be required to determine the exact location of all wetlands, including high quality wetlands, as well as a functional assessment by an experienced wetland delineator.

Deployment Impacts

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. It is anticipated that there would be no impacts to wetlands since the activities that would be conducted at these small entry and exit points are not likely to produce perceptible changes.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to wetlands because there would be no ground disturbance.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment*:* It is anticipated that the installation of permanent equipment on existing structures, adding equipment to satellites being launched for other purposes, and the use of portable devices that use satellite technology is not likely to impact wetlands since there would be no ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wetlands, it is anticipated that this activity would have no impact on wetlands.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wetlands because of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct effects, other direct effects, and indirect effects on wetlands. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to wetlands include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wetlands. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct and indirect impacts to wetlands. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity

to wetlands and type of wetlands that could be affected. Implementing BMPs and mitigation measures could reduce impact intensity.

- New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would potentially impact wetlands found along shorelines. Additional project-specific environmental reviews would be required to assess potential impacts to wetland environments.
- New Build – Aerial Fiber Optic Plant: Potential impacts would be similar to Buried Fiber Optic Plant. Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected.
- Collocation on Existing Aerial Fiber Optic Plant: Any ground disturbance could cause direct and indirect impacts to wetlands from increased suspended solids and runoff from activities, depending on the proximity to wetlands and type of wetlands that could be affected.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading or other ground disturbance to install small boxes or hunts, or access roads, there could potentially be direct and indirect impacts to wetlands. The amount of impact from a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depends on the land area affected, installation technique, and location. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could potentially cause direct and indirect impacts to wetlands. The activities could cause a temporary increase in the amount of suspended solids running off construction sites and into wetlands, depending on their proximity. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type. If trenching were to occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - Collocation on Existing Wireless Tower, Structure, or Building*:* Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wetlands. However, if additional power units, structural hardening, and physical security measures required ground disturbance, such as grading, or excavation activities, impacts to wetlands could occur near wetlands, it could cause impacts on wetlands. Implementing BMPs and mitigation measures could reduce impact intensity.
  - Deployable Technologies*:* Implementation of deployable technologies could result in potential impacts to wetlands if deployment occurs in unpaved areas, or if the

implementation results in paving of previously unpaved surfaces. Some staging or landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. The amount of impact depends on the land area affected, installation technique, and location. Implementing BMPs and mitigation measures could reduce impact intensity. The activities could also result in other direct impacts on wetlands if fuels leak into nearby waterbodies or wetlands. Deployment of drone, balloon, or blimp piloted aircraft could have other direct impacts on wetlands if fuels spill or other chemicals seep into nearby waterbodies or wetlands.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Depending on the deployment activity for this infrastructure, potential impacts to wetlands may occur. The amount of impact depends on the land area affected, installation technique, proximity to wetlands, and type of wetland that could be affected (e.g., high quality). Any ground disturbance could cause direct and indirect impacts wetlands, depending on the proximity to wetlands and type of wetlands that could be affected. These impacts are expected to be less than significant at the programmatic level 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 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there could be ongoing potential other direct impacts to wetlands if heavy equipment is used for routine operations and maintenance application of herbicides occurs to control vegetation along all ROWs and near structures, depending on the proximity to wetlands. The intensity of the impact depends on the amount of herbicides used, frequency, and location of nearby sensitive wetlands. These impacts are expected to be less than significant at the programmatic level due to the limited nature of deployment activities. It is also anticipated that routine maintenance activities would be conducted on existing roads and utility ROW. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.5.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As explained above, implementation of deployable technologies could result in less than significant impacts to wetlands. Some staging or launching/landing areas (depending on the type of technology) may require land/vegetation clearing, excavation, and paving. These activities could result in direct and indirect impacts to wetlands from a temporary increase in the amount of suspended solids running off construction sites to nearby surface waters. The amount of impact depends on the land area affected, installation technique, and proximity to wetlands, and wetland type; however, impacts are expected to be less than significant at the programmatic level 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 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the 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 at the programmatic level to wetlands associated with routine inspections of the Deployable Technologies Alternative as it is likely existing roads and utility ROW would be utilized for maintenance and inspection activities. Site maintenance, including mowing or herbicides, is anticipated to result in less than significant effects at the programmatic level 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 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to wetlands from construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.5, Wetlands.

10.2.6. Biological Resources

10.2.6.1. Introduction

This Chapter describes potential impacts to terrestrial vegetation, wildlife, fisheries and aquatic habitat, and threatened and endangered species in New Mexico associated with deployment and operation of the Proposed Action and its Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.6.2. 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 10.2.6-1. As described in Section 10.2, 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 10.2.6.3, 10.2.6.4, and 10.2.6.5, respectively, are presented as a range of possible impacts.

Refer to Section 10.2.6.6 for impact assessment methodology and significance criterial associated with threatened and endangered species in New Mexico.

Table 10.2.6-1: Impact Significance Rating Criteria for Terrestrial Vegetation, Wildlife, Fisheries, and Aquatic Habitats

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than significant	Impact Level: No Impact
Direct Injury/Mortality	Magnitude or Intensity	Population-level or sub-population injury/mortality effects observed for at least one species depending on the distribution and the management of said species. Events that may impact endemics, or concentrations during breeding or migratory periods. Violation of various regulations including: MBTA and Bald and Golden Eagle Protection Act (BGEPA).	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Individual mortality observed but not sufficient to affect population or sub-population survival.	No direct individual injury or mortality would be observed.
	Geographic Extent	Regional effects observed within New Mexico for at least one species. Anthropogenic[a] disturbances that lead to exclusion from nutritional or habitat resources, or direct injury or mortality of endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than significant**	**No Impact**
Vegetation and Habitat Loss, Alteration, or Fragmentation	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species or vegetation cover type, depending on the distribution and the management of the subject species. Impacts to terrestrial, aquatic, or riparian habitat or other sensitive natural community vital for feeding, spawning/breeding, foraging, migratory rest stops, refugia, or cover from weather or predators. Violation of various regulations including: MBTA and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Habitat alteration in locations not designated as vital or critical for any period. Temporary losses to individual plants within cover types, or small habitat alterations take place in important habitat that is widely distributed and there are no cover type losses or cumulative effects from additional projects.	Sufficient habitat would remain functional to maintain viability of all species. No damage or loss of terrestrial, aquatic, or riparian habitat from project would occur.
	Geographic Extent	Regional effects observed within New Mexico for at least one species. Anthropogenic disturbances that lead to the loss or alteration of nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than significant	No Impact
Indirect Injury/Mortality	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Exclusion from resources necessary for the survival of one or more species and one or more life stages. Anthropogenic disturbances that lead to mortality, disorientation, the avoidance or exclusion from nutritional or habitat resources for endemics or a significant portion of the population or sub-population located in a small area during a specific season. Violation of various regulations including: MBTA and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Individual injury/mortality observed but not sufficient to affect population or sub-population survival. Partial exclusion from resources in locations not designated as vital or critical for any given species or life stage, or exclusion from resources that takes place in important habitat that is widely distributed. Anthropogenic disturbances are measurable but minimal as determined by individual behavior and propagation, and the potential for habituation or adaptability is high given time.	No stress or avoidance of feeding or important habitat areas. No reduced population resulting from habitat abandonment.
	Geographic Extent	Regional or site specific effects observed within New Mexico for at least one species. Behavioral reactions to anthropogenic disturbances depend on the context, the time of year age, previous experience and activity. Anthropogenic disturbances that lead to startle responses of large groupings of individuals during haulouts, resulting in injury or mortality.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level: Potentially Significant	Impact Level: Less than Significant with BMPs and Mitigation Measures Incorporated	Impact Level: Less than significant	Impact Level: No Impact
Effects to Migration or Migratory Patterns	Magnitude or Intensity	Population-level or sub-population effects observed for at least one species depending on the distribution and the management of said species. Temporary or long-term loss of migratory pattern/path or rest stops due to anthropogenic activities. Violation of various regulations including: MBTA and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Temporary loss of migratory rest stops due to anthropogenic activities take place in important habitat that is widely distributed and there are no cumulative effects from additional projects.	No alteration of migratory pathways, no stress or avoidance of migratory paths/patterns due to project.
	Geographic Extent	Regional effects observed within New Mexico for at least one species. Anthropogenic disturbances that lead to exclusion from nutritional or habitat resources during migration, or lead to changes of migratory routes for endemics or a significant portion of the population or sub-population located in a small area during a specific season.		Effects realized at one location when population is widely distributed, and not concentrated in affected area.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several years for at least one species.		Temporary, isolated, or short-term effects that are reversed within one to three years.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than significant**	**No Impact**
Reproductive Effects	Magnitude or Intensity	Population or sub-population level effects in reproduction and productivity over several breeding/spawning seasons for at least one species depending on the distribution and the management of said species. Violation of various regulations including: MBTA and BGEPA.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Effects to productivity are at the individual rather than population level. Effects are within annual variances and not sufficient to affect population or sub-population survival.	No reduced breeding or spawning success.
	Geographic Extent	Regional effects observed within New Mexico for at least one species. Anthropogenic disturbances that lead to exclusion from prey or habitat resources required for breeding/spawning or stress, abandonment and loss of productivity for endemics or a significant portion of the population or sub-population located in a small area during the breeding/spawning season.		Effects realized at one location.	NA
	Duration or Frequency	Chronic and long-term effects not likely to be reversed over several breeding/spawning seasons for at least one species.		Temporary, isolated, or short-term effects that are reversed within one breeding season.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than significant**	**No Impact**
Invasive Species Effects	Magnitude or Intensity	Extensive increase in invasive species populations over several seasons.	Effect that is potentially significant, but with BMPs and mitigation measures is less than significant.	Mortality observed in individual native species with no measurable increase in invasive species populations.	No loss of forage and cover due to the invasion of exotic or invasive plants introduced to project sites from machinery or human activity.
	Geographic Extent	Regional impacts observed throughout New Mexico.		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, 2015g)
NA= Not Applicable

10.2.6.3. Terrestrial Vegetation

Impacts to terrestrial vegetation occurring in New Mexico 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 10.2.6-1, direct injury or mortality impacts could be significant if population-level or sub-population effects were observed for at least one species depending on the distribution and the management of the subject species. Although unlikely, direct mortality/injury to plants could occur in construction zones from land clearing, excavation activities, or vehicle traffic; however, FirstNet deployment events are expected to be relatively small in scale and therefore would have less than significant impacts at the programmatic level. The implementation of standard BMPs, mitigation measures, and avoidance measures could help to minimize or altogether avoid potential impacts to plant population survival. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

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 potential 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. In New Mexico, about 52 percent of the total land cover is rangeland and about 34 percent is federal land. Additionally, about 7 percent of the land cover is unfragmented forest, primarily in northern and western regions of the state (NRCS, 2010).

Construction of new infrastructure and long-term facility maintenance could result in the alteration of the type of vegetative communities in these localized areas, and in some instances the permanent loss of vegetation. In general, these impacts are expected to be less than significant at the programmatic level due to the short-term, localized nature of the deployment activities. 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 recommended and consultation with appropriate resource agencies, if required, could be undertaken to minimize or avoid potential impacts. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Indirect Injury/Mortality

Indirect effects are effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8[b]). Indirect injury/mortality could include stress related to disturbance. The alteration of soils or hydrology within a localized area could result in stress or mortality of plants. Construction activities that remove large quantities of soil in the immediate vicinity of trees could cause undue stress to trees from root exposure, although this is unlikely to occur due to the small size of expected FirstNet activities. Indirect injury/mortality impacts vary depending on the species, time of year and duration of construction or deployment. Overall, these impacts are expected to be less than significant at the programmatic level due to the short-term and small-scale nature of deployment activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize 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.

As described in Section 10.1.6.4, when non-native species are introduced into an ecosystem in which they did not evolve, their populations sometimes increase rapidly. The New Mexico Noxious Weed Management Act (76-7D-1 through 76-7D-6 NMSA 1978) stipulates that the New Mexico Department of Agriculture be responsible for establishing the noxious weed list and coordination of integrated noxious weed management programs to identify noxious weed control methods and educate the public on noxious weeds. The New Mexico Noxious Weed Control Act (76-7-1 through 76-7-22 NMSA 1978) allows for the establishment of noxious weed control districts to determine which noxious weeds shall be subject to control within the district and the appropriate control method. Currently, 37 state-listed noxious species are targeted as noxious weeds for control or eradication pursuant to the Noxious Weed Management Act of 1998.

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.

Overall, these impacts are expected to be less than significant at the programmatic level due to the small-scale and localized nature of likely FirstNet activities. BMPs could help to minimize or avoid the potential for introducing invasive plant species during implementation of the Proposed Action. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to terrestrial vegetation resources and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range impacts, from no impacts to less than significant impacts, depending on the deployment scenario or site-specific conditions. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology[144], and the nature as well as the extent of the habitats affected. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

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.

[144] Phenology is the seasonal changes in plant and animal lifecycles, such as emergence of insects or migration of birds. (USEPA, 2015g)

- 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.

<u>Activities with the Potential to Have Impacts</u>

Potential deployment-related impacts to terrestrial vegetation as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; indirect injury/mortality; and invasive species effects. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to terrestrial vegetation include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to terrestrial vegetation. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. BMPs and mitigation measures could help avoid or minimize potential impacts.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilities to house outside plant equipment could result in potential impacts to terrestrial vegetation. Impacts may vary depending on the number or individual poles installed, but could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. 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 or near bodies of water would not impact terrestrial vegetation. However, impacts to terrestrial vegetation could potentially occur as a result of the construction of landings and/or facilities on shores or the banks of water bodies that accept the submarine cables could potentially occur as a result of land clearing, excavation activities, and heavy equipment use. Effects could include direct or indirect injury to plants; the loss, alteration, or fragmentation of vegetative communities; and invasive species effects. 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: 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. Despite the variability, these impacts are expected to be less than significant at the programmatic level due to the small scale and limited geographic scope of expected deployment activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The terrestrial vegetation that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be no impacts to terrestrial vegetation associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections because there would be no ground disturbance. Site maintenance, including mowing or herbicides, may result in less than significant at the programmatic level 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 at the programmatic level due to the small-scale of expected activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

<u>Deployment Impacts</u>

As described above, implementation of deployable technologies could result in less than significant impacts at the programmatic level 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. Nonetheless, impacts are expected to remain less than significant due to the relatively small-scale of FirstNet activities at individual locations. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

<u>Operational Impacts</u>

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. The impacts could vary greatly among species, vegetative community, and geographic region, but are expected to remain less than significant at the programmatic level. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts at the programmatic level to terrestrial vegetation associated with routine operations and maintenance due to the relatively small scale of likely FirstNet project sites. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to 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 10.1.6.3, Terrestrial Vegetation.

10.2.6.4. Wildlife

Impacts to amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates occurring in New Mexico are discussed in this section. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

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 10.2.6-1, less than significant impacts would be anticipated at the programmatic level given that the majority of proposed deployment activities are likely to be small-scale and would be dependent on the location and type of deployment activity. Although anthropogenic disturbances may be measurable (although minimal) for some FirstNet Proposed Actions, 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; therefore, impacts are generally expected to be less than significant at the programmatic level, as discussed further below. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Vehicle strikes are common sources of direct mortality or injury to both small and large mammals in New Mexico. Mammals are attracted to roads for a variety of reasons including use as a source of minerals, foraging, and migration (FHWA, 2009). 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.

For example, if tree-roosting bats, and particularly maternity colonies are present at a site location, removal of trees during land clearing activities could result in direct injury/mortality if bats are utilizing them as roost trees or for rearing young. The scale of this impact would be expected to be small-scale and would be dependent on the location and type of deployment activity, and tree removal. Site avoidance measures could be implemented to avoid disturbance to bats.

<u>Birds</u>

Mortalities from collisions or electrocutions with manmade cables and wires are environmental concerns for avian species and violate. Generally, collision events occur to night-migrating birds, "poor" fliers (e.g., ducks), heavy birds (e.g., swans and cranes), and birds that fly in flocks; while species susceptible to electrocution are birds of prey, ravens, and thermal soarers, typically having large wing spans (FAA, 2012; Gehring, Kerlinger, & and Manville, 2011).

Avian mortalities or injuries could also result from vehicle strikes, although typically occur as isolated events.

Direct injury and mortality of birds could occur to ground-nesting birds when nests are either disturbed or destroyed during land clearing, excavation, and trenching, and other ground disturbing activities. Removal of trees during land clearing activities, could also result in direct injury/mortality to forest dwelling birds if they are utilizing them as roost trees for resting or shelter from predators and inclement weather, or as nest trees for rearing young. The scale of this impact would be associated with the amount of tree removal and the abundance of forest-dwelling birds roosting/nesting in the area. These impacts could be particularly pronounced in IBAs within the state as these areas provide them with essential habitat that supports various life stages (Hill, et al., 1997). Direct injury/mortality are not anticipated to be widespread or affect bird populations due to the small-scale of likely FirstNet actions.

Direct mortality and injury to birds of New Mexico are not likely to be widespread or affect populations of species as a whole; individual impacts may be realized depending on the location and type of deployment activity. Direct injury/mortality are not anticipated to be widespread or affect bird populations due to the small scale of likely FirstNet actions. If siting considerations, BMPs, and mitigation measures are implemented (Chapter 16), potential impacts could be minimized. Additionally, potential impacts under MBTA and BGEPA could be addressed through BMPs and mitigation measures, as defined through consultation with USFWS.

<u>Reptiles and Amphibians</u>

In New Mexico, reptiles and amphibians could be found nearly everywhere in New Mexico in each type of vegetation community. Many species are widespread throughout the state, and a few are more commonly found in more specific habitats. 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.

Environmental consequences pertaining to amphibians are discussed in Section 10.2.6.6, Threatened and Endangered Species and Species of Conservation Concern.

<u>Terrestrial Invertebrates</u>

The terrestrial invertebrate populations of New Mexico 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 fragmentation is the loss or breaking down of continuous and connected habitat. In New Mexico, about 52 percent of the total land cover is rangeland and about 34 percent is federal land. Additionally, about 7 percent of the land cover is unfragmented forest, primarily in northern and western regions of the state (NRCS, 2010).

As described in Section 10.2.6.3, habitat loss could occur through exclusion, directly or indirectly, preventing an animal from accessing an optimal habitat (e.g., breeding, forage, or refuge), either by physically preventing use of a habitat or by causing an animal to avoid a habitat, either temporarily or long-term. It is expected that activities associated with the Proposed Action would cause exclusion effects only in very special circumstances, as in most cases an animal could fly, swim, or walk to a nearby area that would provide refuge.

In general, potential effects of vegetation and habitat loss, alteration, or fragmentation are expected to be less than significant because of the small-scale nature and limited geographic scope of expected deployment activities. These potential impacts are described for New Mexico's wildlife species below. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

<u>Terrestrial Mammals</u>

Mammals occupy a wide range of habitats throughout New Mexico and may experience localized effects of habitat loss or fragmentation. Removal or loss of vegetation may impact large mammals (e.g., black bear) 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, foxes) that utilize these areas for roosting, foraging, sheltering, and for rearing their young. Loss of habitat or exclusions from these areas could be avoided or minimized by BMPs and mitigation measures (see Chapter 16).

<u>Birds</u>

The direct removal of migratory bird nests is prohibited under the MBTA. The USFWS and the ODFW provide regional guidance on the most critical time periods (e.g., breeding season) to avoid vegetation clearing. The removal and loss of vegetation could affect avian species directly by loss of nesting, foraging, stopover, and cover habitats.

Noise disturbance and human activity, as discussed previously, could directly restrict birds from using their preferred resources. Greater human activity of longer duration would increase the likelihood that birds would avoid the area, possibly being excluded from essential resources. These impacts could be particularly pronounced in IBAs within the state as birds may temporarily avoid these areas (Hill, et al., 1997).

The degree to which habitat exclusion affects birds depends on many factors. The impact to passerine[145] species from disturbance or displacement from construction activities is likely to be short-term with minor effects from exclusion. Exclusion from resources concentrated in a small migratory stop area during peak migration could have major impacts to species that migrate in large flocks and concentrate at stop overs (e.g., shorebirds). BMPs and mitigation measures, including nest avoidance during construction-related activities, would help to avoid or minimize the potential impacts to birds from exclusion of resources, as appropriate.

