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13.0 Resilience and Climate Change

This chapter provides an overview of climate trends and natural hazards that impact Santa Fe. Trends in the Southwest region of the United States show increased threats of drought, wildfire, diminishing water supply, variable precipitation, and extreme temperatures. These trends suggest that the impacts of natural hazards will be exacerbated by climate change and affect the resiliency of New Mexico and the city of Santa Fe.

13.1 Key Findings

Natural hazards that pose the greatest risk to the city of Santa Fe include wildfire, drought, extreme heat, and flooding. Many of these hazards are interconnected as they directly or indirectly exacerbate other hazards. For example, higher temperatures in the region can reduce snowpack and result in earlier snowmelt that can exacerbate drought conditions. Moreover, increased periods of drought and variable precipitation can lead to more conducive conditions for wildfires to occur, which increases the amount of burned areas that are more susceptible to runoff and flooding. Similarly, the interconnectedness of wildlife and natural ecosystems emphasizes that natural ecosystems are vulnerable to multiple natural hazards, and one natural hazard event can have cascading effects associated with other natural hazards (e.g., wildfire leading to increased erosion, mudslides, and flooding). These and other examples demonstrate the interconnectedness of natural hazards and addressing risks from potential impacts will require a holistic approach to developing adaptation strategies. This type of approach is important as these natural hazards are anticipated to impact various areas of the city's built and natural environment, as well as disproportionately impact vulnerable critical facilities and infrastructure, community members, and natural and managed resources. As Santa Fe's population continues to grow and urban development increases the use of impervious surfaces, the vulnerability of community members can change due to demographic shifts in population and changes in high-risk areas for natural hazards, such as wildfires. Therefore, a holistic approach to addressing impacts from natural hazards can be administered through the general plan update and complemented by updated analysis of the city's demographic profile, equity, and future land use scenarios.

Preparing for and adapting to the impacts of natural hazards exacerbated by climate change are described by the topic of climate resilience. Climate resilience is referenced in the 2020 Santa Fe Mitigation Plan (MP), which serves as a baseline for addressing the risk and vulnerability to natural hazards exacerbated by climate change. State and local plans and policies also provide a framework for increasing climate resilience. Examples of state climate action include the recently developed Priority Climate Action Plan (2024), the establishment of the Climate Change Bureau at the New Mexico Environment Department, and Executive Order 2019-003, which established a state interagency Climate Change Task Force. Local climate action by Santa

Climate Resilience

The Santa Fe 25-Year Sustainability Plan describes resilience as the ability to absorb disturbances, anticipate challenges, be prepared to cope with stress, and evolve to adverse climate stressors and risks.

Fe includes the City's objective to become carbon neutral by 2040, the creation of the Sustainable Santa Fe Commission (SSFC) and Climate Action Task Force, and development of a 25-Year Sustainability Plan. The Santa Fe 25-Year Sustainability Plan provides a description of local impacts from climate change in addition to the MP. More specifically, it describes that climate change is anticipated to exacerbate threats of drought, wildfire, diminishing water supply, and extreme temperatures.

In addition to providing a baseline framework for the evaluation of risk and vulnerability to natural hazards, existing plans and policies include measurable actions that can be applied as new goals and policies for the general plan update. The Sustainability Plan provides a set of 91 strategies related to carbon neutrality, ecological resilience, economic vitality, and quality of life and social equity. Progress towards achieving these strategies is measured on the City's website with the Sustainability Dashboard, which includes past accomplishments in adaptive capacity, such as a community and municipal greenhouse gases (GHG) inventory, tree inventory, a clean energy fund, and water conservation strategies.

Key findings related to adaptive capacity can be found below in Section 13.1.1, along with three potential areas of focus for the general plan update in Section 13.1.2.

13.1.1 Adaptive Capacity Findings

Despite past progress towards climate resilience and adaptive capacity, limitations in available data, financial resources, and interagency capacity, pose challenges for the City of Santa Fe to increase its resilience to natural hazards exacerbated by climate change and implement climate adaptation strategies identified in existing plans and policies. The City can address these challenges by improving its adaptive capacity. In general, future opportunities for the City to increase adaptive capacity include updating existing plans and associated goals and policies (e.g., developing a Santa Fe climate action plan, or updating the Sustainability Plan to align with the state's Priority Climate Action Plan); integrating geographic information system (GIS) data in climate planning; partnering with local, regional, and state agencies and community organizations; and providing public involvement opportunities for the public to participate in planning for climate resilience.

13.1.1.1 Climate Plans and Policies

As discussed in Section 13.9.1, Community Plans, various plans address the city's resilience to natural hazards and identify specific goals, policies, and action items. Important natural hazards that pose a risk to Santa Fe include extreme heat, wildfire, flooding, and drought. Most community plans either directly or indirectly address these natural hazards. For example, the Water Conservation and Drought Management Plan provides long-term goals and specific programs and projects under its five-year scorecard. As existing plans are updated, these goals, policies, and action items can be updated to reflect new risks and vulnerabilities to natural hazards. Other future opportunities include developing a city-specific climate action plan or updating the current Sustainability Plan to align with the state's Priority Climate Action Plan.

13.1.1.2 Climate Data and Resources

Planning for a community's resilience to natural hazards requires adequate financial resources to prepare for and respond to natural hazards, as well as comprehensive data collection on climate trends

and existing risk and vulnerability to natural hazards. The Santa Fe MP provides information on financial resources and climate resilience data. The MP is required for the City's eligibility for federal disaster assistance, including Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance grants, such as the Hazard Mitigation Grant Program, the Pre-Disaster Mitigation Program, and the Flood Mitigation Assistance Program. In addition to these grants, the MP includes a table of mitigation actions that identifies potential funding sources for actions that address each natural hazard with funding sources, including federal, state, and county grants. Other existing grants, such as the Climate Pollution Reduction Grant, administered by the Environmental Protection Agency (EPA) as part of the Inflation Reduction Act of 2022, provide funding for reducing GHG emissions. Opportunities for future grants specific to climate resilience will depend, in part, on the New Mexico State legislature and U.S. Congress.

The Santa Fe Mitigation Plan also includes data sources from City GIS data, statewide GIS datasets, previous mitigation plans, online data sources, and data and information from other existing plans and studies. Examples include:

- Santa Fe County Hazard Mitigation Plan (2018)
- State of New Mexico Hazard Mitigation Plan (2018)
- City of Santa Fe Wildland Urban Interface – Wildland Fire Hazard and Risk Analysis (2006)
- U.S. Drought Monitor
- National Drought Impact Reporter from the National Drought Mitigation Center
- FEMA National Flood Hazard Layer datasets
- National Weather Service Heat Index

While the Santa Fe MP provides many data resources and information, this data can be outdated, not regularly updated, or limited in scope. FEMA flood map layers have not been updated in several decades, making the determination of flood risk with accuracy difficult. These sorts of data gaps restrict the adaptive capacity of the City to monitor climate trends and natural hazards. GIS data often provides valuable information for climate resilience and the ability to visualize the exposure of assets to various natural hazards. The City and County both host GIS webpages with various data layers. Future opportunities include providing new layers to visualize risk to natural hazards and incorporate or reference data from online sources and data from county departments and state agencies. One example is the Office of Emergency Management's 'Know Your Zone' application that was created in 2023 and allows users to view evaluation zones in the city's wildland-urban interface (WUI). Other opportunities to address data gaps are to use online resources provided by federal and state agencies in the development of climate resilience plans and policies, such as FEMA's National Risk Index or the U.S. Department of Agriculture Forest Service's Wildfire Risk to Communities.

13.1.1.3 Partner Agencies, Community Organizations, and Public Involvement

Coordination with local, regional, and state agencies can help the City identify additional financial resources (e.g., grants) and develop or update natural resources management plans to prepare for natural hazards. Community organizations, such as Coalition of Sustainable Communities New Mexico (CSCNM) and 350 Santa Fe, provide resources for climate resilience advocacy and building community support for climate resiliency goals and policies. Areas of partnership include the co-management of the Upper Santa Fe Watershed, where there is focus on vegetation management, wildfire prevention, and

sedimentation management. The City and the Santa Fe Watershed Association also lead the New Mexico Climate Masters program, which provides roughly 30 hours of climate adaptation and mitigation centered programming over a nine-week timeframe. After course completion, students continue to engage in the community, strengthening climate knowledge and response at the local level. Additional organizations can be identified to help champion climate resilience as a local priority. Future opportunities for public involvement will allow community members to help develop goals and policies that meet their needs and the needs of the future people of Santa Fe. Community engagement included in existing plans, such as the Sustainability Plan, demonstrates the value of community input and can be used to model future community engagement activities and events.

13.1.2 General Plan Update Focus Areas

Three focus areas for the general plan update where the City could pursue building adaptive capacity based on identified goals, policies, or actions in community plans include disaster response management and strategies, natural resource management, and community engagement.

