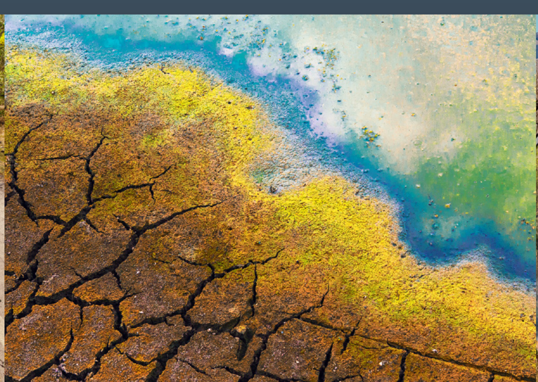
State of New Mexico Hazard Mitigation Plan


2023-2028

PLAN ADOPTION

As Governor's Authorized Representative, I hereby adopt the 2023 State of New Mexico Hazard Mitigation Plan.

The 2023 State of New Mexico Hazard Mitigation Plan meets the criteria established in Title 44, Chapter 1, Part 201.4 of the Code of Federal Regulations (CFR) for a Standard Natural Hazard Mitigation Plan. The State of New Mexico will continue to comply with all applicable federal statutes and regulations in compliance with 44 CFR 13(c), and will amend this plan whenever necessary to reflect changes in state or federal laws and statutes as required in 44 CFR 13.11(d).

David Dye ______________________ ______9/1/2023______________

David Dye, Cabinet Secretary, DHSEM Date

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1 INTRODUCTION

44 CFR Part 201.4
States must have an approved Standard State Mitigation Plan meeting the requirements of this section as a condition of receiving non-emergency Stafford Act assistance and FEMA mitigation grants. *The mitigation plan is the demonstration of the State's commitment to reduce risks from natural hazards and serves as a guide for State decision makers as they commit resources to reducing the effects of natural hazards.*

1.1 Executive Summary

The purpose of hazard mitigation is to reduce or eliminate long-term risk to people and property from disasters or hazardous events. Studies have found that hazard mitigation is extremely cost-effective, with every dollar spent on mitigation saving an average of $6 in avoided future losses. The Federal Emergency Management Agency (FEMA) requires that HMPs be updated every five years for the jurisdictions to be eligible for federal mitigation assistance.

The New Mexico State Hazard Mitigation Plan Update (SHMP or "the Plan") was developed as a cooperative effort of State agencies under the coordination of the New Mexico Department of Homeland Security and Emergency Management (NM DHSEM). It discusses the process used to identify, profile, and assess natural hazards in New Mexico. The Plan also identifies the actions which should be taken to mitigate those hazards. The SHMP facilitates the delivery of mitigation grant funding to agencies, jurisdictions, Tribes, and non-profit organizations through FEMA's Hazard Mitigation Assistance grant programs. The Plan also addresses mitigation planning requirements for these grant sources.

All sections of the 2018 SHMP were reviewed and updated for 2023 to reflect new data, changing priorities, and the results of past mitigation activities. Changing conditions to include the impacts of climate change and changes in development are highlighted. An emphasis on ensuring social equity in hazard mitigation was stressed throughout the planning process.

The Goals of the 2023 State of New Mexico Hazard Mitigation Plan are:

Goal 1: Reduce the number of injuries and fatalities from natural hazards

Goal 2: Reduce the amount of property damage, both public and private, from natural hazards

Goal 3: Reduce the number of necessary evacuations

Goal 4: Shorten recovery time for community functions and the natural environment after natural hazard events

Goal 5: Improve communication, collaboration and integration among State, Tribal and Local emergency management agencies

Goal 6: Increase awareness and understanding of risks and opportunities for mitigation among the citizens and elected officials of New Mexico

Goal 7: Mitigate repetitive loss and severe repetitive loss structures in the state to reduce impacts of flooding

Goal 8: Promote equity by ensuring vulnerable populations and under-served communities are included in mitigation planning and activities.

This plan concentrates on 14 natural hazards, listed in Table 1-1 in order of highest to lowest estimated risk.

Table 1-1 2023 Hazard Risk Rankings

Hazard	Ranking
Wildfires	High
Floods	High
Thunderstorm	High
Drought	High
Winter Storm	Medium
High Wind	Medium
Extreme Heat	Medium
Dam Failure	Medium
Tornado	Medium
Earthquake	Low
Landslide	Low
Land Subsidence	Low
Expansive Soil	Low
Volcanoes	Low

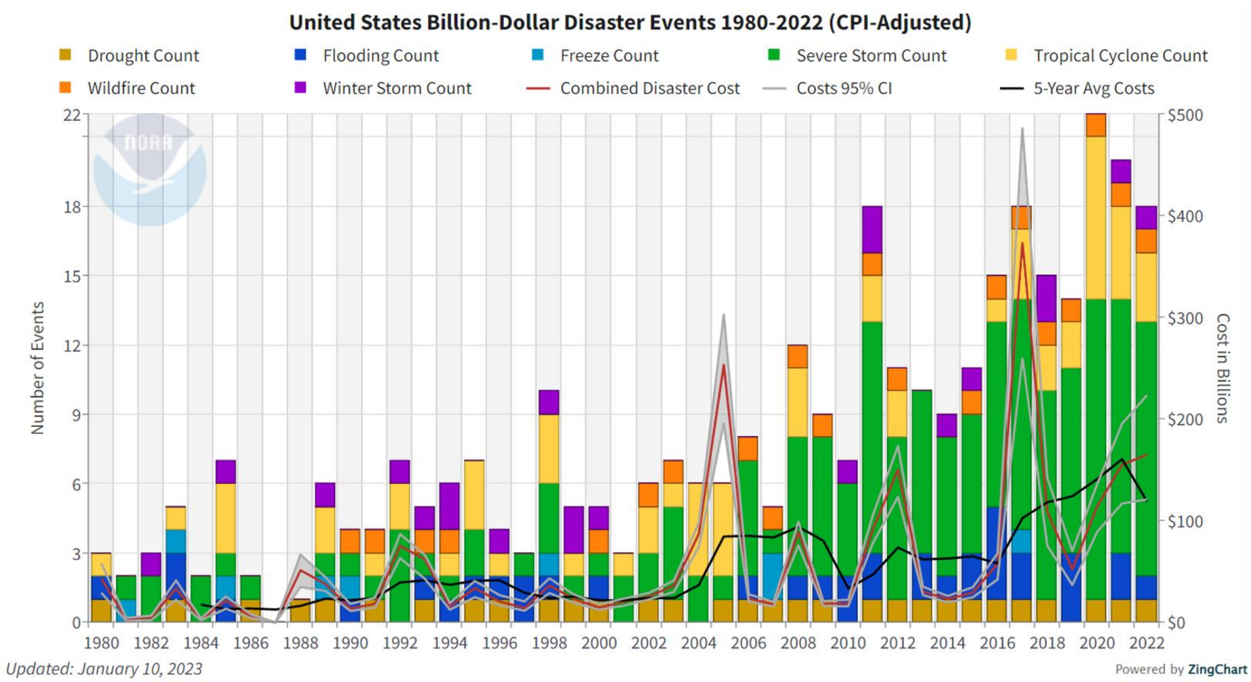
The 2023 NM SHMP also includes an assessment of the state's ability to conduct mitigation activities (Section 4), and a roll up of local and tribal HMPs in the state (Section 5). Finally, the Plan identifies 57 recommended mitigation activities to reduce future disaster losses (Section 7). However this Plan is not a firm commitment of resources; mitigation projects will be undertaken as funding and circumstances permits.

The NM SHMP will continue to be reviewed and enhanced as new data and mitigation opportunities become available. Comments and suggestions are welcome and should be forwarded to the State Hazard Mitigation Officer.

1.2 Purpose and Background

Hazard mitigation is defined by FEMA as "any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event." Each year in the U.S., disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. Additional expenses to insurance companies and non-governmental organizations are not reimbursed by tax dollars, making the costs of disasters several times higher than calculated amounts. Figure 1-1 shows the number and type of natural disasters in the U.S. that have done more than one billion dollars in damage (adjusted for inflation). The chart shows how the frequency and cost of major disasters have risen over the past two decades.

Figure 1-1 Billion-Dollar Disasters in the U.S., 1980-2022



Source: National Oceanic and Atmospheric Administration (NOAA)

However, some types of hazards are predictable, and much of the damage caused by these events can be mitigated through the use of various zoning, construction and permitting vehicles and other preventative actions. Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies to lessen impacts are determined, prioritized, and implemented. The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves communities an average of $6 in avoided future losses in addition to saving lives and preventing injuries, as illustrated in Figure 1-2.

Figure 1-2 Financial Benefits of Hazard Mitigation

	ADOPT CODE	ABOVE CODE	BUILDING RETROFIT	LIFELINE RETROFIT	FEDERAL GRANTS
Overall Benefit-Cost Ratio	11:1	4:1	4:1	4:1	6:1
Cost ($ billion)	$1/year	$4/year	$520	$0.6	$27
Benefit ($ billion)	$13/year	$16/year	$2200	$2.5	$160
Riverine Flood	6:1	5:1	6:1	8:1	7:1
Hurricane Surge	not applicable	7:1	not applicable	not applicable	not applicable
Wind	10:1	5:1	6:1	7:1	5:1
Earthquake	12:1	4:1	13:1	3:1	3:1
Wildland-Urban Interface Fire	not applicable	4:1	2:1	not applicable	3:1

Source: National Institute of Building Sciences, Natural Hazard Mitigation Saves: 2019 Report

This 2023 update to the New Mexico State Hazard Mitigation Plan (SHMP) is intended to guide New Mexico's mitigation program to reduce the impacts of significant hazards to the state, to include threats to life, property, critical facilities, the economy, the environment, and historic/cultural resources. It serves as a public and private sector reference document and management tool for mitigation activities throughout the State. It is also intended to meet the state planning requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, and other federal and state requirements as detailed in Section 1.4. This statewide Plan is administered by the New Mexico Department of Homeland Security and Emergency Management (DHSEM) and the State Hazard Mitigation Planning Team (SHMT) for the State of New Mexico.

State government serves a critical role in planning, coordinating, and supporting mitigation in New Mexico. DHSEM coordinates mitigation planning at the state, local, and tribal level, including reviewing and submitting local hazard mitigation plans to FEMA for approval. DHSEM assists local and tribal governments in obtaining and managing grant funding, and provides training and technical assistance.

1.3 Scope

The Plan Update addresses those natural hazards that have resulted in claims for Federal assistance as well as other major natural hazards identified as presenting a substantial risk to human life and private and public property. The Plan Update utilizes a multi-agency planning process to identify hazards that can affect the State and to devise mitigation strategies to reduce or eliminate the effects of those hazards. The State Plan Update provides guidance to local governments in preparing their own mitigation plans by prioritizing mitigation goals and objectives, proposing solutions to certain mitigation problems, and identifying possible funding sources for mitigation projects.

This Plan update is not intended to address the prevention or mitigation of the possible impacts of terrorist activity, hazardous materials, transportation accidents or any other human-caused hazard. DHSEM addresses these hazards in the Human Caused and Technological Hazard Mitigation Plan.

1.4 Authority

The Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended by the Disaster Mitigation Act of 2000, provides the legal basis for State, Tribal, and Local governments to undertake risk-based approaches to reducing natural hazard risks through mitigation planning. Specifically, the Stafford Act requires State, Tribal, and Local governments to develop and adopt FEMA-approved hazard mitigation plans as a condition for receiving certain types of non-emergency disaster assistance. The Stafford Act authorizes the following grant programs; Hazard Mitigation Grant Program, Pre-Disaster Mitigation Grant Program, Public Assistance Grant Program and Fire Management Assistance Grant Program.

The Sandy Recovery Improvement Act (SRIA) of 2013 amended the Stafford Act to provide federally recognized tribal governments the option to request a Presidential emergency or major disaster declaration independent of a State. Tribal governments may still choose to seek assistance, as they have historically, under a state declaration request.

Title 44, Chapter 1, Part 201 (44 CFR Part 201) of the Code of Federal Regulations (CFR) contains requirements and procedures to implement the hazard mitigation planning provisions of the Stafford Act. The bullets below document the history of changes to the hazard mitigation planning regulations since the State's Mitigation Plan was approved in 2013. The current regulations referenced above incorporate, or supersede, each of these rule changes.

- October 2, 2015 Final Rule (80 FR 59549)
- December 19, 2014 Interim Final Rule (79 FR 76085)
- April 25, 2014 Final Rule (79 FR 22873)

1.5 Assurances

The State of New Mexico will continue to comply with all applicable federal statutes and regulations during the periods for which it receives grant funding, and will amend its plan whenever necessary to reflect changes in state or federal laws and statutes.

This 2023 Plan update meets the requirements of FEMA's State Mitigation Planning Policy Guide that went into effect April 19. 2023. The State of New Mexico will continue to comply with the Policy Guide going forward. The Plan has also been written to meet all applicable standards of the Emergency Management Accreditation Program (EMAP).

2 PLANNING PROCESS

44 CFR Part 201.4
An effective planning process is essential in developing and maintaining a good plan. The mitigation planning process should include coordination with other State agencies, appropriate Federal agencies, interested groups, and be integrated to the extent possible with other ongoing State planning efforts as well as other FEMA mitigation programs and initiatives. To be effective the plan must include [a description] of the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how other agencies participated.

The New Mexico Department of Homeland Security and Emergency Management (DHSEM) oversaw and directed the planning process required to update and revise the Plan for adoption in 2023. The update process began in Spring 2022 and continued through Summer 2023. DHSEM contracted with a consulting team for technical assistance throughout the process including meeting facilitation, risk assessment expertise, and plan updating and alignment with FEMA requirements. The consultant team was led by WSP USA and assisted by Synergy Disaster Recovery. Four formal planning meetings were supplemented by calls among team members and contract staff, as well as general communication via e-mail and digital data sharing to facilitate draft reviews and collection of comments.

The 2022-2023 update followed a four phase process:

- Phase 1: Organize Resources
- Phase 2: Risk Assessment Update
- Phase 3: Mitigation Plan Update
- Phase 4: Adoption and Implementation

2.1 Planning Team and Stakeholder Involvement

The State of New Mexico ’s mitigation planning process has included all relevant stakeholders at the state, regional, local, tribal, and federal level, as well as private sector entities, nonprofits, academia, and the public. The engagement of stakeholders is a key aspect of the State’s mitigation strategy.

The New Mexico State Hazard Mitigation Team (SHMT) is the principal body responsible for coordinating the state’s comprehensive hazard mitigation program. The SHMT consists of one or more representatives from each of the departments and offices involved in hazard mitigation. The role and participation expectations for SHMT membership included:

- Attending planning meetings
- Assisting with data collection
- Reporting on agency mitigation capabilities
- Leveraging funding/programs to maximize benefits.
- Providing input to mitigation strategy/actions
- Reviewing the draft of the updated SHMP

The State Hazard Mitigation Officer (SHMO) communicated regularly via e-mail and follow-up phone calls with members of the SHMT and other stakeholders. The SHMO ensured that the SHMT members were given multiple opportunities to provide input during the planning process.

As was done for the 2018 plan update, the SHMT identified a list of stakeholders from state, regional, local, tribal, and federal agencies to solicit input. A wide variety of organizations and individuals were contacted, representing all sectors, community lifelines, and necessary areas of expertise. For practical purposes, all stakeholders who participated in the planning process were considered to be part of the SHMT. Involvement of local governments and the public are discussed in Section 2.4 below.

Agency and stakeholder participation in the planning process, including their participation in the four planning meetings, are listed in Table 2-1. The SHMT represented a broad range of stakeholders, disciplines, and expertise as shown in Table 2-2 through Table 2-4.

Table 2-1 New Mexico State Hazard Mitigation Team (SHMT)

Agency	Title	Mtg 1	Mtg 2	Mtg 3	Mtg 4
American Radio Relay League	Assistant Section Emergency Coordinator	X			
American Red Cross	Disaster Relations Director	X			
City of Clovis	Emergency Manager	X			
City of Roswell	Emergency Manager	X			
Dona Ana County	Deputy Emergency Manager	X			
E911	Program Coordinator	X	X		
Earth Data Analysis Center, UNM	Cooperating Technical Partner Coordinator	X		X	X
FEMA	Lead Planner	X	X		X
FEMA Integration Team Hazard Mitigation	Deputy Branch Director	X	X		
FEMA Region 6	Mitigation Specialist	X			
Grant County	Emergency Manager	X			
Los Alamos County OEM	Emergency Manager	X			
Luna County	Emergency Manager	X			
Luna County	Road Department Director	X			
Nambe Pueblo	Community Health Worker	X			
National Weather Service	Acting Meteorologist in Charge	X			
New Mexico Association of Emergency Management Professionals	Board Member	X	X	X	
New Mexico Floodplain Managers Association	Climate & Resilience Senior Lead	X	X	X	
New Mexico State University	State Climatologist				X
NM Bureau of Geology	Seismic Network Manager	X			
NM Bureau of Geology and Mineral Resources	Field Geologist	X		X	
NM Bureau of Geology and Mineral Resources	Field Geologist II		X	X	
NM Bureau of Geology and Mineral Resources	Senior Field Geologist	X			X
NM Department of Finance & Administration, Local Government	Division Director	X			
NM Department of Finance & Administration, Local Government	Rural Ombudsman	X	X	X	X
NM DHSEM	Deputy Cabinet Secretary		X	X	
NM DHSEM	Local Preparedness Coordinator		X	X	
NM DHSEM	Mitigation Specialist		X	X	
NM DHSEM	Mitigation Specialist	X	X	X	
NM DHSEM	Mitigation Specialist	X			

Agency	Title	Mtg 1	Mtg 2	Mtg 3	Mtg 4
NM DHSEM	Mitigation Specialist				X
NM DHSEM	Operations Manager				X
NM DHSEM	Recovery Specialist				X
NM DHSEM	Statewide Emergency Coordinator		X	X	
NM DHSEM (contractor)	Mitigation Contractor				X
NM DOH Bureau of Emergency Management	All Hazards Emergency Planner	X			
NM DOH Bureau of Emergency Management	Emergency Planner	X			
NM DOT	Engineer intern				X
NM DOT	Natural Resources Section Supervisor				X
NM DOT	Planning Division Director	X	X	X	
NM DOT Drainage Design Bureau	Bureau Chief			X	X
NM EMNDRD Forestry	Assistant State Fire Management Officer		X	X	X
NM EMNDRD Forestry	Community Wildfire Defense Grant Coordinator				X
NM EMNDRD Forestry	Resource Protection Bureau Chief			X	X
NM EMNRD	Assistant Supervisor				X
NM EMNRD	Climate Policy Bureau Chief				X
NM EMNRD	Resilience Coordinator				X
NM EMNRD	VFA Program Coordinator				X
NM Environment Department	Incident Response Coordinator	X	X	X	
NM Indian Affairs Department	Special Projects Coordinator	X			
NM State Police	Captain		X	X	
Office of the State Engineer, Dam Safety Bureau	Bureau Chief	X			
Otero County	Emergency Manager	X			
Otero County Emergency Management	Admin Assistant	X			
PNM Resources	Crisis Management Team	X	X	X	
San Miguel/Las Vegas OEM	Emergency Manager	X			
San Miguel/Las Vegas OEM	Emergency Manager	X			
Socorro County	Deputy Administrator Fire & Emergency Management	X			
Socorro County	Emergency Manager	X			
Southwest Border Food Protection and Emergency Preparedness Center	Co-Director	X			
Torrance County	Emergency Manager	X			
Union County	Emergency Manager	X			
US Bureau of Reclamation	Technical Services Division	X			
US DHS Cybersecurity and Infrastructure Security Agency	Protective Security Advisor	X	X	X	X
USACE	Security Assistant		X		
Village of Corrales	Deputy Chief EMS and EM	X			
WSP USA	Consultant Project Manager	X	X	X	X
WSP USA	Consultant Hazard Mitigation Lead	X	X		
WSP USA	GIS Analyst	X			
WSP USA	Hazard Mitigation Planner	X			
WSP USA	Hazard Mitigation Planner	X			X

Agency	Title	Mtg 1	Mtg 2	Mtg 3	Mtg 4
WSP USA	Hazard Mitigation Specialist	X			
WSP USA	Hazard Mitigation Specialist			X	
Synergy Disaster Recovery	Consultant		X		
Synergy Disaster Recovery	Consultant		X	X	X
Synergy Disaster Recovery	Consultant	X	X	X	X
Synergy Disaster Recovery	Consultant		X		

Table 2-2 State Hazard Mitigation Team (SHMT) Expertise by Sector

Agency	Emergency Management	Economic Development	Land Use & Development	Building Codes	Housing	Health & Social Services	Infrastructure	Natural/ Cultural Resources
American Radio Relay League	X						X	
American Red Cross	X				X	X		
E911						X	X	
Earth Data Analysis Center, UNM	X	X	X	X	X	X	X	X
FEMA Region 6	X	X	X	X	X	X	X	X
Local & Tribal Governments	X	X	X	X	X	X	X	X
National Weather Service	X							X
New Mexico Association of Emergency Management Professionals	X		X		X		X	
New Mexico Floodplain Managers Association	X		X					X
New Mexico State University		X	X	X	X	X	X	X
NM Bureau of Geology and Mineral Resources			X					X
NM Department of Finance & Administration, Local Government		X						
NM DHSEM	X	X	X	X	X	X	X	X
NM DOH Bureau of Emergency Management	X					X		
NM DOT	X						X	X
NM EMNRD		X	X	X				X
NM Environment Department								X
NM Indian Affairs Department		X				X		
NM State Police	X							
Office of the State Engineer, Dam Safety Bureau							X	
PNM Resources							X	
Southwest Border Food Protection and Emergency Preparedness Center	X							
US Bureau of Reclamation			X					X
US DHS Cybersecurity and Infrastructure Security Agency	X						X	
US Army Corps of Engineers			X				X	X

Table 2-3 State Hazard Mitigation Team (SHMT) Expertise by Community Lifeline

Agency	Communications	Energy	Food, Water & Shelter	Hazmat	Health & Medical	Safety & Security	Transportation
American Radio Relay League	X						
American Red Cross	X		X			X	
E911	X					X	
Earth Data Analysis Center, UNM	X	X	X	X	X	X	X
FEMA Region 6	X	X	X	X	X	X	X
Local & Tribal Governments	X	X	X	X	X	X	X
National Weather Service	X						
New Mexico Association of Emergency Management Professionals	X	X	X	X	X	X	X
New Mexico Floodplain Managers Association	X	X			X	X	X
New Mexico State University	X	X	X	X	X	X	X
NM Bureau of Geology and Mineral Resources							
NM Department of Finance & Administration, Local Government							
NM DHSEM	X	X	X	X	X	X	X
NM DOH Bureau of Emergency Management			X				
NM DOT							X
NM EMNRD		X		X		X	
NM Environment Department				X			
NM Indian Affairs Department					X	X	
NM State Police						X	
Office of the State Engineer, Dam Safety Bureau	X	X					
PNM Resources		X					
Southwest Border Food Protection & Emergency Preparedness Center	X						
US Bureau of Reclamation			X				
US DHS Cybersecurity and Infrastructure Security Agency	X	X				X	
US Army Corps of Engineers	X	X		X		X	X

Table 2-4 State Hazard Mitigation Team (SHMT) Engagement With Key Stakeholders

Agency	Climate Change	Social Vulnerability & Underserved Communities	Floodplain Managers, NFIP	Population & Demographics	State Geologists	Dam Safety
American Radio Relay League						
American Red Cross		X				
E911		X				
Earth Data Analysis Center, UNM		X		X		
FEMA Region 6		X	X			X
Local & Tribal Governments		X	X	X		
National Weather Service	X					
New Mexico Floodplain Managers Association & NMEMA	X		X			
New Mexico State University	X	X		X		
NM Bureau of Geology and Mineral Resources					X	
NM Department of Finance & Administration, Local Government		X		X		
NM DHSEM	X	X	X	X		
NM DOH Bureau of Emergency Management		X		X		
NM DOT		X		X		
NM EMNRD	X	X			X	
NM Environment Department	X	X	X		X	
NM Indian Affairs Department		X		X		
NM State Police		X				
Office of the State Engineer, Dam Safety Bureau						X
PNM Resources				X		
Southwest Border Food Protection and Emergency Preparedness Center		X		X		
US Bureau of Reclamation		X				X
US DHS Cybersecurity and Infrastructure Security Agency						
USACE	X					X

2.2 Planning Meetings

The 2023 planning process involved four formal SHMT meetings.