Reptiles and Amphibians

Important habitats for New Mexico's amphibians and reptiles typically consist of wetlands and the surrounding upland forest. Impacts are expected to be less than significant at the programmatic level given the short-term nature and limited geographic scope of individual activities. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures (see Chapter 16) would be implemented to avoid or minimize the potential impacts.

Filling or draining of wetland breeding habitat (see Section 10.2.4, Water Resources) and alterations to ground or surface water flow from development associated with the Proposed Action may also have effects to New Mexico's amphibian and reptile populations, though BMPs and mitigation measures would help to avoid or minimize the potential impacts.[146]

Terrestrial Invertebrates

Habitat loss and degradation are the most common causes of invertebrate species' declines; however, habitat for many common terrestrial invertebrates is generally assumed to be abundant and widely distributed across the state, therefore no significant effects to terrestrial invertebrates are expected. Impacts to sensitive invertebrate species are discussed below in Section 10.2.6.6, 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. Overall, impacts are expected to remain less than significant at the programmatic level due to the short-term nature and limited geographic scope of expected activities, though BMPs and mitigation measures could further help to avoid or minimize the potential impacts. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize 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 to roosting bats from noise, light, or human disturbance causing them to

[145] Passerines are an order of "perching" birds that have four toes, three facing forward and one backward, which allows the bird to easily cling to both horizontal and nearly vertical perches.
[146] See Section 10.2.5, Wetlands, for a discussion of BMPs for wetlands.

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, and repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Birds

Repeated disturbance, especially during the breeding and nesting season, could cause stress to individuals lowering fitness and productivity. These impacts could be particularly pronounced in IBAs within the state if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, et al., 1997). The majority of FirstNet deployment activities would be short-term in nature, and repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Reptiles and Amphibians

Changes in water quality, especially during the breeding seasons, could cause stress resulting in lower productivity. The majority of FirstNet deployment activities would be short-term in nature, and repeated disturbances would not occur. Depending on the project type and location, individual species may be disturbed resulting in less than significant impacts.

Terrestrial Invertebrates

Terrestrial invertebrates 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 at the programmatic level.

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. Overall, potential impacts are anticipated to be less than significant at the programmatic level due to the small-scale and localized nature of expected activities, which would be unlikely to result in long-term avoidance. Potential effects to migration patterns of New Mexico's amphibians and reptiles, terrestrial mammals, birds, and terrestrial invertebrates are described below. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Terrestrial Mammals

Some large mammals (e.g., black bears) 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[147]. Any clearance, drilling, and construction activities needed for network deployment, including noise associated with these activities, has the potential to divert mammals from these migratory routes. Impacts could vary depending on the species, time of year of construction/operation, and duration, but are generally expected to be less than significant at the programmatic level given the short-term nature and limited geographic scope for individual activities. 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.

Birds

Because many birds have extremely long migrations, protection efforts for critical sites along migratory routes must be coordinated over distances often involving many different countries. For example, as a group, shorebirds migrating through New Mexico undertake some of the longest-distance migrations of all animals. According to the New Mexico Audubon Society, a total of 62 IBAs have been identified in the state, including breeding, migratory stop-over, feeding, and over-wintering areas, and a variety of habitats such as native grasslands, biogeographical "sky islands," high elevation pine forest, desert, rivers, canyons, and wetland/riparian[148] areas (National Audubon Society, 2015). Many migratory routes are passed from one generation to the next. Impacts could vary (e.g., mortality of individuals or abandonment of stopover sites by whole flocks) depending on the species, time of year of construction/operation, and duration, and impacts are expected to be less than significant at the programmatic level 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. Species that use streams as dispersal or migratory corridors may be impacted if these waterways are restricted or altered, but impacts are expected to be less than significant at the programmatic level. 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.

Terrestrial Invertebrates

The proposed deployment activities would be expected to be short-term or temporary in nature. No effects to migratory patterns of New Mexico's terrestrial invertebrates are expected as a result of the Proposed Action.

[147] A location chosen by an animal for hibernation.

[148] Riparian: "Referring to the areas adjacent to rivers and streams with a differing density, diversity, and productivity of plant and animal species relative to nearby uplands" (USEPA, 2015g).

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. Overall, potential impacts are anticipated to be less than significant at the programmatic level due to the short-term and limited nature of expected activities. Chapter 16 BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

<u>Terrestrial Mammals</u>

Restricted access to important winter hibernacula or summer maternity roosts for bats and dens for large mammals, such as the black bear, has the potential to negatively affect body condition and reproductive success of mammals in New Mexico.

Disturbance from deployment and operations could also result in the abandonment of offspring leading to reduced survival, although these activities are expected to be small-scale and impacts are expected to be less than significant at the programmatic level. Reproductive effects as a result of displacement and disturbance could be minimized through the use of BMPs and mitigation measures.

<u>Birds</u>

Impacts due to Proposed Action deployment and operations could include abandonment of the area and nests due to disturbance. Disturbance (visual and noise) may displace birds into less .suitable habitat and thus reduce survival and reproduction. These impacts could be particularly pronounced in IBAs within the state if birds temporarily avoid those areas, since they provide essential habitat for various life stages (Hill, et al., 1997). Because the majority of FirstNet deployment or operation activities are expected to be small-scale in nature and short duration, impacts to the reproduction of birds is expected to be less than significant at the programmatic level. Applicable BMPs and mitigation measures, as defined through consultation with USFWS for MBTA or BGEPA, if required, could help to avoid or minimize any potential impacts. Environmental consequences pertaining to federally listed species will be discussed in Section 10.2.6.6, Threatened and Endangered Species.

<u>Reptiles and Amphibians</u>

Reproductive effects to reptile nests may occur through direct loss or disturbance of nests. For example, the spiny softshell turtle will lay its eggs in exposed soil in late spring or summer (USGS, 2015i) where they are vulnerable to anthropogenic activities such as foot and off-road vehicle traffic.

Reproductive effects to sub-populations of amphibians and reptiles may occur through the direct loss of vernal pools as breeding habitat if deployment activities occur near breeding pools, alter water quality through sediment infiltration, or obstruction of natural water flow to pools, though BMPs would help to avoid or minimize the potential impacts.

Terrestrial Invertebrates

The majority of FirstNet deployment or operation activities are likely to be short-term in nature; therefore, no reproductive effects to terrestrial invertebrates are expected as a result of the Proposed Action.

Invasive Species Effects

When human activity results in a species entering an ecosystem new to it, the species is classified as introduced or invasive. The introduction of invasive species could have a dramatic effect on natural resources. New Mexico has not adopted official rules regarding invasive wildlife species. One species, feral hog, is considered invasive and known to cause damage to habitat, contaminate water sources, destroy agricultural crops, and competes with native wildlife species as well as newborn livestock species. The NMDGF encourages legal hunting of feral hogs (NMDGF 2011).

FirstNet deployment or operation activities could result in short-term or temporary changes to specific project sites although these sites are expected to return to their natural state in a year or two. Invasive species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers. Therefore, potential impacts are expected to be less than significant at the programmatic level.

Potential invasive species effects to New Mexico's wildlife are described below.

Terrestrial Mammals

In New Mexico, feral hogs adversely impact native wildlife. They feed on young mammals, destroy native vegetation resulting in erosion and water resource concerns, and could carry/transmit disease to livestock and humans (NMDGF 2011). FirstNet deployment or operation activities could result in short-term or temporary changes to specific project sites, although these sites are expected to return to their natural state in a year or two. FirstNet deployment activities are not expected to introduce terrestrial mammal species to project sites, as these activities are temporary and would not provide a mechanism for transport of invasive terrestrial mammals to project sites from other locations.

Birds

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 from machinery or construction workers.

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. 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 could pose a threat to New Mexico's forest and agricultural resources. 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 could help to avoid or minimize the potential for introducing invasive terrestrial invertebrate species during implementation of the Proposed Action. Invasive species effects related to terrestrial invertebrates could be minimized with the implementation of BMPs and mitigation measures (Chapter 16).

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to wildlife resources and others would not. In addition, and as described in this section, infrastructure developed under the Preferred Alternative could result in a range of impacts, from no impacts to less than significant impacts, depending on the deployment scenario or site-specific conditions. The wildlife that would be affected would depend on the ecoregion, the species' phenology and the nature and extent of the habitats affected. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit

points of the existing conduit in previously disturbed areas. Noise generated by equipment required to install fiber would be infrequent and of short duration, and unlikely to produce measurable changes in wildlife behavior. It is anticipated that effects to wildlife would be temporary and would not result in any perceptible change.

- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to wildlife resources because there would be no ground disturbance.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures, attaching equipment to satellites launched for other purposes, and the use of portable devices that use satellite technology would not impact wildlife because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it may include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact wildlife resources, it is anticipated that this activity would have no impact on wildlife resources.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to wildlife resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including direct injury/mortality; vegetation and habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; reproductive effects; and invasive species effects. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential impacts to wildlife resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to wildlife resources. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of wildlife that are not mobile enough to avoid construction activities (e.g., reptiles, small mammals, and young individuals), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (such as ground-nesting birds). Disturbance, including noise, associated with the above activities involving heavy equipment or land clearing could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects. Implementation of BMPs and mitigation measures could help to avoid or minimize potential impacts.
  - New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private

easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential impacts to wildlife resources. Impacts may vary depending on the number or individual poles installed and the extent of ground disturbance, but could include direct injury/mortality of individual species as described above; habitat loss, alteration, or fragmentation; effects to migratory patterns; indirect injury/mortality; and invasive species effects.

- Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, habitat loss or alteration, effects to migratory patterns, indirect injury/mortality, and invasive species effects. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in migratory effects and indirect injury/mortality.
- New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water and construction of landings and/or facilities on the shores or banks of water bodies that accept the submarine cables could potentially impact wildlife (see Section 10.2.4, Water Resources, for a discussion of potential impacts to water resources). Potential effects could include direct injury/mortality; habitat loss, alteration, or fragmentation depending on the site location. If activities occurred during critical time periods, effects to migratory patterns as well as reproductive effects and indirect injury/mortality could occur.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of wildlife as described for other New Build activities. Habitat loss, alteration and fragmentation; effects to migration or migratory patterns, indirect injury/mortality, and invasive species effects could occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to wildlife resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could result in direct injury/mortality, habitat loss, alteration or fragmentation, and effects to migratory patterns. Security lighting and fencing could result in direct and indirect injury or mortality, effects to migratory patterns, as well as reproductive effects. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, which would not result in impacts to wildlife. However, if new power

units, replacement towers, or structural hardening are required, impacts would be similar to new wireless construction. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- Deployable Technologies: Implementation of deployable technologies including COWs, COLTs, or SOWs could result in direct injury/mortalities to wildlife on roadways. If external generators are used, noise disturbance could potentially impact migratory patterns of wildlife. RF hazards could result in indirect injury or mortality as well as reproductive effects depending on duration and magnitude of operations. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

  Deployment of drones, balloons, blimps, and piloted aircraft could potentially impact wildlife by direct or indirect injury/mortality from collision, entanglement, or ingestion and effects to migratory patterns and reproductive effects from disturbance and/or displacement due to noise. The magnitude of these effects depends on the timing and frequency of deployments. However, deployment activities are expected to be temporary and isolated, and likely affecting only a small number of wildlife.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers or poles; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to wildlife resources associated with deployment of this infrastructure are anticipated to be less than significant at the programmatic level 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, and are therefore expected to remain less than significant at the programmatic level. Proposed FirstNet actions at some individual sites may have a higher level of impacts due to location-specific conditions, and therefore those proposed activities would undergo site-specific environmental review. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The wildlife that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected.

It is anticipated that there would be less than significant impacts to wildlife resources at the programmatic level 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. Potential spills of these materials would be expected to be in small quantities.

During operations, direct injury/mortality of wildlife could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms.

Wildlife resources could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of terrestrial wildlife, particularly during migrations between winter and summer ranges or in calving areas.

In addition, the presence of new access roads and transmission line ROWs may increase human use of the surrounding areas, which could increase disturbance to wildlife resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. As stated above, these impacts would likely be limited to individuals and unlikely to cause population-level impacts, and therefore would likely than less than significant at the programmatic level given the short-term nature and limited geographic scope for individual activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

Deployment Impacts

As described above, implementation of deployable technologies could result in less than significant impacts from direct and indirect injury or mortality events, changes in migratory patterns, disturbance, or displacement. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain less than significant at the programmatic level because deployment activities are expected to be temporary and localized, likely affecting only a small number of wildlife. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operational Impacts

As described above, operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be less than significant impacts at the programmatic level because deployable activities are expected to be temporary and likely affecting only a small number of wildlife. Proposed FirstNet actions at specific individual sites may have a higher level of impacts due to location-specific conditions, and therefore those proposed activities could undergo site-specific environmental review. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to wildlife resources as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.6.4, Terrestrial Wildlife.

10.2.6.5. Fisheries and Aquatic Habitats

Impacts to fisheries and aquatic habitats occurring in New Mexico are discussed in this section. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Description of Environmental Concerns

Direct Injury/Mortality

The most common direct injuries are entanglement, vessel strike, problems associated with accidental ingestion, and injuries incurred by sensitive animals from disturbance events (EPA 2012).

Based on the impact significance criteria presented in Table 10.2.6-1, less than significant impacts would be anticipated at the programmatic level given that the majority of proposed deployment activities are likely to be small-scale and would be dependent on the location and type of deployment activity. Although anthropogenic disturbances may be measurable (although minimal) for some FirstNet projects, direct injury or mortality impacts at the population-level or sub-population-level 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

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, potential impacts are expected to be less than significant. Additionally, deployment activities with the potential for impacts under the MSFCMA or other sensitive aquatic habitats could be addressed through BMPs and mitigation measures as defined through consultation with the appropriate resource agency.

Indirect Injury/Mortality

Erosion or sedimentation from land clearing and excavation activities near or within riparian areas, floodplains, wetlands, streams, and other aquatic habitats could have potential impacts on water quality. Exposure to contaminants from accidental spills from vehicles and equipment could also potentially affect water quality. These potential effects 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. Nonetheless, these impacts are expected to be less than significant due to the short-term nature and limited geographic scope of deployment activities. BMPs and mitigation measures to protect water resources (see Section 10.2.4, 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 would vary depending on the species, time of year, and duration of deployment, but would be localized and small-scale, and therefore 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.

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, due to likely infrequent and minimal deployment activities in or near waterways. 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.

Invasive Species Effects

The potential to introduce invasive plants within construction zones could occur from vessels and equipment being transported from one region to another. 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 species are not expected to be introduced to project sites as part of the deployment activities from machinery or construction workers. Therefore, impacts are anticipated to be less than significant at the programmatic level. BMPs and mitigation measures could help to avoid or minimize the potential for introducing invasive aquatic plant and animal species during implementation of the Proposed Action.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to fisheries and aquatic habitats and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species' phenology, and the nature and extent of the habitats affected. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

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: 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 and aquatic habitat would be temporary and would not result in a 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 disturbance of the 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. 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 fisheries and aquatic habitats if activities occur near water resources that support fish. Impacts may vary depending on the number or individual poles installed or if access roads or stream crossings are needed, but could include habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
- Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening, if conducted near water resources that support fish, result in habitat loss, alteration and fragmentation; indirect injury/mortality; and invasive species effects.
- New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water and construction of landings and/or facilities on the shores or the banks of water bodies that accept the submarine cables could result in direct injury/mortalities of fisheries and aquatic invertebrates that are not mobile enough to avoid construction activities (e.g., mussels), that utilize burrows (e.g., crayfish), or that are defending nest sites (some fish). Disturbance, including noise, associated with the above activities could result in habitat loss, effects to migration patterns, indirect injury/mortality, reproductive effects, and invasive species effects.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, particularly near water resources that support fish, such disturbance could result in habitat loss, alteration and fragmentation; indirect injury/mortality, and invasive species effects.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to fisheries and aquatic habitats if such actions were deployed near water resources. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads, particularly if they occur near waterbodies, could result in habitat loss or indirect injury/mortality, and invasive species effects, although highly unlikely. Refer to Section 2.4, Radio Frequency Emissions, for more information on RF emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an

existing tower which would not result in impacts to fisheries and aquatic habitats. However, if new power units, replacement towers, structural hardening, or physical security measures required 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 at the programmatic level due to the small scale and localized nature of deployment activities that have the potential to impact aquatic habitats. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operational activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. The fisheries and aquatic habitats that would be affected would depend on the ecoregion, the species’ phenology, and the nature and extent of the habitats affected.

It is anticipated at the programmatic level, that there would be less than significant impacts to fisheries and aquatic habitats associated with routine inspections of the Preferred Alternative. Site maintenance activities that may result in accidental spills from maintenance equipment or pesticide runoff near fish habitat are expected to have less than significant effects to fisheries and aquatic habitats. Potential spills of these materials would be expected to be in small quantities.

Fisheries and aquatic habitat could still be affected by the reduction in habitat quality associated with habitat fragmentation from the presence of access roads, transmission corridors, and support facilities. These features could also continue to disrupt movements of fish passage. In addition, the presence of new access roads and transmission line ROWs near water resources that support fish may increase human use of the surrounding areas, which could increase disturbance to fisheries and aquatic habitats resulting in effects to migratory pathways, indirect injury/mortalities, reproductive effects, as well as the potential introduction and spread of invasive species as explained above. Fisheries and aquatic habitat may also be impacted if increased access leads to an increase in the legal or illegal take of biota. However, impacts are expected to be less than significant at the programmatic level 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 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Alternatives Impact Assessment

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

Deployable Technologies Alternative

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

<u>Deployment Impacts</u>

As explained above, implementation of deployable technologies could result in less than significant impacts from habitat loss, alteration, and fragmentation; indirect injury/mortality, and invasive species effects. Greater frequency and duration of deployments could change the magnitude of impacts depending on species, life history, and region of the state. However, impacts are expected to remain less than significant at the programmatic level due to the limited nature of expected deployment activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

<u>Operational Impacts</u>

Operational activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, the impacts could vary greatly among species and geographic region. Nonetheless, 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. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to fisheries and aquatic habitats as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.6.5, Fisheries and Aquatic Habitats.

10.2.6.6. Threatened and Endangered Species and Species of Conservation Concern

This section describes potential impacts to threatened and endangered species in New Mexico 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 16, 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 10.2.6-2. 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 10.2.6-2: 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 10.2.6-2, any direct injury or mortality of a listed species at the individual-level, as well as any impact that has the potential to result in unpermitted take of an individual species at any geographic extent, duration, or frequency, may affect and likely adversely affect a listed species. Direct injury/mortality environmental concerns pertaining to federally listed terrestrial mammals, birds, reptiles and amphibians, fish, invertebrates, and plants with known occurrence in New Mexico are described below. 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 16, may be implemented as appropriate to further minimize potential impacts.

<u>Terrestrial Mammals</u>

Six endangered and one threatened species are federally listed and known to occur in the state of New Mexico; they are the black-footed ferret, Canada lynx, Mexican wolf, jaguar, lesser long-nosed bat, Mexican long-nosed bat, and the New Mexico meadow jumping mouse.

Direct mortality to the federally listed black-footed ferret, New Mexico meadow jumping mouse, or Peñasco least chipmunk 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 these species. Impacts would likely be isolated, individual events and therefore may affect, but are not likely to adversely affect, a 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 16, may be implemented as appropriate to further minimize potential impacts.

Direct mortality to the federally listed Canada lynx, gray wolf, or jaguar could occur from vehicle strikes, as these species are occasionally found along transportation corridors. 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.

Direct mortality or injury to the federally listed lesser long-nosed bat or Mexican long-nose bat could occur if vegetation clearing activities occurred at foraging sites while bats were present or if caves were flooded or blocked off while bats were present (NMDGF, 2016) (USFWS, 2016a). 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.

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 16, may be implemented as appropriate to further minimize potential impacts.