- **Disaster response management and strategies.** Disaster response management is directly tied to potential impacts from high-risk natural hazards, such as wildfires. Existing resources for evacuation preparedness and zones are provided by the City of Santa Fe Office of Emergency Management, and these resources provide useful information for emergency preparedness. However, the lack of temporary shelters and established evacuation routes emphasizes the need for future policy considerations for evacuation infrastructure to protect critical facilities in high-risk areas.
- **Natural resource management.** As an important part of Santa Fe's natural environment and cultural history, natural resource management covers water resources, riparian and wetland ecosystems, local habitats and wildlife, forests, woodlands, shrublands, grassland, and soil resources. Existing plans and policies, as well as the Santa Fe city code, provide a baseline approach for natural resource management. Updates to existing policies and city code can ensure that natural resource management actions, such as water conservation measures and policies, will continue to improve adaptive capacity.
- **Community engagement.** Community engagement included in existing plans, such as the Sustainability Plan, demonstrates the value of community input and provides a background of the needs of present and future people in Santa Fe. Community engagement activities as part of the general plan update will allow community members to provide their input on how natural hazards have affected them and help identify future opportunities for reducing GHG emissions.

13.2 Climate Trends

Climate change is the observation of changes in temperature and weather patterns. Historical observations of changes in temperature and weather patterns are often used to predict future scenarios, including the influence of human activities and the increase of GHGs¹, such as carbon dioxide. Observed changes in climate, or climate trends, include both historical observations in natural changes in temperature and weather patterns, as well as observations in the concentration of GHG emissions from fossil fuel combustion and other human activities. Future climate conditions, i.e., future temperature and weather patterns, will include the combination of natural changes and the

¹ According to the EPA, GHGs are gases that trap heat in the atmosphere. The most common GHG is carbon dioxide, which enters the atmosphere through burning fossil fuels. Other GHGs include methane, nitrous oxide, and fluorinated gases.

concentration of GHGs in the atmosphere and are anticipated to result in impacts to the natural and built environment. New Mexico and the city of Santa Fe are anticipated to face changing climate conditions and challenges associated with preparing for impacts. Notable impacts from anticipated changes in climate conditions include increased intensity and frequency of precipitation events, drought, and heat events. The increasing volatility and unpredictability in weather patterns places the city in a vulnerable position, as some disasters may occur within a short timeframe, resulting in recovery efforts for one event overlapping with the aftermath of another. This scenario strains community resources and heightens the risk of adverse outcomes. Furthermore, the effects of climate change are expected to disproportionately affect vulnerable populations and critical infrastructure.

The importance of addressing climate change is reflected in state and local policies, programs, and goals. At the state level, New Mexico recently developed a Priority Climate Action Plan in March 2024 as part of the Climate Pollution Reduction Grant program from EPA. Other state actions include the establishment of the Climate Change Bureau at the New Mexico Environment Department and Executive Order 2019-003, which established a state interagency Climate Change Task Force. Furthermore, climate change legislation has also been proposed, albeit unsuccessfully, to place limits on GHG emissions in the state through the Clear Horizons and Greenhouse Gas Emissions Act (Senate Bill 4). Locally, in 2014, the Santa Fe City Council adopted resolution 2014-84 establishing a Climate Action Task Force and an objective for the city to become carbon neutral by 2040. Resolutions 2015-30 and 2015-57 combined these efforts and directed the SSFC, created in 2007, to work with City staff to develop a 25-Year Sustainability Plan. The 25-Year Sustainability Plan is intended to be reviewed and updated every five to six years and outlines 91 strategies for four elements, including carbon neutrality, ecological resilience, economic vitality, and quality of life and social equity. In addition to the full review and update every five or six years, the 25-Year Sustainability Plan identifies the need for an annual sustainability report to be provided to City Council covering components of the 25-Year Sustainability Plan, such as performance metrics, targets and strategies, community engagement activities, and the annual work plan. The 25-Year Sustainability Plan also includes a website, “Santa Fe Sustainability Dashboard,” that provides an overview of the City’s progress towards its goal of carbon neutrality. This progress is documented in the 2015 and 2021 community GHG inventories and the 2018 and 2022 municipal GHG inventories. The 2021 community GHG inventory recommends an updated inventory in two to five years to assess progress from actions identified in the 2021 inventory.

The Global Change Research Act of 1990 mandates that the U.S. Global Change Research Program delivers a report to the U.S. Congress and President approximately every four years. The most recent report (2022) is the Fifth National Climate Assessment (NCA5), and it provides national and regional information on the impacts of climate change through the analysis of climate change trends and projected major trends, both human-induced and natural, to the end of the century. Projected changes in climate outcomes are based on a range of scenarios, referred to as Representative Concentration Pathways. The Southwest region includes a broad range of climate conditions, including the hottest and driest climate in the United States. Regional changes in climate reported in the NCA5 include increases in severe drought and increased frequency of intense precipitation events, wildfires, and heat waves. Climate conditions have changed in the Southwest as average temperatures in the region increase. According to the EPA, the Southwest has experienced higher average temperatures between 2000 and 2023 than the long-term average between 1895 and 2023, with some areas of the region experiencing more than 2 degrees warmer than average. Across the region, impacts from increased temperatures are

reflected in extreme heat episodes threatening the health and well-being of vulnerable populations, transportation disruptions, reduction in seasonal maximum snowpack, reduced groundwater recharge, and hydrological droughts (e.g., severe shortages of water in the Rio Grande).

Locally, the 25-Year Sustainability Plan describes that climate change is anticipated to exacerbate threats of drought, wildfire, diminishing water supply, and extreme temperatures. These impact the region's energy, ecological, water, transportation, economic, food, health, and sociological systems. While historical and ongoing land management practices have exacerbated some hazards, such as the development of impermeable surfaces leading to extreme temperatures and flooding, different land management practices can help climate adaptation, such as incorporating green stormwater infrastructure. These initiatives cannot solve climate change as a whole.

13.3 Natural Hazards

The City of Santa Fe prepared a Hazard Mitigation Plan (HMP) in 2020 describing the risks and effects of natural hazard events in the planning area². Included in the HMP is a hazard analysis and risk assessment with descriptions of each natural hazard, identification of community assets, analysis of risks, and a summary of vulnerability. The six natural hazards analyzed in the HMP, and their local significance are shown in Table 13-1. Overall hazard significance is based on a combination of Geographic Area Coverage, Probability of Future Occurrence, and Potential Magnitude/Severity. Based on these criteria, each natural hazard is assigned a significance rating of either low, medium, or high. Human-caused hazards are also discussed in the HMP; however, many natural hazards have a potential for climate change to affect the frequency and severity of the natural hazard in the future.

As shown in Table 13-1, natural hazards with high overall significance complement existing climate trends that show anticipated exposure to climate risks, such as extreme heat, wildfire, flooding, and drought. An important note about these natural hazards is that while these hazards can occur as singular events, these events often directly or indirectly exacerbate other hazards. For example, higher temperatures in the region can reduce snowpack and result in earlier snowmelt, which in turn can exacerbate drought conditions. For severe weather events, the monsoon season in New Mexico is commonly associated with extreme rainfall events and more intense events can result in an increase in the frequency of flood events. Furthermore, increased periods of drought and variable precipitation can lead to conditions for wildfires to occur, increasing the amount of burned areas that are more susceptible to runoff and flooding. These and other examples demonstrate the interconnectedness of these hazards and achieving resiliency will require a holistic approach to developing adaptation strategies. Each natural hazard is further described on the following pages in addition to anticipated climate impacts.

² The planning area includes the city limits of Santa Fe.

Table 13-1. City of Santa Fe Natural Hazards

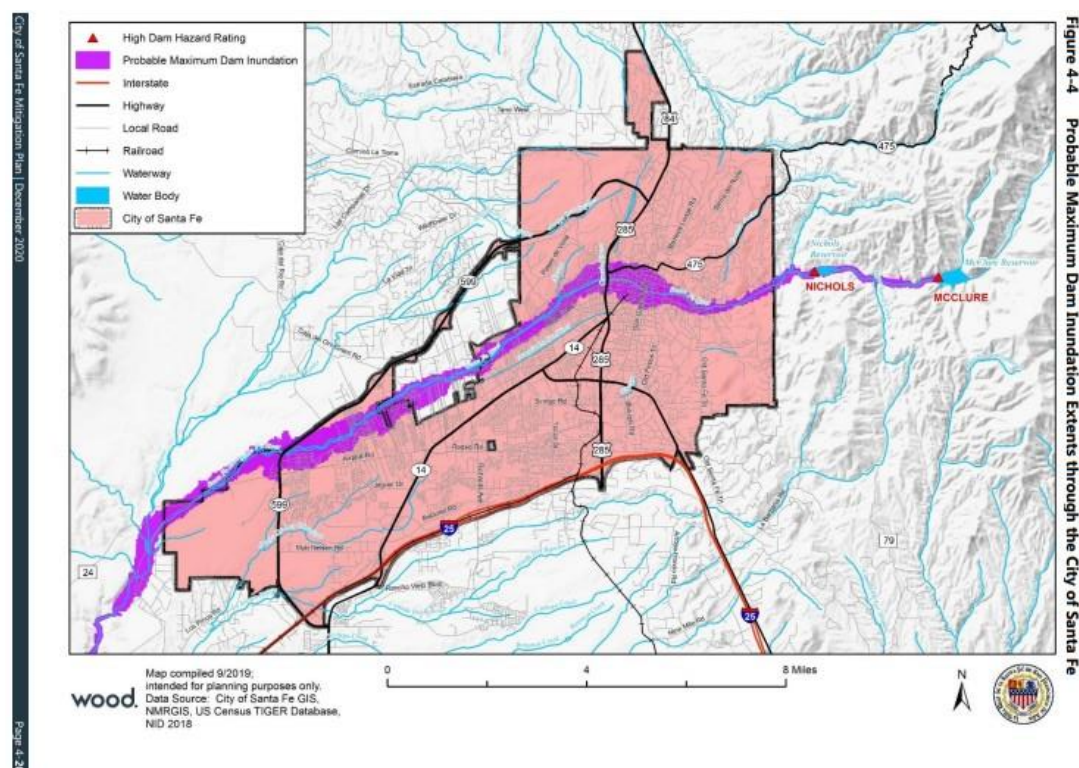
Natural Hazard	Geographic Area	Probability of Future Occurrence	Magnitude/Severity (Extent)	Overall Significance
Dam Failure	Significant	Occasional	Catastrophic	Medium
Drought	Extensive	Likely	Limited	Medium
Flood	Significant	Likely	Critical	High
Severe Weather: Thunderstorm, Hail, Lightning	Extensive	Likely	Limited	Medium
Severe Weather: Extreme Temperatures (cold and heat)	Extensive	Highly Likely	Limited	Medium
Severe Weather: Winter Storms	Extensive	Highly Likely	Limited	Medium
Tornado	Limited	Occasional	Limited	Low
Wildfire/Wildland Urban Interface	Significant	Likely	Catastrophic	High
Geographic Area Limited: Less than 10% of planning area Significant: 10-15% of planning area Extensive: 50-100% of planning area Probability of Future Occurrences Highly Likely: Near 100% chance of occurrence in next year or happens every year. Likely: Between 10 and 100% chance of occurrence in next year or has a recurrence interval of 10 years or less. Occasional: Between 1 and 10% chance of occurrence in the next year or has a recurrence interval of 11 to 100 years. Unlikely: Less than 1% chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.			Magnitude/Severity (Extent) Catastrophic—More than 50% of property severely damaged; shutdown of facilities for more than 30 days; and/or multiple deaths Critical—25-50% of property severely damaged; shutdown of facilities for at least two weeks; and/or injuries and/or illnesses result in permanent disability Limited—10-25% of property severely damaged; shutdown of facilities for more than a week; and/or injuries/illnesses treatable do not result in permanent disability Negligible—Less than 10% of property severely damaged; shutdown of facilities and services for less than 24 hours; and/or injuries/illnesses treatable with first aid Significance Low: minimal potential impact Medium: moderate potential impact High: widespread potential impact	