Table 2-5 State Hazard Mitigation Team (SHMT) Meeting

Meeting	Date	Method	Topics
#1	August 19, 2022	Virtual	Project kickoff, process & requirements, review of 2018 SHMP, stakeholder engagement
#2	January 26, 2023	Hybrid	Hazards & vulnerabilities, local/tribal plan rollup
#3	March 2, 2023	Virtual	State & local capabilities, social vulnerability, mitigation goals, progress on 2018 mitigation actions, new actions
#4	May 12, 2023	Hybrid	Climate resiliency, funding sources, plan implementation & maintenance, mitigation program SWOT analysis

Meeting #1, Project Kickoff: August 21. 2022

The kickoff meeting was conducted virtually via TEAMS with the SHMT and other key stakeholders. 50 people participated, representing a mix of the consultant team, state departments, county and municipal representatives, school districts, and stakeholders. The meeting agenda was as follows:

- Introductions
- Hazard Mitigation Purpose
- Hazard Mitigation Planning Process and Requirements
- Overview of 2018 NM State Hazard Mitigation Plan
- Coordination with Other Agencies, Related Planning Efforts, & Recent Studies
- Planning for Public Involvement
- Project Schedule, Information Needs and Next Steps
- Questions and Answers

Meeting #2, Risk Assessment: January 26, 2023

This was a hybrid meeting held in person at the offices of the DHSEM and online via Zoom; 24 people attended in person or remotely. The meeting focused on updating the statewide risk assessment, including input from local and tribal hazard mitigation plans: The meeting agenda was as follows:

- Introductions
- Mitigation Planning Process
- Review
- Local Hazard Mitigation Plans
- Summary Roll Up
- Hazards and Vulnerability Assessment Update

Meeting #3, Mitigation Strategy: March 2, 2023

The third meeting of the SHMT was a virtual meeting presented online via Teams; 22 people participated. The meeting focused on updating the state mitigation strategy, mitigation capabilities, and a discussion on social vulnerability and underserved populations. The meeting agenda was as follows:

- Introductions
- Mitigation Planning Process Update

- Social Vulnerability, Vulnerable Populations, and Equity
- Summary Roll-Up of Local Mitigation Capabilities
- State Mitigation Capabilities
- Mitigation Goals
- Types of Mitigation Actions
- Progress on Mitigation Actions From 2018 SHMP
- Development of New Mitigation Actions
- Next Steps

Meeting #4, Draft Plan Finalization: May 12, 2023

This was a hybrid meeting held in person at the offices of the DHSEM and online via Teams; 24 people participated. The meeting focused on finalizing on plan implementation, a discussion of climate resiliency and its relation to mitigation planning, and a Strength-Weaknesses-Opportunities-Threats (SWOT) analysis of the State's hazard mitigation program. The meeting agenda was as follows:

- Welcome and Introductions
- Mitigation Planning Process
- Climate Resiliency Discussion
- Mitigation Goals
- Sources of Mitigation Funding
- State & Local Mitigation Capability Assessment
- Mitigation Program SWOT Analysis
- Plan Implementation and Maintenance
- Preview of 2023 Draft SHMP
- Next Steps

Meeting attendance is shown in Table 2-1 above. Copies of meeting invitations, agendas, sign-in sheets, presentations, meeting summaries, and handouts used throughout the planning process are on file at DHSEM.

An important element of all SHMT meetings was a review of local and tribal hazard mitigation plans, to include hazards data, local/tribal capabilities, and mitigation activities, as described in Section 5.

2.3 Additional Coordination Between Planning Team & Stakeholders

The four formal meetings were supplemented with bi-weekly planning calls, frequent email communications, one-on-one calls between DHSEM staff, contractors, SHMT members, and other stakeholders.

One group that was directly involved in the plan update was the Interagency Climate Change Task Force, which oversees the State's climate resilience and adaptation planning. The Task Force provided a briefing on their work during SHMT Meeting #4, and is using information from the updated risk assessment in their work. The Task Force is currently updating the New Mexico Climate Strategy for 2023; when finished, that plan will become an annex to this SHMP.

In the *Fiscal Year 2021 DHSEM Strategic Plan*, DHSEM describes their programmatic Four Strategic Goals. Goal 1 is to "Build a culture of trust, credibility and collaboration by putting People-First". Later, Action

Step 1.5 states "Increase communication with the local communities through a robust community engagement plan that includes social media, in-person trainings and consistent partnerships for problem-solving." This will be accomplished through the procurement of "technology and human capital to create training and educational opportunities such as webcasts, virtual training, podcasts and archived in-person trainings." The report provides examples of how technology and human-caused hazards were addressed through procurements.

On their website, the DHSEM's Preparedness Bureau provides local emergency management programs with resources for emergency preparedness for natural hazards. The website is located at: https://www.nmdhsem.org/preparedness-bureau/.

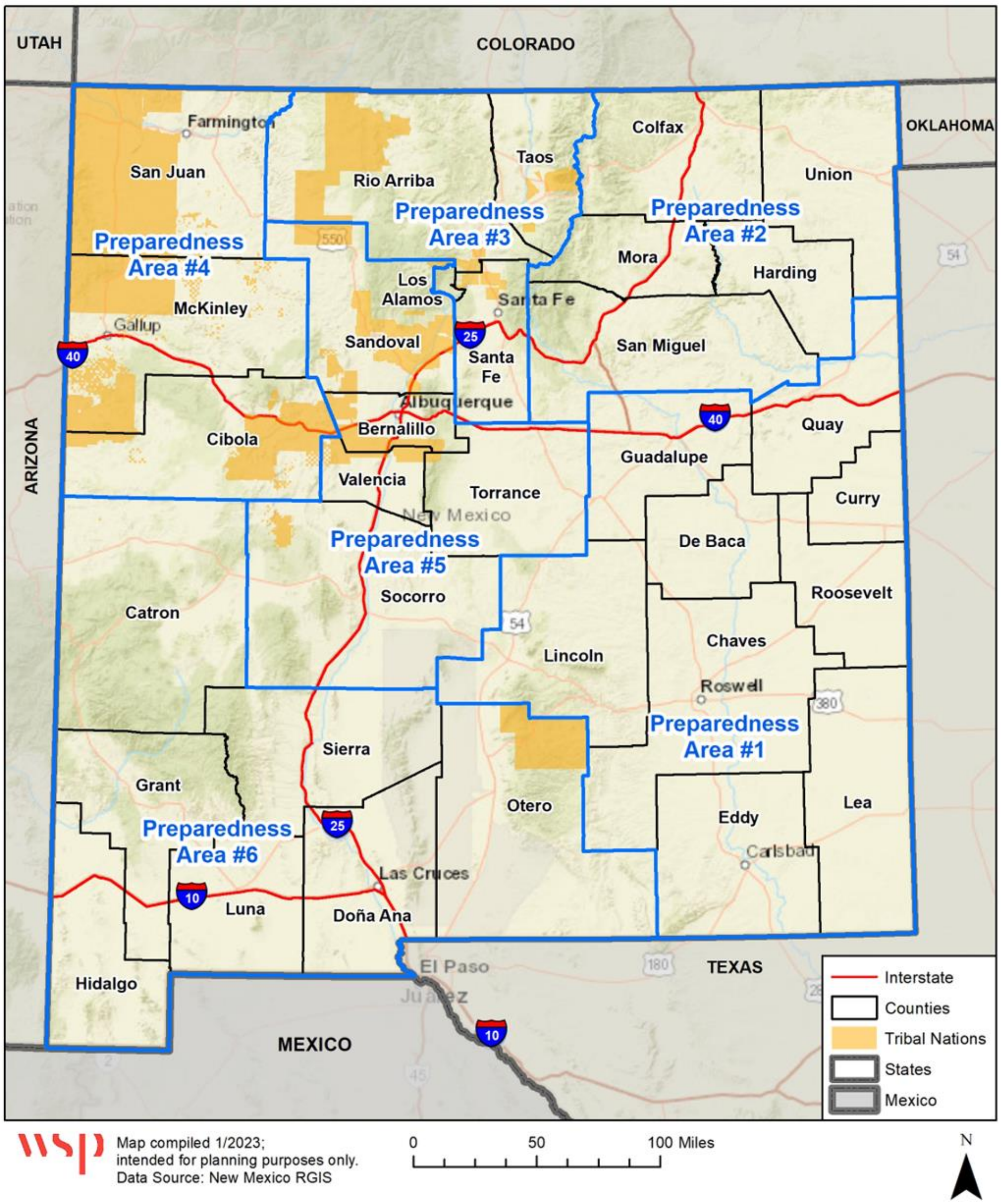
During the planning process DHSEM noted that their mitigation section had not conducted as much public outreach as in the past five years. This was identified as an area for improvement going forward.

3 New Mexico State Profile

3.1 Location

New Mexico is located in the southwestern region of the United States. Contiguous states include Colorado, Arizona, and Utah at its northwestern corner to form the "four corners" region. Bordering New Mexico is Oklahoma to the northeast, Texas to the south and east, Mexico to the south, Arizona to the west, and Colorado to the north (see Figure 3-1). The State's total land area is approximately 121,598 square miles (5th largest in the nation). 121,365 square miles of New Mexico are land areas; water covers only a small part of the State.

Figure 3-1 Map of New Mexico



3.2 Geographic Features

Known for its varied topography, New Mexico includes desert terrain, mesas, grassy plains, wooded forests, and mountain peaks. The Rio Grande runs through the middle of the State from north to south. The highest point in New Mexico is Wheeler Peak, rising to 13,161 feet above sea level in the Sangre de Cristo Mountain range in north-central New Mexico. The mean elevation of the State of New Mexico is 5,700 feet above sea level. The State can be divided into six geographic provinces (Figure 3-2), which are described below (clockwise, starting in the northwest, SRM = southern Rocky Mountains; RGR = Rio Grande rift).

The Colorado Plateau occupies the northwestern part of the State. It features mesas, generally a few hundred feet to a thousand feet in height, separated by broad valleys. Three mountain ranges, the Chuska Mountains, Zuni Mountains and Mount Taylor, rise up to 8,000-11,000 ft in elevation and support forests containing juniper, pinon, ponderosa and spruce pines. Otherwise, the vegetation of most of this sparsely populated region is characterized by desert scrub with saltbush, shadscale, and drought tolerant grasses. In the northern part of the Colorado Plateau, the San Juan River flows westward through a valley supporting agriculture and the city of Farmington.

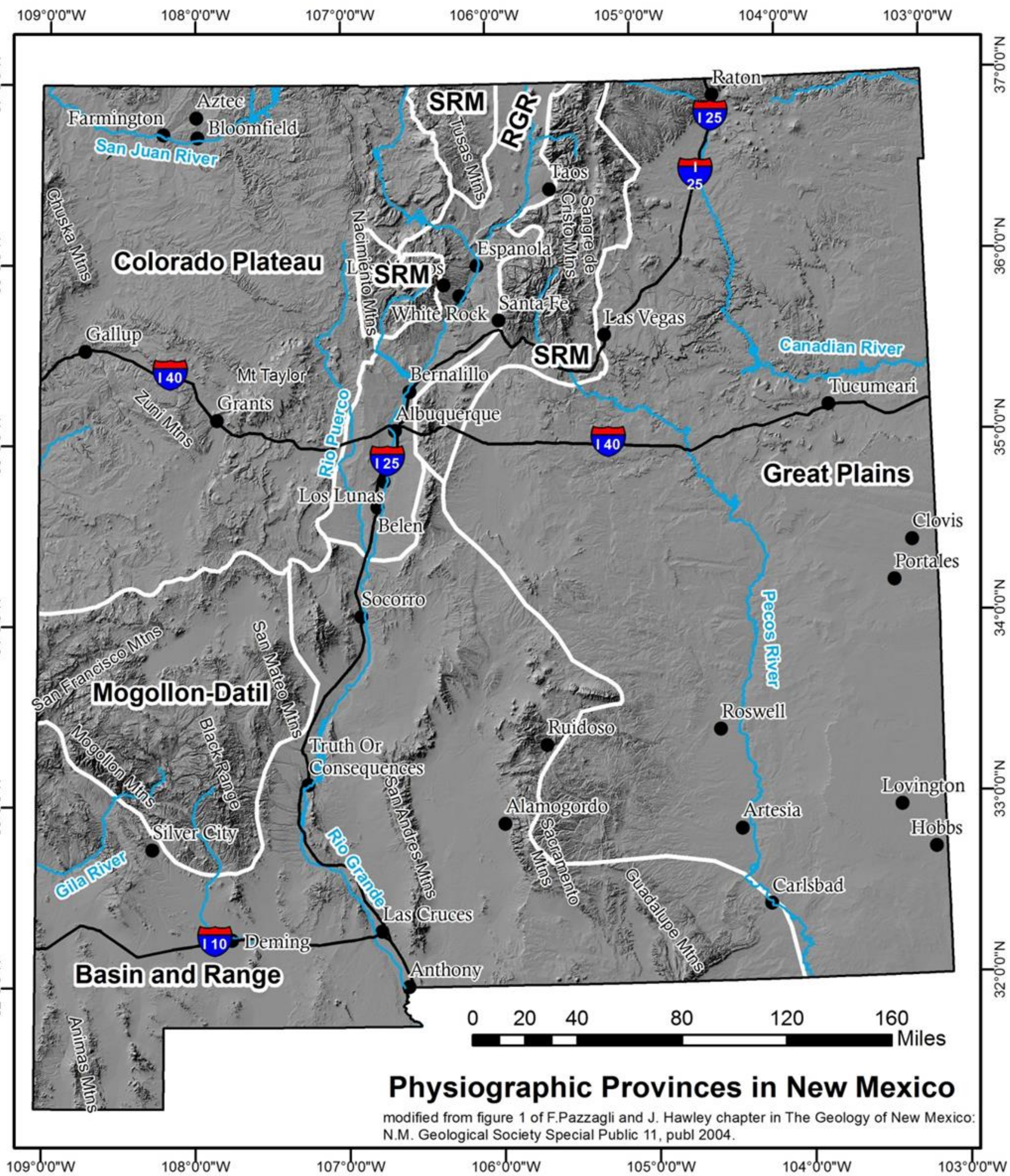
In the central part of New Mexico, the southern Rocky Mountains extend southward into north-central New Mexico from Colorado. The Rio Grande rift separates two arms of the Rocky Mountains. On the west lies forested mountains attaining elevations of 9,000-11,000 feet; these western mountains include the Tusas, Jemez, and Nacimiento Mountains. To the east of the Rio Grande rift, the Sangre de Cristo (Blood of Christ) Range are somewhat higher than the western mountains (having maximum elevations of 12,000-13,000 ft). The Sandia Mountains, located immediately east of Albuquerque, may be considered as part of this eastern arm of the southern Rocky Mountains. Vegetation in the Rocky Mountains is characterized by pinon and juniper at lower elevations, but at higher elevations grows ponderosa, fir, spruce, and aspen.

The Rio Grande rift extends southward down the middle of the State, merging with the Basin and Range Region near Socorro, New Mexico. Within the Rio Grande rift lies the Rio Grande, the State's most important river, that heads in south-central Colorado and flows south and then southeast to the Gulf of Mexico. Three of the State's four largest cities lie near the Rio Grande: Albuquerque (~564,000 pop.), Rio Rancho (~104,000 pop.), and Santa Fe (~87,000 pop). Sagebrush, pinon-juniper, and juniper savanna is the characteristic vegetation of the rift north of Santa Fe, but to the south the rift is a desert grassland.

Covering the eastern third of New Mexico is the Great Plains. Generally, a shortgrass prairie, the Great Plains extend from high plateaus in the north to lower plains in the south between Hobbs and Carlsbad. Rivers in the high plateau have locally cut deep canyons into the landscape, such as the Canadian River Canyon. Besides the Canadian River, an important drainage is the Pecos River, which heads in the eastern arm of the Sangre de Cristo Mountains and flows southward into Texas. In its valley lies the cities of Roswell, Artesia, and Carlsbad. The High Plains or Staked Plains (Llano Estacado) are near the eastern edge of New Mexico south of the Canadian River.

The Basin and Range Region covers about one-third of the State. This area is marked by rugged mountain ranges separated by wide desert basins. The mountains generally support desert shrubs and pinon-juniper forests and include the Guadalupe, Sacramento, San Andres, Caballo, and Animas Mountains. In the intervening basins, vegetation is mainly characterized by creosote-mesquite shrublands, with some grasslands. The Rio Grande flows north to south through the Basin and Range Region; in its fertile valley include the towns of Socorro, Truth or Consequences, Hatch, and Las Cruces. The Rio Grande exits New Mexico in the vicinity of El Paso, Texas.

Figure 3-2 New Mexico's Six Geographic Provinces



The Mogollon-Datil plateau is a relatively high-topography area that includes the Gila wilderness. The Gila and San Francisco Rivers, which flow westward into Arizona, both head in this wilderness area. The Mogollon-Datil plateau features mountains supporting pinon-juniper, ponderosa, and fir-spruce forests. The mountain fronts can be relatively steep, such as in the Silver City and Glenwood areas, but topography is somewhat gentler to the north. On its north edge, this physiographic province includes the grasslands of the San Agustin Plains.

3.3 Land Ownership

More than half of the land in New Mexico is publicly owned. 33.8% of the state owned by the federal government, 11.9% by the state, 10.3% are tribal lands, and 0.1% are owned by city, county, or other government entities. Only 44.1% of New Mexico is privately owned.

Figure 3-3 Land Ownership in New Mexico

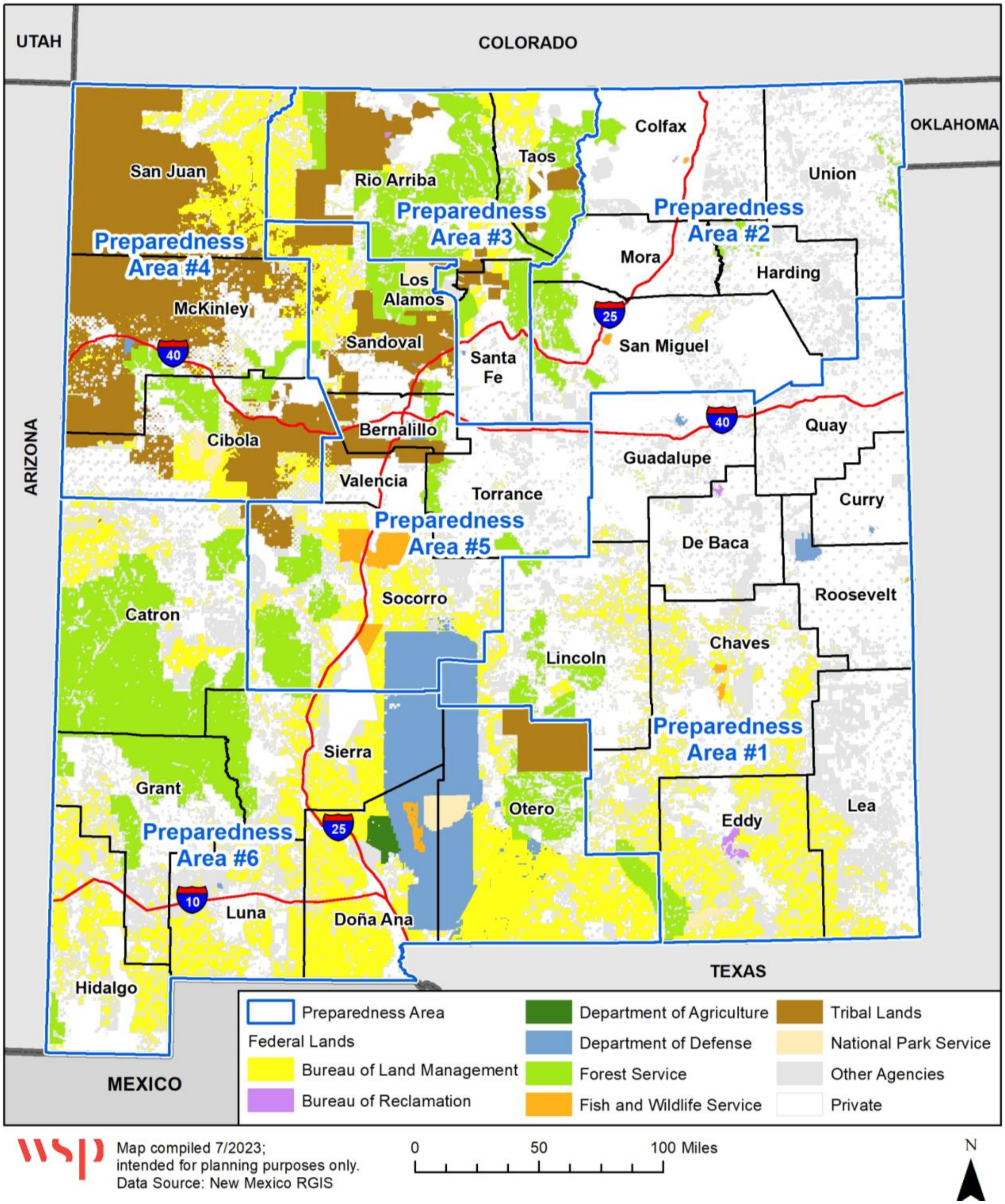


Figure 3-4 New Mexico Military Bases and Major Federal Sites

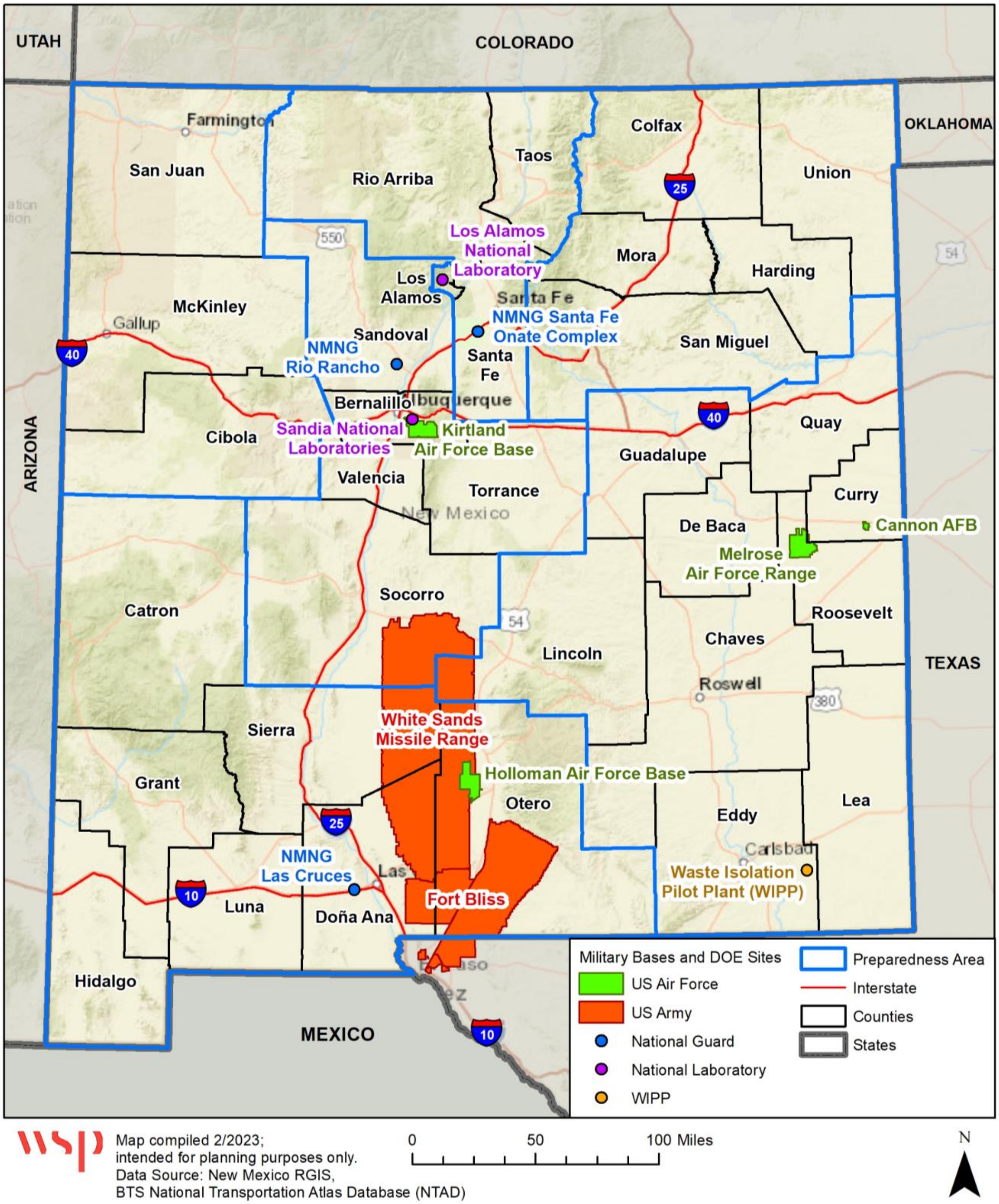


Table 3-1 Landownership in New Mexico

Landownership	Acres	% of State
Private Lands	4,306,591	44.1%
Conservation Easement	305,945	0.4%
Federal Lands	26,283,866	33.8%
Forest Service	9,224,226	11.9%
BLM	13,486,005	17.3%
National Park Service	470,961	0.6%
Military	2,570,554	3.3%
Other Federal	532,120	0.7%
State Lands	9,113,539	11.7%
State Trust Lands	8,857,185	11.4%
Other State	256,354	0.3%
Tribal Lands	8,051,637	10.3%
City, County, Other	63,919	0.1%
Total	**77,829,693**	**100%**

Source: headwaterseconomics.org/eps

3.4 Climate

Temperature – Mean annual temperatures range from 64° F in the extreme southeast to 40°F or lower in high mountains and valleys of the north. During the summer months, individual daytime temperatures quite often exceed 100°F at elevations below 5,000 feet; but the average monthly maximum temperatures during July, the warmest month, range from the low 90's at lower elevations to the upper 70's at high elevations. In January, the coldest month, average daytime temperatures range from the middle 50's in the southern and central valleys to the low 20's in the higher elevations of the north. Minimum temperatures below freezing are common in all sections of the State during the winter, but subzero Fahrenheit temperatures are rare except in the mountains. The highest temperature recorded in New Mexico is 116°F on July 14, 1934, at Orogrande and at Artesia on June 29, 1918. The lowest temperature recorded was -50 °F, on February 1, 1951, at Gavilan.