Birds

Two endangered and four threatened species are federally listed and known to occur in the state of New Mexico; they are the least tern, lesser prairie-chicken, Mexican spotted owl, piping plover, southwestern willow flycatcher, and yellow-billed cuckoo. 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. However, these potential impacts may affect, but are not likely to adversely affect, listed species as FirstNet would attempt to avoid deployment activities in areas where they are known to nest. If proposed project sites were unable to avoid sensitive areas, BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Fish

Nine endangered and five threatened fish species are federally listed and known to occur in the state of New Mexico, as summarized in Table 10.2.6-4. Direct mortality or injury to this species could occur from entanglements resulting from the Proposed Action, but are unlikely as the majority of FirstNet deployment projects would not occur in the aquatic environment. Therefore, potential impacts may affect, but are not likely to adversely affect, 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 16, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

One endangered and one threatened amphibian species are federally listed and known to occur in the state of New Mexico, the Chiricahua leopard frog and Jemez Mountains salamander. Direct mortality to the species could occur in construction zones either by excavation activities or by vehicle strikes. Potential effects would likely be isolated, individual events, and FirstNet would attempt, as practicable and feasible, to avoid areas where the species may occur. Therefore, potential impacts may affect, but would not likely adversely affect, the listed species.

Three threatened reptile species are federally listed and known to occur in the state of New Mexico; they include the narrow-headed garter snake, New Mexican ridge-nosed rattlesnake, and northern Mexican gartersnake. Direct mortality or injury could occur from watercraft and vessels strikes are unlikely as the majority of the FirstNet deployment projects would not occur in an aquatic environment. Therefore, potential impacts may affect, but would not likely adversely affect, 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 16, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Eight endangered invertebrate species are federally listed and known to occur in the state of New Mexico; they are the Alamosa springsnail, Chupadera springsnail, Koster's springsnail, Noel's amphipod, Pecos Assiminea snail, Roswell springsnail, Socorro springsnail, and the , Socorro isopod. The majority of FirstNet deployment projects would not occur in an aquatic environment. Potential impacts may affect, but are not likely to adversely affect, 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 16, may be implemented as appropriate to further minimize potential impacts.

Plants

Seven endangered and six threatened plant species are federally listed and known to occur in the state of New Mexico, as summarized in Table 10.1.6-9. The Holy Ghost ipomopsis occurs in north-central New Mexico. The Knowlton's cactus, Mancos milk-vetch, Mesa Verde cactus, and the Zuni fleabane occur in northwestern New Mexico. The Sacramento Mountains thistle, Sacramento prickly poppy, and the Sneed pincushion cactus occur in southern New Mexico. The Todsen's pennyroyal occurs in south-central New Mexico. The Gypsum wild-buckwheat and the Lee pincushion cactus occur in southeastern New Mexico. The Kuenzler hedgehog cactus and Pecos sunflower occur in central and southeastern New Mexico.

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. FirstNet would attempt, as practicable and feasible, to avoid areas where these species may occur; therefore, potential impacts may affect, but are not likely to adversely affect, 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 16, may be implemented as appropriate to further minimize potential impacts.

Reproductive Effects

Reproductive effects are considered those that either directly or indirectly reduce the breeding success of a listed species either by altering its breeding timing or location, or reducing the rates of growth, maturation, and survival of offspring, which could affect the breeding success. Potential effects to federally listed terrestrial mammals, birds, terrestrial reptiles, amphibians, fish, invertebrates, and plants with known occurrence in New Mexico 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; however, they are anticipated to be small-scale and localized. FirstNet would attempt to avoid these areas.

Therefore, potential impacts may affect, but are not likely to adversely affect, 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 16, may be implemented as appropriate to further minimize potential impacts.

Birds

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. FirstNet would attempt to avoid these areas. Therefore, potential impacts may affect, but are not likely to adversely affect, 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 16, may be implemented as appropriate to further minimize potential impacts.

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 10.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects to federally listed fish species in New Mexico are unlikely as the majority of FirstNet deployment projects would not occur in an aquatic environment and FirstNet would attempt to avoid these areas. Therefore, potential impacts may affect, but are not likely to adversely affect, 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 16, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

Changes in water quality, especially during the breeding seasons, could cause stress resulting in lower productivity. Further, land clearing activities, noise, and human disturbance during the critical time periods (e.g., mating, nesting) could lower fitness and productivity. Changes in water quality, especially during the breeding seasons, resulting from ground disturbing activities could cause stress resulting in lower productivity. FirstNet would attempt to avoid these areas. Therefore, potential impacts may affect, but are not likely to adversely affect, 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 16, 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 aquatic snails, mussels, and crustaceans. Deployment activities are not expected to cause changes to water quality that could result in impacts. At the programmatic level, impacts associated with deployment activities are expected to result in less than significant changes to water quality. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Plants

Potential impacts could occur from ground-disturbing activities to listed plant species as a result of the Proposed Action. However, FirstNet would attempt to avoid these areas. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

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 New Mexico are described below.

Mammals

Habitat loss or alteration, particularly from fragmentation or invasive species, could affect breeding and foraging sites of the federally listed terrestrial mammals, resulting in reduced survival and productivity. However, the localized nature of disturbances during deployment activities are not anticipated to stress federally listed terrestrial mammals. Ground disturbing activities could impact food sources for the federally listed terrestrial mammals in New Mexico. Further, increased human disturbance, noise, and vessel traffic could cause stress to these species causing them to abandon breeding locations or alter migration patterns. Terrestrial mammals have the capacity to divert from sound sources during feeding and migration. FirstNet would attempt to avoid areas, as practicable and feasible, where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, 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 16, 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 distances often involving many different countries. Disturbance in stopover, foraging, or breeding areas (visual or noise) or habitat loss/fragmentation could cause stress to individuals causing them to abandon areas for less desirable habitat and potentially reduce over fitness and productivity. Activities related to the Proposed Action, such as aerial deployment or construction activities, could result in effects to federally listed birds. FirstNet would attempt, as practicable and feasible, to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, 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 16, may be implemented as appropriate to further minimize potential impacts.

Fish

Changes in water quality as a result of ground disturbing activities could impact food sources for the federally listed fish species in New Mexico. Further, increased human disturbance, noise, and vessel traffic could cause stress to these species causing them to abandon spawning locations or alter migration patterns. Behavioral changes to these listed species are unlikely as the majority of FirstNet deployment projects would not occur in aquatic environment. Therefore, potential impacts may affect, but are not likely to adversely affect, 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 16, may be implemented as appropriate to further minimize potential impacts.

Reptiles and Amphibians

Habitat loss or alteration, particularly from fragmentation or invasive species, could affect nesting and foraging sites of the federally listed reptiles and amphibian species, resulting in reduced survival and productivity; however, the localized nature of disturbances during deployment activities are not anticipated to stress federally listed reptiles or amphibians. FirstNet would attempt, as practicable and feasible, to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, 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 16, may be implemented as appropriate to further minimize potential impacts.

Invertebrates

Changes in water quality, habitat loss or alternation, and introduction of aquatic invasive species could impact food sources for federally listed mussels resulting in lower productivity. Disturbances to food sources utilized by the federally listed terrestrial species, especially during the breeding season, could impact foraging behavior. FirstNet would attempt, as practicable and feasible, to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, 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 16, 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. In some cases, large-scale impacts could occur that would not diminish the functions and values of the habitat, while in other cases, small-scale changes could lead to potentially significant adverse effects, such as 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, reptiles and amphibians, fish, invertebrates, and plants with designated critical habitat in New Mexico are described below.

<u>Terrestrial Mammals</u>

One of the federally listed terrestrial mammals in New Mexico has federally designated critical habitat. Critical habitat for the jaguar was designated in Hidalgo County. Land clearing, excavation activities, and other ground disturbing activities in these critical habitats in New Mexico could lead to habitat loss or degradation, which could affect this federally listed mammal 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 16, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other federally listed terrestrial mammal species in New Mexico.

<u>Birds</u>

Two of the federally listed bird species in New Mexico have federally designated critical habitat. Critical habitat for the Mexican spotted owl was designated as six units in northwest New Mexico. Critical habitat for the southwestern willow flycatcher was designated along the middle Rio Grande and upper Gila River. FirstNet would attempt, as practicable and feasible, to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other two federally listed bird species in New Mexico.

<u>Fish</u>

Six of the federally listed fish species in New Mexico have federally designated critical habitat. Critical habitat for the Colorado pikeminnow was designated in San Juan County. Critical habitat for the Gila chub was designated in Turkey Creek in the upper Gila River in Grant County. Critical habitat for the loach minnow was designated in Catron, Grant, and Hidalgo Counties. Critical habitat for the razorback sucker was designated in the San Juan River Basin. Critical habitat for the Rio Grande silvery minnow was designated on the middle Rio Grande from Cochiti Dam downstream to the crossing of the Atchison Topeka and Santa Fe Railroad near San Marcial. Critical habitat for the spikedace was designated in Catron, Grant, and Hidalgo Counties. Loss or degradation of critical habitat of these listed species is unlikely but could occur from the Proposed Action as the majority of FirstNet deployment projects would not occur in the aquatic environment. Therefore, potential impacts may affect, but are not likely to adversely affect, 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 16, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other eight federally listed fish species in New Mexico.

Reptiles and Amphibians

Both of the federally listed amphibian species in New Mexico have federally designated critical habitat. Critical habitat for the Chiricahua leopard frog was designated in Catron, Grant, Hidalgo, Sierra, and Socorro Counties. Critical habitat for the Jemez Mountains salamander was designated in Los Almos, Rio Arriba, and Sandoval Counties.

One of the three federally listed reptile species in New Mexico has federally designated habitat. Critical habitat for the New Mexican ridge-nosed rattlesnake was designated in West Fork, Bear, Indian, and Spring Canyons in the Animas mountain range in Hidalgo County.

Land clearing, excavation activities, and other ground disturbing activities in these regions of New Mexico could lead to habitat loss or degradation, which could lead to adverse effects to these species depending on the duration, location, and spatial scale of the associated activities. Proposed FirstNet deployment activities near water would likely occur onshore with limited activities in the water and therefore would not likely disturb critical habitat. FirstNet would attempt, as practicable and feasible, to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other federally listed reptile species in New Mexico.

Invertebrates

Five of the federally listed invertebrate species in New Mexico have federally designated critical habitat. Critical habitat for the Chupadera springsnail was designated in 1.9 acres of private property in Socorro County. Critical habitat for the Koster's springsnail, Noel's amphipod, Pecos Assiminea, and Roswell springsnail was designated in Chaves County. Land clearing, excavation activities, and other ground disturbing activities in these regions of New Mexico could lead to habitat loss or degradation, which could affect these invertebrates depending on the duration, location, and spatial scale of the associated activities. FirstNet would attempt, as practicable and feasible, to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other three federally listed invertebrate species in New Mexico.

<u>Plants</u>

Two of the federally listed plant species in New Mexico have federally designated critical habitat. Critical habitat for the Gypsum wild-buckwheat was designated in 130 acres of Eddy County. Critical habitat for the Todsen's pennyroyal was designated as wherever it occurs in Otero and Sierra Counties. Land clearing, excavation activities, and other ground disturbing activities in this region of New Mexico could lead to habitat loss or degradation, which affect these plants depending on the duration, location, and spatial scale of the associated activities. FirstNet would attempt, as practicable and feasible, to avoid areas where these species are known to occur; therefore, potential impacts may affect, but would likely not adversely affect, designated critical habitat. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

No critical habitat has been designated for the other 11 federally listed plant species in New Mexico.

Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential effects to threatened and endangered species and others would not. In addition, and as explained in this section, the same type of Proposed Action infrastructure could result in a range of no impacts to less than significant impacts at the programmatic level 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. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Activities Likely to Have No Effect

Of the types of facilities or infrastructure deployment scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are expected to have no effect on threatened and endangered species or their habitat under the conditions described below:

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: Disturbance, including noise, associated with the installation of fiber optic cable in existing conduit would be limited to entry and exit points of the existing conduit in previously disturbed areas. Although threatened and endangered species and their habitat could be impacted, it is anticipated that effects to threatened and endangered species would be temporary, infrequent, and likely not conducted in locations designated as vital or critical for any period.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to threatened and endangered species or their habitat because there would be no ground disturbance and very limited human activity.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would have no effect on threatened and endangered because those activities would not require ground disturbance.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to affect protected species, it is anticipated that this activity would have no effect on protected species.

Activities with the Potential to Affect Listed Species

Potential deployment-related effects to threatened and endangered species and their habitats as a result of implementation of the Preferred Alternative would encompass a range of effects that could occur, including direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The types of infrastructure development scenarios or deployment activities that could be part of the Preferred Alternative and result in potential effects to threatened and endangered species include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing, trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to threatened and endangered species. Land/vegetation clearing and excavation activities, associated with construction of POPs, huts, or other associated facilities could result in direct injury/mortalities of threatened and endangered species that are not mobile enough to avoid construction activities (e.g., reptiles,

mollusks, small mammals, and young), that utilize burrows (e.g., ground squirrels), or that are defending nest sites (e.g., ground-nesting birds). Disturbance, including noise, associated with the above activities could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat.

- New Build – Aerial Fiber Optic Plant: The installation of new poles and hanging cable and associated security, safety, or public lighting components on public ROWs or private easements as well as the construction of access roads, POPs, huts, or facilitates to house outside plant equipment could result in potential effects to threatened and endangered species and their habitat. Impacts may vary depending on the number or individual poles installed, but could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat.
- Collocation on Existing Aerial Fiber Optic Plant: Land clearing and excavation during replacement of poles and structural hardening could result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat to threatened and endangered species. Noise disturbance from heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in reproductive effects or behavior changes.
- New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water and construction of landings and/or facilities on the shores or the banks of water bodies that accept the submarine cables could potentially affect threatened and endangered species and their habitat, particularly aquatic species (see Section 10.2.4, Water Resources, for a discussion of potential impacts to water resources). Effects could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. If activities occurred during critical time periods, reproductive effects and behavioral changes could occur.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no impacts to threatened and endangered species or their habitats. If installation of transmission equipment required construction of access roads, trenching, and/or land clearing, such disturbance could result in direct injury/mortality of threatened and endangered species as described for other New Build activities. Reproductive effects, behavioral changes, and loss/degradation of designated critical habitat could also occur as a result of construction and resulting disturbance.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to threatened and endangered species and their habitat. Land/vegetation clearing, excavation activities, landscape grading, and other disturbance activities during the installation of new wireless towers and associated structures or access roads could

result in direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. Security lighting and fencing could result in direct injury/mortality, disruption of normal behavior patterns, as well as reproductive effects. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. FirstNet activities would be infrequent, temporary, or short-term in nature and are unlikely to result in direct injury/mortality or behavioral changes to threatened and endangered species. However, if replacement towers, or structural hardening are required, effects would be similar to new wireless construction. Hazards related to security/safety lighting and fencing may produce direct injury/mortality, reproductive effects, and behavioral changes. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
- Deployable Technologies: Implementation of land-based deployable technologies including COWs, COLTs, or SOWs could result in direct injury/mortalities to threatened and endangered species on roadways. If external generators are used, noise disturbance could potentially result in reproductive effects or behavioral changes to threatened and endangered species. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

  Deployment of drones, balloons, piloted aircraft, or blimps could potentially impact threatened and endangered species by direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat. The magnitude of these effects depends on the timing and frequency of deployments.

In general, the abovementioned activities could potentially involve land/vegetation clearing; excavation and trenching; construction of access roads; installation or restructuring of towers, poles, or underwater cables; installation of security/safety lighting and fencing; and deployment of aerial platforms. Potential impacts to threatened and endangered species associated with deployment of this infrastructure could include direct injury/mortality, reproductive effects, behavioral changes, and loss/degradation of designated critical habitat depending on the species' phenology and the nature and extent of the habitats affected. FirstNet would attempt, as practicable and feasible, to avoid areas where these species are known to occur; therefore, potential impacts may affect, but are 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 16, 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.

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 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 16, may be implemented as appropriate to further minimize potential impacts.

During operations, direct injury/mortality of threatened and endangered species could occur from collisions and/or entanglements with transmission lines, towers, and aerial platforms. FirstNet would attempt, as practicable and feasible, to avoid areas where these species are known to occur. Therefore, 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 16, 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. FirstNet would attempt, as practicable and feasible, to avoid areas where these species are known to occur. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

Alternatives Impact Assessment

The following section assesses potential effects to threatened and endangered species associated with the Deployable Technologies Alternative and the No Action Alternative.

Deployable Technologies Alternative

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

Therefore, potential effects to threatened and endangered species as a result of implementation of this alternative could be as described below.

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. FirstNet would attempt, as practicable and feasible, to avoid areas where these species are known to occur. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, 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. FirstNet would attempt, as practicable and feasible, to avoid areas where these species are known to occur. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented. Additional BMPs and mitigation measures, as defined in Chapter 16, may be implemented as appropriate to further minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the nationwide, interoperable, public safety broadband network would not be deployed; therefore there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no 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 10.1.6.6, Threatened and Endangered Species and Species of Concern.

10.2.7. Land Use, Recreation, and Airspace

10.2.7.1. Introduction

This section describes potential impacts to land use, recreation, and airspace resources in New Mexico associated with deployment and operation of the Proposed Action and Alternatives, and discusses BMPs and mitigation measures that would avoid or minimize those potential impacts. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.7.2. 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 10.2.7-1. As described in Section 10.2, 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 10.2.7-1: Impact Significance Rating Criteria for Land Use, Recreation, and Airspace

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with BMPs and Mitigation Measures Incorporated**	**Less Than Significant**	**No Impact**
Direct land use change	Magnitude or Intensity	Change in designated/permitted land use that conflicts with existing permitted uses, and/or would require a change in zoning. Conversion of prime or unique agricultural lands.	Effect that is potentially significant, but with mitigation is less than significant.	Minimal changes in existing land use, or change that is permitted by-right, through variance, or through special exception.	No changes to existing development, land use, land use plans, or policies. No conversion of prime or unique agricultural lands.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Land use altered indefinitely.		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase.	NA
Indirect land use change	Magnitude or Intensity	New land use directly conflicts with surrounding land use pattern, and/or causes substantial restriction of land use options for surrounding land uses.	Effect that is potentially significant, but with mitigation is less than significant.	New land use differs from, but is not inconsistent with, surrounding land use pattern; minimal restriction of land use options for surrounding land uses.	No conflicts with adjacent existing or planned land uses.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Land use altered indefinitely.		Short-Term: Land use altered for as long as the entire construction phase or a portion of the operations phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with BMPs and Mitigation Measures Incorporated**	**Less Than Significant**	**No Impact**
Loss of access to public or private recreation land or activities	Magnitude or Intensity	Total loss of access to recreation land or activities.	Effect that is potentially significant, but with mitigation is less than significant.	Restricted access to recreation land or activities.	No disruption or loss of access to recreational lands or activities.
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance.		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Loss of enjoyment of public or private recreation land (due to visual, noise, or other impacts that make recreational activity less desirable)	Magnitude or Intensity	Total loss of enjoyment of recreational activities; substantial reduction in the factors that contribute to the value of the recreational resource, resulting in avoidance of activity at one or more sites.	Effect that is potentially significant, but with mitigation is less than significant.	Small reductions in visitation or duration of recreational activity.	No loss of enjoyment of recreational activities or areas; no change to factors that contribute to the value of the resource.
	Geographic Extent	Most or all recreational land/sites in a state or territory; recreational lands/sites that are of national significance.		Effects realized at one or multiple isolated locations; recreational lands that are not nationally significant, but that are significant within the state/territory.	NA
	Duration or Frequency	Persists during or beyond the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with BMPs and Mitigation Measures Incorporated**	**Less Than Significant**	**No Impact**
Use of airspace	Magnitude or Intensity	Measurable, substantial change in flight patterns and/or use of airspace.	Effect that is potentially significant, but with mitigation is less than significant.	Alteration to airspace usage is minimal	No alterations in airspace usage or flight patterns.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Permanent: Airspace altered indefinitely.		Short-Term: Airspace altered for as long as the entire construction phase or a portion of the operations phase.	NA

NA = Not Applicable

10.2.7.3. Description of Environmental Concerns

Direct Land Use Change

Changes in land use could be influenced by the deployment, operation, and maintenance of facilities or other infrastructure, and the acquisition of rights-of-way or easement, as required. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with exiting development or land use. The installation of poles, towers, structures, or other above-ground facilities or assets could have short- or long-term effects to existing development or land use based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of ROWs or easements and the construction of roads to access facilities and locations could influence changes in land use. The effects from these actions would depend on the geographic location; compatibility with existing land uses; and characteristics of the right-of-way, easement, or access road. These characteristics, such as the length, width, and location could change the existing land use to another category or result in the short- or long-term loss of the existing land use.