Source: Santa Fe Hazard Mitigation Plan (2020)

13.4 Dam Failure

Dams are human-constructed structures built for a variety of uses, such as flood protection. When dams are constructed for flood protection, they are usually engineered to withstand a flood with a computed risk of occurrence. Prolonged rainfall or flooding can exceed a dam's design requirements and lead to overtopping and dam failure. Consequences of dam failure include catastrophic flooding that could damage life, as well as roads, bridges, and homes. Electric-generating facilities and transmission lines could also be damaged and affect life support systems in communities outside the immediate hazard area. Associated water supply, water quality, and health concerns could also be an issue. According to data provided by the National Inventory of Dams (2018), there are two dams (Nichols and McClure) located on the Santa Fe River, upstream of the city of Santa Fe (Figure 13-1). These dams serve as water reservoirs along the Santa Fe River storing snowmelt from the Santa Fe watershed before being treated for potable water or bypassed to support the Santa Fe River riparian corridor. Both dams are classified as high hazard, which indicates that a failure would probably result in a loss of life.

Figure 13-1. Nichols and McClures Dams and Probable Maximum Dam Inundation through Santa Fe



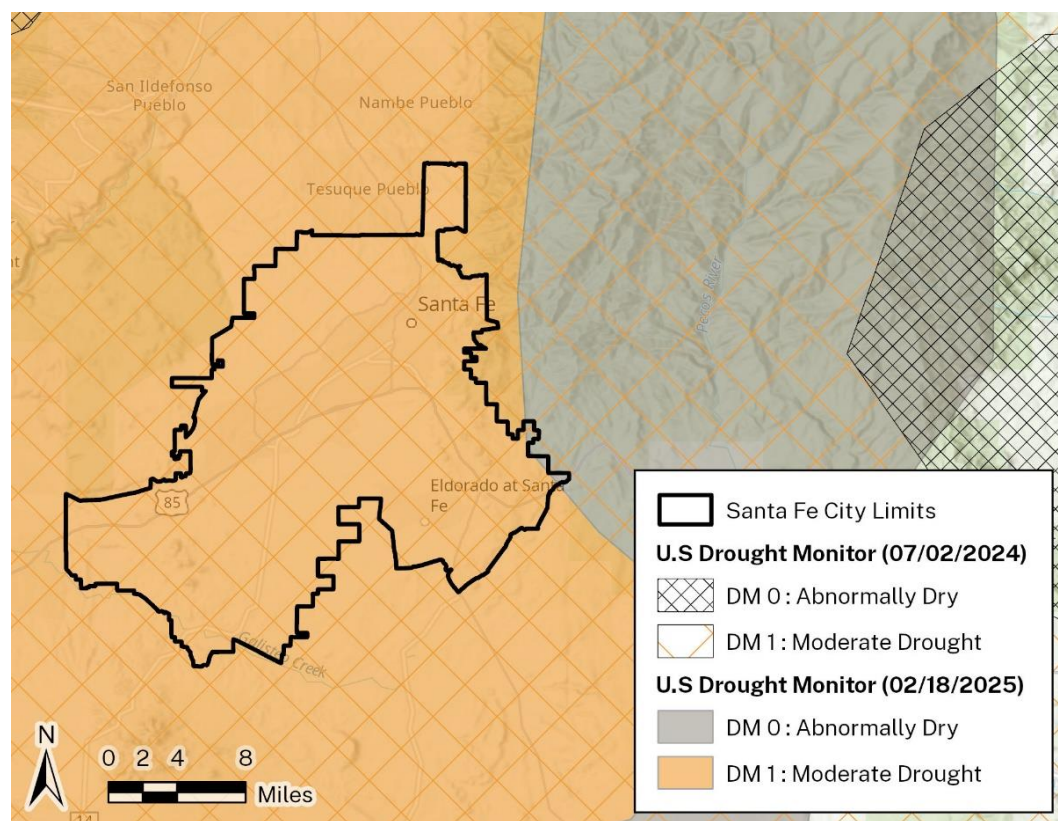
Source: Santa Fe Hazard Mitigation Plan (2020)

The potential for climate change to affect the likelihood of dam failure is not fully understood at this point in time. With the potential for more extreme precipitation events as a result of climate change, this could result in large inflows to reservoirs. However, this could be offset by generally lower reservoir levels if storage water resources become more limited or stretched in the future due to climate change, drought, or population growth.

13.5 Drought

Droughts typically include shortages in local or regional water supply over a given time period. They occur slowly, over a multi-year period, and it is often not obvious or easy to quantify when a drought begins and ends. Drought can be defined regionally based on various factors, such as precipitation levels, subsurface and surface water supplies, and temperature. Different types of droughts, such as metrological, agricultural, hydrological, and socioeconomic, also reflect the various effects of drought conditions. One way to classify droughts is with the U.S. Drought Monitor scale, which categorizes droughts based on its intensity. Figure 13-2 shows the drought intensity in Santa Fe. Possible impacts from moderate drought include some damage to crops or pastures, some water shortages developing or imminent, and voluntary water-use restrictions requested. While current conditions may not always show high intensity for drought conditions, the city of Santa Fe is vulnerable to any category of drought. According to the MP, past drought conditions often coincide with wildfires in the area, such as the 2003 Molina Complex Fire and 2011 Las Conchas Fire.