Precipitation – Average annual precipitation ranges from less than ten inches over much of the southern desert and the Rio Grande and San Juan Valleys to more than 40 inches at higher elevations in the State. Summer rains fall almost entirely during brief, but frequently intense thunderstorms. July and August are the rainiest months over most of the State, with from 30 to 40% of the year's total moisture falling at that time. During the warmest six months of the year, May through October, total precipitation averages from 60% of the annual total in the Northwestern Plateau to 80% of the annual total in the eastern plains. Much of the winter precipitation falls as snow in the mountain areas, but it may occur as either rain or snow in the valleys. Average annual snowfall ranges from about three inches at the Southern Desert and Southeastern Plains stations to well over 100 inches at Northern Mountain stations. It may exceed 300 inches in the highest mountains of the north.

Sunshine – The average number of hours of annual sunshine ranges from near 3,700 in the southwest to 2,800 in the north-central portions.

Humidity – Relative humidity ranges from an average of near 65% about sunrise to near 30% in mid-afternoon; however, afternoon humidity in warmer months is often less than 20% and occasionally may go as low as 4%. The low relative humidity during periods of extreme temperatures alleviates the discomforts of summer and winter temperatures. These low humidity levels contribute to decreased winter temperatures since the atmosphere is unable to retain heat in the evenings.

3.5 Tribal Nations

There are 23 Indian tribes located in New Mexico - nineteen Pueblos, three Apache tribes, and the Navajo Nation. Each Tribe is a sovereign nation with its own government, traditions, and culture.

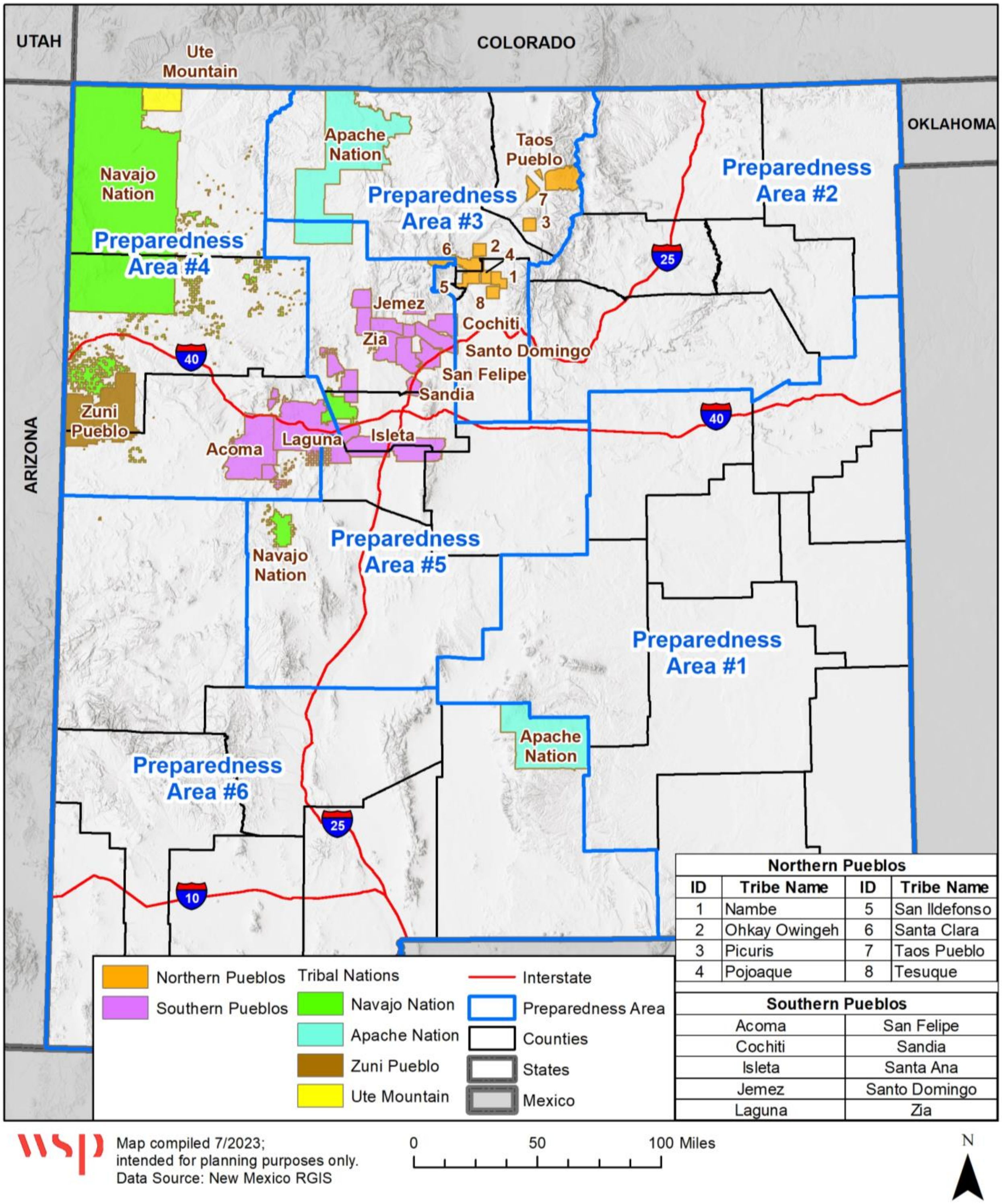
Table 3-2 lists New Mexico's 23 tribal nations with information on location, population, and native language. Population figures are based on the 2020 Census and include off-reservation trust lands where applicable, but for multi-state tribes only include the New Mexico portion of their population. The tribes are mapped in Figure 3-5.

As sovereign nations, the tribes can work directly with FEMA for mitigation funding and assistance. However, DHSEM works with each tribal nation to help facilitate hazard mitigation activities, to include seeking funding, at the discretion of the tribal entity.

Table 3-2 Tribal Nations in New Mexico

Tribe	County	Population	Language
Acoma Pueblo	Cibola, Socorro, Catron	3,223	Keres
Cochiti Pueblo	Sandoval	1,465	Keres
Fort Sill Apache Tribe	Luna	-	Fort Sill Apache
Isleta Pueblo	Bernalillo & Valencia	4,075	Tiwa
Jemez Pueblo	Sandoval	2,042	Towa
Jicarilla Apache Nation	Rio Arriba	3,108	Jicarilla Apache
Laguna Pueblo	Bernalillo, Cibola, Sandoval, Valencia	4,514	Keres
Mescalero Apache Tribe	Lincoln, Otero	4,005	Mescalero
Nambe Pueblo	Santa Fe	2,026	Tewa
Navajo Nation	Bernalillo, Cibola, McKinley San Juan, Socorro	62,576	Navajo
Ohkay Owingeh	Rio Arriba	6,861	Tewa
Picuris Pueblo	Taos	2,340	Northern Tiwa
Pojoaque Pueblo	Santa Fe	3,608	Tewa
San Felipe Pueblo	Sandoval	3,590	Keres
San Ildefonso Pueblo	Santa Fe	2,261	Tewa
Sandia Pueblo	Bernalillo, Sandoval	5,306	Tiwa
Santa Ana Pueblo	Sandoval	1,131	Keres
Santa Clara Pueblo	Rio Arriba, Sandoval, Santa Fe	11,893	Tewa
Santo Domingo Pueblo	Sandoval	2,792	Keres
Taos Pueblo	Taos	5,180	Northern Tiwa
Tesuque Pueblo	Santa Fe	1,156	Tewa
Zia Pueblo	Sandoval	873	Keres
Zuni Pueblo	Catron, Cibola, McKinley	8,445	Zuni

Figure 3-5 Map of Tribal Nations in New Mexico

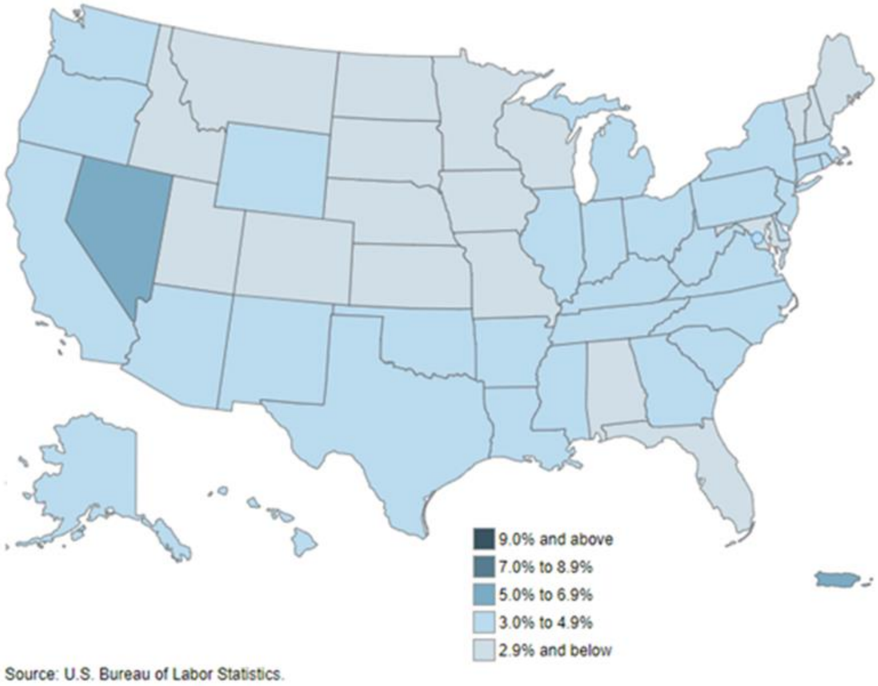


3.6 Economy

State gross state product (GDP) is a measurement of a state's output, or the sum of value added from all industries in the state. It is a common indicator used to track the health of a state's economy. New Mexico's GDP in 2022 reached $95.3 billion, with growth of 1.4% over the 5 years to 2022, representing an increase of 1.4% from 2021. Moreover, New Mexico's trailing five-year GDP growth ranks it 23rd out of all 50 US states. In general, all business indices grew marginally or stayed flat during 2022.

As of 2021, New Mexico’s average unemployment rate was 7.1%, and 0.7 percentage point lower than New Mexico’s rate in 2010. The State’s unemployment rate has declined more slowly than the rates of most other States in recent years, and it stagnated in 2016, leaving New Mexico with the highest unemployment rate in the country. As of March 2023, New Mexico’s unemployment rate is 3.5%, which is 0.1% higher than the U.S. unemployment rate of 3.4%.

Figure 3-6 U.S. Unemployment Rates, 2013 to 2023, seasonally adjusted



The nation’s labor force participation rate has generally recovered from the 10% nation-wide dip experienced during the Covid-19 pandemic. The rate rose from 62.8% to 63.1% between 2017 and 2021. New Mexico’s labor force participation rate was 56.6% as of 2021, 6.5% percentage points lower than the national rate. Total employment in 2021 was 606,085, which is a -7% change in 2020-2021. New Mexico’s employment-to-population ratio was 52.9% in 2021, 7.5 percentage points below the U.S. ratio of 60.4%. Table 3-3 shows the 2021 rates of employment and unemployment participation by race for New Mexico.

Table 3-3 2021 New Mexico Employment / Unemployment Rates by Race

	Population	Participation	Unemployment Rate
White	1,113,427	57.10%	6.00%
Black or African American	35,722	60.90%	9.00%
American Indian and Alaska Native	151,708	54.10%	11.10%
Asian	28,244	66.20%	4.60%
Native Hawaiian and Other Pacific Islander	1,482	52.20%	7.60%
Other	163,223	56.90%	6.50%
Two or more races	188,762	59.40%	6.80%
Hispanic or Latino	782,410	60.10%	6.70%
Not Hispanic or Latino	664,400	54.10%	5.50%

Source: US Census Bureau

According to the 2021 US Census, the largest private-sector industry in New Mexico was the Office and Administration Sector, followed by Management, and Sales Sector in the number 2 and 3 spots, respectively. Collectively, the top three private sectors employed 273,973 people or 31.7% of the State's total employed persons.

The private-sectors that employed the highest number of males was the Construction and Extraction Industry, while the private-sector that employed the highest number of females was in Office and Administrative Support. The sector that averaged the highest earnings for both males ($93,979) and females ($77,368) was Architecture & Engineering. In New Mexico, women earned more than men in only two private-sectors: the Installation, Maintenance, Repair industry (+8.21%) and the Community & Social Services industry (+5.01%). The highest gender-based, earnings gap was 51.7% in the Farming, Fishing & Forestry industry. For all industries including farming, the State's average pay gap in 2022 was 15.3%, placing the state 10th in the nation for smallest pay gaps based on average salary. Maryland was slightly better at 15.2%, the District of Columbia had the nations' best rate of an 8.1% pay gap, while Wyoming had the highest pay gap at 34.6%. Table 3-5 shows the 2021 employment numbers and earnings by gender, by the business sector, and shows the earnings pay gap between men and women in New Mexico's labor force.

Table 3-4 2021 Occupational Earnings by Gender

Occupation	Total Sector Employees	Male		Female		Earnings Gap
		Population	Earnings	Population	Earnings	
Office & Admin Support	102,191	24,761	$35,017	77,430	$29,262	-16.43%
Management	86,429	48,817	$66,999	37,612	$53,890	-19.57%
Sales	85,353	41,476	$32,258	43,877	$19,672	-39.02%
Educational & Library	62,386	17,972	$44,989	44,414	$37,897	-15.76%
Construction & Extraction	54,236	52,870	$37,286	1,366	$28,565	-23.39%
Healthcare Practitioners	52,624	14,255	$76,871	38,369	$60,229	-21.65%
Food Prep & Serving	51,642	23,753	$16,356	27,889	$13,646	-16.57%
Healthcare Support	39,535	7,333	$22,112	32,202	$19,355	-12.47%
Business & Financial	38,053	16,401	$64,745	21,652	$53,129	-17.94%
Building & Grounds Cleaning	35,238	20,744	$23,155	14,494	$15,140	-34.61%
Installation, Maintenance, & Repair	33,268	32,010	$41,205	1,258	$44,587	8.21%
Transportation & Material Moving	32,902	28,312	$39,308	4,590	$25,129	-36.07%
Production	30,266	22,655	$36,765	7,611	$21,560	-41.36%
Personal Care & Services	22,596	6,848	$21,070	15,748	$14,999	-28.81%
Computer & Mathematical	21,462	15,446	$70,000	6,016	$64,133	-8.38%
Architecture & Engineering	21,340	18,060	$93,979	3,280	$77,368	-17.68%
Community, Social Service	18,505	6,196	$38,735	12,309	$40,677	5.01%
Arts, Design, Entertainment Sports, and Media	16,329	7,836	$36,886	8,493	$24,136	-34.57%
Life, Physical, & Social Science	14,409	9,013	$84,306	5,396	$63,497	-24.68%
Firefighters & Protective Services	13,098	10,259	$40,193	2,839	$30,940	-23.02%
Legal	11,775	4,482	$79,796	7,293	$53,697	-32.71%
Law Enforcement	10,873	8,835	$56,906	2,038	$43,945	-22.78%
Farming, Fishing, Forestry	8,045	6,613	$26,649	1,432	$13,039	-51.07%

Source: The New Mexico Partnership https://nmpartnership.com/

The top three Companies by employment and headquartered in New Mexico are the New Mexico State Government, Walmart, and Honeywell International. Table 3-5 provides a list of the top 10 employers in the state and their respective employee numbers. State Government as a major sector throughout New Mexico standing at 2% of the total workforce.

Table 3-5 Top 10 Companies Headquartered in New Mexico by Employment

	Company	2022 Employment	2022 Employment %
1.	State Of New Mexico	18,350	2.0%
2.	Walmart Inc.	15,222	1.6%
3.	Honeywell International Inc.	12,206	1.3%
4.	Presbyterian Healthcare Services	11,178	1.2%
5.	Albuquerque Public Schools	10,297	1.1%
6.	University of New Mexico Hospital	6,772	0.7%
7.	City of Alburquerque	5,800	0.6%
8.	University Of New Mexico	4,210	0.5%
9.	New Mexico State University	3,800	0.4%
10.	Lovelace Health System	3,589	0.4%

Source: The New Mexico Partnership https://nmpartnership.com/

Major industry sectors where the share of employment in New Mexico is notably greater than the share in the nation include: mining and logging; government; and construction. Major industry sectors that have comparatively smaller shares of employment include: both durable and non-durable goods manufacturing, wholesale trade, and financial activities. Mining activities are primarily concentrated in the southeastern (oil and natural gas extraction in the Permian Basin along with potash mining) and northwestern parts of the State (mostly natural gas extraction in the San Juan Basin). The mining and logging industry experienced significant declines in employment between 2014-2016 that were the result of the precipitous fall in oil prices but have since rebounded.

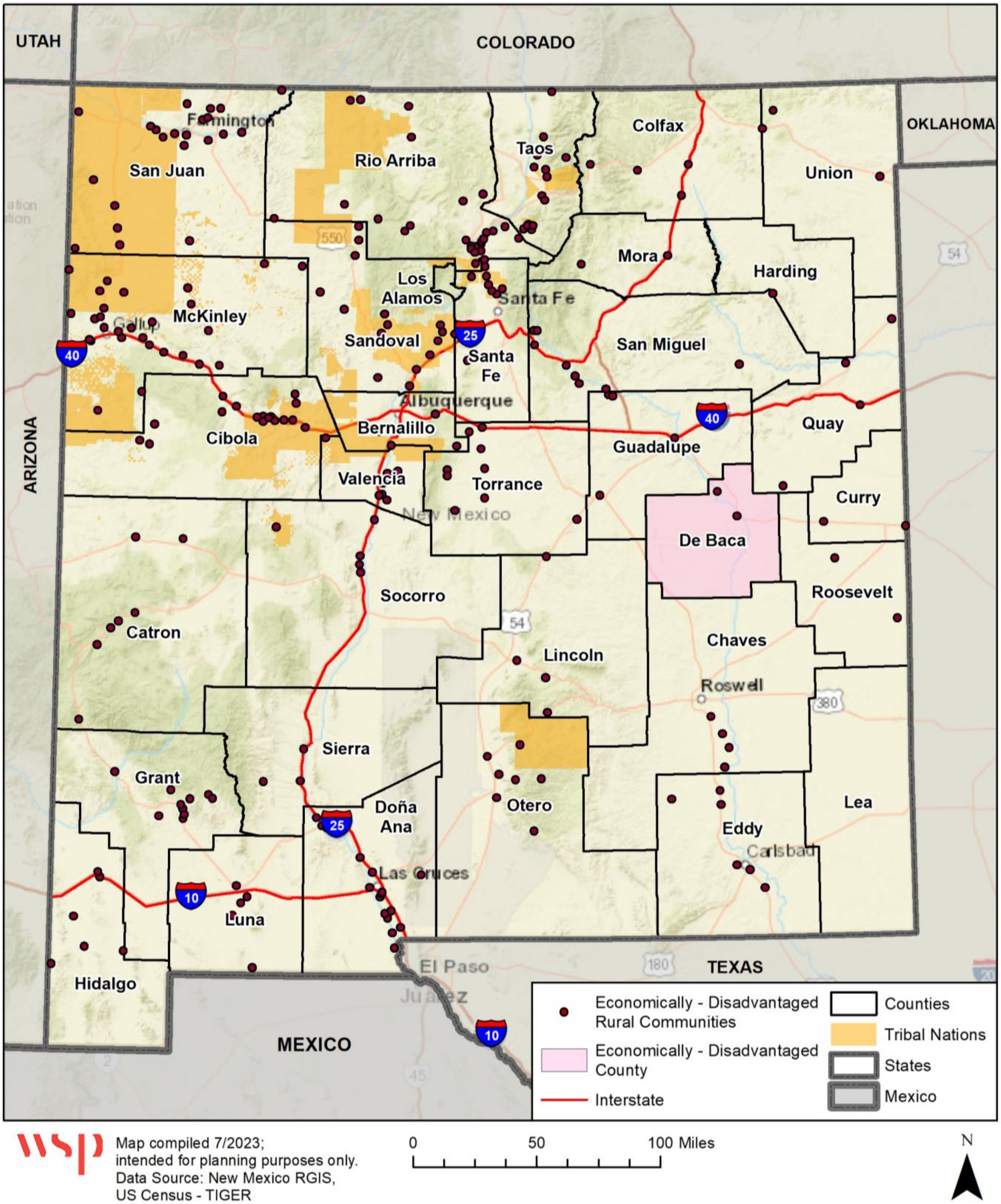
Construction is another large industry for the State. After taking a significant hit during the Great Recession, the industry was slow to recover and further impacted during the Covid-19 pandemic. Non-residential construction was $1.6 billion in 2022, which ranks it 14th out of all US states. Residential construction was $40.4 million in 2022, which places New Mexico 47th in the United States. The number of building permits issued in New Mexico in 2022 was 8,605, representing a 12.6% annualized growth rate between 2017 and 2022.

3.6.1 Economically Disadvantaged Rural Communities

FEMA defines an economically disadvantaged rural community as a community of 3,000 or fewer individuals identified by the applicant that is economically disadvantaged, with residents having an average per capita annual income not exceeding 80% of the national per capita income. The term replaces "small impoverished communities" as defined at 42 U.S.C. § 5133(a). Economically disadvantaged rural communities are eligible for an increase in cost share up to 90 percent federal / 10 percent non-federal for FEMA grants to include the BRIC program.

Based on 2020 Census data, there are 267 communities in New Mexico that qualify as economically disadvantaged rural communities. These communities are mapped in Figure 3-7; see Appendix G for the complete listing.

Figure 3-7 Economically Disadvantaged Rural Communities



3.6.2 Tourism

New Mexico's diverse and scenic beauty is a major draw for visitors. The Rocky Mountains, the Chihuahua Desert, portions of the Great Plains, spectacular canyons and the Rio Grande all combine to make the State a popular tourist destination.

Of the many features that set New Mexico apart, one is the presence of numerous Native American and Spanish colonial ruins. The Aztec Ruins and Chaco Canyon in the northwest region and the Bandelier National Monument in the north-central region are considered key national monuments. El Morro National Monument contains inscription rock that bears autographs, drawings, and messages from Spanish explorers and westbound pioneers. Fort Selden Monument consists of remains of the 19th-century adobe fort. Other attractions include the Gila Cliff Dwellings National Monument, Pecos National Historic Park (which contains ruins of a pueblo and Spanish colonial mission abandoned by 1838), Poshouinge Ruins, Salmon Ruins and Heritage Park, and the Three Rivers Petroglyph National Recreation Site, Carlsbad Caverns National Park, and White Sands National Monument. The Organ Mountains-Desert Peaks National Monument was declared a national monument on May 21, 2014.

The State is home to a myriad of museums. The Museum of New Mexico includes the New Mexico History Museum/Palace of the Governors in Santa Fe. The Palace of the Governor's is the oldest continually occupied public building in the country. The Museum of New Mexico also includes the New Mexico Museum of Art, the Museum of Indian Arts and Culture and the Museum of International Folk Art. New Mexico Tech (NM Tech) in Socorro houses the Mineral Museum, known as one of the finest mineral collections in the world. In addition, there are numerous of private art museums throughout the State such as the Georgia O'Keefe Museum (Santa Fe), The International Rattlesnake Museum (Albuquerque) and the International UFO Museum (Roswell).

There are several National Park locations in New Mexico including: Aztec Ruins National Monument (Aztec), Bandelier National Monument (Los Alamos), Capulin Volcano National Monument (Capulin), Carlsbad Caverns National Park (Carlsbad), Chaco Culture National Historic Park (Nageezi), El Camino Real de Tierra Adentro (New Mexico and Texas), El Malpais National Monument (Grants), El Moro National Monument (Ramah), Gila Cliff Dwellings (Silver City), Organ Mountains Desert Peak National Monument (Dona Ana County), Pecos National Monument (Pecos), Petroglyph National Monument (Albuquerque), Valles Caldera National Preserve (Jemez Springs), White Sands National Monument (Alamogordo). New Mexico also contains many State monuments, including the Jemez State Monument in Jemez Springs, the Coronado State Monument in Bernalillo County, the Fort Sumner State Monument, the Lincoln State Monument, and the Fort Selden State Monument in Radium Springs.