Based on the impact significance criteria presented in Table 10.2.7-1, less than significant impacts at the programmatic level would be anticipated given the size and nature of the majority of the proposed deployment activities. Direct land use changes would be minimized and isolated at specific locations and all required permits would be obtained; only short-term impacts during the construction phase would be expected.

Indirect Land Use Change

Changes in surrounding land use patterns and options for surrounding land uses could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of rights-of-way or easement. The deployment, operation, and maintenance of structures, towers, roads, and other permanent features could conflict with surrounding land use patterns and options for surrounding land uses. The installation of poles, towers, structures, or other above-ground facilities or assets could have short- or long-term effects to surrounding land use patterns or options for surrounding land uses based on the characteristics of the structures or facilities, such as the location, type, or height. In addition, the acquisition of ROWs or easements and the construction of roads to access facilities and locations could influence changes in surrounding land uses. The effects from these actions would depend on the geographic location; compatibility with surrounding land uses; and characteristics of the ROW, easement, or access road. These characteristics, such as the length, width, and location could conflict with surrounding land use patterns or restrict options for surrounding land uses.

Based on the impact significance criteria presented in Table 10.2.7-1, less than significant impacts at the programmatic level would be anticipated as any new land use would be small-scale and short-term during the construction phase.

Loss of Access to Public or Private Recreation Land or Activities

Access to public or private recreation land or activities could be influenced by the deployment, operation, and maintenance of facilities and the acquisition of ROW or easement. Localized, short-term accessibility to recreation land or activities could be impacted by the deployment and maintenance of structures, towers, roads, and other permanent features. In the long-term, the deployment and installation of poles, towers, structures, or other aboveground facilities could alter the types and locations of recreation activities.

Based on the impact significance criteria presented in Table 10.2.7-1 less than significant impacts at the programmatic level would be anticipated as restricted access or a loss of access to recreation areas would not occur; only short-term impacts or small-scale limitations during the construction phase would be expected.

Loss of Enjoyment of Public or Private Recreation Land

The deployment of new towers, and the resulting built tower, could influence the enjoyment of public or private recreation land. Enjoyment of recreation land could be temporarily impacted by crews accessing the site during the deployment and maintenance of structures, towers, roads, and other permanent features. The deployment of poles, towers, structures, or other aboveground facilities could affect the enjoyment of recreational land based on the characteristics of the structures or facilities, including permanent impacts to scenery, short-term noise impacts, and the presence of deployment or maintenance crews.

Based on the impact significance criteria presented in Table 10.2.7-1, less than significant impacts at the programmatic level 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 obstruct navigable airspace depending on the tower location. Use of aerial technologies could result in SUA considerations.

Based on impact significance criteria presented in Table 10.2.7-1, airspace impacts are not likely to change or alter flight patterns or airspace usage. As drones, balloons, and piloted aircraft would likely only be deployed in an emergency and for a short period, FirstNet would be unlikely to have a significant impact on airspace resources.

10.2.7.4. 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 at the programmatic level depending on the deployment scenario or site-specific conditions. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

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 with the Potential to Have Impacts below.
    - <u>Recreation:</u> See Activities with the Potential 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 10.1.7.5 and 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 with the Potential 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 10.1.7.5 and Obstructions to Airspace Considerations).

- New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) ROWs or easements and the potential construction of access roads.
  - Land Use: See Activities with the Potential to Have Impacts below.
  - Recreation: See Activities with the Potential to Have Impacts below.
  - Airspace: Installation of new poles would not have an effect on airspace because utility poles are an average of 40 feet in height and do not intrude into useable airspace.
- Collocation on Existing Aerial Fiber Optic Plant: Installation of new fiber on existing poles would be limited to previously disturbed areas.
  - Land Use: It is anticipated that there would be no impacts to land use since the activities that would be conducted would not directly or indirectly result in changes to existing and surrounding land uses.
  - Recreation: No impacts to recreation would be anticipated since the activities that would be conducted would not cause disruption or loss of access to recreational lands or activities or the enjoyment of those lands or activities.
  - Airspace: No impacts are anticipated to airspace from collocations.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting of dark fiber and installation of new equipment in existing huts.
  - Land Use: It is anticipated that there would be no impacts to land use since the activities would not directly or indirectly result in changes to existing and surrounding land uses.
  - Recreation: Use of existing dark fiber would not impact recreation because it would not impede access to recreational resources.
  - Airspace: Lighting of dark fiber would have no impacts to airspace.
- New Build – Submarine Fiber Optic Plant: Installing cables in or near bodies of water and the constructing landings and/or facilities on shores or the banks of water bodies that accept the submarine cable.
  - Land Use: See Activities with the Potential to Have Impacts below.
  - Recreation: See Activities with the Potential to Have Impacts below.
  - Airspace: The installation of cables in limited nearshore and inland bodies of water and construction of landings/facilities would not impact flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 10.1.7.5 and 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, and airspace resources if deployment of new boxes, huts, or access roads is required.
  - Land Use: See Activities with the Potential to Have Impacts below.
  - Recreation: See Activities with the Potential to Have Impacts below.
  - Airspace: No impacts to airspace would be anticipated since the activities would not affect flight patterns or cause obstructions that would require FAA and/or state review based on FAR 14 CFR, Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (See Section 10.1.7.5 and Obstructions to Airspace Considerations).

- Wireless Projects
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, structure, or building.
    - Land Use: There would be no impacts to existing and surrounding land uses. The potential addition of power units, structural hardening, and physical security measures would not impact existing or surrounding land uses.
    - Recreation: See Activities with the Potential to Have Impacts below.
    - Airspace: See Activities with the Potential to Have Impacts below.
- Deployable Technologies
  - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
    - Land Use: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
    - Recreation: No impacts to recreation are anticipated as deployable technologies would not affect the use or enjoyment of recreational lands.
    - Airspace: Use of land-based deployable technologies (COW, COLT, and SOW) is not expected to result in impacts to airspace, provided antenna masts do not exceed 200 feet Aboveground Level (AGL) or do not trigger any of the other FAA obstruction to airspace criteria listed in Section 10.1.7.5 and Obstructions to Airspace Considerations.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: Installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: It is anticipated that there would be no impacts to existing or surrounding land uses because these technologies would be temporarily located in areas compatible with other land uses.
    - Recreation: It is anticipated that there would be no impacts to recreational uses because these technologies would be temporarily deployed but would not restrict access to, or enjoyment of, recreational lands.
    - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact airspace because those activities would not result in changes to flight patterns and airspace usage or result in obstructions to airspace.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the deployment of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. As adding equipment to an existing launch vehicle would be very unlikely to impact to land use, recreation, or airspace, it is anticipated that this activity would have no impact on land use, recreation, or airspace.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to land use, recreation, and airspace resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur, including changes to existing and surrounding land uses. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to land use resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring alongside the road in utility corridors or within public road rights-of-way.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations.
    - Recreation: It is anticipated that plowing, trenching, or directional boring may cause temporary, localized restrictions to recreational land or activities, which may persist during the deployment phase. It is reasonable to anticipate that small reductions in visitation to localized areas may occur during the deployment phase.
    - Airspace: No impacts are anticipated – see previous section.

- New Build – Aerial Fiber Optic Plant: Installing new poles and hanging cables on previously disturbed or new (undisturbed) rights-of-way or easements and the potential construction of access roads.
  - Land Use: These activities could result in term potential impacts to land uses. Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New structures, poles, or access roads on previously undisturbed rights-of-way or easements could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new structures with existing and surrounding land uses.
  - Recreation: Deployment activities may cause temporary, localized restricted access to recreation land or activities, which may persist for the duration of the deployment phase. Small reductions to visitation during the deployment phase may be anticipated.
  - Airspace: No impacts are anticipated – see previous section.
- New Build – Submarine Fiber Optic Plant: Installing cables in or near bodies of water and the constructing landings and/or facilities on shores or the banks of water bodies that accept the submarine cable.
  - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New landings and/or facilities on shore could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
  - Recreation: Deployment may temporarily restrict recreation on or within limited nearshore and inland bodies of water and the surrounding area during the deployment phase. Reductions in visitation may result during deployment.
  - Airspace: No impacts are anticipated – see previous section.
- Installation of Optical Transmission or Centralized Transmission Equipment: Installation of equipment including construction of new boxes, huts, or access roads.
  - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New boxes, huts, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
  - Recreation: Deployment of installation equipment and the construction of boxes, huts, or access roads may restrict access to recreation land or activities. Reductions in visitation during deployment may occur.
  - Airspace: No impacts are anticipated – see previous section.

- Wireless Projects
  - New Wireless Communication Towers: Installing new wireless towers, associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads.
    - Land Use: Construction activities could temporarily restrict existing and surrounding land uses at isolated locations. New wireless towers, associated structures, or access roads could have long-term impacts to existing and surrounding land uses. The magnitude of the impact would depend on the specific location and the compatibility of the new facilities with existing and surrounding land uses.
    - Recreation: Deployment of new towers and associated structures could result in temporary, localized restricted access for recreation land or activities for the duration of the deployment phase. Reductions in visitation or duration of recreational activity may result from restricted access.
    - Airspace: Installation of new wireless towers could result in impacts to airspace if towers exceed 200 feet AGL or meets the other criteria listed in Section 10.1.7.5 and Obstructions to Airspace Considerations. An OE/AAA could be required for the FAA to determine if the proposed construction does affect navigable airways or flight patterns of an airport if the aerial fiber optic plant is located in proximity to one of New Mexico's airports.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower.
    - Land Use: No impacts are anticipated – see previous section.
    - Recreation: Installation of antennas or microwaves to existing towers may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
    - Airspace: Collocation of mounting or installing equipment (such as antennas or microwave dishes) on an existing tower, addition of power units, structural hardening, and physical security measures could result in impacts if located near airports or air navigation facilities.
- Deployable Technologies
  - Deployable Technologies: These technologies would be used where permanent, fixed infrastructure cannot be deployed due to a variety of factors such as the need to supplement coverage or to avoid or mitigate permanent impacts to sensitive resources or receptors.
    - Land Use: No impacts are anticipated – see previous section.
    - Recreation: No impacts are anticipated – see previous section.

- Airspace: Implementation of deployable aerial communications architecture could result in temporary or intermittent impacts to airspace. Deployment of tethered systems (such as balloons or blimps) could pose an obstruction hazard if deployed above 200 feet and near New Mexico airports (See Section 10.1.7.5 and Obstructions to Airspace Considerations). Potential impacts to airspace (such as SUAs and MTRs) may be possible depending on the planned use of drones, piloted aircraft, untethered balloons, and blimps (e.g., frequency of deployment, altitudes, proximity to airports and airspaces classes/types, length of deployment, etc.). Coordination with the FAA would be required to determine the actual impact and the required certifications. It is expected that FirstNet would attempt to avoid changes to airspace and the flight profiles (boundaries, flight altitudes, operating hours, etc.).

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The installation of permanent equipment on existing structures and the use of portable devices that use satellite technology.
    - Land Use: No impacts are anticipated – see previous section
    - Recreation: It is anticipated the installation of equipment on existing structures may cause temporary, localized restricted access to recreation lands or activities during installation, which may cause small reductions in visitation for the duration of installation.
    - Airspace: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology may impact airspace if equipment creates an obstruction.

In general, the abovementioned activities could potentially involve construction activities, 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 could include obstructions. These potential impacts are expected to be less than significant at the programmatic level 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 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

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, and airspace resources 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. Operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. It is anticipated that there would be no impacts to land use, recreation resources, or airspace associated with routine inspections, assuming that the same access roads used for deployment are also used for inspections.

The degree of change in the visual environment (see Section 10.2.8, 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. Once deployment locations are known, the location would be subject to an environmental review to help ensure environmental concerns are identified. 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. FirstNet would coordinate with the FAA to review required certifications. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.7.5. Alternatives Impact Assessment

The following section assesses potential impacts to land use, recreation, and airspace resources associated with the Deployable Technologies Alternative and the No Action Alternative.[149]

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 associate with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementations 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

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

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 at the programmatic level 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 at the programmatic level 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 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to land use, recreation, and airspace resources 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 at the programmatic level due to the temporary nature of deployment activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure, or satellites and other technologies. As a result, there would be no impacts to land use, recreation, and airspace resources. Environmental conditions would therefore be the same as those described in Section 10.1.7, Land Use, Recreation, and Airspace.

10.2.8. Visual Resources

10.2.8.1. Introduction

This section describes potential impacts to visual resources in New Mexico associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.8.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on visual resources were evaluated using the significance criteria presented in Table 10.2.8-1. As described in Section 10.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 10.2.8-1: Impact Significance Rating Criteria for Visual Resources

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
Adverse change in aesthetic character of scenic resources or viewsheds	Magnitude or Intensity	Fundamental and irreversibly negative change in aesthetic character.	Effect that is potentially significant, but with mitigation is less than significant.	Intermittently noticeable change in aesthetic character that is marginally negative.	No visible effects.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	No visible effects.
	Duration or Frequency	Permanent or persistent changes to aesthetic character lasting throughout or beyond the construction or deployment phase.		Persisting through the construction and deployment phase, but aesthetics of the area would be returned to original state following the construction and deployment phase.	Transient or no visible effects.
Nighttime lighting	Magnitude or Intensity	Lighting dramatically alters night-sky conditions.	Effect that is potentially significant, but with mitigation is less than significant.	Lighting alters night-sky conditions to a degree that is only intermittently noticeable.	Lighting does not noticeably alter night-sky conditions.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	No visible effects.
	Duration or Frequency	Permanent or persistent changes to night-sky conditions lasting throughout or beyond the construction or deployment phase.		Persisting through the construction and deployment phase, but lighting would be removed and night-sky conditions would be returned to original state following the construction and deployment phase.	Transient or no visible effects.

10.2.8.3. 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 New Mexico, residents and visitors travel to many national monuments, historic sites, and state parks, such as Carlsbad Cavern National Park, which contains 46,000 acres of lands famous caves that contain a range of visual resources (NPS, 2015q). 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. New Mexico regulates impacts to visual resources for historic properties through their State Historic Preservation Office to avoid or minimize adverse visual effects on historic properties wherever feasible. Historic properties in the state are assessed prior to a proposed project to determine if any adverse effects to the integrity or historic significance could occur. 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 10.2.8-1, 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 at the programmatic level.

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 10.2.8 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 16, BMPs and Mitigation Measures. BMPs and mitigation measures, as defined through consultation with the appropriate resource agency, would be implemented.

10.2.8.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could result in the deployment of various types of facilities or infrastructure. Depending on the physical nature and location of the facility/infrastructure and the specific deployment requirements, some activities would result in potential impacts to visual resources and others would not. In addition, and as explained in this section, the same type of Proposed Action Infrastructure could result in a range of no impacts to less than significant impacts depending on the deployment scenario or site-specific conditions. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

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 lightning.
  - 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 and perceptible changes.
- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: It is anticipated that the installation of permanent equipment on existing structures and the use of portable devices that use satellite technology would not impact visual resources since those activities would not require ground disturbance or vegetation removal.

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

Activities with the Potential to Have Impacts

Potential deployment-related impacts to visual resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance, vegetation removal, or installation of permanent structures if development occurs in scenic areas. The types of deployment activities that could be part of the Preferred Alternative and result in potential impacts to visual resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to visual resources. The degree of impact would depend on the timing, location, and type of project; installation of a hut or POP would be permanent, whereas ground disturbing activities would be short-term. In most cases, development located next to existing roadways would not affect visual resources unless vegetation were removed or excavation occurred in scenic areas.
  - New Build – Aerial Fiber Optic Plant: Construction and installation of new or replacement poles and hanging cables could result in impacts to the aesthetic character of scenic resources or viewsheds depending on the location of the installation. In most cases, development in public rights-of-ways would not affect visual resources unless vegetation were removed or construction occurred in scenic areas. If new lighting were necessary, impacts to night skies could occur. Construction of new roadways could result in linear disruptions to the landscape, surface disturbance, and vegetation removal; all of which could impact the aesthetic character of scenic resources or viewsheds, depending on the location of the installation.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact visual resources. However, impacts to the aesthetic character of scenic resources or viewsheds could potentially occur as result of the construction of landings and/or facilities on shore to accept submarine cable.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment required grading, vegetation removal, or other ground disturbance to install small boxes or huts, or access roads, potential impacts to visual resources could occur but effects would be temporary and localized.
- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation

lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to visual resources. Land/vegetation clearing, excavation activities, landscape grading, and other surface disturbing activities during the installation of new wireless towers and associated structures or access roads could result in the degradation of the aesthetic character of scenic resources or viewsheds. Impacts may be experienced by viewers if new towers were located in or near a national park unit or other sensitive area. If new towers were constructed to a height that required aviation lighting, nighttime vistas could be impacted in areas where the night skies do not have light disruptions or are within unpopulated areas. If nighttime lighting were necessary for the operation or function of a facility, impacts to night sky conditions could occur.

- Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower and would not likely result in additional impacts to visual resources. However, if additional power units, structural hardening, or physical security measures required ground disturbance or removal of vegetation, impacts to the aesthetic character of scenic resources or viewsheds could occur.
- Deployable Technologies: Implementation of deployable technologies could result in potential impacts to visual resources if long-term deployment occurs in scenic areas, or if the implementation requires minor construction of staging or landing areas, results in vegetation removal or areas of surface disturbance or additional nighttime lighting.

In general, the abovementioned activities could potentially involve land/vegetation clearing, and potential scenic intrusion of towers, poles, roads, infrastructure, and other structures. Potential impacts to visual resources associated with deployment could include interruptions of landscapes, degradation of the aesthetic character of scenic resources or viewsheds, and overall changes in valued scenic resources, particularly for permanent fixtures such as towers or facilities. These impacts are expected to be less than significant due to the temporary and small-scale nature of deployment activities. As discussed above, potential impacts to night skies from lighting are expected to be less than significant with BMPs and mitigation measures incorporated. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be no impacts to visual resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. Nighttime lighting in isolated rural areas or if sited near a national park would be less than significant with BMPs and mitigation measures incorporated during operations.

Additionally, FirstNet would work closely with the NPS to address any concerns they might have if a tower needed to be placed in an area that might affect the nighttime sky at a NPS unit. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.8.5. 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 at the programmatic level, as they would generally be limited to the deployment location and could often be screened or otherwise blocked from view. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to visual resources associated with routine inspections of the Preferred Alternative, assuming that the same access roads used for deployment are also used for inspections. The potential visual impacts—including aesthetic conditions and nighttime lighting—of the operation of deployable technologies would be less than significant at the programmatic level given the limited geographic scope for individual activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

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 10.1.8, Visual Resources.