Figure 13-2. U.S. Drought Monitor Conditions in Santa Fe, New Mexico

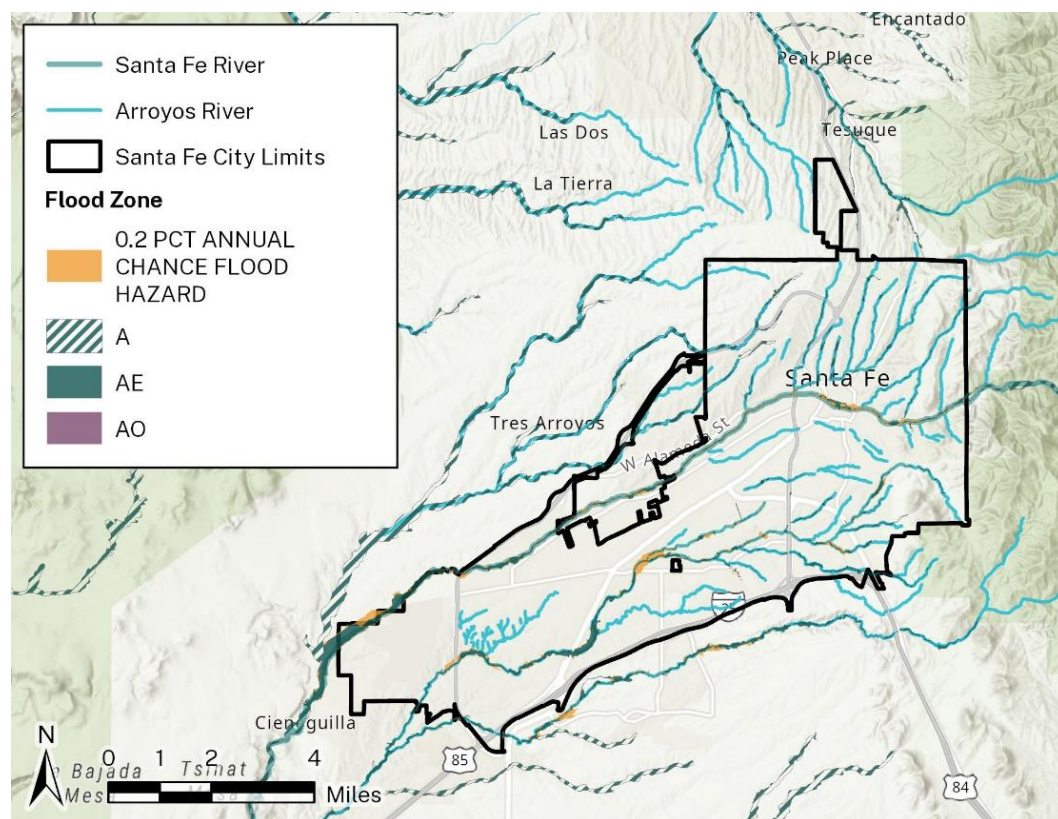


The impacts of drought as a result of climate change will have an effect on the city's water quality and water supply. Drought events are projected to increase in frequency and with longer duration due to shifts in seasonal precipitation and impacts, such as decreases in snowpack, earlier peak of snow-fed streamflow, and increases in proportion of rain to snow. Decreases in snowpack are especially significant as a majority of the discharge from the Santa Fe River, the city's main water supply, is from snowmelt runoff. These impacts are important for the future demand of water in the city and how residents, businesses, industry, and wildlife will have to adapt to changes.

13.6 Flood

Flooding is characterized by the rising and overflowing of a body of water onto normally dry land or the inundation of land or property in a built environment caused by rainfall overwhelming the capacity of drainage systems. Floods can cause substantial damage to structures, landscapes, and utilities, and even life safety issues. Areas of potential flooding include floodplains illustrated on inundation maps, and typically refer to the FEMA regulatory inundation areas. The 100-year flood, or the flood that has 1 percent chance in any given year of being equaled or exceeded, is the national minimum standard to which communities regulate their floodplains through the National Flood Insurance Program (NFIP). The 500-year flood, or the flood that has a 0.2 percent chance of being equaled or exceeded in any given year, is also used for development and regulatory purposes. Flood risk data and mapped areas for the city of Santa Fe are included as part of FEMA's NFIP, Flood Insurance Study (the current Santa Fe County Flood Insurance Study is dated December 4, 2012), and Flood Insurance Rate Maps (FIRMs). The 100-year and 500-year floodplains are mapped on each FIRM. Flood hazard areas in Santa Fe are shown in Figure 13-3.

Figure 13-3. FEMA Flood Zones in Santa Fe, New Mexico



Common flooding events in Santa Fe occur during the monsoon season, which occurs generally between June and October. Rainfall events during the monsoon season include heavy to severe downpours that produce large amounts of runoff and flash flooding, which can cause risks for people, property, and agricultural land. Santa Fe is vulnerable to flooding due to the river and multiple tributaries (creeks and streams), numerous arroyos, and acequias located throughout the city that serve as irrigation ditches. These irrigation canals, or ditches, are particularly vulnerable to flash flooding due to extended dry

periods. When heavy rainfall occurs, they cannot absorb excess water efficiently, as they are engineered structures designed for controlled water flow rather than naturally functioning ecosystems. Specific areas where flooding occurs in the city include areas along the Santa Fe River, Arroyo de los Chamisos, Cañada Ancha, Arroyo los Frijoles, Arroyo Hondo, and smaller tributaries from these waterways. Floods can be exacerbated by wildfires as burned areas lead to the destruction of vegetation and increases the inability of the natural landscape to absorb water and catch runoff during rain events. The increased stormwater runoff further exposes the risk of flash floods and mudslides, as well as ashy sediment and other contaminants entering the city's watersheds.

Impacts of climate change on flooding include more intense rainfall events, even as total annual precipitation is projected to decrease in the Southwest. This in turn results in an increase in high frequency flood events, such as flash flooding. Increased potential for runoff and flooding is also likely due to increasing periods of drought and lack of precipitation that may exacerbate conditions for wildfires. The increased runoff from these flood events will impact areas near waterways, as well areas in the city with impervious surfaces and inadequate storm drainage systems.

13.7 Severe Weather

Severe weather can include various weather events, such as thunderstorms, hail, lightning, extreme temperatures, high wind, and winter storms. These events tend to be seasonal in Santa Fe with warmer weather having thunderstorms, including hail, lightning, and monsoons. Colder weather includes winter storms and wind, and extreme temperatures can occur year-round. Each severe weather hazard is briefly described below along with areas of impact in the city and projected climate change impacts.

13.7.1 Thunderstorms

In Santa Fe, thunderstorms often occur during the monsoon season, which generally refers to a seasonal wind shift, or monsoon circulation, that produces a radical change in moisture conditions in an area or region. Thunderstorms can be accompanied by lightning or hail, causing damage to objects and people. Lightning can also be a cause of wildfires from the natural ignition of vegetation (e.g., June 2003 Molina Comple Fire). Lightning, which is a form of electrical discharge caused by thunderstorms, can cause direct or indirect damage to objects and kill or injure people, particularly from cloud-to-ground lightning. Hail, which is formed when water droplets freeze and thaw as they enter the upper atmosphere, is sometimes associated with severe storms in the city and can cause damage to roofs, buildings, cars, vegetation, and crops. In recent years, residents have noted hail becoming larger and more frequent, with extreme wind getting more intense and unpredictable as well.

13.7.2 Extreme Temperatures

Extreme heat is defined by FEMA as temperatures that can reach 10 degrees or more above the average high temperature of the region and last for several weeks. One measurement of heat severity is the National Weather Service's (NWS) Heat Index. Extreme heat can have negative effects on people's health in the form of heat disorders. Groups of people, such as the elderly, children, people with chronic illnesses, and people with weight or alcohol problems, are particularly susceptible to heat reactions. Past extreme heat events are not described in the Santa Fe MP; however, impacts from extreme heat events are common in other cities in the Southwest. In Maricopa County, which includes the majority of the Phoenix, Arizona, metropolitan area, a heat-related death occurred every day from June 18, 2024 to

July 31, 2024, including 14 excessive heat warnings issued and 14 high temperature records broken, according to the County's 2024 Preliminary Heat-related Deaths Report.

While cold temperatures during the winter are normal in this part of New Mexico, extreme cold is described by the Santa Fe MP as when temperatures drop at least 20 degrees below normal winter lows. Extreme cold is often accompanied by winter storm conditions and high winds. Winter storms occur when precipitation and freezing temperatures mix to produce a significant accumulation of snow or ice and are most likely to occur in the winter months of December, January, and February. Similar to extreme heat, the NWS has a Wind Chill Temperature Index as a measure of extreme cold. Prolonged exposure to extreme cold can cause frostbite or hypothermia with infants and the elderly being the most susceptible. Extreme cold and winter storms can also cause damage to pipes, road closures, and disruptions to communications facilities, which can be amplified by strong, high winds.

According to the Santa Fe MP, projected impacts from climate change on severe weather include changes in precipitation and extreme heat. Increased variability in weather patterns across New Mexico is observed in past studies and climate projections predict a decrease in the number of heavy rainfall events and an increase in intensity. As indicated in Section 13.2, Climate Trends, a warming trend in summer temperatures is observed in New Mexico and heat waves are becoming more common. However, due to its high elevation, extreme heat events are anticipated to be less pronounced for Santa Fe compared to other areas in the region, such as Maricopa County, as well as cities with a higher percentage of impervious surfaces where urban heat island effects pose a greater risk (e.g., human health risk).

13.7.3 Tornado

The Santa Fe MP defines tornadoes as rotating columns of air, usually formed when cool, dry air sits on top of warm, moist air, that can reach speeds of up to 300 miles per hour. While there are past occurrences of this natural hazard, the future probability is low, and the impact of climate change is uncertain.

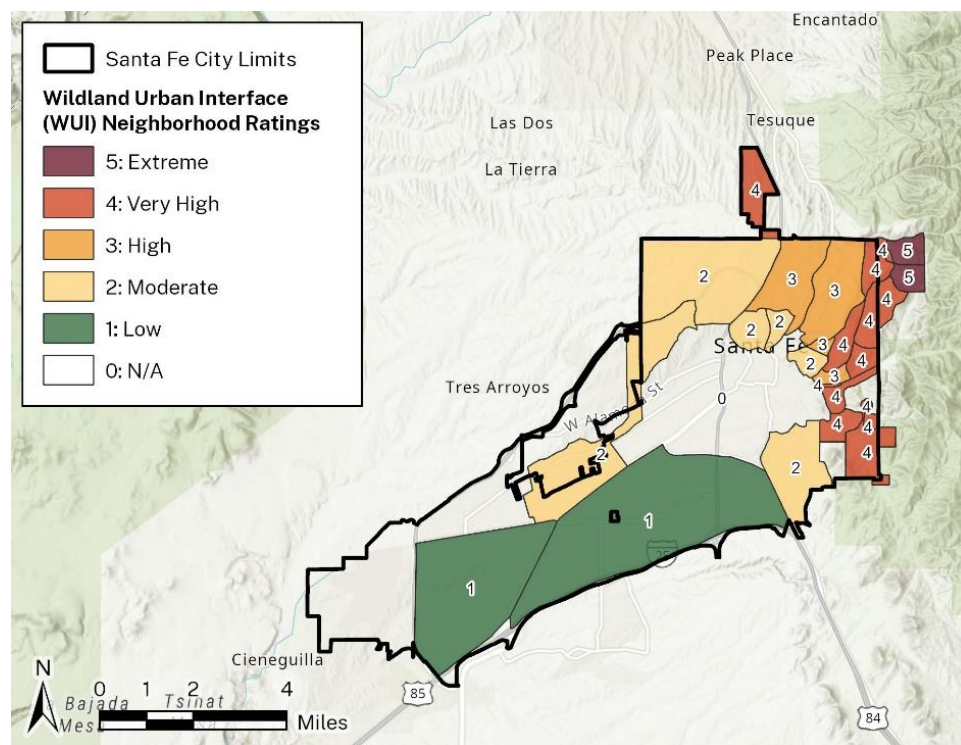
13.7.4 Wildfire/Wildland Urban Interface