3.6.3 Agriculture and Animal Production

Agriculture is dispersed across the State and is vulnerable to most natural hazards particularly fire, flooding, drought, and severe weather. Agriculture production in the State of New Mexico is the State's third largest economy and is important regionally, nationally, and internationally. In New Mexico, all counties have some form of food and fiber production. In addition to the top economic crops grown in the State other crops include hay, alfalfa, corn, cotton, sorghum, wheat onions, peanuts, and pistachios. Many small vineyards and fruit orchards are scattered around the State. The world's largest cheese production plant is in New Mexico and survives because of the State's dairy industry.

In 2021, New Mexico's total value of agriculture production was slightly higher at $3.17 billion, 5 percent above 2020. New Mexico chili pepper and pecan production ranked in the top two spots in the nation in

2021. Also contributing to the state's value of production, onions ranked 3rd in the nation at $128 million, milk ranked 9th in the nation at $1.26 billion, and cattle and calves ranked 16that $1.07 billion.

The total value of the agriculture sector output from New Mexico totaled $3.49 billion, up 4 percent from 2020. The value of livestock production decreased slightly to $2.32 billion in 2021. Crop value increased to $740 million, up 18 percent from a year earlier. Revenues from farm-related income totaled nearly $426 million in 2021, up 5% from the previous year. After deductions for production expenses, hired labor, and other economic factors, the state's net farm income was down to $839 million.

New Mexico crop and livestock product sales in 2021 totaled $3.2 billion, a 5% increase from the previous year. Total cash receipts from livestock products in 2021 increased 2% from the previous year to $2.41 billion. The number one cash commodity for the state was milk followed by cattle and calves. Total crop cash receipts were higher when compared with 2020, at $756 million. Pecan sales increased to $189 million in 2021 and ranked third overall behind milk and cattle. Onions ranked as the fourth largest cash commodity in the state at $128 million. Hay came in as the fifth commodity, followed by cotton.

New Mexico farmers and ranchers purchased $2.06 billion of inputs in 2021 to produce crops and livestock. This was up 6.4% from the previous year. As in earlier years, livestock feed continued to be the largest purchase at $790 million, followed by livestock purchases of $362 million. Petroleum fuel and oil costs were up to $121 million while repair and maintenance of capital items cost farmers and ranchers $150 million, a decrease of 1% from the previous year.

Direct government payments to New Mexico producers totaled $204 million in 2021. Conservation program payments decreased to $43.1 million. Ad hoc and disaster programs decreased to $141 million. Price Loss Coverage payments decreased from $22.8 million in 2020 to $9.26 million in 2021.

3.7 Demographic Features

3.7.1 Population

New Mexico's population reached 2,117,522 in 2020, according to the U.S. Census Bureau, ranking the State 36th in the nation for population. Population in New Mexico grew by 2.8% between 2010 and 2020. This growth, which was lower than the national growth of 7.4%, ranked the State 40th in the nation. In 2023, there are 797,596 households in New Mexico with an average household size of 2.59 people and there are 497,024 families with an average family size of 3.3 people.

Between 2020 and 2021, the Census Bureau estimated that the State of New Mexico experienced a -0.2% change in the population. In 2022, the counties with the highest populations in New Mexico are Bernalillo County (684,730), Dona Ana County (224,974), and Santa Fe County (153,634). In New Mexico between 2010 and 2021, Sandoval County had the largest growth with 18,932 more residents and San Juan County had the largest decline with 9,216 fewer people. Table 3-7 shows New Mexico's population growth from 2017 to 2022.

New Mexico's population growth rate between 2010 and 2021 was basically unchanged over the past decade with a natural increase in population from births, at a 2.8% increase. This is the smallest rate recorded for New Mexico since statehood in 1912. During the period, the natural increase of the population equaled 51,263 people (contributing to 68% of the population change), while net migration dropped at -2,405 people (contributing to 32% of the population change). This ranked the State 28th in the nation for rate of net migration. According to US Census.gov, New Mexico in 2023 is experiencing a growth rate of 0.64% annually, which ranks 30th in the country.

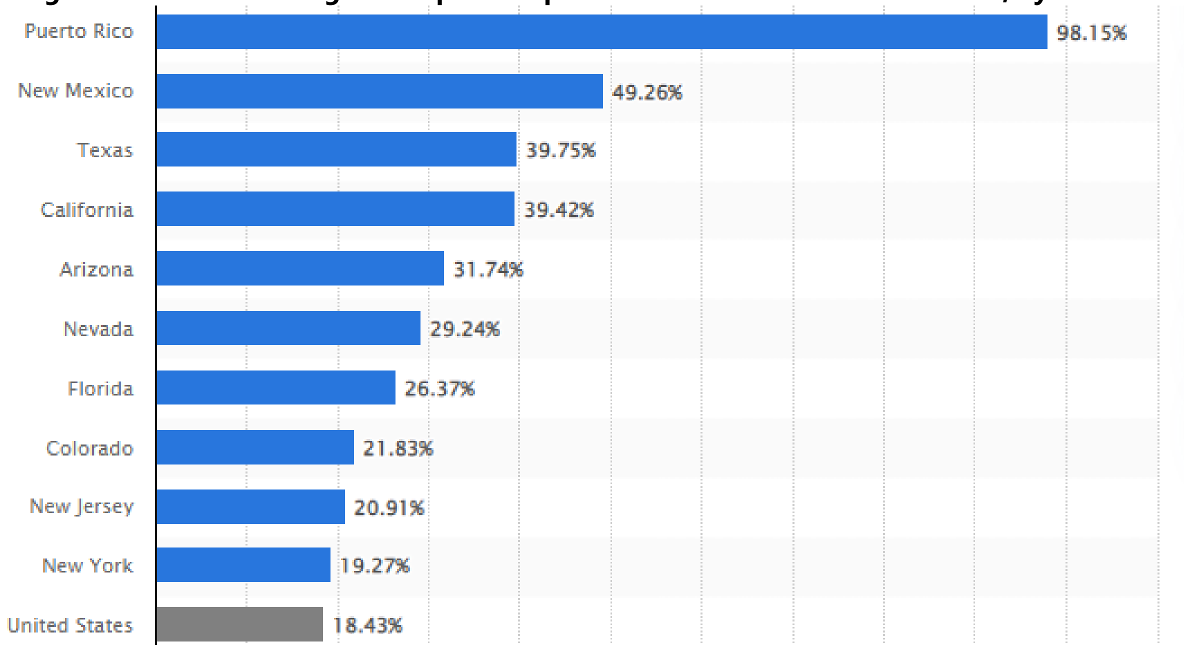
As of 2021, 50.1% of New Mexico's population was Hispanic/Latino, which is the largest concentration of Hispanic/Latino residents than any other U.S. State (Figure 3-8). The minority racial group with the largest share of New Mexico's population as of 2021 was American Indian/Alaska Native at 11.2%. In 2021, persons identifying as two or more races was recorded at 2.7%, and 2.7% of people were of Black/African descent. The population that is White alone, not Hispanic or Latino, was 35.9% of the state's population.

Table 3-6 New Mexico's Population Growth From 2017 to 2022

Region	2022 Population	Annual Growth 2017-2022 (%)	Population Growth 2022 (%)
Bernalillo	684.7k	0.20%	32.30%
Dona Ana	225.0k	0.80%	10.60%
Santa Fe	153.6k	0.60%	7.30%
Sandoval	152.8k	1.30%	7.20%
San Juan	121.3k	-0.80%	5.70%
Valencia	78.6k	0.70%	3.70%
Lea	73.3k	1.00%	3.50%
Mckinley	69.7k	-0.80%	3.30%
Otero	69.1k	0.80%	3.30%
Chaves	64.7k	Not Available	3.00%
Eddy	58.9k	0.40%	2.80%
Curry	48.2k	-0.60%	2.30%
Rio Arriba	38.0k	-0.60%	1.80%
Taos	32.4k	-0.30%	1.50%
San Miguel	26.8k	-0.70%	1.30%
Grant	26.7k	-0.50%	1.30%
Cibola	25.9k	-0.80%	1.20%
Luna	23.9k	Not Available	1.10%
Lincoln	20.2k	0.80%	0.90%
Los Alamos	19.9k	1.10%	0.90%
Roosevelt	18.0k	-0.90%	0.80%
Socorro	16.4k	-0.50%	0.80%
Torrance	15.5k	Not Available	0.70%
Colfax	11.7k	-0.80%	0.60%
Sierra	10.8k	-0.50%	0.50%

Source: IBISWorld https://www.ibisworld.com/

Figure 3-8 Percentage of Hispanic Population in the United States in 2019, by State



Source: Statista https://www.statista.com/

In 2017, the University of New Mexico's Geospatial Population Studies released a set of population growth projections for the time period 2010 to 2040. Table 3-7 shows New Mexico total population growth projections by county.

Table 3-7 New Mexico Projected Population Growth (2010 - 2040)

County	2000 Census	2010 Census	2020 Census	2025 Projection	2030 Projection	2035 Projection	2040 Projection
Bernalillo	556,678	662,564	679,037	740,500	763,571	783,612	799,465
Catron	3,543	3,725	3,547	3,109	2,875	2,641	2,418
Chaves	61,382	65,645	64,912	70,083	71,403	72,607	73,393
Cibola	25,595	27,213	26,763	28,875	29,030	29,103	29,058
Colfax	14,189	13,750	12,106	12,114	11,893	11,651	11,397
Curry	45,044	48,376	49,502	54,849	56,339	57,951	59,581
De Baca	2,240	2,022	1,995	1,776	1,687	1,605	1,520
Doña Ana	174,682	209,233	217,696	244,455	255,070	264,537	273,074
Eddy	51,658	53,829	57,865	58,220	58,547	58,609	58,233
Grant	31,002	29,514	27,391	27,449	26,407	25,371	24,365
Guadalupe	4,680	4,687	4,336	4,555	4,468	4,374	4,251
Harding	810	695	432	587	545	504	462
Hidalgo	5,932	4,894	4,234	4,333	4,072	3,809	3,535
Lea	55,511	64,727	70,359	77,308	78,992	80,612	81,635
Lincoln	19,411	20,497	19,640	19,145	18,455	17,699	16,915
Los Alamos	18,343	17,950	18,976	17,326	17,092	16,846	16,426
Luna	25,016	25,095	24,022	25,021	24,795	24,589	24,348

County	2000 Census	2010 Census	2020 Census	2025 Projection	2030 Projection	2035 Projection	2040 Projection
McKinley	74,798	71,492	71,956	76,604	76,623	76,256	75,365
Mora	5,180	4,881	4,500	4,424	4,210	3,997	3,774
Otero	62,298	63,797	66,804	65,606	65,304	64,977	64,402
Quay	10,155	9,041	8,265	7,997	7,797	7,580	7,323
Rio Arriba	41,190	40,246	38,962	40,649	40,041	39,332	38,496
Roosevelt	18,018	19,846	18,723	21,896	22,328	22,586	22,719
San Juan	113,801	130,044	144,954	131,278	134,446	137,173	138,762
San Miguel	30,126	29,393	125,608	27,843	26,753	25,495	24,123
Sandoval	89,908	131,561	144,954	163,767	180,269	197,371	213,929
Santa Fe	129,292	144,170	150,319	157,104	162,782	169,142	175,242
Sierra	13,270	11,988	10,988	9,964	9,357	8,821	8,368
Socorro	18,078	17,866	16,723	17,922	17,616	17,252	16,812
Taos	29,979	32,937	32,759	33,309	33,172	32,855	32,336
Torrance	16,911	16,383	15,477	15,424	15,324	15,089	14,684
Union	4,174	4,549	4,106	4,501	4,491	4,467	4,413
Valencia	66,152	76,569	76,518	79,574	82,721	81,576	80,655
State Total	**1,819,046**	**2,059,179**	**2,117,522**	**2,247,564**	**2,308,475**	**2,360,091**	**2,401,480**

Source: US Census Bureau, Geospatial and Population Studies Group, University of New Mexico

3.7.2 Housing

According to the Census Bureau American Community Survey one-year estimates, the total number of occupied housing units in the State in 2021 totaled 948,110, with a homeownership rate of 68.2%. The State-wide median value of owner-occupied housing units was $184,800 per unit (national median value is $244,900 per unit). The median value is much higher in urban/suburban and resort areas in the State. The median value of a residential structure in Santa Fe County, for example, is approximately $315,100. The State-wide average household size was 2.59 persons per household for 797,596 households. The national average is 3.13 persons per household.

3.7.3 Income

The per capita income for New Mexico 2017-2021 (in 2021 dollars) is $29,624, ranking the State 49th in the nation for income. On average, New Mexico's real per capita personal income grew at an annual rate of 2.05% over 1959-2021. The state posted its highest growth in 2020 (6.25%) and recorded its lowest growth in 2013 (-3.16%). In 2021, New Mexico's real per capita personal income grew by 3.43%. New Mexico’s annual median household income was $54,020 and the average household income is $74,363, as of 2021.

3.8 Utilities and Infrastructure

3.8.1 Electricity

New Mexico has several large power generating facilities, upon which significant portions of the State are dependent. The Four Corners Power Plant and San Juan Power Plant northwest of Farmington in San Juan County are the two major power generation plants in the State. Both plants not only generate electricity for New Mexico, but also for Arizona, Utah, and Colorado. The Four Corners Power Plant is operated by the Arizona Public Service Company and provides electrical transmission to the Tucson Power Company, the

Pacific Corporation in Utah, and the Western Area Power Administration in Colorado. The San Juan Power Plant is run by the Public Utility Company of New Mexico (PNM) and provides electrical transmission to many rural electric cooperatives, as well as customers in the Albuquerque Metro Area. Other major PNM generating plants are located in Albuquerque, Afton, and Las Vegas.

3.8.2 Gas

There are several natural gas distributors serving the population of New Mexico. PNM is the major distributor, along with the El Paso Natural Gas Company, Transwestern Pipeline Company, and the Natural Gas Pipeline Company of America.

Two major gas pipelines cross the State, running roughly parallel southeast from Gallup toward Roswell and Carlsbad. There are several regional gas pipelines serving the valley areas, but not crossing over any mountain passes. Major gas pipeline compressor stations are located in Otero, Sierra, Lea, Curry, Rio Arriba, San Juan, Sandoval, McKinley, Bernalillo, and Valencia Counties. Within the State are many propane distributors, which are dependent upon truck and rail transportation.

Located west of the Albuquerque International Sunport are several bulk petroleum tank farms. These facilities are located near the Rio Grande and are primarily in agricultural and light industrial areas.

New Mexico has a significant oil production industry. There are two major refineries in the State, one east of Gallup and the largest one in Artesia.

3.8.3 Water Supply

Water is a precious resource in New Mexico, which averages only 13.85” of rain a year. The State relies on both groundwater and surface water sources, but about 87% of New Mexico’s public water supply comes from ground water. No other southwestern state gets such a large percentage of its domestic water from groundwater sources. Surface water (rivers, lakes, and streams) in New Mexico originates as rain or melting snow, but over 95% of that water evaporates or is transpired by plants. Most jurisdictions have their own water companies, while extensive rural areas are dependent upon private wells or mutual domestic water users’ associations.

Currently, the State’s principal surface water supplies are low due to drought conditions that have prevailed for many years. Drought conditions have impacted groundwater supplies as well, and the reduction of well water reserves is a serious concern for the State’s water planners. Forest and watershed health conditions in contributing headwater areas affect New Mexico’s surface water supplies and groundwater recharge. Aging water infrastructure exacerbates the problem: the City of Truth or Consequences recently reported that in 2022 43% of the City’s water supply was lost due to leaks in the City’s water supply system.

3.9 Transportation

3.9.1 Roadways

Three major interstate highways serve New Mexico: I-40, I-10, and I-25. I-40, running through Albuquerque, is the major east/west corridor through central New Mexico. I-10 serves the southern portion of the State from El Paso through Las Cruces to the Arizona border. I-25 is the major north-south corridor in the State, originating in Las Cruces, running northward through Albuquerque, and continuing into Colorado. I-40 and I-25 converge in Albuquerque to form an intersection popularly known as "the Big I."

New Mexico has many important highway bridges crossing the Rio Grande and other major rivers. In urban areas such as Albuquerque and Las Cruces, there are other routing alternatives if a bridge should be rendered inoperable. In areas that are more rural river crossings are less frequent, and considerable detouring would be necessary if a bridge were to close.

3.9.2 Railroads

Since 1878, when the first transcontinental railway service began across New Mexico, railways have been an important component of the State's transportation and economic network. Two freight carriers (BNSF and Union Pacific) and a passenger train (Amtrak) serve the State. In addition to carrying large tonnages of freight from the West coast, the railways serve as a mechanism for transporting hazardous materials, which are a major concern to populated areas along the rails, specifically the Albuquerque metro area. In addition, the State operates a narrow-gauge tourist railroad called the Cumbres, and Toltec Scenic Railroad. This tourist railroad runs between Chama, New Mexico, and Antonito, Colorado.

The Burlington Northern Santa Fe (BNSF) Railroad hauls 90% of all freight originating in New Mexico and 80% of all cargo terminating in the State. The BNSF has two major routes that provide east-west and north-south service. The east-west route from the Texas border generally parallels U.S. Route 60 thru Vaughn to Belen. From Belen, the route parallels State Road 6 toward the intersection again with I-40.

3.9.3 Rail Runner Express

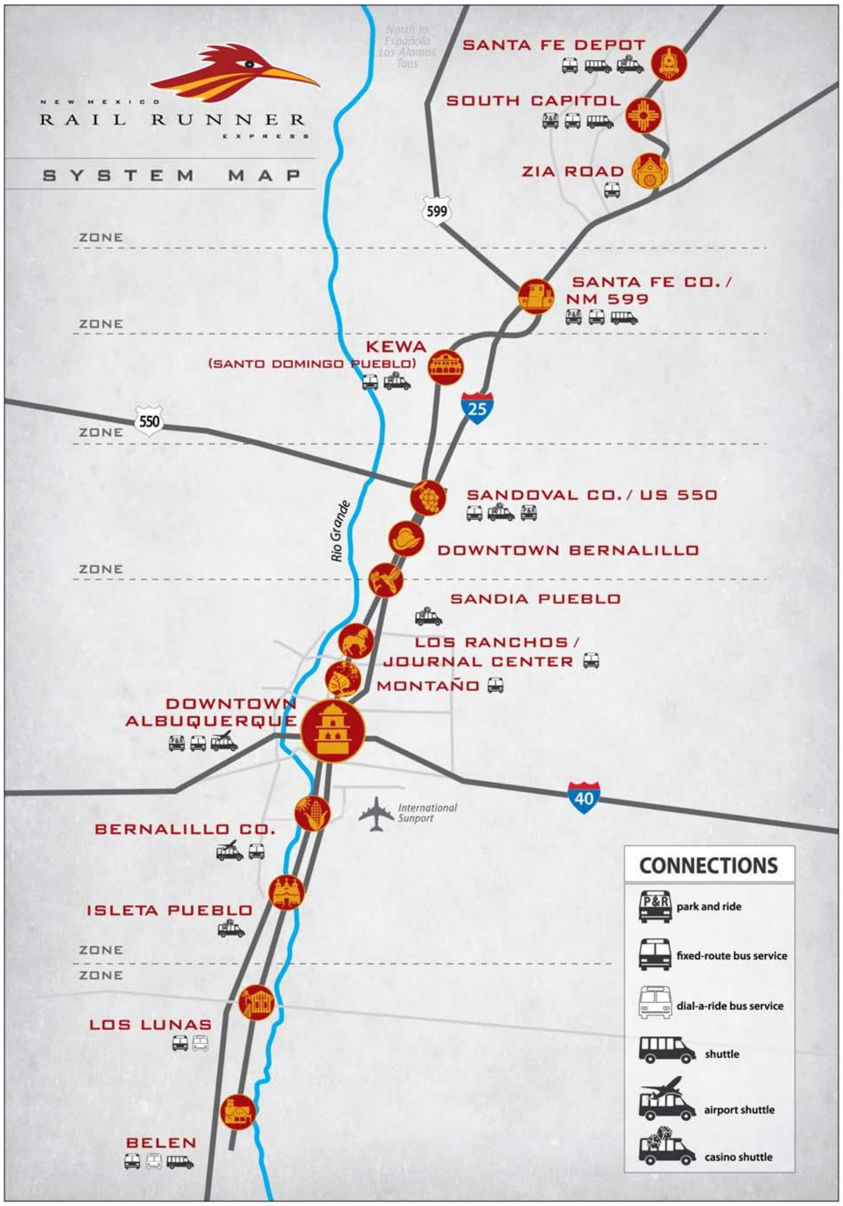
The New Mexico Department of Transportation and the Mid-Region Council of Governments are responsible for developing the Rail Runner. While the NMDOT is the ultimate authority responsible for the Rail Runner, the Mid-Region Council of Governments is the lead agency for implementation of the new passenger rail service. The Rail Runner Express is a commuter rail system serving the metropolitan area of Albuquerque, New Mexico. The Rail Runner Express is administered by the New Mexico Department of Transportation (NMDOT) and a regional government planning association known as the Mid-Region Council of Governments (MRCOG).

In addition to the NMDOT and the MRCOG, local governments (including counties, towns, and the Native American Tribes and Pueblos in the corridor) all play key roles in the planning and execution of the Rail Runner. This local involvement is an essential ingredient in the development of the project. Specifically, local jurisdictions have participated in the planning stages as well as the facilitation of public involvement and outreach. These communities will play important roles in the day-to-day operations of the Rail Runner.

The Rail Runner officially went into service on July 14, 2006. Using the existing Santa Fe Southern Railway track from Lamy to Santa Fe, which is filled with sharp curves, would have required the train to slow to 15 miles per hour (24 km/h) in some places, so new tracks were laid to the west (near Interstate 25) to produce travel times comparable to the automobile. The route uses a previously existing track from Bernalillo to the base of La Bajada, a hill south of Santa Fe. It then runs on a newly built track, with a new associated right-of-way to Santa Fe. In Santa Fe, the Rail Runner uses improved Santa Fe Southern Railway track from I-25 to the terminal at the Santa Fe Railyard (Figure 3-9). The Rail Runner currently serves the following communities:

- Cities, Villages, and Towns: City of Belen, Village of Los Lunas, City of Albuquerque, Town of Bernalillo, and the City of Santa Fe
- Counties: Valencia County, Bernalillo County, Sandoval County and Santa Fe County

Figure 3-9 Rail Runner System Map



Source: Rio Metro Regional Transportation District https://www.riometro.org/

3.9.4 Airports

New Mexico is home to 65 FAA-recognized airports. Of these, the Albuquerque International Sunport, the Las Cruces International Airport, and the Santa Fe Airport are the only ones with out-of-state commercial service. Nine of the State's airports have unpaved runways suitable only for light aircraft. Two of the State's airports, Holloman AFB and Cannon AFB, are not open for public use.

The Albuquerque International Sunport is the main arrival and departure point for New Mexico, with commuter flights available to Clovis, Hobbs, Farmington, Gallup, Roswell, Ruidoso, and Silver City.

Kirtland AFB provides aircraft rescue and firefighting services for the Albuquerque Sunport and shares their runways. FAA facilities in Albuquerque include the Airport District Office, Air Traffic Control Tower, Automated Flight Service Station, Civil Aviation Security Office, Flight Standards District Office, and Rio Grande SMO (Airways Facilities). The Transportation Security Administration (TSA) occupies office space at the historic Old Terminal Building. The National Weather Service and U.S. Postal Service Express Mail Facility are also located at the airport. Adjacent to the airport is a major Southwest Airlines Reservations Center.

Corporate jet manufacturer Eclipse Aviation has expanded its operations to Double Eagle II Airport. This airport located on Albuquerque's west side is used primarily for training, military, air ambulance service, charter, and corporate flights.

3.9.5 Waste Isolation Pilot Plant (WIPP) Program

The Waste Isolation Pilot Plant (WIPP), shown in Figure 3-4, is the nation's only deep geologic long-lived radioactive waste repository. Located 26 miles southeast of Carlsbad, WIPP permanently isolates defense-generated transuranic (TRU) waste 2,150 feet underground in an ancient salt formation. WIPP's disposal rooms are nearly a half mile below the surface. By comparison, the Empire State Building is only 1,454 feet high.

TRU waste began accumulating in the 1940s with the beginning of the nation's nuclear defense program. As early as the 1950s, the National Academy of Sciences recommended deep disposal of long-lived TRU radioactive wastes in geologically stable formations, such as deep salt beds. Sound environmental practices and strict regulations require such wastes to be isolated to protect human health and the environment.

Bedded salt is free of fresh flowing water, easily mined, impermeable and geologically stable — an ideal medium for permanently isolating long-lived radioactive wastes from the environment. However, its most important quality in this application is the way salt rock seals all fractures and naturally closes all openings.

Throughout the 1960s, government scientists searched for an appropriate site for radioactive waste disposal, eventually testing a remote desert area of southeastern New Mexico where, 250 million years earlier, evaporation cycles of the ancient Permian Sea had left a 2,000-foot-thick salt bed. In 1979, Congress authorized WIPP, and the facility was constructed during the 1980s. Congress limited WIPP to the disposal of defense-generated TRU wastes in the 1992 Land Withdrawal Act. In 1998, the U.S. Environmental Protection Agency certified WIPP for safe, long-term disposal of TRU wastes. On March 26, 1999, the first waste shipment arrived at WIPP from Los Alamos National Laboratory in New Mexico.