10.2.9. Socioeconomics

10.2.9.1. Introduction

This section describes potential impacts to socioeconomics in New Mexico associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.9.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on socioeconomics were evaluated using the significance criteria presented in Table 10.2.9-1. As described in Section 10.2, 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 10.2.9-1: Impact Significance Rating Criteria for Socioeconomics

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with BMPs and Mitigation Measures Incorporated	Less than Significant	No Impact
Impacts to real estate (could be positive or negative)	Magnitude or Intensity	Changes in property values and/or rental fees, constituting a significant market shift.	Effect that is potentially significant, but with mitigation is less than significant.	Indiscernible impact to property values and/or rental fees.	No impacts to real estate in the form of changes to property values or rental fees.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Changes to spending, income, industries, and public revenues	Magnitude or Intensity	Economic change that constitutes a market shift.	Effect that is potentially significant, but with mitigation is less than significant.	Indiscernible economic change.	No change to tax revenues, wages, major industries, or direct spending.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated cities/towns.	NA
	Duration or Frequency	Persists during or beyond the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Impacts to employment	Magnitude or Intensity	High level of job creation at the state or territory level.	Effect that is potentially significant, but with mitigation is less than significant.	Low level of job creation at the state/territory level.	No job creation due to project activities at the state/territory level.
	Geographic Extent	Regional impacts observed throughout the state/territory.		Effects realized at one or multiple isolated cities/towns.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with BMPs and Mitigation Measures Incorporated**	**Less than Significant**	**No Impact**
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA
Changes in population number or composition	Magnitude or Intensity	Substantial increases in population, or changes in population composition (age, race, gender).	Effect that is potentially significant, but with mitigation is less than significant.	Minor increases in population or population composition.	No changes in population or population composition.
	Geographic Extent	Regional impacts observed throughout the state or territory.		Effects realized at one or multiple isolated locations.	NA
	Duration or Frequency	Persists during the life of the project.		Persists for as long as the entire construction phase or a portion of the operations phase.	NA

NA= Not Applicable

10.2.9.3. Description of Environmental Concerns

This section discusses at a high level the types of socioeconomic impacts that could result from deployment of the NPSBN. Socioeconomic impacts could be negative or positive. Subsections below address socioeconomic impacts in four general areas, following the breakdown of the significance rating criteria in the table above:

- Impacts to Real Estate;
- Economic Benefits or Adverse Impacts related to changes in Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; and
- Changes in Population Number or Composition.

In addition to the specific impacts noted below, the Proposed Action would likely have broad, beneficial impacts to all four areas in times of disaster, by improving the response of public safety personnel. Reduced damages and faster recovery would result. This would support property values; maintain corporate income, personal income, and government revenues; preserve jobs; and reduce disruptions to populations.

Impacts to Real Estate

Deployment of the NPSBN has the potential to improve property values in areas that have reduced property values below typical market values due to below average public safety communication services. Improved services would reduce response times and improve responses. These effects would reduce the potential for economic losses and thus support investments in property and greater market value for property. Any increases in property values are most likely in areas that have low property values and below average public safety communication services. Increases are less likely in areas that already have higher property value. As discussed in Affected Environment, property values vary considerably across New Mexico. Median values of owner-occupied housing units in the 2009–2013 period ranged from over $261,000 in the greater Santa Fe area, to around $90,000 in the Roswell and El Paso (New Mexico portion) areas. These figures are general indicators only. Property values are probably both higher and lower in specific localities. Any property value effects of deployment of the NPSBN would occur at a localized level.

Some telecommunications infrastructure, such as wireless communications towers, may adversely affect property values, depending on infrastructure location and other characteristics. Researchers believe these negative impacts relate to perceptions of the aesthetics of towers, or fears over electromagnetic radiation. Economists and appraisers have studied this issue and use a statistical analysis methodology known as hedonic pricing, or hedonic modelling, to assess how different attributes of properties such as distance from a tower affect property value (Bond, Sims, & Dent, 2013). Essentially, analysts compare the value of multiple properties while statistically controlling for differences in property attributes, in order to isolate the effect of a specific attribute such as proximity of a communications tower.

A recent literature review examined such studies in the United States, Germany, and New Zealand (Bond, Sims, & Dent, 2013). These studies all focused on residential properties. One study identified a positive effect on price in one neighborhood due to the presence of a wireless communications tower. Most studies identified negative effects on price. Generally, these negative effects were small: an approximately two percent decrease in property price. In one case, the average reduction in price was 15 percent. In all cases, the effects declined rapidly with distance, with some cases showing no effect beyond 100 meters (328 feet) and one case showing effects up to about 300 meters (984 feet).

Based on review of the particulars of each study, the literature review authors hypothesize that many additional factors regarding communications towers, besides distance, may affect property value. These include the type, height, size, and appearance of communication towers; grouping of towers; the level of activity in the property market at the time properties are listed or sold; and the level of negative local media focus on potential health effects of communication towers at the time properties are listed or sold.

Economic Benefits or Adverse Impacts related to Changes in Spending, Income, Industries, and Public Revenues

Developing the NPSBN may increase economic activity as governments and contractors make expenditures to deploy, operate, and maintain telecommunications and broadband infrastructure. Funds for such expenditures would come primarily from federal, state, and local government sources or through private entities under a written agreement with such governmental entities. FirstNet has three primary sources of funding to carry out its mission: (1) up to $7 billion in cash funded by proceeds of incentive auctions authorized by the Act; (2) network user or subscriber fees; and (3) fees from covered leasing agreements that allow FirstNet to permit secondary users to access network capacity on a secondary basis for non-public safety services only. The use of NPSBN capacity on a secondary basis for non-public safety services, including commercial services, by parties entering into a covered leasing agreement with FirstNet may also increase economic activity and generation of income for such party. Direct spending of federal, state, and private sector funds to deploy and operate the NPSBN would likely represent new income to businesses that provide goods and services for the network, resulting in a positive impact. This direct impact would lead to indirect impacts (as directly impacted businesses purchase supporting goods and services) and induced impacts (as the employees of all affected businesses spend the wages they have earned). Because most FirstNet infrastructure investments would be dispersed across the nation, the business income and wages generated in any particular state or community would generally be small relative to the overall state or community economy, but measurable. Based on the significance criteria above, the business income and wage impacts would be considered positive and less than significant at the programmatic level. 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's 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 at the programmatic level. However, even small employment gains are beneficial, and would be especially welcomed in areas that have high unemployment. As discussed in Affected Environment, unemployment rates (as shown by the unemployment rate map and selected economic indicators table) vary considerably across New Mexico. The average unemployment rate in 2014 was 6.5 percent, somewhat higher than the national rate of 6.2 percent. In general, counties with unemployment rates below the national average (that is, better employment performance) were located in the eastern half of the state. Three counties in the Albuquerque and Santa Fe areas, in the north-central part of the state, also had relatively low unemployment rates. Counties with high unemployment rates were located in the western half of the state, and in areas east of Los Lunas, Albuquerque, and Santa Fe.

Large companies that win major contracts for deploying and operating the NPSBN may have concentrations of employees in some specific locations; for instance, engineers and other system designers may be located in one or a few specific offices. While such employment concentrations could be important to specific communities, these and other employment impacts would still not be significant based on the criteria in Table 10.2.9-1 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 could 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.

10.2.9.4. Potential Impacts of the Preferred Alternative

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

Deployment Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, implementation of the Preferred Alternative could deploy various types of facilities or infrastructure. Almost all deployment activities would have socioeconomic impacts, because all represent economic activity that would result, for instance, in expenditures and generation of income. These effects are measurable by economists, even if very small, but their significance is determined by application of the criteria in Table 10.2.9-1. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

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

Activities with the Potential to Have Impacts

Potential impacts to socioeconomics for the Preferred Alternative would encompass a range of impacts that could result from deployment activities. The discussion below indicates which of the four types of socioeconomic impacts discussed above and listed again here apply to each type of deployment activity. For greater detail on the nature of these impacts, see the Description of Environmental Concerns section above.

- Impacts to Real Estate;
- Changes to Spending, Income, Industries, and Public Revenues;
- Impacts to Employment; 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 at the programmatic level.
    - 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 at the programmatic level.
    - 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 at the programmatic level.
    - 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 at the programmatic level.
    - 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 at the programmatic level.
    - 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 at the programmatic level.
  - 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 at the programmatic level.
  - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads would have the following types of socioeconomic impacts:
    - Impacts to Real Estate – As discussed above, communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). Such impacts, if they occur, would be limited to a small area around each project and would generally be a small percentage reduction in property value; thus, the impacts would be less than significant at the programmatic level.
    - 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 at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility would have the following types of socioeconomic impacts. While communication towers

sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013), the impacts of existing wireless towers are presumably already factored into property values and would not be affected by the addition of new equipment.

    - Changes to Spending, Income, Industries, and Public Revenues – Materials and labor for these projects would represent new expenditures that would generate income, help support industries, and may generate public revenues. All such effects would be small in scale relative to the regional and state economy and of limited duration; their impacts would be less than significant at the programmatic level.
    - Impacts to Employment – Similarly, expenditures for these projects would generate temporarily a less than significant number of jobs regionally and statewide.

  - Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch/landing areas. Development of such areas, or enlargement of existing areas to accommodate FirstNet equipment, would have the following types of socioeconomic impacts:
    - Impacts to Real Estate – It is possible that development or enlargement of storage, staging, and launch/landing areas could have adverse impacts on nearby property values. This is because such facilities may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles), equipment maintenance activities at such facilities may generate noise, and operational activities may generate traffic. Such factors could affect nearby property values. These impacts, if they occur, would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region and state. Therefore, these impacts would be less than significant at the programmatic level.
    - 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 at the programmatic level.
    - 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 at the programmatic level.

- 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. 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 at the programmatic level. 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. To the extent that certain activities could have adverse impacts to property values, those impacts are also expected to be less than significant at the programmatic level, as described above. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

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 at the programmatic level.
- Impacts to Employment – Public and private sector organizations responsible for operating the NPSBN would sustain existing employees and/or hire new employees to carry out operational activities. They would generate a less than significant number of jobs regionally and statewide.

The potential negative impacts on property values mentioned above for deployment of new wireless communication towers and deployable technology storage, staging, and launch/landing areas may also apply in the operations phase. The ongoing presence of such facilities has aesthetic and other effects that may reduce nearby property values, relative to values in the absence of such facilities. These impacts, if they occur, would be less than significant as they would occur within a limited distance of each site, and would be limited to a relatively small number of sites within the region. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.9.5. 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 at the programmatic level.

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 at the programmatic level as described above. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

All operational activities represent economic activity and thus have socioeconomic impacts. These impacts would primarily be beneficial, and because they are small individually, overall impacts would be less than significant at the programmatic level.

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 at the programmatic level as they would be limited to a relatively small number of sites within the region. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed. Therefore, there would be no associated deployment or installation activities to deploy wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to socioeconomics from deployment and operation of the No Action Alternative. Socioeconomic conditions would therefore be the same as those described in Section 10.1.9, Socioeconomics.

10.2.10. Environmental Justice

10.2.10.1. Introduction

This section describes potential impacts to environmental justice in New Mexico associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.10.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on environmental justice were evaluated using the significance criteria presented in Table 10.2.10-1. As described in Section 10.2, 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 10.2.10-1: Impact Significance Rating Criteria for Environmental Justice

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

10.2.10.3. Description of Environmental Concerns

Effects Associated with Other Resource Areas that have a Disproportionately High and Adverse Impact on Low-Income Populations and Minority Populations

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (Executive Office of the President, 1994), and guidance from CEQ, require federal agencies to evaluate potential human health and environmental effects on environmental justice populations. Specifically, “Such effects may include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or Indian tribes when those impacts are interrelated to impacts on the natural or physical environment” (CEQ, 1997). Thus, effects associated with other resource areas are of interest from an environmental justice perspective. This includes Human Health and Safety, Cultural Resources, Socioeconomics, Noise, Aesthetics and Visual Resources, and other resources.

Potential concerns noted in the impact analyses for these resources include dust, noise, traffic, and other adverse impacts of construction activities. New wireless communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). See Socioeconomics Environmental Consequences for additional discussion. The presence and operation of large storage, staging, and launch/landing areas for deployable technologies could raise environmental justice concerns as described below. American 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 10.2.9).

Construction impacts are localized, and property value impacts of wireless telecommunications projects rarely extend beyond 300 meters (984 feet) of a communications tower (Bond, Sims, & Dent, 2013). In addition, impacts related to deployment are of short duration. The potential for significant environmental justice impacts from the FirstNet deployment activities would be limited. Most, but not all, of the FirstNet operational activities have very limited potential for impacts as these activities are limited in scale and short in their duration.

Before FirstNet deploys projects, additional site-specific analyses to identify specific environmental justice populations and assess specific impacts on those populations may be necessary. Such analyses could tier-off the methodology and results of this PEIS. The areas shown in the environmental justice screening map of Affected Environment (Section 10.1.10.4) as having moderate potential or high potential for environmental justice populations would particularly warrant further screening. As discussed in Section 10.1.10.3, Environmental Setting: Minority and Low-Income Populations, New Mexico's population has higher percentages of certain minorities than the region or the nation; these include persons identifying as American Indian/Alaska Native, Some Other Race, and Hispanic. The state's percentage of All Minorities is considerably higher than that of the South region and the nation. New Mexico also has a considerably higher poverty rate than the region and nation. A large proportion of New Mexico has high potential for environmental justice populations. The high potential areas are somewhat more prevalent in the northwest and north-central portions of the state, and along its southern border. They occur both within and outside of the 10 largest population concentrations. The distribution of areas with moderate or low potential for environmental justice populations is also somewhat uneven across the state; these areas are more prevalent in the southern and eastern portions of the state. Further analysis using the data developed for the screening analysis in Section 10.1.10.4, 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, 2015j; USEPA, 2016d).

A site-specific analysis would also evaluate whether an actual environmental justice impact on those populations would be likely to occur. Analysts could use the evaluation presented below under "Activities with the Potential to Have Impacts" as a starting point. Analysts should bear in mind that any such activities that are problematic based on the adverse impact criterion of environmental justice may also have beneficial impacts on those same environmental justice communities.

10.2.10.4. 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. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

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 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 environmental justice, it is anticipated that this activity would have no impact on environmental justice.

Activities with the Potential to Have Impacts

Potential deployment-related impacts to environmental justice for the Preferred Alternative would encompass a range of impacts that could occur as a result of disturbance to communities from construction activities, such as noise, dust, and traffic. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to environmental justice communities include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: New fiber optic cable installation usually requires construction activities such as trenching, plowing (including vibratory plowing), or directional boring, as well as construction of hand holes, pulling vaults, junction boxes, huts, and POP structures. These activities could temporarily generate noise and dust, or disrupt traffic. If such impacts occur disproportionately to environmental justice communities, they would be considered environmental justice impacts.
  - New Build – Aerial Fiber Optic Plant: Pole/structure installation could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in

environmental justice communities, they would be considered environmental justice impacts.

- New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water would not impact environmental justice because there would be no ground disturbance or other impacts associated with this activity that would adversely impact communities. Associated onshore activities occurring at existing facilities such as staging of equipment and materials, or connection of cables, would be small in scale and temporary; thus, they would not impact environmental justice communities. Construction of new landings and/or facilities on shores or the banks of water bodies that accept the submarine cable could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
- Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts, there would be no adverse impacts on surrounding communities, and thus no potential for environmental justice impacts. Installation of optical transmission equipment or centralized transmission equipment requiring construction of new utility poles, hand holes, pulling vaults, junction boxes, huts, and POP structures could temporarily generate noise and dust, or disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures, such as generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads, or access roads requires construction activities that could temporarily generate noise and dust, or disrupt traffic. New communication towers sometimes have adverse impacts on nearby property values (Bond, Sims, & Dent, 2013). (See Socioeconomics Environmental Consequences for additional discussion.) If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would include mounting or installing equipment (such as antennas) on an existing facility. This activity would be small in scale, temporary, and highly unlikely to produce adverse human health or environmental impacts on the surrounding community. Thus, it would not impact environmental justice communities. If collocation requires construction for additional power units, structural hardening, and physical security measures, the construction activity could temporarily generate noise and dust and disrupt traffic. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

- Deployable Technologies: COWs, COLTs, and SOWs and aerial deployable technologies require storage, staging, and (for aerial deployables) launch and landing areas. To the extent such areas require new construction, noise and dust could be temporarily generated, and traffic could be disrupted. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts.

In general, the impacts from the abovementioned activities would be short-term and could potentially involve objectionable dust, noise, traffic, or other localized impacts due to construction activities. In some cases, these effects and aesthetic effects could potentially impact property values, particularly from new towers. These impacts are expected to be less than significant at the programmatic level, 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 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of 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 at the programmatic level. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.10.5. 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 at the programmatic level because they would be temporary in nature. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

The ongoing presence of facilities for housing and maintaining deployable technologies may have adverse aesthetic aspects (e.g., large areas of pavement and large numbers of parked vehicles) that could negatively affect the value of surrounding properties. In addition, equipment maintenance activities at such facilities may temporarily generate noise, and operational activities may generate traffic. These effects may be adverse in themselves, and may impact property values. If these effects occur disproportionately in environmental justice communities, they would be considered environmental justice impacts. Impacts are expected to be less than significant at the programmatic level as operations are expected to be temporary in nature. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

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 10.1.10, Environmental Justice.

10.2.11. Cultural Resources

10.2.11.1. Introduction

This section describes potential impacts to cultural resources in New Mexico associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.11.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on cultural resources were evaluated using the significance criteria presented in Table 10.2.11-1. As described in Section 10.2, 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 10.2.11-1: Impact Significance Rating Criteria for Cultural Resources

Type of Effect	Effect Characteristics	Impact Level: Adverse Effect	Impact Level: Mitigated Adverse Effect[a]	Impact Level: Effect, but not Adverse	Impact Level: No Effect
Physical damage to and/or destruction of historic properties[b]	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No direct effects to historic properties.
	Geographic Extent	Direct effects APE.		Direct effects APE.	Direct effects APE.
	Duration or Frequency	Permanent direct effects to a contributing portion of a single or many historic properties.		Permanent direct effects to a non-contributing portion of a single or many historic properties.	No direct effects to historic properties.
Indirect effects to historic properties (i.e., visual, noise, vibration, atmospheric)	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a contributing or non-contributing portion of a single or many historic properties.	No indirect effects to historic properties.
	Geographic Extent	Indirect effects APE.		Indirect effects APE.	Indirect effects APE.
	Duration or Frequency	Long-term or permanent indirect effects to a single or many historic properties.		Infrequent, temporary, or short- or long-term or permanent indirect effects to a single or many historic properties.	No indirect effects to historic properties.
Loss of character defining attributes of historic properties	Magnitude or Intensity	Effects to a contributing portion of a single or many historic properties.	Adverse effect that has been procedurally mitigated through Section 106 process.	Effects to a non-contributing portion of a single or many historic properties.	No direct or indirect effects to historic properties.
	Geographic Extent	Direct and/or indirect effects APE.		Direct and/or indirect effects APE.	Direct and/or indirect effects APE.

Type of Effect	Effect Characteristics	Impact Level			
		Adverse Effect	Mitigated Adverse Effect[a]	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.

[a] 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 American Indian Tribes and Native Hawaiian Organizations, to develop appropriate mitigation.

[b] 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 American 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.

10.2.11.3. 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 10.2.11-1, 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 New Mexico, some deployment activities may be in these areas, in which case BMPs (see Chapter 16) would help avoid or minimize the potential impacts.

Indirect Effects to Historic Properties (i.e., visual, noise, vibration, atmospheric)

The potential for indirect effects to historic properties would be present during deployment of the proposed facilities/infrastructure and during trenching, grading, and/or foundation excavation activities. Indirect effects include the introduction of visual, noise, atmospheric, and/or vibration effects that diminish a property's historic integrity. The greatest likelihood of potentially significant impacts from indirect effects would be from the deployment of equipment in areas that would cause adverse visual effects to historic properties. To the extent practicable, FirstNet would attempt to minimize activities in areas within or adjacent to historic districts or properties.

Loss of Character Defining Attributes of Historic Properties

Deployment of FirstNet equipment has the potential to cause the loss of character defining attributes of historic properties; such attributes are the features of historic properties that define their NRHP eligibility. Examples of such impacts would be the loss of integrity of archaeological sites through ground disturbing activities, and direct impacts to historic buildings from equipment deployment that adversely alter historic architectural features. Significant impacts such as these could be avoided or minimized through BMPs (see Chapter 16).

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 Indian. 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.