The Santa Fe MP defines wildfires as a fire burning uncontrolled on lands covered wholly or in part by timber, brush, grass, grain, or other flammable vegetation. Types of wildfires include planned and unplanned wildfires that can result from natural causes, such as lighting, or human causes. Planned wildfires can include prescribed fires and wildland fire use (WFI), which are fires that occur from natural causes but are allowed to burn for forest management purposes (e.g., reducing tree density or canopy in the Santa Fe National Forest) under minimal suppression from firefighters. Wildfires that pose the greatest risk and concern for the city of Santa Fe are WUI wildfires. WUI fires occur in areas where the natural and built environment intersect and structures and vegetation are sufficiently close so that a wildland fire, which could be naturally occurring and managed, could spread to structures or a structure fire could ignite vegetation. Water towers are regarded as essential infrastructure, ensuring immediate access to water resources for fire suppression in the WUI. Generally, the worst fires occur during the hotter and drier months between May and July before the monsoon season. The WUI/Wildland Fire Hazard and Risk Analysis for the City of Santa Fe (2006) and the Community Wildfire Protection Plan for Santa Fe County provide details for the three main factors that sustain wildfires and allow for predictions of a given area's potential to burn. These factors include fuel, topography, and weather.

Fuel is the material that feeds the fire and can include built structures and associated combustibles, as well as vegetation, which in Santa Fe ranges from open grasslands to dense canopies of mixed conifer. Topography affects the susceptibility to wildfire spread as fire intensities and rate of spread increase as slope increases. The natural arrangement of vegetation throughout a hillside can also contribute to increased fire activity on slopes. Weather can include components, such as temperature, relative humidity, wind, and lightning, that can affect the potential for wildfire. High temperatures and low relative humidity dry out the fuels that feed wildfire, creating a situation where fuel will more readily ignite and burn more intensely. The City is a member of numerous fire-related groups, such as the Greater Santa Fe Fireshed Coalition, that work to reduce wildfire threat by reducing fuels and wildland management.

Areas of the city that are within the WUI are defined in the WUI/Wildland Fire Hazard and Risk Analysis for the City of Santa Fe (Figure 13-4). Neighborhoods considered to be high or extreme risk are located on the northern and eastern portions of the city where there are steeper slopes, higher elevation, and more biofuels and vegetation near the Santa Fe National Forest. Past occurrences of wildfires in the county and near the city include 17 recorded wildfires in the federal database that exceed 100 acres since 1970. Notable fires mentioned in the Santa Fe MP include the June 2003 Molina Complex Fire, June 2011 Pacheco and Las Conchas Fires, and the 2016 McClure Fire. Other significant fires in the greater Santa Fe region due to their scale or degree of impact include the 1996 Dome Fire, 1998 Oso Complex Fire, 2000 Cerro Grande Fire, and 2022 Calf Canyon/Hermits Peak Fire. Effects from wildfires can include direct effects to water sources, structures, and wildlife, as well as ancillary effects from wildfire smoke that can impact people with respiratory illnesses and conditions.

Figure 13-4. Wildland Urban Interface Areas in Santa Fe, New Mexico



Climate change is anticipated to impact the factors that sustain wildfires and impact an area's potential to burn. As with other hazards in the Southwest region, climate change is anticipated to lead to hotter and drier temperatures, as well as decreases in humidity, resulting in red flag conditions³ and increased wildfire risk. Current climate change scenarios show that with high temperatures and prolonged drought events the severity, frequency, and geographic extent of wildfire events are likely to increase. Other anticipated effects include increased tree mortality due to invasive species (e.g., ponderosa pine bark beetle, spruce beetle, and piñon ips bark beetle) and drought making vegetation more susceptible to burning.

13.8 Climate Vulnerability

The U.S. Climate Resilience Toolkit describes best practices for approaches to achieving climate resilience for local communities, such as the city of Santa Fe. Key concepts within the toolkit include vulnerability, risk, and adaptive capacity. The concepts of vulnerability and risk are used to describe the impact of natural hazards to assets. Assets can include a variety of built, social, and environmental items, such as homes, schools, public buildings, roads, rivers and streams, hillsides, local wildlife, farmers markets, and so on. The Santa Fe MP groups these assets into six categories: (1) people, (2) economy, (3) built environment, (4) critical facilities and infrastructure, (5) historical, cultural, and natural resources, and (6) future development. To provide a generalized assessment of vulnerability to climate exacerbated natural hazards, the categories from the Santa Fe MP are grouped into three overarching categories: critical facilities and infrastructure, community members, and natural and managed resources.

Vulnerability is characterized by the exposure of an asset to a natural hazard and to what degree an asset might be harmed. Assets that are more vulnerable to natural hazards are more likely to be negatively impacted by a hazard. Risk is characterized by the probability of a hazard occurring, as well as the magnitude of consequences from a hazard (e.g., cost of repair, number of buildings damaged). The Santa Fe MP includes a hazard analysis and risk assessment in addition to a vulnerability assessment. The following discussion of vulnerability incorporates findings from the risk assessment in the MP to summarize the vulnerability of certain assets to natural hazards.⁴ Adaptive capacity of assets to natural hazards in Santa Fe is discussed in Section 13.9. As described in the previous section on natural hazards, climate change is anticipated to exacerbate the impacts of some natural hazards and these impacts are interconnected as some natural hazards can exacerbate other hazards.

13.8.1 Vulnerable Critical Facilities and Infrastructure

Critical facilities and infrastructure in Santa Fe generally include medical facilities, water storage, treatment and distribution systems, roads and bridges, transmission lines, communication towers, and schools. Specific facilities and infrastructure that could be impacted by each natural hazard are described below (Table 13-2).

³ According to the NWS, a red flag warning indicates that warm temperatures, very low humidities, and stronger winds are expected to combine to produce an increased risk of fire danger.

⁴ Tornadoes are excluded from this section as the future probability for this natural hazard in Santa Fe is low.

Table 13-2. Vulnerability of Critical Facilities and Infrastructure to Natural Hazards

Natural Hazard	Magnitude/Severity (extent)	Potential Impact(s)
Dam Failure	Significant	There are a total of 68 critical facilities within dam inundation zones (Figure 1). Areas downstream along the Santa Fe River would be affected and potentially inundated. Roads and bridges would be vulnerable to washouts. Upper Canyon Road, a popular tourist destination and economic corridor, would be immediately affected from failure of Nichols or McClure Dams.
Drought	Extensive	Long-term drought would affect the City's water supply and facilities with a consistent water demand (e.g., medical facilities). Water storage, treatment, and distribution systems would be affected, and water use restrictions may occur. Low water levels in City-owned dams could affect water quality.
Flood	Significant	One critical facility (cell tower) is located within the 0.2% annual chance (500-year) flood zone. Various transit facilities (bus stops) are located near the 1% annual chance (100-year flood zone).
Severe Weather: Thunderstorm, Hail, Lightning	Extensive	All City critical facilities or lifelines are considered to be equally exposed to these severe weather hazards.
Severe Weather: Extreme Temperatures (cold and heat)	Extensive	Extreme cold combined with high wind or ice storms can down power lines leading to power outages or frozen pipes. Prolonged heat exposure increases the potential of pavement deterioration and strains energy systems and consumption. Air conditioners run at a higher rate and longer.
Severe Weather: Winter Storms	Extensive	Roads are generally affected due to closures. Heavy snow accumulation may lead to downed power lines.
Wildfire/Wildland Urban Interface	Significant	There are a total of 162 critical facilities within the WUI area. Common types of facilities include communication towers (64) and government services (33). Critical facilities in the very high-risk WUI area include schools and a preschool/daycare, including Atalaya Elementary School, Rio Grande School, St. John's College, Desert Montessori School, and Santa Fe Preparatory School.

Source: Santa Fe Hazard Mitigation Plan (2020)

Most natural hazards are anticipated to include some type of impact to critical facilities and infrastructure in Santa Fe. Of these natural hazards, dam failure, drought, and wildfire pose the highest risks to critical facilities and infrastructure. Additionally, drought and wildfire natural hazards are anticipated to be exacerbated by climate change (see Sections 13.5 and 13.7.4 for details).

Critical facilities and infrastructure located within the dam inundation zone are the most vulnerable to dam failure. The MP identified 68 critical facilities that would be located in the dam inundation zone, and roads and bridges within the city of Santa Fe would be flooded and inaccessible. Both dams provide surface water sources for the city, and dam failure would result in the loss of both facilities and a decrease in water supply. Upper Canyon Road is noted as a key roadway that would be affected, and further analysis would be needed to determine the sensitivity of each of the 68 critical facilities to dam failure. Compared to other hazards, the risk of dam failure is low as the probability of occurrence is lower.