In February 2014, a fire broke out in the underground facility, prompting an evacuation. WIPP shipments and site operations were halted for three years of cleanup, reopening in January 2017.

In September 2017, the Department of Energy issued a modification to the contract with Nuclear Waste Partnership (NWP) for the management and operations of WIPP. The contract modification enhances the focus on safety, provides cost incentives that will increase the value to the taxpayers, and rewards the workforce for safe and efficient operations. The contract modification also provides greater support for the community of Carlsbad. The Department has extended NWP's period of performance to September 30, 2020, which exercises a newly negotiated option to extend three of the available five years remaining on the contract.

In 2019, utility shaft construction began under a $135 million contract. Completion of Panel 8 was scheduled for 2020. More than 112,000 tons of salt will be removed from the underground to complete the panel, which will contain seven disposal rooms for waste emplacement. Each disposal room is 300 feet long, 33 feet wide and 13 feet high. Mining at WIPP is timed so that a panel is only ready when it is needed for waste emplacement. This is because the natural movement of salt causes mined openings to close. In fact, panels are mined slightly larger than the desired size to account for this closure. This is the salt rock behavior that will eventually permanently encapsulate the waste.

In 2021, WIPP implemented a variety of safety improvements and ventilation testing began. The increased airflow provides added comfort to the underground workers and better support of the Department of Energy's operational mission. Additionally, the NWP awarded a subcontract valued at approximately $163 million for the construction of the Safety Significant Confinement Ventilation System. In 2022, enhancement of the contract between NWP and WIPP are expected to ensure WIPP is operated safely and efficiently in both waste emplacement and mining operations.

3.10 Social Vulnerability

Vulnerability to disasters depends on more than the relationship between a place and its exposure to hazards. Social vulnerability to disasters refers to the characteristics and situation of a person or group that influence their capacity to anticipate, cope with, resist, or recover from the impact of a hazard. It is determined by a number of pre-existing social and economic characteristics, including race, age, income, renter status, or institutionalized living. These overburdened communities are not inherently vulnerable because of their demographics, but often experience greater risk from climate change and other hazards because of a history of structural racism and environmental discrimination. Very often, the impacts of hazards fall disproportionately on the most underserved or marginalized people in a community – people with low income, children, people who are aging, people with disabilities, and minorities. During emergencies, for example, self-evacuation can be difficult or nearly impossible for individuals who are disabled or institutionalized. Additionally, the willingness of an individual/family to invest in residential mitigation actions is often limited if their home is a rental and they are averse to investing money in long-term mitigation activity. Not only do conditions like these limit the ability of some communities to get out of harm's way, but they also decrease the ability of communities to recover from and thrive in the aftermath of a disaster event.

The term social vulnerability is used here to describe communities more vulnerable to a risk or hazard, such as high vulnerability due to wildfires or floods based upon geography, topography, hydrology, or weather. Referencing people themselves directly with the term vulnerable can cause individual community members to be seen with a deficit lens, leaving the impression that the vulnerability is a result of the lack of responsibility and/or adequate planning of the individual. Instead, vulnerability occurs when the system that the individual is part of fails to provide equitable accessibility to resources or services, known as access and functional needs, for the individual to survive, respond to, and recover from an event. Barriers that may be exacerbated by certain social and economic factors – including race, age, income, renter status, or institutionalized living – directly affect a community's ability to prepare for, respond to, and recover from hazards and disasters. The concept of social vulnerability helps explain why communities often experience a hazard event differently, even when they experience the same physical impacts or property loss.

Social vulnerability analysis is particularly useful in the context of hazard mitigation planning because it can reveal disparities within a community that make a difference when it comes to the ability of residents to mitigate, prepare, evacuate, mobilize resources, and recover from disasters. Areas on the map that have medium to high social vulnerability represent areas where age, poverty, race/ethnicity, or special needs factors may make it more difficult for people to prepare, respond, and recover from hazard events. Social vulnerability information can also be used to help communities design effective and appropriate local risk communication and hazard mitigation outreach activities.

The HMPC examined several existing methods of measuring social vulnerability, particularly the SVI index developed by the US Centers of Disease Control and Prevention (CDC) and the SoVI index developed by the University of South Carolina. However the HMPC felt that none of the existing methodologies did a good job of capturing New Mexico's unique conditions and concerns. Instead a number of key metrics were examined individually to compare the social vulnerability of New Mexico counties, using data from the New Mexico Department of Health and the 2020 U.S. Census:

- Children Under Age 18 Living in Poverty
- People 65 Years or Older
- Unable to Get Needed Medical Care Because of Cost
- Adults Experiencing Frequent Mental Distress
- High School Graduation Rate
- Unemployment Rate
- People With Disabilities: People with disabilities
- Mobile Homes
- Households with No Vehicle
- Households w/o Broadband

The following tables list these characteristics for each county and for the state as a whole. (NA indicates data was not available for that county.) Counties are listed from highest vulnerability to lowest. The hazard profiles in Section 6 discuss how those hazards can have disproportionate impacts on vulnerable populations. This data can be better understood through maps; see NMclimateriskmap.org for a free, easy to use web application using up-to-date data.

3.10.1 Children Under Age 18 Living in Poverty

Young children frequently need more assistance during disasters. Families living in poverty have fewer resources to prepare for, mitigate against, and recover from hazard events and disasters. Children born into poverty are less likely to have regular health care, proper nutrition, and opportunities for mental stimulation and enrichment, leading to long-term increased vulnerability.

Jurisdiction	Children Under 18 in Poverty
McKinley	39.3%
Socorro	38.1%
Catron	36.4%
Quay	34.9%
Luna	34.6%
Sierra	33.5%
Cibola	32.4%
San Juan	29.7%
De Baca	29.2%
Guadalupe	28.9%
Lincoln	28.6%
Torrance	27.6%
Dona Ana	27.3%
Union	27.2%
Rio Arriba	27.1%
Taos	26.6%
Hidalgo	26.3%
Chaves	26.2%
Grant	26.2%
Mora	26.1%
San Miguel	25.5%
Colfax	25.2%
Otero	24.7%
Roosevelt	24.1%
Harding	23.7%
New Mexico	**21.6%**
Valencia	20.4%
Curry	19.4%
Santa Fe	17.4%
Bernalillo	17.0%
Eddy	14.2%
Lea	14.2%
Sandoval	12.2%
Los Alamos	2.8%

3.10.2 People 65 Years or Older

Senior Citizens tend to be more vulnerable to hazard events, both due to decreased health resilience, a lack of resources, and in many cases increased social isolation.

Jurisdiction	People 65+ Years
Catron	41.6%
Sierra	36.4%
Mora	31.0%
Harding	29.2%
Lincoln	28.6%
Colfax	27.7%
Grant	27.2%
Taos	26.4%
Quay	24.7%
Santa Fe	24.3%
Hidalgo	21.9%
San Miguel	21.5%
Union	21.1%
Guadalupe	20.7%
Torrance	20.6%
Luna	20.5%
Socorro	19.4%
Rio Arriba	19.3%
Sandoval	17.8%
Valencia	17.8%
Los Alamos	17.6%
New Mexico	**17.4%**
Otero	17.2%
Cibola	16.8%
Bernalillo	16.3%
Chaves	15.8%
Dona Ana	15.7%
San Juan	14.8%
De Baca	14.5%
Eddy	14.4%
Roosevelt	14.3%
Curry	12.4%
McKinley	12.3%
Lea	11.1%

3.10.3 Unable to Get Needed Medical Care Because of Cost

Lack of health insurance coverage has been associated with increased risk of chronic disease and mortality. People who forgo needed health care services may be more likely to succumb to preventable illnesses and to suffer complications from those illnesses, and possibly be more likely to die prematurely. They also are likely to be far less resilient to disasters.

Jurisdiction	Unable to Get Medical Care
Colfax	21.4%
Lea	20.1%
San Juan	18.4%
Socorro	18.1%
Chaves	17.1%
McKinley	17.1%
Roosevelt	15.4%
Santa Fe	13.7%
San Miguel	13.6%
Catron	13.4%
Curry	13.3%
Quay	13.3%
Hidalgo	13.2%
Sandoval	13.1%
Torrance	13.1%
Valencia	12.7%
Dona Ana	12.4%
Eddy	12.3%
Luna	12.2%
Bernalillo	12.0%
Grant	11.7%
Cibola	11.5%
Union	11.3%
Rio Arriba	11.1%
Sierra	9.9%
New Mexico	**9.8%**
Guadalupe	9.8%
Mora	9.5%
Los Alamos	9.4%
Lincoln	7.5%
Otero	6.7%
Taos	3.1%
De Baca	NA
Harding	NA

3.10.4 Adults Experiencing Frequent Mental Distress

Among measures that have been suggested by the CDC as potential tools for assessing population well-being and mental health is the frequency with which people experience poor mental health. This measure is based on the single question, "How many days during the past 30 days was your mental health not good?" Respondents who report that they experienced 14 or more days when their mental health was "not good" were classified as experiencing Frequent Mental Distress.

Jurisdiction	People in Mental Distress
Luna	28.8%
San Miguel	25.4%
Roosevelt	24.7%
Bernalillo	24.4%
Rio Arriba	24.4%
Cibola	24.0%
Grant	24.0%
Eddy	23.4%
San Juan	23.4%
New Mexico	**22.0%**
Dona Ana	22.0%
Santa Fe	21.4%
Chaves	20.7%
Lea	20.3%
Otero	20.3%
Sandoval	19.3%
Valencia	17.1%
McKinley	17.0%
Lincoln	16.1%
Curry	14.5%
Taos	14.1%
Los Alamos	10.6%
Catron	NA
Colfax	NA
De Baca	NA
Guadalupe	NA
Harding	NA
Hidalgo	NA
Mora	NA
Quay	NA
Sierra	NA
Socorro	NA
Torrance	NA
Union	NA

3.10.5 High School Graduation Rate

Education level is associated with better earning potential and higher income. Short-term health problems associated with not graduating from high school include substance use, pregnancy, and psychological, emotional, and behavioral problems. Mental illness and emotional disturbance also account for a significant proportion of students who don't graduate.

Jurisdiction	High School Graduation
Guadalupe	5.00%
De Baca	6.30%
Los Alamos	8.60%
Grant	14.80%
Hidalgo	15.30%
Dona Ana	16.70%
Lea	17.20%
Sandoval	18.50%
San Miguel	18.90%
Roosevelt	19.90%
Curry	20.20%
Torrance	20.60%
Eddy	20.70%
Lincoln	21.70%
Mora	21.90%
Otero	22.80%
McKinley	23.80%
Valencia	23.90%
New Mexico	**25.00%**
Quay	25.20%
Sierra	25.30%
San Juan	25.60%
Taos	26.10%
Chaves	27.40%
Santa Fe	29.10%
Bernalillo	29.20%
Colfax	31.60%
Cibola	32.60%
Socorro	32.80%
Rio Arriba	33.40%
Luna	37.80%
Catron	60.60%
Harding	NA
Union	NA

3.10.6 Unemployment Rate

Areas with higher unemployment have fewer financial resources, and unemployed people may have fewer social connections.

Jurisdiction	Unemployment Rate
McKinley	7.2%
Cibola	6.8%
Luna	5.6%
Roosevelt	5.1%
De Baca	5.0%
San Juan	4.9%
Taos	4.8%
Dona Ana	4.4%
Sierra	4.4%
Sandoval	4.1%
Valencia	4.0%
Rio Arriba	3.9%
New Mexico	**3.8%**
Lea	3.8%
Otero	3.7%
San Miguel	3.7%
Curry	3.6%
Hidalgo	3.6%
Mora	3.6%
Bernalillo	3.5%
Grant	3.4%
Torrance	3.3%
Colfax	3.1%
Chaves	2.9%
Eddy	2.8%
Guadalupe	2.6%
Catron	2.5%
Quay	2.5%
Santa Fe	2.4%
Los Alamos	2.3%
Lincoln	2.1%
Socorro	2.0%
Union	1.3%
Harding	0.5%

3.10.7 People With Disabilities

People with disabilities can be disproportionately affected by hazard events and often need more assistance following a disaster. For example, people who depend on electricity for oxygen or mobility can be threatened by power outages.

Jurisdiction	People With Disabilities
Mora	35.3%
Catron	32.1%
San Miguel	26.0%
Sierra	25.5%
Colfax	24.4%
Socorro	24.2%
Union	23.2%
Cibola	22.1%
Quay	22.0%
Lincoln	21.8%
Valencia	21.0%
Grant	20.6%
Luna	20.6%
Guadalupe	19.5%
Hidalgo	19.5%
Roosevelt	19.4%
Otero	19.3%
Torrance	18.6%
Harding	18.3%
Taos	17.5%
Chaves	17.0%
Curry	17.0%
De Baca	17.0%
McKinley	16.1%
New Mexico	**15.8%**
San Juan	15.0%
Eddy	14.9%
Rio Arriba	14.7%
Dona Ana	14.6%
Bernalillo	14.5%
Santa Fe	14.2%
Sandoval	13.9%
Lea	12.1%
Los Alamos	8.5%

3.10.8 Percentage of Housing That are Mobile Homes

Manufactured homes are more vulnerable to many hazards such as high winds and tornadoes.

Jurisdiction	Mobile Homes
Torrance	42.7%
Sierra	39.3%
Hidalgo	39.0%
Rio Arriba	36.5%
Socorro	36.4%
San Miguel	35.2%
Luna	33.7%
Valencia	32.4%
San Juan	32.3%
Catron	31.2%
Mora	30.3%
Guadalupe	29.5%
Otero	26.5%
Grant	26.0%
Cibola	25.7%
Quay	25.6%
De Baca	22.4%
McKinley	22.1%
Lincoln	22.0%
Dona Ana	21.3%
Harding	21.0%
Roosevelt	18.8%
Union	18.3%
Colfax	18.2%
Lea	17.6%
Taos	17.2%
New Mexico	**16.7%**
Eddy	16.5%
Chaves	14.6%
Santa Fe	14.6%
Curry	9.2%
Sandoval	8.7%
Bernalillo	5.5%
Los Alamos	4.5%

3.10.9 Households with No Vehicle

Many evacuation plans assume that a large percentage of residents will be able to self-evacuate. Households without access to a vehicle are more likely to need help evacuating or getting resources.

Jurisdiction	Households with No Vehicle
De Baca	11.0%
McKinley	10.5%
Harding	10.2%
Colfax	8.2%
Luna	7.9%
Sierra	7.5%
Socorro	7.1%
Bernalillo	6.9%
Cibola	6.6%
San Miguel	6.5%
Union	6.3%
Dona Ana	6.2%
Roosevelt	5.8%
New Mexico	**5.7%**
Grant	5.7%
Guadalupe	5.7%
Hidalgo	5.7%
San Juan	5.4%
Rio Arriba	5.3%
Otero	5.2%
Chaves	5.0%
Mora	4.9%
Taos	4.9%
Eddy	4.7%
Quay	4.6%
Catron	4.4%
Lincoln	4.1%
Lea	3.9%
Santa Fe	3.9%
Curry	3.6%
Valencia	3.3%
Torrance	3.0%
Sandoval	2.9%
Los Alamos	2.4%

3.10.10 Households Without Broadband Internet

Lack of broadband access correlates to low financial resources in general, and also makes it more difficult to get access to information before, during, and after a disaster.

Jurisdiction	Households w/o Broadband
Mora	54.4%
McKinley	52.7%
Guadalupe	48.5%
Harding	48.3%
Catron	42.5%
Socorro	40.7%
Quay	39.9%
Rio Arriba	39.3%
San Miguel	36.0%
Cibola	35.8%
San Juan	33.3%
Union	32.9%
Torrance	32.7%
Sierra	31.3%
De Baca	31.2%
Luna	30.7%
Valencia	28.6%
Colfax	28.5%
Chaves	27.0%
Hidalgo	26.7%
Taos	25.8%
Lincoln	23.0%
Dona Ana	22.6%
New Mexico	**22.1%**
Grant	21.4%
Eddy	19.6%
Lea	19.4%
Roosevelt	18.7%
Santa Fe	18.0%
Otero	17.1%
Bernalillo	17.0%
Curry	15.8%
Sandoval	14.4%
Los Alamos	8.4%

4 State Mitigation Capabilities

44 CFR Part 201.4
This section shall include [a] discussion of the State's pre- and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including: an evaluation of State laws, regulations, policies, and programs related to hazard mitigation as well as to development in hazard-prone areas; a discussion of State funding capabilities for hazard mitigation projects; [and] identification of current and potential sources of Federal, State, local, or private funding to implement mitigation activities.

This chapter documents the policies, programs, capabilities, and funding resources for the State of New Mexico to implement and manage a comprehensive mitigation strategy. The strengths, challenges, and resources of partner agencies and jurisdictions are identified in this assessment as a means for developing an effective and appropriate hazard mitigation program.

4.1 State Statutes and Codes

Cornerstones of Emergency Management legislation in New Mexico are as follows:

- **12-11-23 to -25, Emergency Powers Code, 2005**, as amended**:** provides State funds to be expended for disaster relief for any disaster declared by the Governor that is beyond local control. Such funds may also be used as a match for federal disaster relief grants; and,
- **12-10-2 to-5, New Mexico Statutes Annotated (NMSA) 1978** as amended**:** The State Civil Emergency Preparedness Act. This Act establishes the basic structure of Emergency Management as a State agency and defines the role of local government in emergency preparedness.

State statutes that relate to mitigation interests are detailed below. Most policies that relate to mitigation are local initiatives and are not mandated by the state.

- **72-5-32, NMSA** as amended: Gives the Office of the State Engineer the responsibility to regulate dams and their appurtenances. The regulations governing dam design, construction and dam safety are included in **Title 19, Chapter 25 Part 12 of the New Mexico Administrative Code (NMAC)**. These regulations require owners of dams that have the potential to cause loss of life and/or interruption of lifeline infrastructure to prepare and exercise an Emergency Action Plan (EAP). **19.25.12.18 of NMAC** requires that the EAP be prepared through coordination with local emergency managers and that the plan be accepted by the responsible emergency managers prior to review by the State Engineer. These regulations require that the owner exercises the EAP, and it is recommended that a functional exercise be carried out every five years with a tabletop exercise conducted two to three years before the functional exercise. Approximately 39% of dams in this category currently hold an approved EAP, up slightly from 34% in 2018. These statutes and codes help to mitigate dam incidents.
- **3-18-7, NMSA 1978** as amended: Describes additional county and municipal powers, flood and mudslide hazard areas, floodplain permits, land use control, and jurisdiction agreements. The statute designates the Department of Homeland Security and Emergency Management (DHSEM) as the coordinating agency for floodplain management in the State of New Mexico. The statute requires that communities with identified flood hazards adopt a floodplain management ordinance, have a Certified Floodplain Manager (CFM) on staff to review floodplain development, and join the NFIP.
- **3-17-7, 4-37-9.1, 72-14-3.2, 6-21-23, and 72-4A-7, NMSA 1978** as amended: All relate to the requirement for applicants for financial assistance from the New Mexico Finance Authority to submit water conservation plans with funding application, effective December 31, 2005. Water conservation plans help to mitigate drought.

- **74-6-2 and 74-6-4, NMSA 1978** as amended: Allows the use of up to 250 gallons per day of greywater for residential irrigation, subject to certain requirements. This reduces the consumer demand for potable water, helping to mitigate drought.
- **72-4A-2 through 72-4A-7, NMSA 1978** as amended: Allows Water Trust Board funds to be used for water conservation and water re-use activities. This serves to mitigate drought.
- **72-14-3.1, NMSA 1978** as amended: Directs the Interstate Stream Commission to prepare a comprehensive State water plan. This plan helps mitigate drought.
- **68-2-34, NMSA 1978** as amended: Creates the Fire Planning Task Force and outlines its duties. This serves to mitigate wildfire, especially in the Wildland Urban Interface.
- **13-5-3.1 New Mexico Statutes Annotated (NMSA) 1978** as amended**:** A building that receives state appropriations for its construction or that is repaired or improved with state appropriations in an amount greater than fifty percent of the building's value before the repair or improvement shall comply with standards of the national flood insurance program and Section 3-18-7 NMSA 1978. Passed in 2021.

4.1.1 Land Use Codes

Each county and municipality across the state is responsible for monitoring its own zoning and development; the state does not have oversight on this.

- **3-21-1 NMAC:** This zoning authority allows local governments to regulate and restrict within their jurisdiction the: height and size of structure, percentage of a lot that may be occupied, size of open space, density of population, and location and use of buildings, structures, and land.

4.1.2 Building Codes

The State of New Mexico Construction Industries Division (CID) is within the State Regulations and Licensing Department. CID oversees permitting for public agency structures state-wide. CID also oversees permitting for private sector structures for communities that do not have a building permitting program. Before permits are submitted to CID, they must receive zoning approval from either the local or county zoning authority.

The Division has approximately 100 personnel statewide that review and approve building permits plus conduct building inspections.

The State has adopted the 2015 International Building Code (IBC) and 2015 International Residential Code. However, the state has not adopted the National Fire Protection Association Codes (NFPA 5000). The division currently regulates to the following building codes:

- 2021 International Fire Code (IFC)
- 2012 Solar Energy Code (IAPMO)
- 2018 International Energy Conservation Code (IECC)
- 2017 National Electrical Code (NEC)
- 2015 New Mexico Commercial & Residential Building Code
- 2015 International Building Code (IBC)
- 2015 International Residential Code (IRC)
- ICC/ANSI A117.1-2009
- 2012 New Mexico Plumbing and Mechanical Code
- 2012 Uniform Mechanical Code (IAPMO)
- 2012 Uniform Plumbing Code (IAPMO)
- 2012 Uniform Swimming Pool, Spa and Hot Tub Code
- 2012 National Electrical Safety Code

- Liquefied Petroleum Gas Standards
- 2008 National Fire Protection Association (NFPA) 58
- 2006 NFPA 54
- 1999 NFPA 57
- 1999 NFPA 1192
- 1998 NFPA 52

The residential and commercial building codes include some natural hazard mitigation elements. For example, wind and snow load regional charts are utilized for compliance. Floodplain compliance is confirmed by the local floodplain administrator prior to a permit being submitted to CID.

The State of New Mexico Manufactured Housing Division (MHD) is within the State Regulations and Licensing Department. MHD oversees construction of manufactured homes at the facility where assembly takes place. MHD also regulates manufactured and modular home permitting.

In addition, the state subscribes to and enforces the 2015 International Building Code, which requires that certain earthquake and wind loading standards be met for specified categories of structures. Local communities with permitting programs provide a placement permit for the installation to assure compliance with each community's zoning regulations. However, counties that do not have permitting ability rely on the State Construction Industries Division to permit structures.

Each county and municipality across the state is responsible for monitoring its own zoning and development; the state does not have oversight on this. State statutes that relate to building codes are detailed below.

- **3-18-6 NMAC:** This building authority allows locals to regulate and restrict within its jurisdiction the:
  - Standards for constructing and altering buildings;
  - Distance a building may be built from the street line;
  - Standards for construction of partition fences and party walls; and
  - Exclusive ability to enforce permits.
  - Additionally, this authority allows locals to establish fire zones and prohibit within these zones the construction or addition of structures which do not meet the fire resistance ratings or standards established for each zone. This serves to mitigate wildfire.

- **13-5-3 NMSA 1978** as amended: Requires that all buildings built or funded by the state comply with floodplain ordinance requirements. This serves to mitigate flood/flash flood.

- **14.12.1.17 NMAC:** Applies to the Regulation and Licensing Department, Manufactured Housing Division and was initially implemented in 2010. Local planning and zoning jurisdictions or units installed in floodplain or mudslide areas must adhere to the following:

  - All installations of residential manufactured homes must comply with the Manufactured Housing Act, all rules adopted by the division, and all locally adopted zoning and planning requirements.
  - Prior to delivery of a manufactured home every dealer shall have the consumer sign a document acknowledging that the consumer has been advised to check with the local governing body in the locality of the site where the home will be installed to determine flood zone area installation requirements.

4.2 State Agencies and Programs

4.2.1 Department of Homeland Security and Emergency Management (DHSEM)

The New Mexico Department of Homeland Security and Emergency Management (DHSEM) works to protect the people of New Mexico and the nation through a comprehensive and coordinated program of mitigating hazards, preparing for emergencies, preventing attacks, and recovering from disasters regardless of cause. The department prepares for a wide variety of emergencies, including wildfires, flooding, health crises, and domestic attacks. When necessary, the state assists localities whose capabilities are overwhelmed, and DSHEM serves as the conduit for federal assistance. DHSEM's work in emergency management is coordinated around the five mission areas of the National Preparedness Goal: **prevention**, **protection**, **mitigation**, **response**, and **recovery**. Additionally, the department facilitates and distributes tens of millions of dollars in federal grants to New Mexico communities every year.