10.2.11.4. 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. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

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

Activities with the Potential to Have Impacts

Potential deployment-related impacts to cultural resources as a result of implementation of the Preferred Alternative would encompass a range of impacts that could occur as a result of ground disturbance activities, including destruction of cultural or historic artifacts. The types of infrastructure deployment activities that could be part of the Preferred Alternative and result in potential impacts to cultural resources include the following:

- Wired Projects
  - New Build – Buried Fiber Optic Plant: Plowing (including vibratory plowing), trenching, or directional boring and the construction of POP, huts, or other associated facilities or hand-holes to access fiber could result in potential impacts to cultural resources. Soil disturbance and heavy equipment use associated with plowing, trenching, or directional boring as well as land/vegetation clearing, excavation activities, and landscape grading associated with construction of POPs, huts, or other associated facilities or hand-holes to access fiber could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - New Build – Aerial Fiber Optic Plant: Ground disturbance during the installation of new utility poles and the use of heavy equipment during the installation of new utility poles and hanging of cables could result in the disturbance of archaeological sites, and the associated structures could have visual effects on historic properties.
  - New Build – Submarine Fiber Optic Plant: The installation of cables in or near bodies of water could impact cultural resources; where sea levels were lower during glacial periods have the potential to contain archaeological sites. Impacts to cultural resources could also potentially occur as result of the construction of landings and/or facilities on shores or the banks of water bodies that accept the submarine cable, which could result in the disturbance of archaeological sites (archaeological deposits are frequently associated with bodies of water), and the associated structures could have visual effects on historic properties.
  - Installation of Optical Transmission or Centralized Transmission Equipment: If installation of transmission equipment would occur in existing boxes or huts and require no ground disturbance, there would be no impacts to cultural resources. If installation of transmission equipment required grading or other ground disturbance to install small boxes or huts, or access roads, there could potentially be impacts to cultural resources. Ground disturbance could impact archaeological sites, and the associated structures could have visual effects on historic properties.
  - Collocation on Existing Aerial Fiber Optic Plant: Soil excavation and excavated material placement during the replacement of poles and structural hardening could result in direct and indirect effects to cultural resources, although any effects to access would be short-term. Heavy equipment use associated with these activities as well as with installing new fiber on existing poles could result in direct and indirect effects to cultural resources.

- Wireless Projects
  - New Wireless Communication Towers: Deployment of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in impacts to historic properties. Land/vegetation clearing, excavation activities, landscape grading, and other ground disturbance activities during the deployment of new wireless towers and associated structures or access roads, could result in the disturbance of archaeological sites. The deployment of new wireless communication towers and their associated structures could result in visual impacts to historic properties or the loss of access to historic properties.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower could result in impacts to historic properties. Ground disturbance activities could result in the disturbance of archaeological sites, and the deployment of collocated equipment could result in visual impacts or physical damage to historic properties, especially in urban areas such as Santa Fe that have larger numbers of historic public buildings.
  - Deployable Technologies: Implementation of deployable technologies could result in potential impacts to cultural resources if deployment occurs in unpaved areas, or if the implementation results in paving of previously unpaved surfaces. In addition, impacts to historic properties could occur if the deployment is long-term, or if the deployment involves aerial technologies with the potential for visual or other indirect impacts.

In general, the abovementioned activities could potentially involve ground disturbance, construction of access roads and other impervious surfaces, landscape grading, and heavy equipment movement. Potential impacts to cultural resources associated with deployment could include physical damage to or destruction of historic properties, indirect impacts including visual effects, the loss of access to historic properties, or the loss of character-defining features of historic properties. These activities could affect, but not adversely affect, cultural resources as the potential adverse effects would be temporary and limited to the area near individual Proposed Action deployment site. Additionally, some equipment proposed to be installed on or near properties that are listed or eligible for listing on the NRHP could potentially be removed. Additionally as appropriate, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be no effect to cultural resources associated with routine inspections of the Preferred Alternative. If usage of heavy equipment as part of routine maintenance or inspections occurs off established access roads or corridors, or if the acceptable load of the surface is exceeded, ground disturbance impacts on archaeological sites could result as explained above. These potential impacts would be associated with ground disturbance or modifications of properties, however, due to the small scale of expected activities, these actions could affect but would not likely adversely affect, cultural resources. In the event that maintenance and inspection activities occur off existing roads, FirstNet would engage in consultation as required under Section 106 of the NHPA. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.11.5. 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 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the deployment impacts, it is anticipated that there would be effects, but no adverse effects to historic properties associated with implementation/running of the deployable technology. No adverse effects would be expected to either site access or viewsheds due to the temporary nature of expected activities. As with the Preferred Alternative, it is anticipated that there would be no impacts 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 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

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 because of deployment and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.11, Cultural Resources.

10.2.12. Air Quality

10.2.12.1. Introduction

This section describes potential impacts to New Mexico's air quality from deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.12.2. Impact Assessment Methodology and Significance Criteria

The impacts of the Proposed Action on New Mexico's air quality were evaluated using the significance criteria presented in Table 10.2.12-1. As described in Section 10.2, 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 New Mexico's air quality addressed in this section are presented as a range of possible impacts.

Table 10.2.12-1: 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

10.2.12.3. Description of Environmental Concerns

Increased Air Emissions

The Proposed Action has the potential to generate air pollutant emissions. These emissions could be beyond what is typically generated in a given area and may alter ambient air quality. Deployment activities may involve the use of vehicles, heavy equipment, and other equipment that could emit exhaust and create fugitive dust in localized areas. During operations, routine maintenance and other use of generators at tower facilities may emit exhaust for specific durations (maintenance) or unpredictable timeframes (if power is lost to a site, for example). Impacts are likely to be less than significant at the programmatic level 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. Bernalillo, Dona Ana, and Grant Counties in New Mexico are in maintenance or nonattainment for one or more criteria pollutants, CO, PM, and SO_2 (see Section 10.1.12, Air Quality, and Table 10.1.12-4).

Based on the significance criteria presented in Table 10.2.12-1, air emission impacts would likely be less than significant at the programmatic level 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 New Mexico; however, NAAQS exceedances are not anticipated. Given that nonattainment areas are present throughout New Mexico (Figure 10.1.12-1), FirstNet would try to minimize potential emissions where possible and would recommend the implementation of BMPs, where feasible and practicable, to avoid or minimize potential impacts.

10.2.12.4. 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. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Activities Likely to Have No Impacts

Of the types of facilities or infrastructure development scenarios described in Section 2.1.2, Proposed Action Infrastructure, the following are likely to have no impacts to 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 at the programmatic level 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 shores or the banks of water bodies that accept the submarine cable could result in products of combustion and fugitive dust from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Emissions associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the power requirements for optical networks are relatively low.

- Wireless Projects
  - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in products of combustion. Operating vehicles and other heavy equipment, running generators while conducing excavation activities and landscape grading to install new wireless towers and associated structures or access roads could result in products of combustion and fugitive dust.
  - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, such as antennas or microwave dishes, on an existing tower could impact air quality. If 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 at the programmatic level due to the limited nature of the deployment. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major communications infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned deployment impacts. It is anticipated that there would be less than significant at the programmatic level 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 at the programmatic level as they would still be limited in nature. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.12.5. 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 at the programmatic level 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 at the programmatic level, given that these activities are of low-intensity and short duration. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

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.

10.2.13. Noise

10.2.13.1. Introduction

This section describes potential noise impacts from construction, deployment, and operation of the Proposed Action and Alternatives in New Mexico. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.13.2. Impact Assessment Methodology and Significance Criteria

The noise impacts of the Proposed Action were evaluated using the significance criteria presented in Table 10.2.13-1. As described in Section 10.2, 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 New Mexico addressed in this section are presented as a range of possible impacts.

Table 10.2.13-1: Impact Significance Rating Criteria for Noise

<table>
<tr><th rowspan="2">Type of Effect</th><th rowspan="2">Effect Characteristics</th><th colspan="4">Impact Level</th></tr>
<tr><th>Potentially Significant</th><th>Less than Significant with BMPs and Mitigation Measures Incorporated</th><th>Less than Significant</th><th>No Impact</th></tr>
<tr><td rowspan="3">Increased noise levels</td><td>Magnitude or Intensity</td><td>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.</td><td rowspan="3">Effect that is potentially significant, but with mitigation is less than significant.</td><td>Noise levels resulting from project activities would exceed natural sounds, but would not exceed typical noise levels from construction equipment or generators.</td><td>Natural sounds would prevail. Noise generated by the action (whether it be construction or operation) would be infrequent or absent, mostly immeasurable.</td></tr>
<tr><td>Geographic Extent/Context</td><td>County or local.</td><td>County or local.</td><td>County or local.</td></tr>
<tr><td>Duration or Frequency</td><td>Permanent or long-term.</td><td>Short term.</td><td>Temporary.</td></tr>
</table>

10.2.13.3. 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 Infrastructure 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 10.1.13, Noise).

Based on the significance criteria presented in Table 10.2.13-1, noise impacts could be less than significant at the programmatic level 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 could help 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.

10.2.13.4. 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. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

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 shores or the banks of water bodies that accept the submarine cable could result in short-term and temporarily increased noise levels to local residents and other noise sensitive receptors from heavy equipment used for grading, foundation excavation, or other ground disturbing activities.
- Installation of Optical Transmission or Centralized Transmission Equipment: Noise associated with the installation of optical transmission or centralized transmission equipment would be limited to the short-term, temporary use of vehicle and construction equipment. Long-term impacts are unlikely, as the noise emissions from optical networks are relatively low. Heavy equipment used to grade and construct access roads could generate increased levels of noise over baseline levels temporarily.

- Wireless Projects
    - New Wireless Communication Towers: Activities associated with installing new wireless towers and associated structures (e.g., generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in localized construction noise. Operating vehicles, other heavy equipment, and generators would be used on a short-term basis and could increase noise levels.
    - Collocation on Existing Wireless Tower, Structure, or Building: Vehicles and equipment used to mount or install equipment, or to grade or excavate additional land on sites for installation of equipment, such as antennas or microwave dishes on an existing tower, could impact the local noise environment temporarily.
    - Deployable Technologies: The type of deployable technology used would dictate the types of noise generated. For example, mobile equipment deployed via heavy trucks could generate noise from the internal combustion engines associated with the vehicles and onboard generators. With the exception of balloons, aerial platforms (e.g., UASs or other aircraft, except balloons) generate noise during all phases of flight, including

takeoff, landing, and flight operations over necessary areas that could impact the local noise environment.

In general, noise from the abovementioned activities would be products of site preparation, installation, and construction activities, as well as additional construction vehicles traveling on nearby roads and localized generator use. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the construction impacts. These impacts are expected to be less than significant at the programmatic level due to the temporary duration of deployment activities. Additionally, pre-existing noise levels achieved after some months (typically less than a year but could be a few hours for linear activities such as pole construction). Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Preferred Alternative would be less than significant at the programmatic level 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 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.13.5. Alternatives Impact Assessment

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

Deployable Technologies Alternative

Under the Deployable Technologies Alternative option, a nationwide fleet of mobile communications systems would provide temporary coverage in areas not covered by the existing, usable infrastructure. There would be no collocation of equipment and minimal new construction associated with wired or wireless projects discussed above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging areas. The specific equipment associated with the Deployable Technologies Alternative would be heavy trucks with onboard generators, aerial vehicles (e.g., UASs or other aircraft), and ground support vehicles and equipment for aerial deployment. The stand-alone Deployable Technologies Alternative differs from the Preferred Alterative in the number of mobile and aerial vehicles likely to deploy, the distances traveled from storage locations and the duration of deployment. The potential noise impacts are as follows:

Deployment Impacts

Implementing deployable technologies could result in noise from mobile equipment deployed via heavy trucks, including not only onboard generators, but also the vehicles themselves. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may increase localized noise levels. Several vehicles traveling together could also create short-term noise impacts on residences or other noise-sensitive receptors as they pass by. With the exception of balloons, the deployment of aerial technology is anticipated to generate noise during all phases of flight. Aerial technologies would have the highest level of noise impact if they are required to fly above residential areas, areas with a high concentration of noise-sensitive receptors (i.e., schools or churches), or over national parks or other areas where there is an expectation of quiet and serenity on their way to their final destinations. Residences near deployment areas for aerial technologies (i.e., airports or smaller airfields) could also be affected during takeoff and landing operations. Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant at the programmatic level, given that these activities are of low-intensity and short duration. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

Operation activities associated with the Deployable Technologies Alternative would be similar to several of the deployment activities related to routine maintenance and inspection of the facilities. Operation of generators could also generate noise in the area. However, deployable technologies could be deployed to areas with few existing facilities, so noise impacts could be minimal in those areas. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that potential noise impacts would be the same as those described for the deployment activities. If usage of vehicles or heavy equipment as part of routine maintenance or inspections occurs, potential noise impacts could result as explained above.

Operational impacts from aerial technologies would include repeated flyovers by UAS vehicles while they are needed in the area. This could generate 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 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, FirstNet would not deploy the NPSBN and there would be no impact to ambient noise. By not deploying the NPSBN, FirstNet would avoid generating noise from construction, installation, or operation of wired, wireless, deployable infrastructure or satellites and other technologies.

10.2.14. Climate Change

10.2.14.1. Introduction

This section describes potential impacts to climate and climate change-vulnerable resources in New Mexico associated with deployment and operation of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.14.2. 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 10.2.14-1. As described in Section 10.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

CEQ requires the consideration of climate change from two perspectives. The first is the potential for impacts on climate change through GHG emissions resulting from the Proposed Action or alternatives. The second is related to the implications and possible effects of climate change on the environmental consequences of the Proposed Action or alternatives. This extends to the impacts of climate change on facilities and infrastructure that would be part of the Proposed Action or alternatives (CEQ, 2014).

CEQ has established the significance criteria for GHG emissions at 25,000 MT CO_2e on an annual basis, with the requirement that if projected emissions exceed this threshold, a GHG emissions quantitative analysis is warranted (CEQ, 2014). Although 25,000 MT is a very small fraction (one 266,920th) of the total U.S. emissions of 6,673 MMT CO_2e in 2013 (USEPA, 2015w), the sum of additional emissions as a consequence of the deployment of FirstNet, combined with multiple new sources of CO_2 and other GHGs from other projects and human activities, could be significant.

CEQ guidance for the consideration of effects of climate change on the environmental consequences of the proposed action is more general. In addition to the consideration of climate change's effects on environmental consequences, it also includes the impact that climate change may have on the projects themselves (CEQ, 2014). Projects located in areas that are vulnerable to the effects of climate change (e.g., sea level rise) may be at risk. Analysis of these risks through the NEPA process could provide useful information to the project planning to ensure these projects are resilient to the impacts of climate change.

Table 10.2.14-1: Impact Significance Rating Criteria for Climate Change

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less Than Significant with BMPs and Mitigation Measures Incorporated**	**Less Than Significant**	**No Impact**
Contribution to climate change through GHG emissions	Magnitude or Intensity	Exceedance of 25,000 metric tons of CO_2e/year, and global level effects observed.	Effect that is potentially significant, but with mitigation is less than significant.	Only slight change observed.	No increase in greenhouse gas emissions or related changes to the climate as a result of project activities.
	Geographic Extent	Global impacts observed.		Global impacts observed.	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term.		Changes occur on a longer time scale. Changes cannot be reversed in the short term.	NA
Effect of climate change on FirstNet installations and infrastructure	Magnitude or Intensity	Climate change effects (such as sea level rise or temperature change) negatively impact FirstNet infrastructure.	Effect that is potentially significant, but with mitigation is less than significant.	Only slight change observed.	No measurable impact of climate change on FirstNet installations or infrastructure.
	Geographic Extent	Local and regional impacts observed.		Local and regional impacts observed.	NA
	Duration or Frequency	Long-term changes. Changes cannot be reversed in a short term.		Changes occur on a longer time scale. Changes cannot be reversed in the short term.	NA

NA= Not Applicable

10.2.14.3. Projected Future Climate

The Southwest is the hottest and driest region in the United States, and the region is already experiencing impacts of climate change. The decade 2001-2010 was the warmest in the 110-year instrumental historical record keeping, with temperatures almost 2 °F higher than historic averages, which included fewer cold air outbreaks and more heat waves. Summertime heat waves are projected to become longer and hotter, whereas the trend of decreasing wintertime cold air outbreaks is projected to continue. These changes will directly affect urban public health and will also have direct impacts on crop yields. (USGCRP, 2014a)

Air Temperature

Figure 10.2.14-1 and Figure 10.2.14-2 illustrate the anticipated temperature changes for low and high GHG emission scenarios for New Mexico from a 1969 to 1971 baseline.

Bsk – Figure 10.2.14-1 shows that by mid-century (2040 to 2059), temperatures in the Bsk region of New Mexico under a low emissions scenario would increase by approximately 4 °F. By the end of the century (2080 to 2099) under a low emissions scenario temperatures in the Bsk region of New Mexico would increase by approximately 5 °F or 6 °F depending on the portion of the region. (USGCRP, 2009)

Figure 10.2.14-2 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 Bsk region of New Mexico, temperatures would increase by approximately 9 °F in the majority of the region and by 10 °F along the northern border of the state/region. (USGCRP, 2009)

Bwk – Under a low emissions scenario temperatures in the Bwk region of New Mexico are expected to increase 4 °F by mid-century (2040 to 2059) and 5 °F by the end of the century (2080 to 2099).

Under a high emissions scenario temperatures in the Bwk region are expected to increase 5 °F by mid-century (2040 to 2059). Under this scenario, temperatures are expected to increase 9 °F by the end of the century. (USGCRP, 2009)

Dfb – Temperatures in the Dfb region of New Mexico are expected to increase by 4 °F by mid-century under a low emissions scenario. By the end of the century, temperatures under a low emissions scenario are expected to increase 6 °F.

Temperatures in the Dfb region are expected to increase 5 °F by mid-century under a high emissions scenario. Under a high emissions scenario for the period (2080 to 2099) in the Dfb region of New Mexico, temperatures would increase by approximately 9 °F or 10 °F depending on the portion of the region.