Drought would impact the city's water quantity and quality, as well as water demand. Specific facilities are not identified in the MP that would be vulnerable to drought conditions; however, facilities with a need for constant water supply to function would be more vulnerable than others. Similarly, infrastructure related to the storage, treatment, and distribution of water would be vulnerable to drought conditions. This includes the McClure and Nichols Reservoirs, the Paseo Real Water Reclamation Facility, and Canyon Road Water Treatment Plant.

In terms of magnitude, wildfire poses the largest risk to critical facilities according to the MP. WUI areas where there is the highest risk of wildfire are in the northern and eastern portions of the city where there are steeper slopes and higher elevation. Various critical facilities are located within the WUI areas rated as high or very high risk and could potentially be affected by a wildfire event. While potential damage to each critical facility is an important consideration of risk for each critical facility, the availability of key evacuation infrastructure, such as evacuation routes and temporary shelters, are important components of understanding the vulnerability of critical facilities and infrastructure to wildfire risk. Existing resources for evacuation preparedness and zones are provided by the City of Santa Fe Office of Emergency Management. The office's website includes preparedness links and resources, such as information on creating a 72-hour disaster kit and completing a family communications plan. Information on shelter in place and lockdowns during an emergency alert is provided on the website, but public shelters or other temporary shelters are not mentioned. As wildfire poses the largest risk to critical facilities, the Office of Emergency Management has a 'Know Your Zone' web application that visualizes evacuation zones within the city's WUI areas and can provide real-time evacuation information in case of an alert. While these resources provide useful information for emergency preparedness, the lack of temporary shelters and established evacuation routes emphasizes the need for evacuation infrastructure to protect critical facilities in high-risk areas. Addressing this need can be a useful policy consideration for the general plan update.

13.8.2 Vulnerable Community Members

Assessments of vulnerability of each natural hazard to community members are described in the MP. Direct impacts range from physical injury and respiratory health risks to loss of life. Indirect impacts include psychological and economic impacts to community members from damaged or destroyed homes or businesses and other disruptions to mobility. As Santa Fe's population grows, the vulnerability of community members can change due to demographic shifts in population and changes in high-risk

areas for natural hazards, such as wildfires. Impacts to community members from each natural hazard are described below.

Dam failure and flooding would include similar impacts to community members. For dam failure, people who live or work directly downstream of the dams and reservoirs are most at risk for inundation, including the downtown area. This also includes the unhoused population, as many of them camp in or near waterways and may not have access to evacuation information due to lack of organized advance notification. Populations near or on Upper Canyon Road along the Santa Fe River would be the most vulnerable to dam failure of either or both dams. For flooding, people living in the 100- or 500-year floodplain are more vulnerable to the impacts of flooding. According to the MP, many homeowners in the city own their homes outright and are not required to have flood insurance, which could increase the vulnerability of homeowners in the case of a flooding event. Other health hazards are common to flood events that may affect community members, such as polluted drinking water, mosquitos from stagnant floodwater, and mold and mildew from wet areas in buildings.

Impacts associated with drought could involve mandatory conservation measures and restrictions on water use. Water use restrictions could have disproportionate impacts on low- to moderate-income households as higher income household may have more financial resources to afford additional surcharge costs and proactively implement conservation measures (e.g., household infiltration, drainage projects, rain gardens). Therefore, low- or moderate-income households may be less likely to quickly adapt to mandatory conservation measures and restrictions and could be more vulnerable to water shortage impacts.

For severe weather events, specific areas in the city are not highlighted in the MP for vulnerable community members. Generally, the elderly or disabled, children, people in poor physical health, and unhoused populations would be more vulnerable to severe weather events. Risks associated with thunderstorms, hail, high wind, and lightning include electrical outages that could affect resident populations in nursing homes, residential facilities, or other special needs housing that may be more vulnerable. Exposure to extreme temperatures can include extreme heat or extreme cold. Unsheltered individuals are more vulnerable to extreme cold. Groups most vulnerable to heat-related illness include people 65 years or older, children, people with chronic health problems (such as heart disease), people who are obese, people who are socially isolated, and people who are on certain medications. Low-income households are less likely to have air conditioning and, therefore, are also more vulnerable to extreme heat.

Vulnerability to wildfire is location specific as the most vulnerable populations are those living in the WUI zones, where residential properties are directly intruding into traditional wildland areas. The MP includes an assessment of wildfire risk through WUI rating by neighborhood (Figure 4-22 in the MP). Specific groups that would be vulnerable to wildfire smoke include children, the elderly, or those with respiratory conditions who may be exposed to high levels of smoke. People living in long-term care facilities or skilled care facilities could also be more vulnerable to wildfire events due to increased evacuation times. As with drought impacts, low- to moderate-income households are more vulnerable to financial burdens caused by property damage or health impacts.

13.8.3 Vulnerable Natural and Managed Resources

Natural and managed resources in Santa Fe include the city's watershed (e.g., arroyos, reservoirs, rivers), local habitat and wildlife, and natural landscapes and landmarks (e.g., hillsides, Sangre de Cristo Mountains and foothills). For the city of Santa Fe, natural resources are determined to be the most vulnerable to drought, extreme heat, and wildfire natural hazards. Each natural and managed resource and its vulnerability to natural hazards is described below.

13.8.3.1 Santa Fe Watershed

Santa Fe's watershed is the entire land surface area that, through a network of surface waterways, which include tributary arroyos and acequias, drain into the Santa Fe River⁵. Acequias are an important part of the watershed as they serve as a source of water conveyance but also have special status in the New Mexico State Constitution as political subdivisions of the state representing historic and integral parts of the culture and heritage of New Mexico. The upper Santa Fe River watershed, which includes water stored in the Nichols and McClure Reservoirs, is one of the larger sources of surface water for the city and includes over 10,000 acres of forest co-managed with the U.S. Forest Service and other partner agencies. According to the City of Santa Fe Water 2023 Annual Report, water demand in Santa Fe includes potable and non-potable water sources in addition to water conservation. Non-potable water sources include reclaimed wastewater and treated wastewater collected by the city's sewer system, which is commonly used for turf grass irrigation. The city has four sources of potable water which include surface water and groundwater sources. Surface water is available from the Santa Fe River and Colorado River via the San Juan – Chama Project (SJCP). The SJCP is a system of dams and tunnels supporting the conveyance of water from the San Juan River Basin to the Rio Grande Basin. As part of the Colorado River, the SJCP provides an average annual diversion of about 91,100 acre-feet (AF) of water from the upper tributaries (Navajo, Little Navajo, and Blanco Rivers) of the San Juan River to supply municipal, domestic, and industrial uses. Groundwater is available from seven active wells within city limits known as the City Wellfield and 13 wells between the city and the Rio Grande known as the Buckman Wellfield. According to the City of Santa Fe Annual Water Report (2023), the monthly water production by source for 2023 was as follows:

- Santa Fe River: 5,098 AF (52%)
- Colorado River Basin: 3,420 AF (35%)
- Buckman Wells 866 AF (9%)
- City Wells 417 AF (4%)

Surface water sources in Santa Fe (Santa Fe River and Colorado River) largely rely on monthly and annual average precipitation in the watershed, particularly snowpack in the mountains. Reduced streamflow and snowpack, as well as variable precipitation, are expected future climate trends that will affect the resiliency of Santa Fe's surface water sources to natural hazards, such as drought. The Santa Fe River is largely dependent on snowpack and runoff in the Sangre de Cristo Mountains, which allows the City of Santa Fe Water Division (CoSFWD) to store surface water in its reservoirs. CoSFWD is permitted to divert up

⁵ Acequias are traditional irrigation ditches located throughout the City whose construction, maintenance, and operation are interconnected with the history of northern New Mexico. There are four operational Acequias which divert water from the Santa Fe River between Nichols Dam and Patrick Smith Park (City of Santa Fe Annual Water Report, 2023).

to 5,040 acre-feet per year (AFY) of native water from the Santa Fe River and store up to 3,921 AF in the Nichols and McClure Reservoirs. When conditions include high snowpack and increased runoff, CoSFw can bypass some river inflows back to the Santa Fe River for “living river flows,” acequia use, and managing reservoir storage.

Similarly, the City’s other surface water source (SJCP) includes the San Juan River watershed, which is part of the larger Colorado River Watershed and originates from snowmelt in the San Juan Mountains in southwest Colorado. Most of CoSFw’s SJCP water is stored in the Heron and Abiquiu Reservoirs, and stored water is released by CoSFw to flow downstream into the Rio Grande before being diverted at the Buckman Direct Diversion Water Treatment Plant. As other municipalities are dependent on the San Juan watershed, allocations are applied to each water contractor based on the availability in the watershed. CoSFw’s maximum SJCP allocation is 5,230 AFY, which is based on historical hydrology at the time of design and construction of the SJCP. Past climate trends have impacted hydrology in the region and between 2014 and 2023 CoSFw has only received its full allocation three times with an average deficit of 12 percent.