DHSEM traces its roots back to 1959 when the Civil Emergency Preparedness Division (CEPD) was formed under the Office of Military Affairs. In 1987, CEPD was moved to the Department of Homeland Security. The New Mexico Office of Homeland Security was established in 2003, and in 2007 the two offices are joined to create DHSEM as a cabinet-level agency. The State Fire Marshal's Office joined DHSEM in 2021.

DHSEM's Mitigation Unit coordinates and administers statewide floodplain management and hazard mitigation programs, including both the planning of natural hazard mitigation projects and project implementation. The goal of the program is to reduce the short- and long-term effects of natural disasters, such as floods, wildfires, droughts, severe storms, and landslides, among others. The Mitigation Unit:

- Assists with identification and promotion of structural and non-structural mitigation practices
- Provides technical assistance during both the application process and the life of mitigation projects
- Ensures compliance with program regulations and professional design standards
- Conducts site visits during implementation

4.2.1.1 State Mitigation Program

The DHSEM Mitigation Section is the primary state entity responsible for coordinating and facilitating technical assistance for local hazard mitigation planning. The Mitigation Section is comprised of the State Hazard Mitigation Officer (SHMO) and a Mitigation Specialist.

The SHMO and the rest of the Mitigation Section are responsible for coordinating and supporting the SHMT, as described in Section 8. The Mitigation Section maintains the State Hazard Mitigation Plan and assists local jurisdictions with development and updates of local hazard mitigation plans. Mitigation Section staff work to promote mitigation activities, work with jurisdictions and agencies to identify potential projects, maintain a strong public outreach effort on the mitigation grant processes and requirements, and maintain a database of all the projects for programmatic and finance performance. Staff assists sub-applicants with submitting complete applications, provides technical assistance to all sub-applicants in all aspects of the grants process, and serves as a liaison between sub-applicants and FEMA Region VIII. Staff completes the state quarterly report, based on reporting from sub-applicants, and submits the report to FEMA. Staff ensures projects follow the approved scope of work, conducts final project inspections, reviews all requests for close-out, and submits final project and disaster close-out requests to FEMA. The Mitigation Section also maintains the state HGMP Administrative Plan and develops a Hazard Mitigation Program Strategy for each federally declared disaster, which lays out disaster-specific mitigation objectives, identifies mitigation actions, and provides a framework for implementing long-term cost, effective measures to minimize future disaster damages statewide.

DHSEM has an ongoing contract for a mitigation consultant team led by WSP USA, allowing the State to leverage contractor assistance to make up for staffing shortages and staff turnover.

4.2.1.2 State Hazard Mitigation Administrative Plan

The New Mexico Department of Homeland Security and Emergency Management (DHSEM) has a Federal Emergency Management Agency (FEMA) approved State Hazard Mitigation Administrative Plan. This plan is required by 44 CFR Part 206.437.d. and applies to all open mitigation disasters, grants, and sub-grants. The purpose of the administrative plan is to establish a functional organizational structure, define roles, responsibilities, and staffing, and outline the management procedures that DHSEM will use to administer FEMA's Hazard Mitigation Assistance (HMA) Program. DHSEM amends the administrative plan whenever necessary to reflect changes in laws, organization, policy, or State agency operation. The plan was most recently updated and readopted in 2022. DHSEM will revise the plan as necessary following each major disaster declaration and submit to FEMA Region for approval.

Since January 2012, the State Mitigation Program has prepared Standard Operating Guidelines (SOG) to detail the responsibilities and tasks necessary to accomplish program and agency goals. The SOGs are updated on a continual basis to reflect changes to grant programs and updates to FEMA policy/guidelines to improve efficiency.

4.2.1.3 State Long-Term Recovery Plan

Led by DHSEM, the State of New Mexico is unifying its recovery objectives in response to the disastrous wildfire season of 2022. There are seven recovery lines of effort (LOEs) which are defined based on strategic priorities for wildfire recovery:

- Community Outreach
- Drinking Water
- Economic Recovery
- Health and Social Services
- Historical and Cultural Resources
- Housing Recovery
- Watershed Mitigation

These LOEs will form the basis of the State Long-Term Recovery Plan currently under development. The Plan will describe the structure to implement activities through the LOEs, including the Unified Command Group which will monitor progress and Task Forces which will coordinate and implement activities. This Long-Term Recovery Plan supersedes and incorporates previous memoranda regarding this subject matter and will be updated as needed.

4.2.1.4 DHSEM Mitigation Training Program

DHSEM provides local mitigation technical support through its Local Preparedness Area Coordinators. These staff assist local communities with hazard awareness and provide education to local organizations and the general public. DHSEM is also in the process of developing a sub-applicant engagement program, to expand state support for local communities to leverage available mitigation funding and programs.

Rockin' Around New Mexico – Earthquake Educational Program

The Emergency Management Performance Grant (EMPG) has funded an annual educational earthquake program for schoolteachers called "Rockin' Around New Mexico" held every summer since 1995. The Workshop provides hands-on mineral resources curriculum and an overview of geology, mining, mineralogy, and environmental problems to New Mexico educators for kindergarten through 12th grade. The New Mexico Institute of Mining and Technology provides the EMPG matching funds and implements the workshop. The workshop is organized, facilitated, and implemented by educators at the institute. They invite other educators and researchers to present and be part of the program.

The workshop allows educators to teach educators. The teachers that implement the program are mostly college, university, or Ph.D. level educators. The teachers that take the workshop as participants tend to be educators for kindergarten through 12th grade. The three-day workshop is held in a different part of the state each summer so that teachers can be exposed to the diverse geologic resources and potential hazards throughout New Mexico. Lessons learned and teaching tools are brought back to the classroom in order to make earth science understandable and relatable in an age-appropriate manner.

The workshop includes hands-on sessions along with field trips to explore local geology. Topics include mineral resources and mining, environmental geology, paleontology, seismic hazards, mitigation, and school earthquake safety.

ShakeOut! – Earthquake Educational Program

The first New Mexico ShakeOut was hosted in 2014; it is an annual earthquake drill that encourages participants to 'Drop, Cover and Hold On". The drill promotes planning and preparation for reducing risk during earthquakes. DHSEM worked with the Southern California Earthquake Center to create a New Mexico specific website. Individual communities throughout the State have implemented ShakeOut! drills as part of their annual emergency exercise requirement. The SHMO serves as the State Earthquake Program Manager, and provides outreach to local emergency managers on ShakeOut! through Preparedness Area Coordinators, NMAEMP membership email listserv, and NMAEMP Quarterly Meetings.

4.2.2 Energy, Minerals, and Natural Resources Department (EMNRD)

The New Mexico Energy, Minerals, and Natural Resources Department (EMNRD) strives to make the state a leader in developing reliable supplies of energy, and energy-efficient technologies and practices, with a balanced approach toward conserving our renewable and non-renewable resources; to protect the environment and ensure responsible reclamation of land and resources affected by mineral extraction; to be effective in leading the state in growing healthy, sustainable forests and managing them for a variety of users and ecologically sound uses; and to improve the state park system into a nationwide leader that contributes to a sustainable economy statewide while protecting New Mexico's natural, cultural, and recreational resources for posterity.

In April of 2023, EMNRD announced the launch of its new Climate Policy Bureau, part of ENMRD's Energy Conservation Management Division (ECMD). It will play an integral role in building New Mexico's capacity to adapt to climate change by supporting interagency efforts to reduce greenhouse gas emissions, grow the state's green economy, and develop and implement a statewide Climate Action Plan.

The Climate Policy Bureau's work will include:

- Supporting state agency efforts to comply with Governor Michelle Lujan-Grisham's Executive Order 2019-003 on Climate Change and Energy Waste Prevention, which directs all state agencies to evaluate the impacts of climate change on their programs and operations and integrate climate change mitigation and adaptation practices into their programs and operations.
- Developing plans for how the state uses federal funds and other grants to make New Mexico Communities more resilient to climate hazards. That will include administering the Building Resilient Infrastructure and Communities (BRIC) program. ECMD received FEMA funding from this program to

assist with developing projects to increase state agencies' climate resilience and develop a statewide Climate Adaptation and Resilience Plan as an Annex to this Plan. Other program objectives include developing tools to communicate climate science information and provide outreach and education to increase climate literacy and technical assistance for local and tribal governments and stakeholders in all New Mexico counties.

- Improving New Mexico's Climate Risk Map. ECMD launched the New Mexico Climate Risk Map web application in 2021: www.NMclimateriskmap.org. This free online resource helps New Mexicans understand place-based risks from natural hazards exacerbated by changing climate conditions, such as increasing heat, aridity, or wildfire. It also helps users to visualize and understand hazards and risks and can help decision makers allocate resources to address climate hazards.

4.2.2.1 State Energy Security Plan

The EMNRD Energy Conservation and Management Division (ECMD) Energy Planning Program Bureau is responsible for maintaining and updating the 2022 New Mexico State Energy Security Plan (SESP), an update to the State's previous Energy Assurance Plan. SESPs are the primary tools used by states to assure a state's energy security across unregulated and regulated electricity, natural gas, and petroleum supplies, as well as mission critical end-use facilities such as water treatment, health care, and first responder organizations.

ECMD is currently updating the New Mexico SESP. The work completed during this update will establish a deeper understanding of the State of New Mexico's energy system component locations, capabilities, and threats. The update will include a risk assessment and dependencies analysis, and location-specific mitigation strategies, and will provide the data and information to support related government emergency management and energy planning priorities.

The next iteration of the SESP will be finalized by September 2023, in accordance with the provisions added by the 2021 federal Infrastructure Investment and Jobs Act. Per these provisions, the New Mexico SESP will:

- Address all energy sources and regulated and unregulated energy providers;
- Provide a state energy profile, including an assessment of energy production, transmission, distribution, and end-use;
- Address potential hazards to each energy sector or system, including physical threats and vulnerabilities and cybersecurity threats and vulnerabilities;
- Provide a risk assessment of energy infrastructure and cross-sector interdependencies;
- Provide a risk mitigation approach to enhance reliability and end-use resilience;
- Address multi-state and regional coordination, planning, and response, and coordination with Indian Tribes (23 New Mexico Tribal Nations) with respect to planning and response; and
- To the extent practicable, encourage mutual assistance in cyber and physical response plans.

4.2.2.2 State Climate Risk Map

The New Mexico Climate Risk Map, developed by EMNRD and UNM EDAC, is designed to help New Mexico communities and residents learn more about factors that contribute to their climate change risk. It allows a user to visualize data related to air quality, drought, heat, flooding, and wildfire in New Mexico. Users can explore the map and generate a report for a selected area of interest.

New Mexico Forestry Division (NMFD)

The New Mexico Forestry Division retains lead responsibility for wildland fire management on all non-federal, non-tribal, and non-municipal lands, maintaining fire suppression capacities and emphasizing public and firefighters' safety. The division promotes healthy, sustainable forests and watersheds in New

Mexico for the benefit of current and future generations. One tool to achieve these goals includes the development of new or updated Community Wildfire Protection Plans (CWPPs), which the division supports development of at the local level.

4.2.2.3 State Forest Action Plan

The New Mexico Forestry Division and their many partners worked together to create the 2020 New Mexico Forest Action Plan. The plan provides an assessment of the current conditions of our natural resources and sets forth all-lands strategies that address key issues in forest and watershed management in a changing climate. To improve forest health, the plan defines ten strategies with related action items, many of which qualify as mitigation. These actions have been incorporated into the Mitigation Strategy section of this Plan update.

4.2.2.4 Wildfire Educational Programs

There are numerous fire prevention outreach and education programs throughout the State. A partial list is below. Most of the programs are administered or coordinated by the State Forestry Division.

- Communities at Risk Report (www.nmforestry.com)
- Firewise Program (www.firewise.org)
- Ready Set Go! (http://wildlandfirersg.org/)
- Living with Fire (www.nmforestry.com)
- Smokey Bear (www.smokeybear.com)
- New Mexico Fire Information (www.nmfireinfo.com)
- New Mexico Fire Viewer (https://arcg.is/01DaGy)
- Social Media such as Facebook and Twitter

State Forestry Education and Outreach links can be found at http://www.emnrd.state.nm.us/SFD/FireMgt/FirePreventionandOutreachProgram.html

4.2.3 Environment Department (NMED)

The mission of the New Mexico Environment Department is to protect and restore the environment and to foster a healthy and prosperous New Mexico for present and future generations.

Key divisions within the Environment Department with critical roles in mitigating hazards include the Climate Change Bureau.

Climate Change Bureau

The Climate Change Bureau identifies, implements, and monitors New Mexico's efforts to reduce greenhouse gas emissions by at least 45% by 2030 as compared to 2005 levels. We are working to meet our climate goals by:

- Leading state climate policy development and implementation within the interagency Climate Change Task Force;
- Implementing actions identified in Executive Order 2019-003 Addressing Climate Change and Energy Waste Prevention;
- Tracking and evaluating the State's greenhouse gas emissions data: 2018 inventory and 2020 oil and gas only inventory;
- Forecasting greenhouse gas emissions reductions from climate actions: 2018 forecast, 2021 forecast, and 2021 climate policy simulator (an open-source modeling tool).

- Implementing the Clean Car Rule and other policies that reduce the greenhouse gas footprint from transportation;
- Initiating the development of clean hydrogen (see the public version of a concept paper submitted to the US Department of Energy's (DOE's) Regional Clean Hydrogen Hubs program); and
- Supporting climate work within the Environment Department, state agencies, and all other public and private entities throughout the state.

4.2.4 Bureau of Geology and Mineral Resources

The New Mexico Bureau of Geology and Mineral Resources is a research and service division of the New Mexico Institute of Mining and Technology (NM Tech) and was established by legislation in 1927. The Bureau serves as the state's geological survey. Staff assist a diverse population through offices, publications, and a website (https://geoinfo.nmt.edu/).

The main goals for the Bureau are to:

- Conduct research and interact with state and federal agencies and industry to facilitate prudent exploitation of the state's geological resources.
- Distribute accurate information to scientists, decision makers, and the New Mexico public regarding the state's geologic infrastructure, mineral and energy resources, and geohydrology (including water quantity and quality).
- Create accurate, up to date maps of the state's geology and resource potential.
- Provide timely information on potential geologic hazards, including earthquakes, volcanic events, soils and subsidence-related problems, and flooding.
- Act as a repository for cores, well cuttings, and a wide variety of geological data. Provide convenient physical and internet access for New Mexicans to such resources.
- Provide public education and outreach through college teaching and advising, a Mineral Museum, and teacher and student training programs.
- Our staff serve on a number of boards and commissions within the State and the region concerned with various geoscience-related issues.

4.2.5 Department of Agriculture – Community Drought Task Forces

The New Mexico Department of Agriculture and New Mexico State University sponsor community drought task forces with local emergency managers. The sponsorship is from the College of Agriculture, Consumer, and Environmental Sciences through the Southwest Border Food Protection and Emergency Preparedness Center. Using a tool developed and sponsored by the Extension Disaster Education Network, drought mitigation strategies are explored by the community and reduction strategies implemented. Examples include the elimination of some water consuming trees along river, wise water usage, and building capacity from rainfall.

4.2.6 Department of Health, Bureau of Health Emergency Management

The New Mexico Department of Health's Bureau of Health Emergency Management is responsible for coordinating emergency response education, family preparedness information, healthcare preparedness and response, hazardous materials preparedness, the Medical Reserve Corps, and the Strategic National Stockpile.

4.2.7 Department of Finance & Administration, Local Government Division

The Department of Finance and Administration, Local Government Division (LGD), provides administrative and technical support to local entities throughout the State of New Mexico. LGD assists local government entities, local representatives, and citizens with the appropriate use of public funds and to strengthen their ability to better serve New Mexico communities to improve their quality of life.

4.2.8 Office of the State Climatologist

The Office of the New Mexico State Climatologist is located in Las Cruces at the campus of New Mexico State University (NMSU). The State Climatologist directs the New Mexico Climate Center that is based in the Plant and Environmental Sciences Department. The Center maintains an archive of meteorological data collected throughout the state of New Mexico from many public and private networks. The Center operates a network of 60 automated surface weather stations throughout the state with plans for a total of 220 deployed. Most of these 18 stations are located at NMSU Agricultural Science Centers.

The Office provides the following services:

- Coordinate and collect weather observations for the purpose of climate monitoring;
- Summarize and disseminate weather and climate information to the user community;
- Demonstrate to the user community the value of climate information in the decision making process;
- Perform climate impact assessments and weather event evaluations; and
- Conduct climate research, diagnosis, and projections.

4.2.9 Office of the State Engineer

The New Mexico Office of State Engineer (OSE) has authority over the supervision, measurement, appropriation, and distribution of all surface and groundwater in New Mexico, including streams and rivers that cross state boundaries.

OSE's Dam Safety Bureau ensures that dams in New Mexico are designed, constructed, operated, and maintained as safely as possible. The responsibilities of the Dam Safety Bureau include inspecting existing dams to verify they are operated and maintained in a safe condition. The bureau reviews plans and specifications for new dams and modifications and repairs to existing dams to ensure compliance with State Engineer design criteria. The bureau also inspects construction to verify that dams are built or repaired in accordance with approved plans on file with the State Engineer.

4.2.9.1 State Water Plan

The New Mexico Interstate Stream Commission (ISC), administratively attached to the New Mexico State Engineer (OSE), oversees the development of the state's 16 water planning regions' water plans and the 2018 New Mexico State Water Plan. The State Water Plan statute calls for "a comprehensive, coordinated state water plan" for the state's waters. The plan is to be reviewed and updated as needed every five years, per state statute. Implementation, evaluation, and review reports of the plan are on the agency's website.

In addition to technical data about water supplies and demands, the regional water plans include information about existing or proposed policies, programs, and projects the major stakeholders in the region identified to address regional water issues.

Many of the regional plans highlight watershed restoration as a high priority to reduce wildfire and floods. The inclusion of the projects, programs, and policies (PPP) list is to provide users of the plan – water managers and interested citizens – with information about specific strategies to solve water-related problems within the region and identify possible regional partners. The purpose of these lists is threefold:

to provide the regions with information about funded Water Trust Board water projects and programs, Infrastructure Capital Infrastructure Projects (ICIP), and Capital Outlay projects.

The State Water Plan, as a blueprint for the strategic management of the state's waters, incorporates the regional data and recommendations for solutions to water problems. The 2018 State Water Plan reflects updated priorities for water management priorities and include goals and strategies for addressing water issues regionally and state-wide.

Per the statute: "the ISC shall convene water planners and stakeholders from diverse constituencies to advise it and the office of State engineer on the State water plan, including State-wide policies, priorities, goals and objectives for the plan, issues of State-wide concern and strategies for implementation of the plan."

The State Water Plan law recognizes the necessity of coordination among other state agencies with water-related responsibilities and will: "Promote strategies and mechanisms for achieving coordination with all levels of government." As such, ISC planners are coordinating with other several other state agencies to link efforts and provide resources to the public, water planners, and legislators for solving water issues.

In 2022, ISC released a significant report "Climate Change in New Mexico over the Next 50 Year: Impacts on Water Resources," which will serve as the technical basis for the 2023 update of the State Water Plan.

4.2.10 Interagency Climate Change Task Force

The Climate Change Task Force is led by EMNRD and the Environment Department. Other key members include the Office of the State Climatologist. The Task Force is comprised of nine smaller, interagency Climate Action Teams responsible for proposing, planning, and implementing strategies to reduce greenhouse gas emissions and enhance New Mexico's ability to adapt to climate change. The Task Force is a key player in developing the statewide Climate Adaptation and Resilience Plan as an Annex to this Plan.

4.2.10.1 State Climate Strategy Plan

The 2021 Climate Strategy, developed by New Mexico's Interagency Climate Change Task Force, identifies a suite of policies that integrate climate change mitigation and adaptation throughout state's government programs and operations. It serves as a strategic guide for the state to achieve the mitigation and adaptation goals as identified in Executive Order 2019-003, mandating lower carbon emissions and adaptations to limit the impacts from climate change. The report summarizes adaptation progress across the state's agencies and the focal sectors of public health, emergency preparedness, and water supply. The 2021 Plan references the 2018 New Mexico State Hazard Mitigation Plan, as well as $700,000 in BRIC funds received by the State to conduct Statewide Resilience Planning.

4.2.11 New Mexico Drought Task Force and Drought Monitoring Working Group (DMWG)

Due to the extreme drought of the 2012 season, the Governor established a Drought Task Force, comprised of representatives from multiple state agencies, including the Office of the State Engineer, Interstate Stream Commission, Environment Department, Economic Development Department, Department of Health, Tourism Department, Department of Agriculture, Finance Authority, Department of Finance and Administration, Homeland Security and Emergency Management, Energy Minerals and Natural Resources Department, and the Office of the Governor.

A Drought Executive Order signed by Governor Martinez on May 11, 2012 (Executive Order 2012-006) summarized the drought conditions at that time and declared a State of Emergency state-wide due to the drought conditions. The Executive Order further directed the continuation of the New Mexico Drought Task Force and for them to meet once a quarter. It also directed the following:

- Assess the continued severity of the drought and its effects on the various sectors of the state's resources and economy.
- Make recommendations to the Governor for intermediate actions and long-term strategies to mitigate drought conditions and impacts in the state.
- Appoint such working groups as may be necessary and appropriate to examine and recommend solutions regarding the drought conditions to the task force.
- Provide information and guidance to the Governor regarding drought conditions.

The Drought Monitoring Working Group (DMWG) is responsible for monitoring all available climatological data, soil moisture readings, reservoir storage levels, and other pertinent information necessary to analyze the current status of drought conditions in the State of New Mexico. The DMWG also examines and reports on long-term forecasts to assist the Drought Task Force in their preparedness and response actions. Members include water resource, agriculture, and climate professionals from all levels of government. The monthly meetings are facilitated by the State Climatologist and National Weather Service (NWS) Albuquerque Office.

The DMWG manages the State Drought Plan described below.

4.2.11.1 State Drought Plan

The 2018 New Mexico Drought Plan (NMDP) provides the state with an updated approach to address drought in order to protect its people and resources. It develops a drought response system that is adaptive to changing needs and conditions and is capable of being continually upgraded through the incorporation of new information. The plan is managed by the State Drought Monitoring Working Group (DMWG), which is described in Section 4.2.9.1 above. The impact sectors identified in the Drought Plan and subsequent updates/status reports are agriculture, wildlife, wildland fire, watersheds, drinking water, economics, tourism, and recreation.

The 2018 NMDP references specific mitigation actions from the 2018 New Mexico State Hazard Mitigation Plan, and lays out additional recommended actions. These actions have been incorporated into the Mitigation Strategy section of this Plan update.

4.2.11.2 New Mexico Floodplain Managers Association (NMFMA)

The NMFMA is the professional association for floodplain managers in the state. Its goals are to:

- Promote public awareness of proper floodplain management;
- Promote the professional status of floodplain management and secure all benefits;
- Promote a liaison between individuals concerned with proper floodplain management;
- Encourage the exchange of ideas; and
- Inform floodplain managers through educational and professional seminars and dissemination of information (both general and technical).

NMFMA is the certifying agency for floodplain managers in New Mexico. As of January 1, 2023, there are 151 Certified Floodplain Managers in the State.

The association partners with DHSEM to provide flood awareness education and training across the state. NMFMA is also an active partner in the National Weather Service "Turn Around Don't Drown" (TADD) campaign by providing local jurisdictions with TADD signs for low water crossings. DHSEM continues to fund attendee registration and travel reimbursement from the Community Assistance Program – State Support Services (CAP-SSSE) Program for eligible attendees at NMFMA workshops and training.

DHSEM, through CAP-SSSE, has funded the following NMFMA projects through sub-grant agreements:

- FloodSmart Calendars;
- Flood awareness coloring books for children;
- TADD signage and outreach;
- Flood Simulation Tables and outreach;
- Revising and printing of state-wide floodplain manager reference materials;
- Website redesign; and
- Workshop and training reimbursements. A floodplain management survey was developed by NMFMA and DHSEM to encourage feedback on improving the State Floodplain Management Program, to update contact information for the 104 NFIP communities in the State, identify any issues, and describe unmet needs. The State Floodplain Coordinator will continue to circulate the survey for maximum participation and follow up on any issues or requests for assistance from the state program.

4.3 Other Programs and Resources

4.3.1 Earth Data Analysis Center (EDAC)

The Earth Data Analysis Center (EDAC) was established at the University of New Mexico (UNM) in 1964 to transfer NASA space-based technology to the private and public sectors. As geospatial technology has progressed EDAC has developed skills to meet those changing requirements. In 1968 EDAC expanded to include a library clearinghouse and in 1992 became a digital data clearinghouse. As remote sensing technology evolved EDAC began processing remote sensing data in 1973 and started image processing in 1979. EDAC acquired GIS software in 1983 and became one of the first ESRI users in New Mexico. In 1990, EDAC began collecting and processing GPS data and in 1999 created an information technologies program within the organization.

EDAC's mission is to serve the spatial needs of these communities by utilizing Geospatial Technologies. We strive to bridge UNM's academic units and the external communities via partnerships, by facilitating and stimulating collaborations and by providing professional services. These partnerships include government agencies, private organizations, and regional universities. EDAC is also committed to strengthening graduate education to meet the increasingly complex resource management and decision needs.