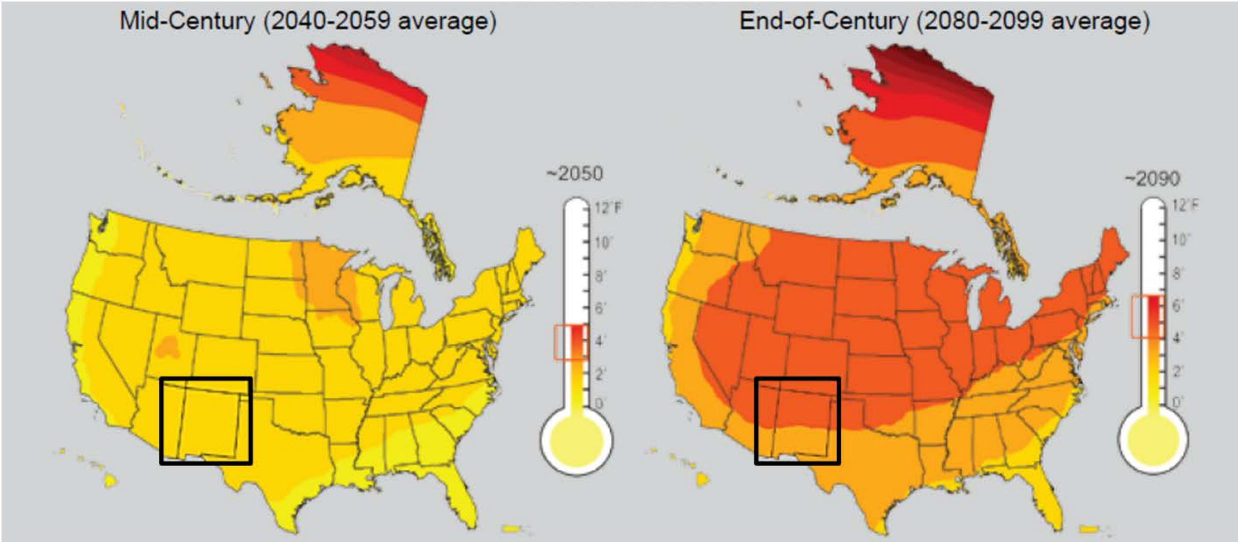

Figure 10.2.14-1: New Mexico Low Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

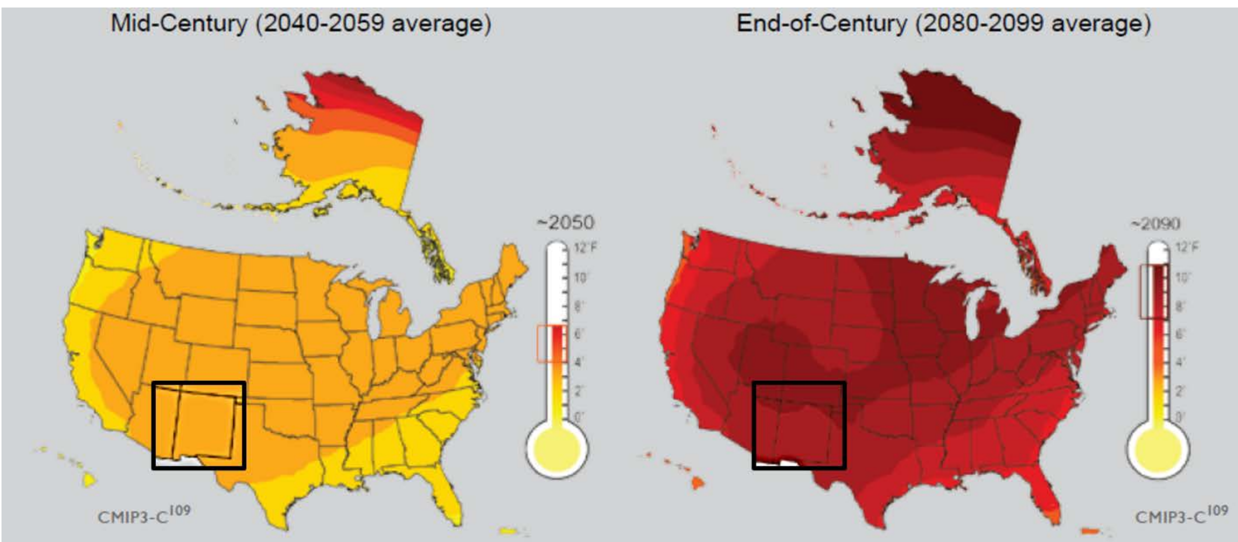

Figure 10.2.14-2: New Mexico High Emission Scenario Projected Temperature Change

Source: (USGCRP, 2009)

Precipitation

Projections of precipitation changes are less certain than those for temperature. Under a high emissions scenario, reduced winter and spring precipitation is consistently projected for the southern part of the Southwest by 2100. In the northern part of the region, projected winter, spring, summer and fall precipitation changes are smaller than natural variations. The Southwest is prone to drought, future droughts are projected to be substantially hotter, and for major river basins such as the Colorado River Basin, drought is projected to become more frequent, intense, and longer lasting. These drought conditions present a huge challenge for the management of water resource and natural hazards such as wildfire. (USGCRP, 2014b)

Figure 10.2.14-3 and Figure 10.2.14-4 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 10.2.14-3 show seasonal changes in a low emissions scenario, which assumes rapid reductions in emissions where rapid reductions means more than 70 percent cuts from current levels by 2050. (USGCRP, 2014b)

Figure 10.2.14-4 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 10.2.14-3 shows that in a low emissions scenario in the 30-year period for 2071 to 2099, precipitation would increase by 10 percent, decrease by 10 percent or remain constant in winter depending on the portion of the region. Spring precipitation is expected to increase by 10 percent or remain constant depending on the portion of the Bsk region in New Mexico. However, there are no expected changes in precipitation in fall or summer other than fluctuations due to natural variability. (USGCRP, 2014b)

Figure 10.2.14-4 shows that if emissions continue to increase, winter precipitation could increase 10 percent, decrease 10 or 20 percent, or remain constant depending on the portion of the region. Spring precipitation could remain constant, decrease 10, 20 or 30 percent over the period 2071 to 2099 depending on the portion of the region. In summer, precipitation in this scenario could decrease 10 or 20 percent, or remain constant depending on the portion of the region. Fall precipitation is expected to remain constant or decrease 10 percent depending on the portion of the region. (USGCRP, 2014b)

Bwk – Under a low emissions scenario, winter precipitation is expected to decrease 10 percent. There are no anticipated changes to spring, summer or fall precipitation in the Bwk region of New Mexico under a low emissions scenario. (USGCRP, 2014b)

Under a high emissions scenario, precipitation is expected to decrease 20 percent in winter and 30 percent in spring. There are no expected changes to summer or fall precipitation in this scenario. (USGCRP, 2014b)

Dfb – Spring precipitation is expected to increase 10 percent or remain constant depending on the portion of the Dfb region. There are no anticipated changes to winter, summer, or fall precipitation in the Dfb region of New Mexico under a low emissions scenario. (USGCRP, 2014b)

Under a high emissions scenario, precipitation is expected to increase 10 percent, decrease 10 percent, or remain constant depending on the portion of the Dfb region. Spring precipitation is expected to decrease 10 or 20 percent. In summer, precipitation is anticipated to remain constant or decrease 10 percent depending on the portion of the region. There are no anticipated changes to fall precipitation. (USGCRP, 2014b)

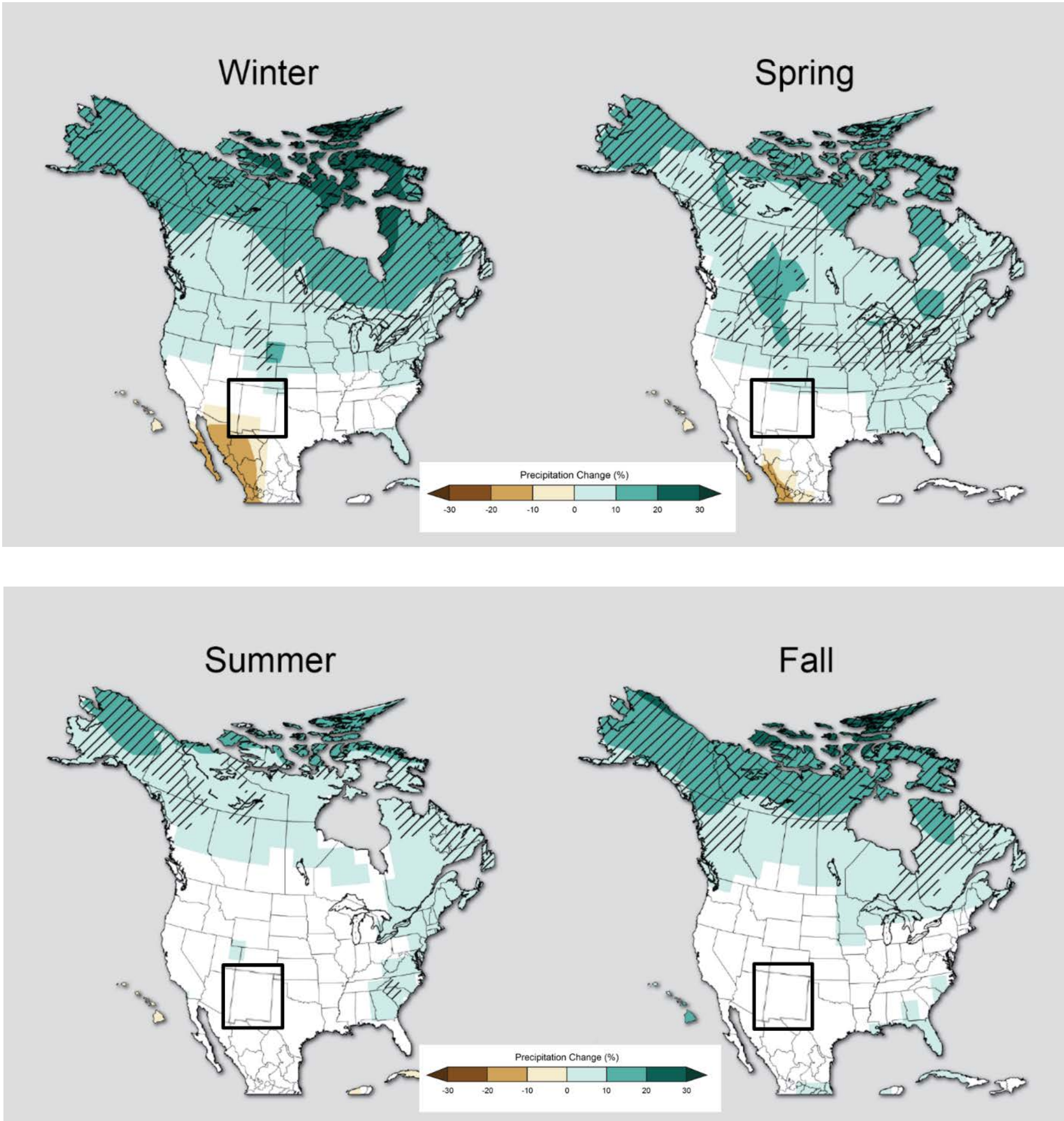

Figure 10.2.14-3: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a Low Emissions Scenario

Source: (USGCRP, 2009)

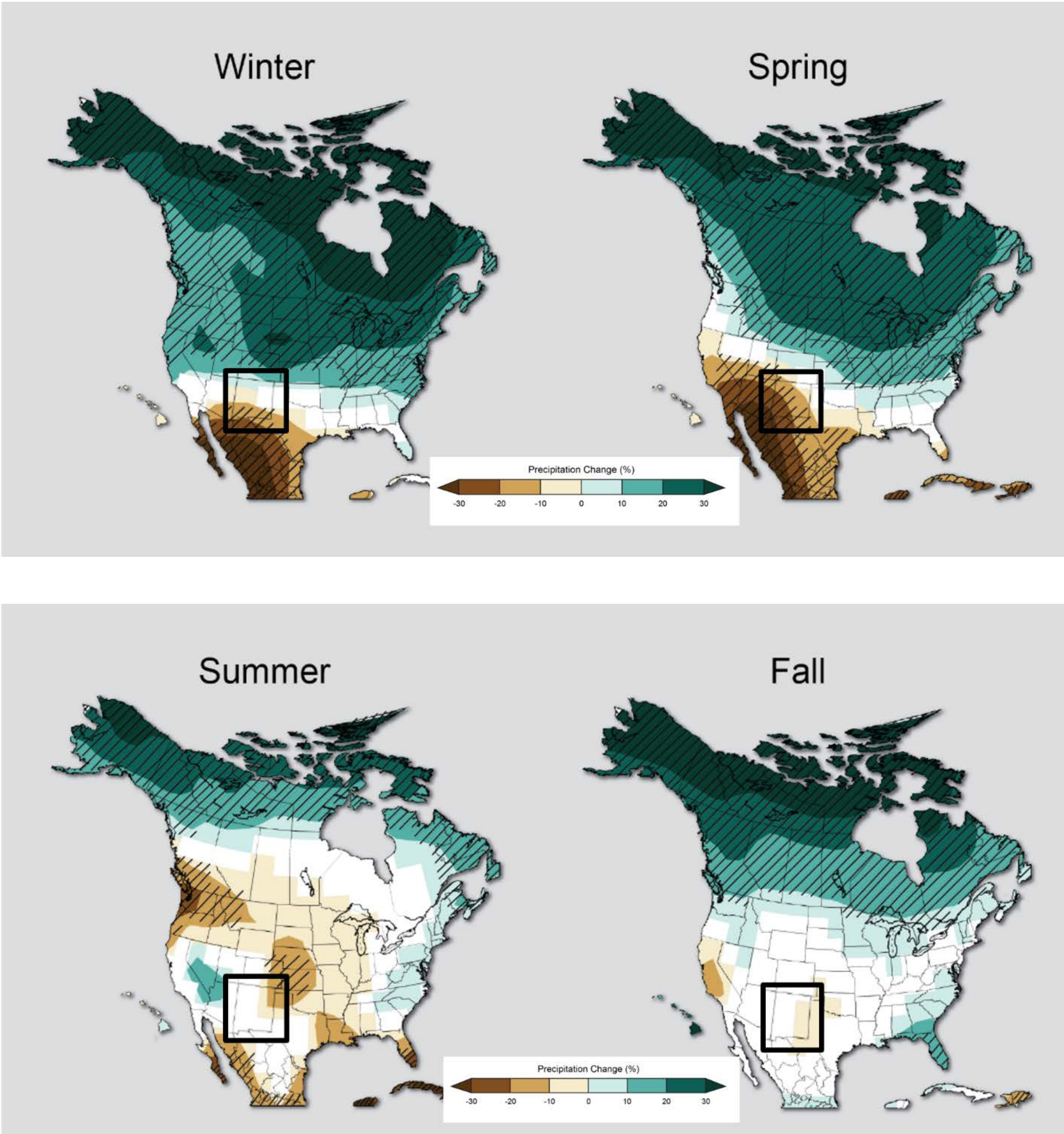

Figure 10.2.14-4: Predicted Seasonal Precipitation Change for 2071 to 2099 Compared to 1970 to 1999 Baseline in a High Emissions Scenario

Source: (USGCRP, 2009)

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. Climate scientists are studying the influences of climate change on severe storms. Recent research has yielded insights into the connections between warming and factors that cause severe storms. For example, atmospheric instability and increases in wind speed with altitude link warming with tornadoes and thunderstorms. Additionally, research has found a link between warming and conditions favorable for severe thunderstorms. However, more research is required to make definitive links between severe weather events and climate change. (USGCRP, 2014c)

10.2.14.4. 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, 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 10.2.14-1, 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 CO2 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 CO2 per gallon (EIA, 2015i). A 60kW transmitter running on a generator would therefore be responsible for 1,221 kg of CO2/day. Running continuously, the tower would cause the emission of 446 MT of CO2 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, 2015x), the same transmitter would be responsible for approximately 271 MT of CO_2 per year running continuously. Actual emissions would depend on the fuel mix and efficiency of the systems from which electricity was generated. Some may even run on low/no-emissions renewable energy. Therefore, this scenario is a "worst-case" for GHG emissions. If the system deployment resulted in the operation of more than 50 60 kW towers operating at maximum power in remote locations on diesel generators on a continuous basis, the 25,000 MT/year threshold may be exceeded and a quantitative analysis required. By comparison, optical fiber is considerably more energy efficient and consumes considerably less power than transmitters (Vereecken, et al., 2011), and would not impact GHG emissions in such a way as to require a quantitative analysis.

Effects of Climate Change on Project-Related Impacts

Climate change may increase project-related impacts by magnifying or otherwise altering impacts in other resources areas. Longer and more intense droughts and their cascading consequences on reduced snowpack and rainfall, are expected to negatively affect both aquatic and terrestrial ecosystems, as well as agriculture. Increased water stress is expected to increase regional dependence on and demand for irrigation for crops and conflict between farmers and endangered species. (USGCRP, 2014d) (Mid-Region Council of Governments of New Mexico, 2014)

The increased likelihood for catastrophic wildfires may have a transformative effect on natural ecosystems, as species adapted to higher temperatures and less rainfall succeed species more suited to wetter, cooler environments, or forestlands yield to grasslands entirely (USGCRP, 2014d).

Impact of Climate Change on FirstNet Installations and Infrastructure

For areas of New Mexico 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). Climate change may expose areas of New Mexico increased intensity and duration of heat waves (USGCRP, 2014e) Extended periods of extreme heat may increase general demand on the electric grid as people use more air conditioning, impede the operation of the grid (DOE, 2015), and overwhelm the capacity on-site equipment needed to keep microwave and other transmitters cool.

The increased severity and length of droughts is expected to increase in New Mexico as snow pack is reduced and temperatures rise. This in turn may contribute to more frequent and larger wildland fires (USGCRP, 2014d) as well as increased fuel load in the form of dead trees caused by invasive bark beetles (USFS, 2012). Wildland fires may present a risk to both permanent and mobile installations as well as to first responders themselves.

10.2.14.5. 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 New Mexico, including deployment and operation activities.

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

Activities Likely to Have No Impacts

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

- Wired Projects
  - Use of Existing Conduit – New Buried Fiber Optic Plant: There would be no short-term emissions associated with construction, as construction would not take place. The equipment required to blow or pull fiber through existing conduit would be used temporarily and infrequently, resulting in no perceptible generation of GHG emissions.
  - Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up dark fiber would require no construction and have no short-term or long-term emissions. This would create no perceptible change in GHG emissions.
- Satellites and Other Technologies
  - Distribution of Satellite Enabled Devices and Equipment: The installation of satellite-enabled equipment on existing structures, or the use of portable satellite-enabled devices would not create any perceptible changes in GHG emissions because they would not create any new emissions sources.
  - Deployment of Satellites: FirstNet does not anticipate launching satellites as part of the NPSBN; however, it could include equipment on satellites that are already being launched for other purposes. Therefore, it is anticipated that there would be no GHG emissions or any climate change effects on the project because of these activities.

Activities with the Potential to Have Impacts

The deployment and use of energy-consuming equipment as a result of the implementation of the Preferred Alternative would result in GHG emissions whose significance would vary depending on their power requirements, duration and intensity of use, and number. The types of infrastructure deployment scenarios that could be part of the Preferred Alternative and result in potential impacts to GHG emissions and climate change include the following:

- Wired Projects
  - New Build - Buried Fiber Optic Plant: This activity would include plowing (including vibratory plowing), trenching, and directional boring, and could involve construction of POPs, huts, or other facilities to house outside plant equipment or hand holes to access fiber. These activities could generate GHG emissions.
  - New Build Aerial Fiber Optic Plant: These projects would require construction equipment for installing or replacing new poles and hanging cables as well as excavation

and grading for new or modified right-of-ways or easements. It could also include construction of POPs, huts, or other facilities to house outside plant equipment. These activities could generate GHG emissions.

- Collocation on Existing Aerial Fiber Optic Plant: These projects would require equipment for replacement of existing wiring and poles. GHG emissions associated with these projects would arise from use of machinery and vehicles to complete these activities.
- New Build – Submarine Fiber Optic Plant: The deployment of small work boats with engines similar to recreational vehicle engines may be required to transport and lay small wired cable. The emissions from these small engine sources would contribute to GHGs.
- Installation of Optical Transmission or Centralized Transmission Equipment: The construction of small boxes or huts or other structures would require construction equipment, which could generate GHG emissions.

- Wireless Projects
  - New Wireless Tower Construction: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads could result in short-term, temporary GHG emissions from vehicles and construction equipment. Long-term, permanent or temporary increases in GHG emissions would result from the electricity requirements of the towers (both grid-provided and back-up), and would depend on their size, number, and the frequency and duration of their use.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on existing towers. There would be no short-term GHG emissions associated with construction as it would not occur... 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 (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. Land use. Emissions occurring as a result of soil disturbance and loss of vegetation are expected to be less than significant at the programmatic level due to the limited and localized nature of deployment activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Climate Change Impacts on FirstNet Infrastructure or Operations

Climate change effects on the Preferred Alternative could be potentially significant to less than significant at the programmatic level with BMPs and mitigation measures incorporated because climate change may potentially impact FirstNet installations or infrastructure during periods of extreme heat, severe storms, and other weather events. FirstNet installations should be evaluated in the design and planning phase through tiering to this analysis, in the context of their local geography and anticipated climate hazards to ensure they are properly hardened or there is sufficient redundancy to continue operations in a climate-affected environment. Mitigation measures could minimize or reduce the severity or magnitude of a potential impact resulting to the project, including adaptation, which refers to anticipating adverse effects of climate change and taking appropriate action to prevent and minimize the damage climate change effects could cause.

Climate change's anticipated impact on extreme weather events such as torrential rains 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 prepare to sustain these operations in areas experiencing climate and weather extremes through the design and planning process for individual locations and operations.

10.2.14.6. 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 above under the Preferred Alternative. Some limited construction could be associated with implementation such as land clearing or paving for parking or staging area. 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 at the programmatic level based on the defined significance criteria, since activities would be temporary and short-term. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operations Impacts

Implementing land-based deployable technologies (COW, COLT, SOW) could result in emissions from mobile equipment on heavy trucks using internal combustion engines associated with the vehicles and onboard generators. While a single deployable vehicle may have an insignificant impact, multiple vehicles operating for longer periods, in close proximity, may have a cumulative impact, although this impact is expected to be less than significant at the programmatic level due to the temporary nature of the operation of deployables. 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 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 at the programmatic level due the limited duration of deployment activities. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Additionally, routine maintenance and inspections of the deployable technologies are anticipated to be less than significant at the programmatic level, given that these activities are of low-intensity and short duration.