As described above, Santa Fe is vulnerable to any category of drought. The city’s surface water sources are especially vulnerable to changes in regional hydrology as observed in SJCP allocations between 2014 and 2023. Groundwater sources are seen as the city’s water savings account to provide a buffer for shortages in renewable surface sources. The intensity of drought conditions will affect the degree of impacts to the city’s water quality and quantity. Direct effects would include restrictions to water consumption and increased or enforced conservation measures to reduce demand and use of renewable surface water and leverage the use of groundwater sources. Existing water consumption in Santa Fe is measured in gallons per capita per day (GPCD), which is total potable water production divided by population served. Since its purchase of the water utility in 1995, the City has reduced GPCD amid population increases through water conservation measures and replenishing groundwater aquifers. This progress in reduced water use emphasizes the importance of continued conservation measures and policies in the general plan to prepare the city for future drought conditions.

13.8.3.2 Local Habitat and Wildlife

In Santa Fe, local habitat and wildlife includes a range of plant and animal species unique to New Mexico and the Southwest region, including animal and plant species that are considered threatened, endangered, or of concern and are subject to protection under the federal Endangered Species Act and the New Mexico Endangered Plant and Animal Act. According to Chapter 8 of the existing 1999 City of Santa Fe General Plan, riparian and wildlife corridors are key natural habitats located in the arroyos, perennial waterways, and foothills. Each natural hazard is anticipated to impact local habitats and wildlife to some extent; however, increased vulnerability is likely to be associated with drought, wildfire, flooding, and extreme heat natural hazards. While each natural hazard event can occur independently, these natural hazards typically involve secondary impacts that include effects from other natural hazards.

A drought natural hazard, particularly one that is severe and prolonged, can impact local habitat and wildlife that depend on the Santa Fe watershed for food, water, and shelter. This interconnectedness of wildlife and natural ecosystems emphasizes that natural ecosystems are vulnerable to multiple natural hazards and one natural hazard event can have cascading effects leading to factors associated with

other natural hazards (e.g., wildfire leading to increased erosion and flooding). The Santa Fe MP describes possible impacts such as shrinkage of habitat, reduction in food supplies, and migration of wildlife to other areas. Other impacts include poor soil quality, loss of wetlands (Santa Fe includes both riverine and palustrine wetland habitat areas), and increased soil erosion. A drought natural hazard is unique as drought can cause dry conditions leading to increased risk of wildfires and cause soil to compact and not effectively absorb water potentially making an area more susceptible to flooding. According to the National Park Service, wildfires can be beneficial to local ecosystems as they reduce dead vegetation, stimulate new growth, and improve habitat for wildlife. However, years of fire suppression has removed the natural cycle of wildfires and increased availability of fuel enabling wildfires. The MP describes that dense vegetation of ponderosa pine, white fir, and Douglas fir is located within the Santa Fe watershed, making it vulnerable to wildfire impacts similar to those from a drought natural hazard. Extreme temperatures can impact natural vegetation and large amounts of dead vegetation can increase vulnerability to natural hazards, such as wildfire. The 2011 Las Conchas Fire was a natural hazard event that captured primary and secondary effects of wildfires, as it generated the largest local erosion event in 1,000 years and burn scars from the fire experienced multiple instances of flash flooding. Continued urban development and increased use of impervious surfaces can also increase the vulnerability of local habitat and wildlife as natural landscapes and soil composition are altered. There is potential for urban land management to support biodiversity and wildlife through innovative development practices, such as green stormwater infrastructure. In the context of the general plan update, this is a potential policy consideration for natural resource management and habitat and wildlife conservation.

13.8.3.3 Natural Landscapes and Landmarks

The importance of natural landscapes and landmarks in Santa Fe is the cultural and historical identity of the city and its inhabitants. Natural features in the city include arroyos that run through the city, hillsides to the north and southeast, and the Sangre de Cristo Mountains to the east. The Sangre de Cristo Mountains, in particular, are sacred for local Indigenous peoples. In addition to the natural environment, the regional setting includes the city's historic downtown district and other unique historic and cultural buildings, such as the adobe buildings that reflect the city's character. According to the Santa Fe MP, the city has six historic districts and three archaeological districts. The vulnerability to natural hazards for natural landscapes and landmarks involves the potential of exposure of the natural environment (arroyos, hillsides, and mountains) and built environment (historical and cultural buildings) to a natural hazard event.

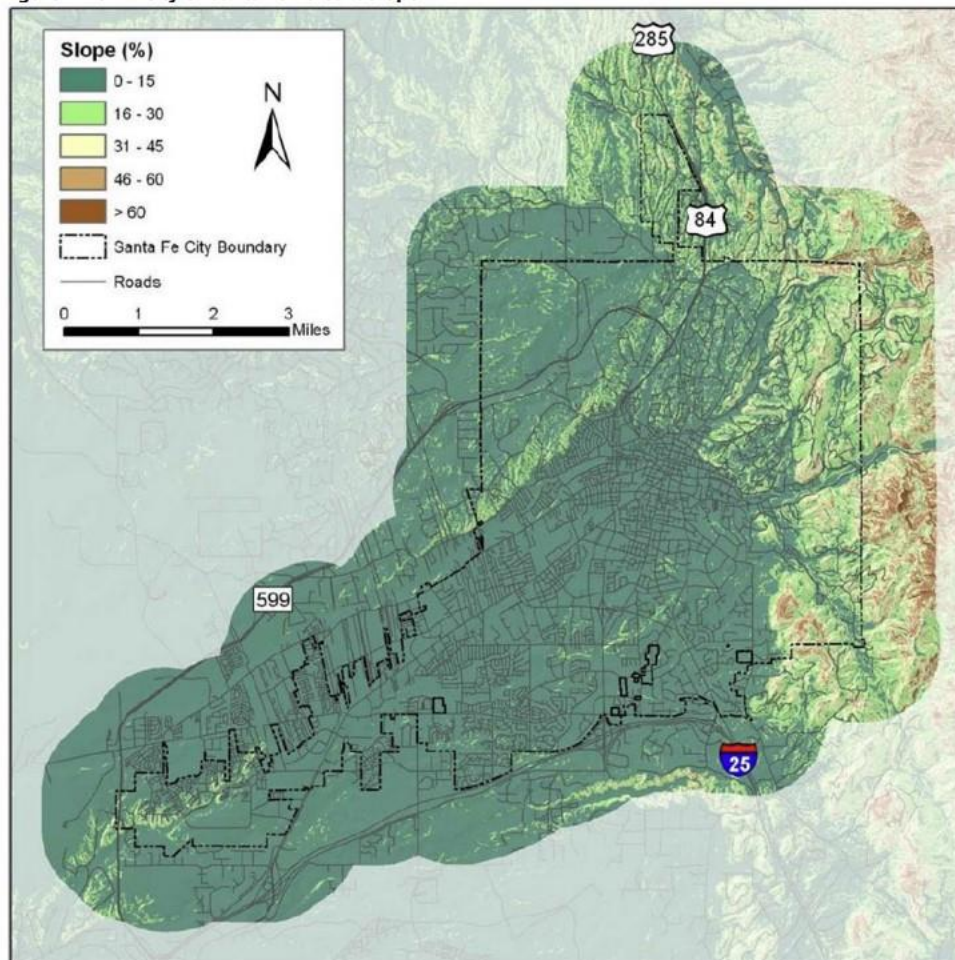
Within the natural environment, there is increased potential for vulnerability to the natural hazards discussed in the Local Habitat and Wildlife section (drought, wildfire, flooding, and extreme heat). Also described in the Natural Hazards section are the three factors that enable wildfires: fuel, topography, and weather. In addition to erosion concerns from steep slopes on hillsides, fire intensities and rates of spread increase as slope increases due to the tendency of heat from a fire to rise. Figures 4-20 and 4-21 in the MP (Figure 13-5 and Figure 13-6) show that the areas in the city of Santa Fe with the largest percent slope and highest elevation are located in the east near the Sangre de Cristo Mountains. These areas are potentially more sensitive to a wildfire hazard event.

For the built environment, buildings and structures would be vulnerable to damage or destruction from natural hazards. The dam inundation zone (Figure 13-1) includes major portions of downtown Santa Fe

and could potentially inundate some significant historic and cultural resources. For flooding events not related to dam failure, historic and archaeological districts in the city may be more vulnerable due to potentially old construction methods, less durable materials, and potential failure to meet building code standards. This vulnerability would similarly apply to a wildfire hazard event, although historic buildings constructed of adobe are less prone to ignition and are generally more wildfire resistant.