EDAC's staff come from a variety of academic disciplines including Geography, Anthropology, and Geology, and have developed skills in working across disciplinary boundaries with a wide variety of collaborating project partners and end-user communities. Our work with collaborators has allowed us to develop successful projects in a wide variety of domains, including:

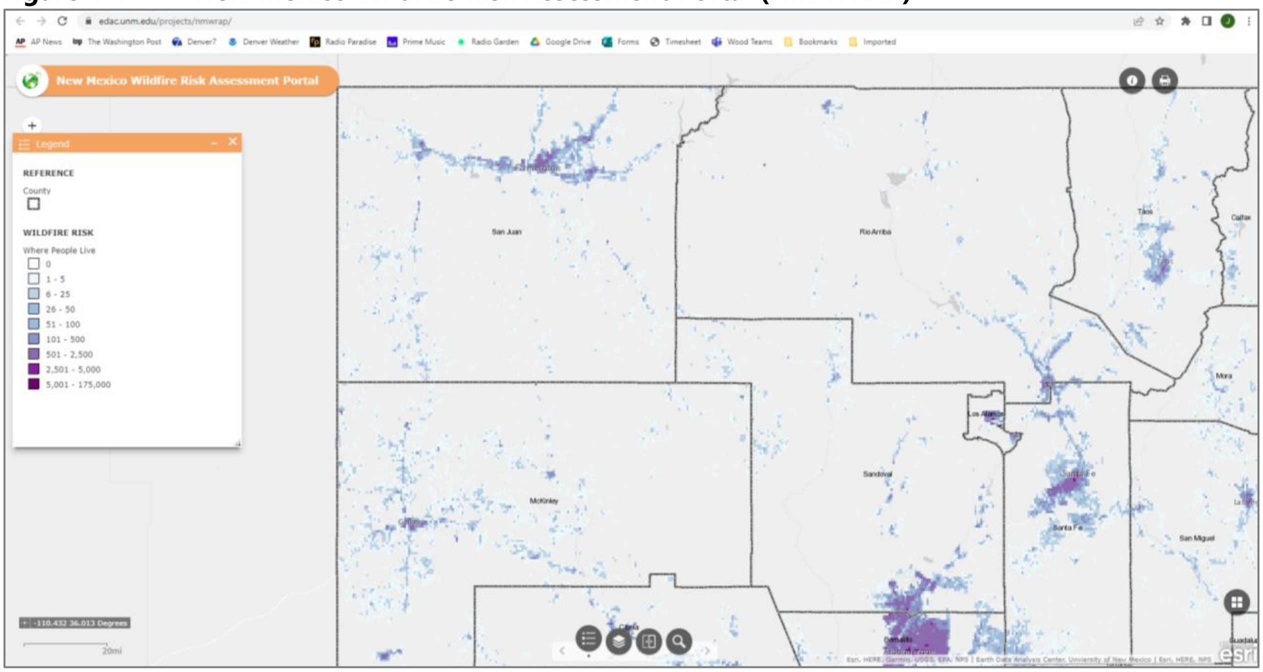
- Public health
- Atmospheric modeling
- Hydrologic modeling
- Transportation infrastructure
- Floodplain management
- Border dispute resolution

- Ecological modeling and habitat analysis
- Resource management
- Online mapping applications

4.3.1.1 State Wildfire Risk Assessment Portal (NM WRAP)

The New Mexico Wildfire Risk Assessment Portal (NM WRAP) is an interactive web-mapping application developed by the Earth Data Analysis Center (EDAC). It provides access to information that determines wildfire risk across the State of New Mexico. It is designed to support the community wildfire protection planning needs of government officials, hazard mitigation planners, and wildland fire professionals, and to inform the general public. Development of the portal was funded through FEMA's Cooperating Technical Partner (CTP) Program.

Figure 4-1 New Mexico Wildfire Risk Assessment Portal (NM WRAP)

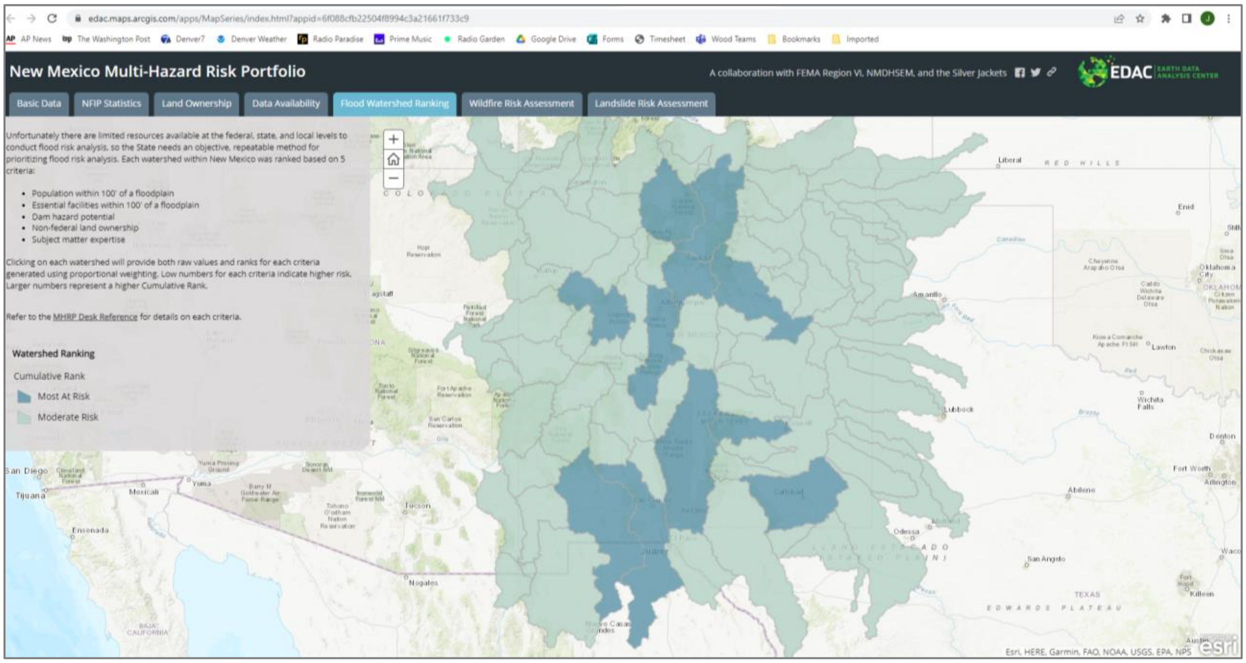


Source: https://edac.unm.edu/projects/nmwrap/

4.3.1.2 State Multi-Hazard Risk Portfolio (MHRP)

EDAC has developed a Statewide Multi-Hazard Risk Portfolio (MHRP) in order to prioritize watersheds for FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) Program and mitigation activities. The MHRP is designed to provide a state or regional level risk assessment and was developed in collaboration with FEMA Region VI, NMDHSEM, and the Silver Jackets. This web map is designed to support the New Mexico Statewide Hazard Mitigation Plan as well as provide data to local emergency managers, planners, and floodplain administrators.

Figure 4-2 New Mexico Multi-Hazard Risk Portfolio (MHRP)



Source: *https://edac.maps.arcgis.com/apps/MapSeries/index.html?appid=6f088cfb22504f8994c3a21661f733c9*

4.3.1.3 Acequia Mapping Project

EDAC, through a sub-grant agreement with the DHSEM, was tasked with mapping and analysis of acequia data statewide. The Office of the State Engineer served as the subject matter expert on the project.

EDAC collected and updated acequia GIS line work locations throughout the state. EDAC also integrated attributes for each of the mapped locations. Analysis of the impact of natural hazards on acequias was also conducted. Impacts were identified through the FEMA Public Assistance (PA) Program.

Two forms of analysis were completed for each area, one being a proximity analysis using the NFHL. The second included the processing of recipients of public assistance to support disaster recovery on acequia infrastructure. Having both of these results, as well as the updated location information, allows DHSEM and New Mexico stakeholders to better identify areas of increased risk and help refine and identify areas for mitigation action.

4.3.2 New Mexico Environmental Review Tool

The [New Mexico Environmental Review Tool (ERT)]() is an interactive tool for conservation planning and review of important resources for wildlife and habitats. The ERT is a partnership that draws upon expertise in wildlife and information management from the New Mexico Department of Game and Fish (NMDGF), Natural Heritage New Mexico, and NatureServe. It provides conservation information on wildlife and habitat diversity, protected lands, and other natural resources, and allows users to submit proposed projects for review of potential impacts to special status species and their habitats in New Mexico. The tool has been leveraged for screening the Environmental Historic Planning and Preservation elements of FEMA HMA grant-funded projects.

4.3.3 Biota Information System of New Mexico (BISON-M)

The Biota Information System of New Mexico (BISON-M) contains accounts for wildlife occurring in New Mexico and Arizona, including threatened, endangered, and sensitive species.

4.3.4 New Mexico Game and Fish Habitat Handbook

The New Mexico Game and Fish Habitat Handbook encourages incorporation of conservation practices in the earliest possible stages of project development. It contains conservation measures, with respect to specific land use practices, targeted toward minimizing impacts of projects on wildlife and habitats. Below is the Handbook link which provides useful information for project planning and mitigation. http://wildlife.state.nm.us/conservation/habitat_handbook/index.htm

4.3.5 Light Detection and Ranging (LIDAR)

The New Mexico Geospatial Advisory Committee (GAC) formed a LIDAR Planning and Acquisition Subcommittee in 2014 in response to New Mexico's needs for enhanced elevation data. The Subcommittee consisted of representatives from local, state, and federal agencies including, US Army Corps of Engineers, US Bureau of Reclamation, US Forest Service, US Natural Resources Conservation Service, Bureau of Land Management, NM Bureau of Geology, Santa Fe County, Mid-Region Council of Governments, UNM EDAC, and the NM Geospatial Data Clearinghouse. The Subcommittee developed the NM State-wide Lidar Acquisition Plan to guide the prioritization and collection of LIDAR data in New Mexico.

The state of New Mexico has statewide QL2 LIDAR coverage. LIDAR data can be used for the identification and assessment of other natural hazards in the state including floodplains, landslides, alluvial fans, and geologic faults, as well as forest and environmental assessments.

4.3.6 Rio Grande Rift Catastrophic Earthquake Response Plan

In April 2012 representatives from FEMA Region 6 and NM DHSEM met to discuss the concept of All-Hazards planning. This resulted in NM DHSEM requesting planning support to address New Mexico's earthquake hazard—associated with the Rio Grande Rift (RGR), a massive and rare continental or dry land rift. Because DHSEM identified the natural hazard in both the State Hazard Mitigation Plan and Threats and Hazards Identification Risk Assessment (THIRA) worksheet, FEMA Region 6 requested funding from FEMA Headquarters to support the deliberate planning initiative, which was approved for federal fiscal year 2015.

The New Mexico Rio Grande Rift Catastrophic Earthquake Response Plan (RGR Plan) describes how FEMA, other federal agencies, and additional community partners will support the state pursuant to the Robert T. Stafford Disaster Relief Emergency Assistance Act (Stafford Act) and other appropriate non-Stafford Act legal authorities.

The RGR Plan is a scenario-based Federal Support Plan intended to outline the joint agreement for federal actions, primarily in the first 96 hours post-incident, in response to a Level 1, no-notice, catastrophic earthquake in New Mexico. The RGR Plan was developed in coordination with local, tribal, state, federal, and private sector partners. The focus was on;

- Interoperability of Command, Control, Communications, and Computers
- Logistics
- Continuity of Operations
- Devolution Planning for Continuity of Government

The scenario entails a magnitude 7.0 earthquake on the Sandia-Rincon faults of the RGR impacting Albuquerque and surrounding areas to include 11 of New Mexico's 33 counties, representing over 1.17 million residents—over half the State's total population—and over $15.7 billion dollars in economic loss.

Some of the most beneficial results of the planning process included:

- Assisting the State with assessing their preparedness for responding to a Level 1 incident with recommendations for improvement.
- Assisting the State and other stakeholders with communicating the value of Continuity of Operations and Continuity of Government.
- Enhancing the existing All-Hazards Emergency Operations Plan and other plans.

4.3.7 Geospatial Data / Viewers / Applications

4.3.7.1 State Environmental Public Health Tracking Program (NM EPHT)

The New Mexico Environmental Public Health Tracking Program, also known as "NMTracking", is the premiere resource for environmental and health data and information in New Mexico. The NM EPHT is part of the National Environmental Public Health Tracking Network and provides many datasets related to environmental health issues impacting the state's communities.

4.3.7.2 State Resource Geographic Information System (RGIS)

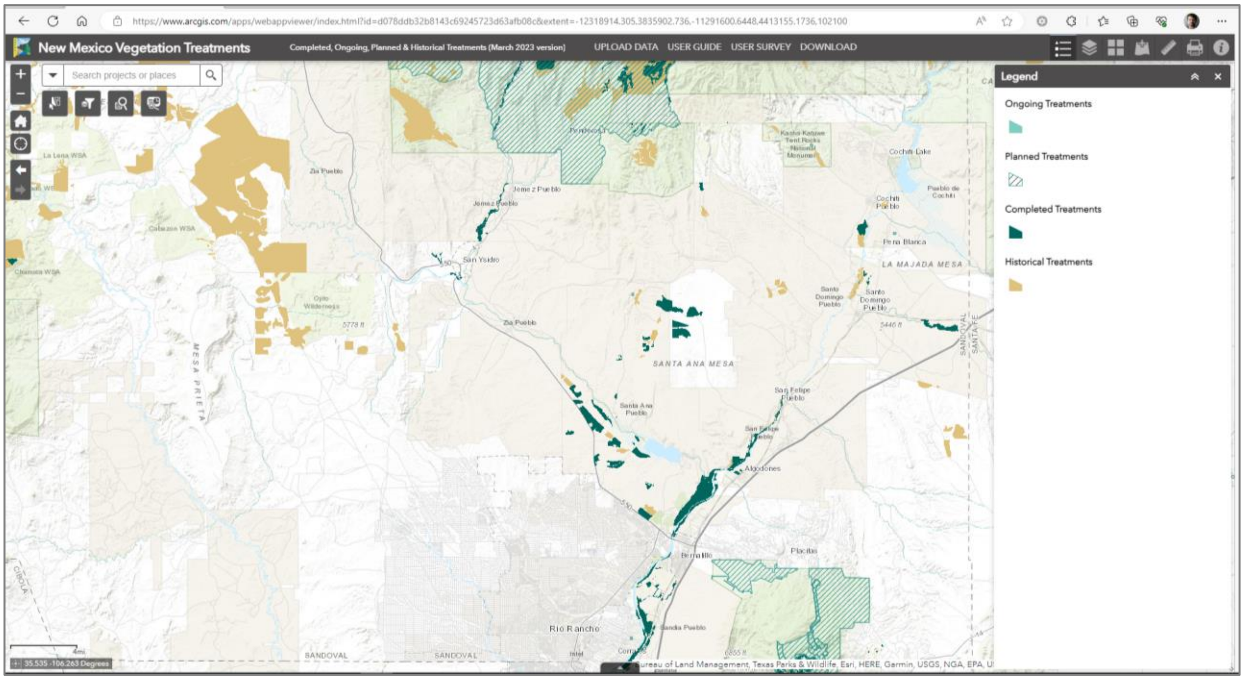
The New Mexico Resource Geographic Information System (RGIS) Program within the EDAC at the University of New Mexico is legislatively designated as the New Mexico State digital geospatial data clearinghouse. RGIS contains a wide range of free digital geospatial data that can be used to address a variety of questions including emergency response, preparedness, and hazard mitigation.

4.3.7.3 State Vegetation Treatments Geodatabase

The New Mexico Opportunity Mapping Project is a collaborative effort by agencies and NGOs to develop up-to-date, accessible information about forest and watershed restoration across New Mexico. The purpose of the Opportunity Mapping Project is to enable planners and managers from all jurisdictions to access data that can help them make decisions about how to invest or match their "next dollar" in a way that will complement past restoration work and achieve a larger-scale outcome. The New Mexico Opportunity Mapping Project is developed as an online database where any agency, organization, or partnership effort can enter information about their project. The resulting maps and data can be accessed at various scales by any user.

The NM Vegetation Treatments geodatabase is the first phase of the Opportunity Mapping Project. Developed and maintained by the New Mexico Forest and Watershed Restoration Institute (NMFWRI), the geodatabase has information about completed, planned, and historic vegetation treatments. This collaborative collection of data from a variety of agencies including the US Forest Service (USFS), NM State Forestry, Bureau of Land Management (BLM), State Land Office, and Tribal Agencies, was funded using a HMGP grant.

Figure 4-3 New Mexico Vegetation Treatments Geodatabase



Source: *https://nmfwri.org/gis-projects/nm-vegetation-treatment-mapping/*

4.3.7.4 Scenario Investment Planning Platform for New Mexico (SIPP-NM)

The Scenario Investment Planning Platform for New Mexico (SIPP-NM) was developed to help the state's forest managers. The tool uses the USFS ForSys model to quickly identify priorities, synergies, and tradeoffs across multiple management scenarios.

4.4 Federal Resources

4.4.1 National Flood Insurance Program (NFIP)

In 1968, Congress created the National Flood Insurance Program (NFIP) in response to the rising cost of taxpayer funded disaster relief for flood victims and the increasing amount of damage caused by floods. The Federal Insurance and Mitigation Administration (FIMA) manages the NFIP and implements a variety of programs authorized by Congress to reduce losses that may result from natural disasters. In addition to providing flood insurance and reducing flood damages through floodplain management regulations, the NFIP identifies and maps the nation's floodplains. Mapping flood hazards creates broad-based awareness of the flood hazards and provides the data needed for floodplain management programs and to actuarially rate flood insurance.

Over 22,000 communities across the United States and its territories participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage (104 New Mexico communities). In exchange, the NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities. Flood insurance is designed to provide an alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods.

The NFIP aims to reduce the impact of flooding on private and public structures. It does so by providing affordable insurance to property owners and by encouraging communities to adopt and enforce floodplain management regulations. These efforts help mitigate the effects of flooding on new and improved structures. Overall, the program reduces the socio-economic impact of disasters by promoting the purchase and retention of general risk insurance, but also of flood insurance, specifically.

The NFIP is self-supporting for the average historical loss year, which means that operating expenses and flood insurance claims are not paid for by the taxpayer, but through premiums collected for flood insurance policies. To obtain secured financing to buy, build, or improve structures in Special Flood Hazard Areas (SFHAs), flood insurance must be purchased. Lending institutions that are federally regulated or federally insured must determine if the structure is located in a SFHA and must provide written notice requiring flood insurance. Flood insurance is available to any property owner located in a community participating in the NFIP. All areas are susceptible to flooding, although to varying degrees.

The State Floodplain Coordinator provides technical assistance to individual communities in order to promote floodplain management practices consistent with the intent of the NFIP. To this end, state officials work with NFIP communities to identify and resolve floodplain management issues before they result in an enforcement action by FEMA. The statute requires that communities with identified flood hazards adopt a floodplain management ordinance, have a Certified Floodplain Manager (CFM) on staff to review floodplain development, and join the NFIP.

The state is in compliance with the NFIP (44 CFR 60.25) as summarized below:

- Enact legislation enabling counties and municipalities to regulate development within flood-prone areas;
- Encourage and help communities qualifying for participation in the NFIP;
- Assist county and municipal public bodies and agencies in developing, implementing, and maintaining local floodplain management regulations;
- Provide local governments and the public with NFIP information on the coordination of local, federal, and state floodplain management requirements;
- Help communities in dissemination of information on minimum elevation requirements;
- Assist in flood-prone areas and supply relevant information to the NFIP;
- Recommend priorities for federal floodplain management activities based on the needs of localities within the state;
- Notify the NFIP of apparent irreconcilable differences between a community's local floodplain management program and the minimum requirements of the NFIP;
- Establish minimum state floodplain management regulatory standards consistent with those of the NFIP and other federal and state environmental and water pollution standards for preventing pollution during flooding;
- Assure coordination and consistency of floodplain management activities with other state, regional, and local planning and enforcement agencies;
- Assist in the identification and implementation of flood hazard mitigation recommendations which are consistent with the minimum floodplain management criteria of the NFIP;
- Participate in the floodplain management training opportunities and other flood hazard preparedness programs whenever practicable.
- Any building that receives state appropriations for its construction or that is repaired or improved with state appropriations in an amount greater than fifty percent of the building's value must comply with NFIP standards.

4.4.1.1 NFIP Participation

As of June 1, 2023 there are 104 New Mexico communities participating in the NFIP: 29 counties, 35 cities, 26 villages, 13 towns and one Tribal jurisdiction. The four counties that do not participate in the NFIP are De Baca and Guadalupe in Preparedness Area 1, and Harding and Union in Preparedness Area 2. This participation is unchanged since 2018. NFIP policy statistics are listed by county in Table 4-1 and summarized by Preparedness Area in Table 4-3. Table 4-2 lists NFIP participation statistics and how they have changed over the last two Plan updates.

Table 4-1 NFIP Policy Statistics by County as of June 1, 2023

County	Number of Policies	Total Coverage	Total Premium	Total Claims Since 1978	Total Paid Since 1978
Bernalillo County	1,135	$308,025,000	$623,927	178	$1,451,189
Catron County	2	$90,000	$1,313	5	$168,085
Chaves County	196	$41,407,000	$146,052	46	$255,247
Cibola County	44	$6,747,000	$34,731	26	$445,471
Colfax County	14	$3,536,000	$9,661	7	$14,219
Curry County	188	$43,376,000	$90,284	51	$498,296
Dona Ana County	881	$222,943,000	$621,143	200	$4,706,679
Eddy County	242	$52,449,000	$247,172	51	$332,647
Grant County	43	$12,129,000	$44,675	12	$116,507
Hidalgo County	3	$290,000	$1,625	3	$27,828
Lea County	768	$150,980,000	$419,624	206	$924,792
Lincoln County	173	$41,213,000	$127,276	95	$2,288,765
Los Alamos County	19	$6,475,000	$8,465	11	$31,798
Luna County	23	$4,667,000	$14,334	4	$151,028
McKinley County	49	$11,388,000	$26,051	16	$19,132
Mora County	3	$700,000	$2,738	0	$0
Otero County	960	$199,141,000	$601,925	128	$1,539,366
Quay County	3	$770,000	$1,852	10	$12,314
Rio Arriba County	133	$32,415,000	$115,057	39	$354,264
Roosevelt County	264	$42,620,000	$188,342	28	$317,444
San Juan County	137	$41,859,000	$127,662	47	$506,764
San Miguel County	72	$16,961,000	$71,536	21	$96,688
Sandoval County	449	$103,151,000	$344,384	36	$279,349
Santa Fe County	372	$111,826,000	$201,863	48	$937,388
Sierra County	24	$5,153,000	$21,963	15	$157,857
Socorro County	144	$33,663,000	$154,939	20	$280,331
Taos County	72	$20,701,000	$60,516	26	$52,123
Torrance County	61	$7,741,000	$47,529	1	$4,797
Valencia County	1,664	$346,364,000	$1,229,384	118	$921,416
State Total	**8,138**	**$1,868,780,000**	**$5,586,023**	**1,448**	**$16,891,784**

Source: FEMA. Note: De Baca, Guadalupe, Harding, and Union Counties do not participate in the NFIP.

Table 4-2 NFIP Participation as of June 1, 2023

	2013	2018	2023	Change 2018-2023
Communities Participating	90	104	104	**0%**
# of Policies	16,899	12,803	8,138	**-36%**
Amount of Insured Assets Covered	$3,088,045,900	$2,772,592,200	$1,868,780,000	**-33%**
Amount of Total Premiums	NA	$10,536,830	$5,586,023	**-47%**
Claims Made Since 1978	1,057	1,317	1,448	**131**
Total Value of Claims Paid since 1978	$11,145,831	$14,946,317	$16,891,784	**$1,945,467**

Source: FEMA

Table 4-3 NFIP Policy Statistics by Preparedness Area as of June 1, 2023

Preparedness Area	Number of Policies	Total Coverage	Total Premiums	Claims since 1978	Total Paid Since 1978	Claims Since 2018
PA 1	1,834	$372,815,000	$1,220,602	487	$4,629,505	42
PA 2	89	$21,197,000	$83,935	28	$110,907	1
PA 3	596	$171,417,000	$385,901	124	$1,375,573	17
PA 4	230	$59,994,000	$188,444	89	$971,367	4
PA 5	3,453	$798,944,000	$2,400,163	353	$2,937,082	52
PA 6	1,936	$444,413,000	$1,306,978	367	$6,867,350	15
State Total	**8,138**	**$1,868,780,000**	**$5,586,023**	**1,448**	**$16,891,784**	**131**

Source: FEMA

Since 2018 the number of policies statewide has decreased by 36%. This decrease has been fairly uniform across the State with the largest decrease in Preparedness Area 4 (-44%) and the smallest decrease in Preparedness Area 4 (-28%). 131 flood claims have been filed since 2018, mainly in Preparedness Areas 5 and 1.