Climate Change Impacts on FirstNet Deployable Infrastructure or Operations

Climate change effects have the most noticeable impacts over a long period. Climate change effects such as temperature, precipitation changes, and extreme weather during operations would be expected but could have little to no impact on the deployed technology due to the temporary nature of deployment. However, if these technologies are deployed continuously (at the required location) for an extended period, climate change effects on deployables could be similar to the Proposed Action, as explained above. Chapter 16, 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 10.1.14, Climate Change.

10.2.15. Human Health and Safety

10.2.15.1. Introduction

This section describes potential impacts to human health and safety in New Mexico associated with deployment of the Proposed Action and Alternatives. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.15.2. 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 10.2.15-1. As described in Section 10.2, Environmental Consequences, the categories of impacts are defined as potentially significant, less than significant with mitigation incorporated, less than significant, or no impact. Characteristics of each impact type, including magnitude or intensity, geographic extent, and duration or frequency, were used to determine the impact significance rating associated with each potential impact.

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

Table 10.2.15-1: Impact Significance Rating Criteria for Human Health and Safety

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with Mitigation 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. A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Exposure to recognized workplace safety hazards (physical and chemical). Violations of various regulations including: OSHA, RCRA, CERCLA, TSCA, EPCRA.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unsafe working conditions or other workplace safety hazards.	No exposure to chemicals, unsafe working conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	Less than Significant with Mitigation Incorporated	Less than Significant	No Impact
Exposure to Hazardous Materials, Hazardous Waste, and Mine Lands as a Result of FirstNet Site Selection and Site-Specific Land Disturbance Activities	Magnitude or Intensity	Exposure to concentrations of chemicals above regulatory limits, or USEPA chemical screening levels protective of the public. A net increase in the amount of hazardous or toxic materials or wastes generated, handled, stored, used, or disposed of, resulting in unacceptable risk, exceedance of available waste disposal capacity and probable regulatory violations. Site contamination conditions could preclude development of sites for the proposed use. Violations of various regulations including OSHA, RCRA, CERCLA, TSCA, EPCRA. Unstable ground and seismic shifting.	Effect is potentially significant, but with mitigation is less than significant.	No exposure to chemicals above health-protective screening levels. Hazardous or toxic materials or wastes could be safely and adequately managed in accordance with all applicable regulations and policies, with limited exposures or risks. No exposure to unstable ground conditions or other workplace safety hazards.	No exposure to chemicals, unstable ground conditions, or other workplace safety hazards.
	Geographic Extent	Regional impacts observed ("regional" assumed to be at least a county or county-equivalent geographical extent, could extend to state/territory).		Impacts only at a local/neighborhood level.	NA
	Duration or Frequency	Occasional frequency during the life of the project.		Rare event.	NA

Type of Effect	Effect Characteristics	Impact Level			
		Potentially Significant	**Less than Significant with Mitigation 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 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

10.2.15.3. 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 could sometimes be hazardous. 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 10.2.15-1, occupational injury impacts could be potentially significant if the FirstNet deployment locations require performing occupational activities that have the highest relative potential for physical injury and/or chemical exposure. Examples of activities that may present increased risk and higher potential for injury include working from heights (i.e., from towers and roof tops), ground-disturbing activities like trenching and excavating, confined space entry, operating heavy equipment, and the direct handling of hazardous materials and hazardous waste. Predominately, these hazards are limited to occupational workers, but may impact the general public if there are trespassers or if any physical of chemical hazard extends beyond the restricted access of proposed FirstNet work sites.

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, 2015c).

- 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[150], 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.

[150] 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, 2015c). To the extent practicable, FirstNet partner(s) would likely implement and abide by work practice controls through employee safety training and by developing site-specific health and safety plans (HASP). The HASPs would identify all potential hazardous materials and hazardous wastes, potential physical hazards, and applicable mitigation steps. Other components of a HASP identifying appropriate PPE for each task and the location of nearby medical facilities. Safety Data Sheets (SDS) describing the physical and chemical properties of hazardous materials used during FirstNet deployment and maintenance activities, as well as the physical and health hazards, routes of exposure, and precautions for safe handling and use would be kept and maintained at all FirstNet project sites. In addition to HASPs and SDSs, standard operating procedures (SOP) would be developed and implemented by FirstNet partner(s) for critical and/or repetitive tasks that require attention to detail, specialized knowledge, or clear directions to prevent worker injury and to ensure proper execution.

Administrative controls are employer-initiated methods to reduce the potential for injury and physical fatigue (OSHA, 2015c). Administrative controls may take the form of limiting the number of hours an employee is allowed to work per day, requiring daily safety meetings before starting work, utilizing the buddy system for dangerous tasks, and any other similar activity or process that is designed to identify and mitigate unnecessary exposure to hazards. When engineering controls, work practice controls, and administrative controls are not feasible or do not provide sufficient protection, employers must also provide appropriate PPE to their employees and ensure its proper use. PPE refers 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 because 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 10.2.15-1, human health impacts could be significant if FirstNet deployment sites are near contaminated properties. Prior to the start of any FirstNet deployment project, potential site locations should be screened for known environmental contamination and/or mining activities using federal resources such as the USEPA Cleanups in My Community database and U.S. Department of Interior’s (USDOI) Abandoned Mine Lands inventory, through the NMDEM, or through an equivalent commercial resource.

By screening sites for environmental contamination, and reported environmental liabilities, the presence of historic contamination and unsafe ground conditions could be evaluated and may influence the site selection process. In general, the lower the density of environmental contamination, the more favorable the site will be for FirstNet deployment projects. If sites containing known environmental contamination are selected for proposed FirstNet deployment activities it may be necessary to implement additional controls (e.g., engineering, work practice, administrative, and/or PPE) to ensure workers, and the public, are not exposed to the associated hazards. Additionally, for any proposed FirstNet deployment site, it is possible undocumented environmental contamination is present.

During FirstNet deployment activities, if any soil or groundwater is observed to be stained or emitting an unnatural odor, it may be an indication of environmental contamination. When such instances are encountered, it may be necessary to stop work until the anomaly is further assessed through record reviews or environmental sampling. Proposed FirstNet deployment would attempt to avoid known contaminated sites. However, in the event that FirstNet is unable to avoid a contaminated site, then site analysis and remediation would be required under RCRA, CERCLA, and applicable New Mexico state laws in order to protect workers and the public from direct exposure or fugitive contamination.

Exposure assessments identify relevant site characteristics, temporal exposure parameters, and toxicity data to determine the likelihood of adverse health effects. More formally known as a human health risk assessment (HHRA), these studies provide mathematical justification for implementing controls at the site to protect human health. If the HHRA determines the potential for adverse health effects is too great, NMDH 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 10.2.15-1, human health impacts could be significant if FirstNet deployment sites are located in areas that are directly impacted by natural and manmade disasters that could lead to exposure to hazardous wastes, hazardous materials, and occupational hazards. FirstNet's emphasis on public safety-grade communications infrastructure may result in a less than significant beneficial impact, as new infrastructure could be deployed with additional structural hardening, and existing infrastructure may also be hardened as appropriate and feasible, in an effort to reduce the possibility of infrastructure damage or destruction to some degree.

Potential mitigation measures for natural disasters is to be aware of current weather forecasts, forest fire activities, seismic activities, and other news worthy events that may indicate upcoming disaster conditions. Awareness provides time and opportunity to plan evacuation routes, to relocate critical equipment and parts, and to schedule appropriate work activities preceding and after the natural disaster. These mitigation steps reduce the presence of workers and dangerous work activities to reduce the potential for injury or death. Manmade disasters could be more difficult to anticipate due to the unexpected or accidental nature of the disaster. Though some manmade disasters are due to malicious intentions, many manmade disasters result from human error or equipment failure. The incidence of manmade disasters affecting FirstNet deployment sites would be difficult to predict and diminish because the source of such disasters is most likely to originate from sources independent of FirstNet activities. Therefore, FirstNet partner(s) would develop disaster response plans that outline specific steps employees should take in the event of a natural or manmade disaster. Chapter 16, 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.

10.2.15.4. 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. Chapter 16, BMPs and Mitigation Measures, provides a listing of BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

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 paths, would be temporary, and intermittent. It is anticipated that there would be no impacts to human health and safety.
- Use of Existing Buried or Aerial Fiber Optic Plant or Existing Submarine Cable: Lighting up of dark fiber would have no impacts to human health and safety because there would be no ground disturbance or heavy equipment used.

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

Activities with the Potential to Have Impacts

Potential deployment-related impacts to human health and safety from 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 FirstNet sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the 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 right-of-ways. 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 FirstNet sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the public in the immediate vicinity. Additionally, some of this work would likely be performed along road ROWs, increasing the potential for vehicle traffic to collide with site workers or equipment. If a proposed deployment activity involves the operation of heavy equipment, managing hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- New Build – Aerial Fiber Optic Plant: Installation of new poles and fiber optic lines would require excavation activities, working from heights, use of hazardous materials, and site locations in ROWs. Hazards associated with the site work include injury from heavy equipment, fall hazards, chemical hazards, and the potential for vehicle traffic to collide with site workers or equipment. Excavation of soil at proposed sites known to contain environmental contamination has the potential to expose workers to harmful chemicals or releases that could impact the 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 public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.
- New Build – Submarine Fiber Optic Plant: The installation of fiber optic cables in or near bodies of water requires workers to operate over aquatic environments, which presents opportunities for drowning. When working over water exposure to sun, high or low temperatures, wind, and moisture could impact worker safety. Construction of landings and/or facilities on shores or the banks of water bodies that accept the submarine cable would require site preparation, construction, and management of hazardous materials and hazardous waste. Excavation of soils or sediments at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and

hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

  - Installation of Optical Transmission or Centralized Transmission Equipment: Installation of transmission equipment would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider.

- Wireless Projects
  - New Wireless Communication Towers: Installation of new wireless towers and associated structures (generators, equipment sheds, fencing, security and aviation lighting, electrical feeds, and concrete foundations and pads) or access roads would require site preparation, construction activities, and management of hazardous materials and hazardous waste. Communication towers would be erected, requiring workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the general public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.
  - Collocation on Existing Wireless Tower, Structure, or Building: Collocation would involve mounting or installing equipment (such as antennas or microwave dishes) on an existing tower. This would require workers to perform their duties from heights sufficient to result in serious injury or death in the event of falling not result in impacts to soils. Working from heights may also result in additional overhead hazards and falling objects. Excavation of soils at proposed sites known to contain environmental contamination may result in workers being exposed to harmful chemicals or releases that could impact the public in the immediate vicinity. If a proposed deployment activity involves the operation of heavy equipment, hazardous materials and hazardous waste management, or other site location challenges, there could be potential human health and safety impacts to consider. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions.

- Deployable Technologies
  - The use of deployable technologies could result in soil disturbance if land-based deployables are deployed on unpaved areas or if the implementation results in paving of

previously unpaved surfaces. The use of heavy machinery presents the possibility for spills and soil and water contamination, and noise emissions could potentially impact human health; and vehicles and heavy equipment present the risk of workplace and road traffic accidents that could result in injury. Set-up of a cellular base station contained in a trailer with a large expandable antenna mast is not expected to result in impacts to human health and safety. However, due to the larger size of the deployable technology, site preparation or trailer stabilization may be required to ensure the self-contained unit is situated safely at the site. Additionally, the presence of a dedicated electrical generator would produce fumes and noise. The possibility of site work and the operation of a dedicated electrical generator have the potential for impacts to human health and safety. For a discussion of radio frequency emissions, refer to Section 2.4, Radio Frequency Emissions. Use of aerial vehicles would not involve telecommunication site work. Prior to deployment and when not in use, the aerial vehicles would likely require preventive maintenance. Workers responsible for these activities may handle hazardous materials, not limited to fuel, solvents, and adhesives.

- Satellites and Other Technologies
  - Satellite-Enabled Devices and Equipment: The use of portable devices that utilize satellite technology would not impact human health and safety because there is no construction activity or use of hazardous materials. The installation of permanent equipment on existing structures may require workers to operate from heights or in sensitive environments. As a result, the potential for falling, overhead hazards, and falling objects is greater and there is a potential to impact human health and safety.

In general, the abovementioned FirstNet activities could potentially involve site preparation work, construction activities, work in potentially harmful environments (road ROWs, work over water, and environmental contamination), management of hazardous materials and hazardous waste, and weather exposure. Potential impacts to human health and safety associated with deployment of the Proposed Project could include injury from site preparation and operating heavy equipment, construction activities, falling/overhead hazards/falling objects, exposure and release of hazardous chemicals and hazardous waste, and release of historic contamination to the surrounding environment. It is anticipated that potential health impacts associated with human exposure to environmental hazardous materials in air, water, or soil, the risk of road traffic, workplace accidents and injuries, noise exposure, and risk of infectious disease transmission would be less than significant at the programmatic level due to the small-scale of likely FirstNet activities that would be temporary and of short duration. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As described in Section 2.1.2, Proposed Action Infrastructure, operation activities associated with the Preferred Alternative would consist of routine maintenance and inspection of the facilities. Any major infrastructure replacement as part of ongoing system maintenance would result in impacts similar to the abovementioned construction impacts. It is anticipated that there would be less than significant at the programmatic level impacts to human health and safety associated with routine inspections of the Preferred Alternative. Use of 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 at the programmatic level due to the small-scale of likely FirstNet activities that would be temporary and of short duration. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

10.2.15.5. 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 because 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 at the programmatic level 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 were an electrical generator, then there would also likely be a need to manage fuel onsite. These activities could result in less than significant impacts at the programmatic level 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 at the programmatic level due to the small-scale of likely FirstNet activities that would be temporary and of short duration. Chapter 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

Operation Impacts

As explained above, operation activities would consist of implementation/running of the deployable technology and routine maintenance and inspections. As with the Preferred Alternative, it is anticipated that there would be no impacts to human health and safety associated with routine inspections. Use of 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 at the programmatic level 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 16, BMPs and Mitigation Measures, provides a listing of the BMPs and mitigation measures that FirstNet and/or its partner(s) would require, as practicable or feasible, to avoid or minimize potential impacts.

No Action Alternative

Under the No Action Alternative, the NPSBN would not be deployed; therefore, there would be no associated construction or installation of wired, wireless, deployable infrastructure or satellites and other technologies. As a result, there would be no impacts to human health and safety as a result of construction and operation of the Proposed Action. Environmental conditions would therefore be the same as those described in Section 10.1.15, Human Health and Safety.

ACRONYMS

Acronym	Definition
AARC	Average Annual Rate of Change
ABC-AQCB	Albuquerque-Bernalillo County Air Quality Control Board
ABQ	Albuquerque International Sunport
ACHP	Advisory Council on Historic Preservation’s
ACS	American Community Survey
AEHD-AQP	Albuquerque Environmental Health Department – Air Quality Program
AGL	Above Ground Level
AIM	Aeronautical Information Manual
AMAFCA	Albuquerque Metropolitan Arroyo Flood Control Authority
AML	Abandoned Mine Lands
AQB	Air Quality Bureau
AQCR	Air Quality Control Region
ARPA	Archaeological Resources Protection Act
ASPM	Aviation System Performance Metrics
ATC	Air Traffic Control
ATO	Air Traffic Organization
BGEPA	Bald and Golden Eagle Protection Act
BISON-M	Biota Information System of New Mexico
BLM	Bureau of Land Management
BLS	Bureau of Labor Statistics
BTOP	Broadband Technology Opportunities Program
CAA	Clean Air Act
CCAG	Climate Change Advisory Group
CCR	Consumer Confidence Reports
CDC	Centers for Disease Control and Prevention
CEQ	Council On Environmental Quality
CFOI	Census of Fatal Occupational Injuries
CGP	Construction General Permit
CH_4	Dioxide (CO_2), Methane
CIMC	Cleanups In My Community
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CRS	Community Rating System

Acronym	Definition
CWA	Clean Water Act
DHSEM	Department of Homeland Security and Emergency Management
DOE	Department of Energy
DTRS	Digital Trunked Radio System
EDACS	Enhanced Digital Access System
EIA	Energy Information Agency
EMNRD	Energy, Minerals, and Natural Resource Department
EMS	Emergency Medical Services
EPCRA	Emergency Planning Community Right To Know Act
EPHT	Environmental Public Health Tracking
FCC	Federal Communication Commission
FEMA	Federal Emergency Management Agency
FGDC	Federal Geographic Data Committee
FLM	Federal Land Manager
FLPMA	Federal Land Policy and Management Act of 1976
FSDO	Flight Standards District Offices
FSS	Flight Service Station
FY	Fiscal Year
GHG	Greenhouse Gas
GNIS	Geographic Names Information System
HAP	Hazardous Air Pollutant
HASP	Health and Safety Plans
HHRA	Human Health Risk Assessment
HMC	Homestake Mining Company
IBA	Important Bird Area
IBIS	Indicator-Based Information System
IFR	Instrument Flight Rules
IPCC	Intergovernmental Panel On Climate Change
LBS	Locations-Based Services
LCCS	Land Cover Classification System
LRR	Land Resource Region
LTE	Long Term Evolution
MBTA	Migratory Bird Treaty Act
MHI	Median Household Income

Acronym	Definition
MLRA	Major Land Resource Areas
MMD	Mining and Minerals Division
MMT	Million Metric Tons
MSL	Mean Sea Level
N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAICS	North American Industry Classification System
NAS	National Airspace System
NASAO	National Association of State Aviation Officials
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NHA	National Heritage Area
NHL	National Historic Landmarks
NHNM	Natural Heritage New Mexico
NIH	National Institutes of Health
NIST	National Institute of Standards and Technology
NM	Nautical Miles
NMAC	New Mexico Administrative Code
NMDGF	New Mexico Department of Game and Fish
NMDH	New Mexico Department of Health
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NM-IBIS	New Mexico’s Indicator-Based Information System
NMPRC	New Mexico Public Regulation Commission
NMSA	New Mexico Statutes Annotated
NNL	National Natural Landmarks
NOTAM	Disseminated Via Notices To Airmen
NO_x	Oxides of Nitrogen
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	National Park Service
NPSBN	National Public Safety Broadband Network
NRC	National Response Center

Acronym	Definition
NRCS	National Resources Conservation Service
NRHP	National Register of Historic Places
NSA	National Security Areas
NTFI	National Task Force On Interoperability
NTIA	National Telecommunications Information Administration
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
OE/AAA	Obstruction Evaluation and Airport Airspace Analysis
PAB/PUB	Palustrine Aquatic
PEM	Palustrine Emergent Wetlands
PFO	Palustrine Forested Wetlands
PGA	Peak Ground Acceleration
PPE	Personal Protective Equipment
PSCR	Public Safety Communications Research
PSCR	Public Safety Communications Research Program
PSD	Prevention of Significant Deterioration
PSS	Palustrine Scrub-Shrub Wetlands
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
SAA	Sense and Avoid
SAIPE	Small Area Income and Poverty Estimates
SASP	State Aviation System Plan
SDS	Safety Data Sheets
SDWA	Safe Drinking Water Act
SF_6	Sulfur Hexafluoride
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SIRCITS	Statewide Interoperable Radio Communication Internet Transport System
SO_2	Sulfur Dioxide
SOC	Standard Occupational Classification
SOP	Standard Operating Procedures
SO_x	Oxides of Sulfur
SPL	Sound Pressure Level
SUA	Special Use Airspace

Acronym	Definition
SWAP	State Wildlife Action Plan
SWPPP	Storm Water Pollution Prevention Plan
TMDL	Total Maximum Daily Load
TRI	Toxics Release Inventory
TS	Terminology Services
TX/NM	Texas/New Mexico
UA	Unmanned Aircraft
UAS	Unmanned Aircraft Systems
UHF	Ultra High Frequency
USACE	U.S. Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFS	US Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USNRC	U.S. Nuclear Regulatory Commission
VFR	Visual Flight Rules
VHF	Very High Frequency
VOC	Volatile Organic Compound
WONDER	Wide-Ranging Online Data For Epidemiologic Research
WWII	With World War II

REFERENCES

The citations in this Draft PEIS reflect the most recent information on the referenced site at the time the document was being written. If the site was updated after that point, the more recent information will be incorporated, as feasible, into the final document.

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