Figure 13-5. City of Santa Fe Percent Slope

Figure 4-20 City of Santa Fe Percent Slope

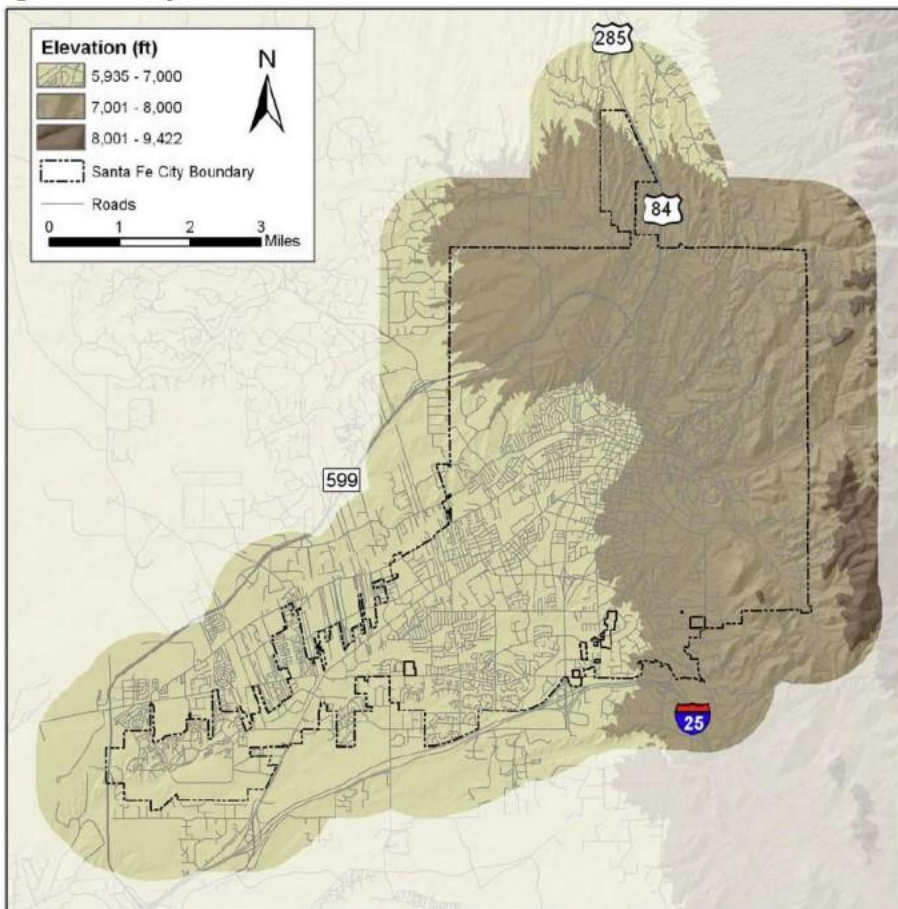


Source: City of Santa Fe Wildland Urban Interface/Wildland Fire Hazard and Risk Analysis, 2006

Source: Santa Fe Hazard Mitigation Plan (2020)

Figure 13-6. City of Santa Fe Elevation

Figure 4-21 City of Santa Fe Elevation



Source: City of Santa Fe Wildland Urban Interface/Wildland Fire Hazard and Risk Analysis, 2006

Source: Santa Fe Hazard Mitigation Plan (2020)

13.9 Adaptive Capacity

Following the previous discussion of the vulnerability and risk of assets in Santa Fe, another important component of climate resilience for Santa Fe is evaluating the adaptive capacity of assets to respond to natural hazards. The U.S. Climate Resilience Toolkit defines adaptive capacity as “the ability of a person, asset, or system to adjust to a hazard, take advantage of new opportunities, or cope with change.” Santa Fe’s existing approach to developing the adaptive capacity of assets and preparing for impacts from climate change is demonstrated through the development of past community plans and established community partnerships. One of example of the positive outcomes from this approach is from actions that have been implemented as part of the Santa Fe 25-Year Sustainability Plan. The plan includes a target of carbon neutrality by 2040, as well as strategies related to energy, waste, ecosystems, water, and transportation. Ongoing progress towards achieving these strategies is described on the City’s Sustainability Dashboard. Key highlights from the dashboard include:

- Between the 2015 and 2021 community GHG inventories, Santa Fe decreased its GHG emissions by 15 percent.

- Between the 2018 and 2022 municipal GHG inventories, Santa Fe reduced its emissions by 38.7 percent.
- Approximately 51.3 percent of electricity supplied by the Public Service Company of New Mexico is from carbon-free sources (i.e., solar, wind, geothermal, and nuclear).
- Since 2010, the number of solar permits approved in Santa Fe has been steadily increasing every year, growing from 0.5 residential permits per 1,000 residents to 4.4 in 2022.
- The most recent update from 2021 shows that 2,685 trees in the city have been inventoried, including about 29 percent of parks.
- Santa Fe has lowered its GPCD by more than 30 percent since 1995, despite a corresponding 31 percent increase in population.
- Vehicle miles traveled (i.e., total annual miles an average person travels by car) decreased between 2017 and 2021.

Actions, such as those mentioned on the City's Sustainability Dashboard, help increase the adaptive capacity of assets in Santa Fe in addition to various co-benefits, such as increased energy efficiency, carbon sequestration from green space, stormwater infiltration, decreased utility costs, and more efficient water use. In addition to addressing the impacts of natural hazards and climate change through these strategies, an additional benefit of increasing adaptive capacity through this approach is the broader economic impact that climate adaptation provides to the City through increased investment in infrastructure and services, as well as decreased utility and public facility costs. The economic benefits of using efficiency technologies for energy and water use provide the City with an incentive to continue investments in efficiency technologies for public utilities and infrastructure, as well as supporting private property owners.

Considering the existing approach to addressing adaptive capacity, going forward, the adaptive capacity of assets in Santa Fe can be addressed through evaluating and updating existing plans and policies that provide measures and action items for local agencies to prepare for and respond to natural hazards. Included in these existing plans is the existing 1999 City of Santa Fe General Plan, which provides policies to help protect and manage resources, such as local habits, water supply, and historic and archaeological districts. The general plan update will revise existing policies, and the addition of a climate element will help address Santa Fe's resilience to natural hazards. Along with existing community plans, coordination with community partners is another useful avenue for the City to leverage local resources to plan for future impacts and build resilience to natural hazards exacerbated by climate change.

13.9.1 Community Plans

Existing plans with goals, policies, or actions items related to climate resilience are included below. These are local or regional plans that address climate resiliency and the impacts of natural hazards.

- 1999 City of Santa Fe General Plan
- City of Santa Fe, New Mexico, Resolution No. 2012-28
- City of Santa Fe, River Corridor Master Plan (1995)
- City of Santa Fe, Water Division Municipal Watershed Management Plan (2010/2013)
- City of Santa Fe Office of Emergency Management 2018-2022 Strategic Plan (March 2018)
- City of Santa Fe Parks, Open Space, Trails & Recreation Master Plan, 2018 (April 2018)
- City of Santa Fe Stormwater Strategic Management Plan (October 2019)

- Santa Fe 25-Year Sustainability Plan (October 2018)
- Santa Fe Basin Study Update (August 2019)
- City of Santa Fe Water Conservation and Drought Management Plan 2015: 2020 Addendum
- City of Santa Fe Mitigation Plan (December 2020)
- Santa Fe National Forest Land Management Plan (July 2022)
- City of Santa Fe Water 2023 Annual Report
- City of Santa Fe Stormwater Management Plan (October 2024)
- City of Santa Fe Watershed Plan (underway)

Building adaptive capacity through climate planning and hazard mitigation includes using existing planning resources to develop pathways for Santa Fe to increase its resilience to natural hazards. Based on the hazard analysis and risk assessment in the Santa Fe MP, extreme heat, wildfire, flooding, and drought are natural hazards anticipated to be exacerbated by climate change and present the greatest risks to the resilience of assets in Santa Fe. Three areas in which the City could pursue building adaptive capacity based on identified goals, policies, or actions in community plans include disaster response management and strategies, natural resource management, and public involvement.

Disaster response management includes identifying agencies and advisory groups that will help the City coordinate, plan for, and respond to natural hazard events, funding sources, and providing community resources, such as notification alerts and education. Community plans that address disaster response management include the 2018-2022 Strategic Plan, Santa Fe MP, and Santa Fe National Forest Land Management Plan. One example of action items included in these plans is Table 5-2 in the Santa Fe MP (City of Santa Fe Mitigation Action Table), which includes action items for wildfire evacuation routes awareness and education.

For the natural hazards identified in this report, natural resource management covers water resources, riparian and wetland ecosystems, local habitats and wildlife, forests, woodlands, shrublands, grassland, and soil resources are key focus areas. Most community plans listed above address natural resource management to some extent. These plans provide important measures for addressing drought and wildfire hazards. The Basin Study Update, Resolution No. 2012-28, Water Conservation and Drought Management Plan, and Water 2023 Annual Report all provide specific measures for long-term water planning (e.g., Santa Fe Water 2100), water conservation, and drought planning (e.g., Santa Fe Water Resources Indicator). For wildfire hazards, the Santa Fe National Forest Land Management Plan addresses the risk of wildfires in the WUI and includes management approaches for wildland fire describing strategies for wildland fire management (e.g., community wildfire protection plans).

While local and regional agencies can develop plans and provide resources for building adaptive capacity, another important aspect is the inclusion of community members in climate resilience planning. Long-range planning typically provides opportunities for the public to participate in the planning process through advisory groups, community meetings and events, and online engagement. The Santa Fe 25-Year Sustainability Plan can serve as a source of best practices for public engagement in future climate planning. Public engagement for the plan was led by the SSFC and included a project website, working groups composed of subject area experts from the community and City staff, and community conversations in four City council districts, which collected ideas to inform the plan's development and priority recommendations.

13.9.2 Community Partners

Existing community plans provide a useful framework for the City to increase its adaptive capacity. Community partners and organizations also provide useful resources to help the City identify measures to increase its resilience to climate exacerbated natural hazards. Two examples include the CSCNM and 350 Santa Fe. CSCNM is a nonprofit, nonpartisan membership organization that provides advocacy and supports legislation in New Mexico that support their member priorities related to sustainability, energy, and climate action. The 350 Santa Fe is a nonprofit organization that similarly provide advocacy services and informational resources on the state's legislative process and climate action.

The City can partner with these and other organizations to develop goals and policies for the climate element and help communicate legislative changes related to climate resilience to the community. These organizations also provide a resource for the City of Santa Fe to communicate the benefits of climate planning to local residents and businesses.