4.4.1.2 Community Rating System (CRS)

The Community Rating System (CRS) is a voluntary program for NFIP participating communities that recognizes and encourages comprehensive community floodplain management activities that exceed the minimum NFIP standards. The CRS has been developed to provide incentives in the form of premium discounts for policyholders, in communities that go beyond the minimum floodplain management requirements and develop extra measures to provide protection from flooding. The goals of the CRS are to (1) reduce flood damages to insurable property, (2) strengthen and support the insurance aspects of the NFIP, and (3) encourage a comprehensive approach to floodplain management.

There are 10 CRS communities in New Mexico, out of a total of 104 NFIP participating communities, shown in Table 4-4. The Cities of Albuquerque and Las Cruces have the best CRS across the state at Class 7, which equates to a 15% insurance premium discount. The other classes and discounts are shown in the following figure. Since the 2018 Plan update, Albuquerque was re-classified from 8 to 7, Dona Ana County from 9 to 10 (no longer participating), and La Cruces 6 to 7. All other classifications remained the same.

Table 4-4 New Mexico CRS Communities as of June 1, 2023

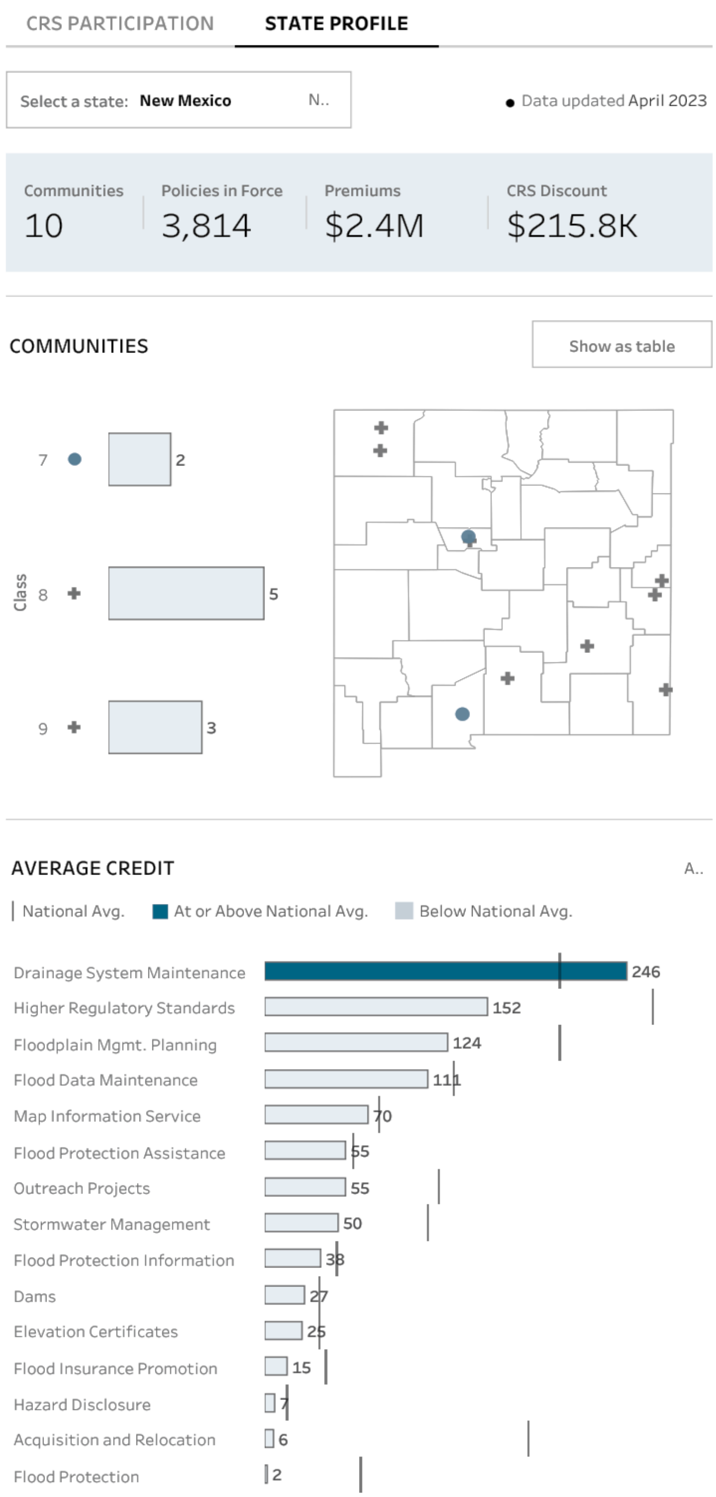
CRS Community	Current NFIP Policies	Current CRS Class	Current % Saving	Current $ Savings	Potential Savings from 1 Class Improvement
Bernalillo County	655	8	10%	$48,552	$72,399
Albuquerque	615	7	15%	$37,644	$51,091
San Juan County	82	8	10%	$4,272	$6,087
Farmington	68	8	10%	$6,807	$9,742
Las Cruces	588	7	15%	$96,445	$129,916
Alamogordo	1,040	9	5%	$32,248	$55,798
Clovis	252	8	10%	$40,488	$60,433
Hobbs	778	8	10%	$45,700	$68,233
Portales	321	9	5%	$11,205	$22,170
Roswell	178	9	5%	$8,688	$16,849

Source: FEMA

Figure 4-4 provides a snapshot of the state's CRS profile. Participation in CRS across the state currently provides flood policy holders with $215,800 in policy discounts annually.

In March of 2022, DHSEM developed and promulgated a CRS Recertification Guide to assist CRS communities with recertification and to help them improve their rating with minimal effort. In July of 2022, DHSEM conducted a virtual workshop for CRS Communities, presenting the Recertification Guide and explaining available CRS credits. In 2023-2024, DHSEM plans to launch a similar program aimed at communities who are not in the CRS program but might benefit from joining.

Figure 4-4 New Mexico CRS Profile



Source: FEMA

4.4.1.3 Repetitive Loss Structures

The NFIP defines a repetitive loss (RL) property as any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling 10-year period since 1978. At least two of the claims must be more than 10 days apart but within 10 years of each other. A repetitive loss property may or may not be currently insured by the NFIP. A Severe Repetitive Loss (SRL) property is one that has had four or more claims of more than $5,000, or that has received claim payments that exceed the current value of the property.

As of June 1, 2023, there are 75 repetitive loss structures identified in the State (Table 4-5) with 129 losses totaling $2,672,844 in damages. The number of repetitive loss properties has nearly doubled since 2018. The biggest increase in number of RL properties has been in Alamogordo (+16), Portales (+6), Las Cruces (+3), and Albuquerque (+3). An additional $634,577 in repetitive loss payments have been made since 2018.

The number of RL properties and claims as of June 1, 2023, as summarized in Table 4-6 and broken down by community in Table 4-5.

Table 4-5 New Mexico Repetitive Loss Properties as of June 1, 2023

Community	RL Properties	# Of Losses	Total payments
Alamogordo, City of	16	25	$534,267
Albuquerque, City of	6	9	$61,817
Aztec, City of	5	10	$383,859
Belen, City of	1	2	$20,000
Bernalillo County	1	2	$23,189
Carlsbad, City of	4	8	$96,239
Chavez County	1	2	$31,671
Clovis, City of	4	7	$409,937
Deming, City of	1	2	$88,421
Dona Ana County	4	9	$198,152
Gallup, City of	1	2	$12,090
Grants, City of	2	2	$44,538
Hobbs, City of	7	13	$175,850
Las Cruces, City of	3	6	$29,796
Portales, City of	8	9	$158,529
Roswell, City of	3	5	$21,414
Ruidoso, Village of	2	3	$78,004
San Juan County	1	2	$6,375
San Miguel County	1	2	$50,004
Santa Fe County	1	2	$56,444
Socorro County	1	3	$35,209
Valencia County	2	4	$157,039
Statewide Total	**75**	**129**	**$2,672,844**

Source: FEMA

Table 4-6 Repetitive Loss Properties and Losses as of June 1, 2023

	2013	2018	2023
Repetitive Loss Properties	39	38	75
Losses Paid	87	122	129
Total Payments	$1,150,000	$2,038,267	$2,672,844

Source: FEMA

As of June 1, 2023, two severe repetitive loss structures were identified in the State (Table 4-7) with seven losses totaling $321,516 in damages. Both structures are residential and were insured at the time of the losses.

Table 4-7 Severe Repetitive Loss Properties (as of 6/1/23)

Community Name Severe Rep Loss	County Name	Zip Code	Losses per Structure	Total Claim Amount Paid Out
City of Hobbs	Lea County	88240-1002	4	$87,194
City of Clovis	Curry County	88101-7829	5	$234,322
TOTAL			9	$321,516

Source: FEMA

"Substantial Damage" is defined by the NFIP as: a structure in a Special Flood Hazard Area (SFHA) or floodplain for which the total cost of repairs is 50% or more of the structure's market value before the disaster occurred, regardless of the cause of damage. A substantially damaged structure must comply with local floodplain regulations during post-flood repairs. The decision about a structure being substantially damaged is made at the local-government level, generally by a building-department official or floodplain manager. For communities that participate in the NFIP, substantial damage determinations generally are required by local floodplain-management ordinances. These rules must be in place for residents of a community to purchase flood insurance.

4.4.2 Flood Hazard Mapping Program

4.4.2.1 NFIP Coordinator

The Governor has selected DHSEM as the coordinating agency for the NFIP. Activities include the following:

- Ensuring that communities have the legal authorities necessary to adopt and enforce floodplain management regulations;
- Establishing minimum state regulatory requirements consistent with the NFIP;
- Providing technical and specialized assistance to local governments and the general public;
- Coordinating the activities of various state agencies that affect the NFIP; and
- Encouraging and assisting communities to qualify for NFIP participation.

The duties and responsibilities of the NFIP State Coordinator are set forth in 44 CFR §60.25 of the NFIP regulations. State responsibilities generally include:

- Monitoring legislation to allow local units of government to adopt ordinances that ensure continued eligibility;
- Encouraging and assisting communities to qualify for participation;
- Ordinance assistance;
- Community assistance;

- Coordination of local floodplain activities;
- Flood Insurance Study (FIS) and mapping assistance;
- Conducting Community Assistance Visits (CAV) and Community Assistance Contacts (CAC);
- Establishing minimum state standards;
- Mitigation; and
- Training.

4.4.2.2 Cooperating Technical Partnership (CTP)

FEMA's CTP Program was developed for state, local, regional, and tribal organizations and universities. It is an innovative approach to creating partnerships between FEMA and entities that have the interest and capability to become more active participants in the FEMA flood hazard mapping program. CTPs strengthen the effectiveness of the National Flood Insurance Program (NFIP) and support FEMA's mitigation objectives by leveraging partnerships to deliver high-quality hazard identification and risk assessment products, provide outreach support, and empower communities to take action to reduce risk based on informed multi-hazard based data and resources. The Earth Data Analysis Center (EDAC) at the University of New Mexico is the New Mexico CTP for FEMA Region VI and coordinates its efforts with NMFMA, the US Army Corps of Engineers (USACE) New Mexico Silver Jackets team, and the New Mexico Geospatial Advisory Council (NMGAC).

EDAC annually updates the New Mexico Risk Map Five Year Business Plan which outlines projects that the CTP will undertake to help New Mexico communities reduce flood risk. These projects are developed in conjunction with the New Mexico State Floodplain Coordinator and FEMA Region VI and are guided by the New Mexico Hazard Mitigation Plan. The projects are prioritized according to Risk Map guidelines in its Multi-Year Plan. The strategies and products address the need for better flood hazard identification and mapping.

4.4.2.3 Community Assistance Program State Support Services Element (CAP-SSSE)

The CAP-SSSE program derives its authority from the National Flood Insurance Act of 1968, as amended, the Flood Disaster Protection Act of 1973, and from 44 CFR Parts 59 and 60. This program provides funding to New Mexico to provide technical assistance to communities in the NFIP and to evaluate community performance in implementing NFIP floodplain management activities. This program provides funding for the State Floodplain Coordinator, a full-time position at DHSEM, as well as NMFMA activities through an annual sub-grant agreement. FEMA Region VI and DHSEM negotiate a CAP-SSSE Agreement that specifies activities and products to be completed in a Statement of Work. The agreement enables the state coordinating agency to meet FEMA's requirements by providing technical assistance and monitoring and evaluating their work. Where possible, the agreement should integrate the expertise of the state on how best to build and maintain community floodplain management capability. The agreement is not intended to fund all floodplain management activities undertaken by the NFIP state coordinating agency, only specific activities that the region and state identify.

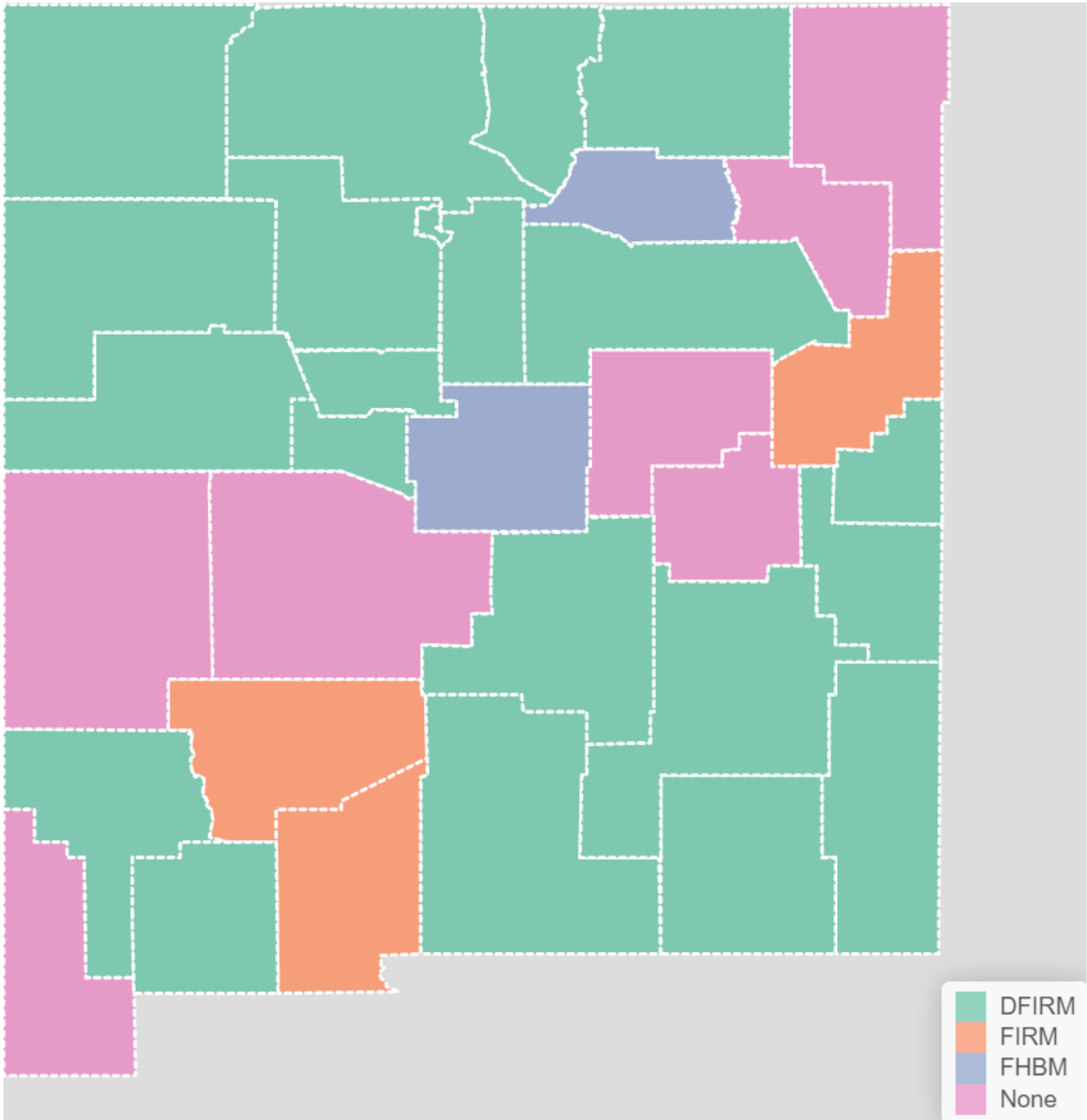
4.4.2.4 Floodplain Mapping

Through FEMA's flood hazard mapping program, Risk Mapping, Assessment and Planning (Risk MAP), FEMA identifies flood hazards, assesses flood risks and partners with states and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. Flood hazard mapping is an important part of the National Flood Insurance Program (NFIP), as it is the basis of the NFIP regulations and flood insurance requirements. FEMA maintains and updates data through Flood Insurance Rate Maps (FIRMs) and risk assessments. FIRMs include statistical information such as data for river flow, storm tides, hydrologic/hydraulic analyses and rainfall and topographic surveys.

During FEMA's Map Modernization program between 2004-2015, Digital Flood Insurance Rate Maps (DFIRMs) for 23 of New Mexico's 33 counties were developed. Ten counties were not digitized and six; Catron, De Baca, Guadalupe, Harding, Hidalgo, and Union Counties, have had no floodplain mapping conducted. Mora and Torrance counties' FIRM effective dates are 1977 and 1978, respectively, and were converted by letter from HUD Flood Hazard Boundary Maps. Sierra County's effective FIRM date was 1986 and Quay County's is 2003. Though county wide mapping is not available for Catron, De Baca, Guadalupe, Hidalgo, and Union Counties, some extent of these counties has some form of floodplain delineation. No mapping for Harding County has ever been conducted.

Figure 4-5 shows the status of each County DFIRM as of June 2017.

Figure 4-5 DFIRM Status in New Mexico as of May 2023



Source: https://nmflood.org/MAPS/mappingstatus/

4.4.2.5 Statewide Multi-Hazard Risk Portfolio (MHRP)

EDAC has developed a Statewide Multi-Hazard Risk Portfolio (MHRP) in order to prioritize watersheds for FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) Program and mitigation activities. The MHRP is designed to provide a state level or regional level risk assessment. The MHRP is a multi-year, multi-stakeholder approach to summarizing and identifying natural hazards by watershed.

4.4.2.6 Base Level Engineering (BLE)

BLE is a watershed-wide engineering modeling method that uses high resolution ground elevation, automated riverine hydrologic and hydraulic modeling, and manual model review to prepare broad and accurate flood risk information. This allows for a baseline understanding of flood risk in a cost efficient and timely manner. It also allows FEMA to assess and update its current flood hazard inventory more efficiently while increasing operational transparency.

The BLE approach also produces a range of flood risk datasets to include floodplains (10%, 1% and 0.2% annual chance events), water surface elevation grids (1% and 0.2% annual chance events), flood depth grids (1% and 0.2% annual chance events), and Hazus flood risk assessment. This wealth of information is intended to elevate the delivery of Zone A Flood Insurance Rate Maps (FIRMs). Production of countywide FIRMs in areas that are currently unmodernized or unmapped allows FEMA to work with local communities, industry, and the CTP to expand partnerships and further inform the national flood hazard inventory with the submittal of FIRM updates via Letters of Map Revision (LOMR).

Local communities can adopt the BLE results, as best available data, to support floodplain management activities. Community access to the data allows the community to review the data prior to FIRM update or creation. This arms communities with data to assist regulation and development decisions without mandatory purchase of flood insurance and other requirements caused by the creation/update of a FIRM.

BLE data provides flood risk information for areas of on-going development where FIRMs may not indicate accurate flood risk. The availability of BLE modeling provides communities a discussion point with local developers and provides them digital hydraulic model files for refinement.

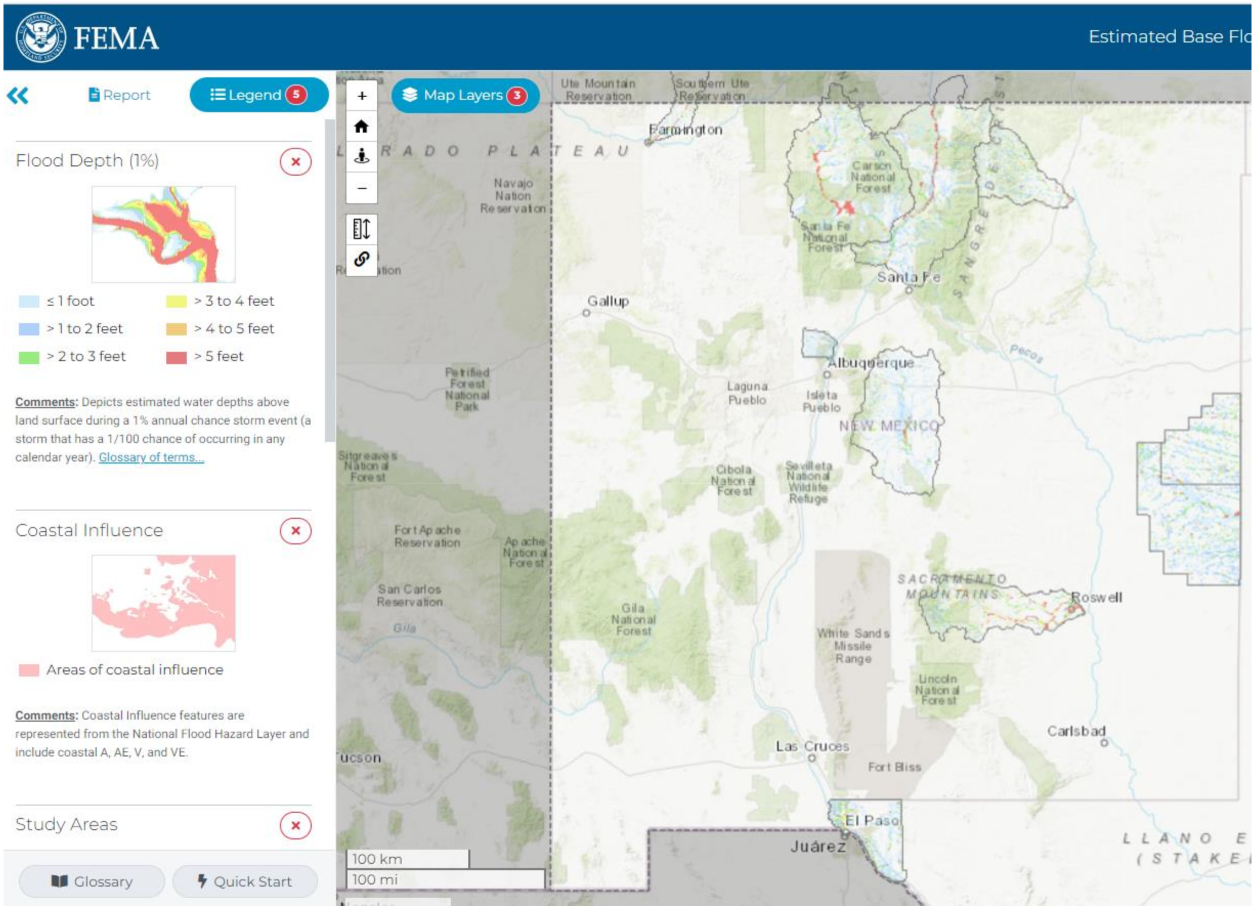
BLE datasets can be used to produce a watershed or river basin Flood Risk Report, Flood Risk Database, and series of Flood Risk Maps. These Flood Risk Products can be analyzed and integrated with local hazard mitigation planning efforts. The data sets can also provide insight to local communities about how datasets may be used locally in advance of an updated FIRM map.

The availability of the 1% and 0.2% floodplains, water surface elevation, and flood depth grids also provide point and click information that is required for a number of FEMA grant applications. Additionally, the BLE datasets and hydraulic models may be used as a starting point for local engineering assessments, greatly reducing the financial burden on communities to provide best available data.

Under certain circumstances BLE data can be utilized to provide Base Flood Elevation for Letters of Map Amendment (LOMA). While the BLE data can be utilized when local communities or property owners submit for Letters of Map Revision (LOMR) or Physical Map Revision (PMR), there are still costs associated with the LOMR process.

FEMA Region VI's Estimated Base Flood Elevation Viewer (estBFE) includes estimated base flood elevation and approximate flood depths determined from gridded datasets constructed from engineering flood models. These datasets simplify thousands of miles of study, providing users a variety of useable and meaningful information. Base Level Engineering watershed assessments use automated modeling and high resolution ground data based on LiDAR to produce credible engineering analysis for thousands of miles of stream at a time. This flood data may be used in coordination with regulatory floodplains as best available flood hazard information. A snapshot of the coverage in New Mexico as of June 2023 is shown below.

Figure 4-6 FEMA's Estimated Base Flood Elevation Viewer (estBFE)



Source: https://webapps.usgs.gov/infrm/estBFE/

4.4.2.7 Silver Jackets

The Silver Jackets is a USACE supported effort to bring together multiple state, federal, and sometimes tribal and local agencies to learn from one another. The goal is to apply the group's collective knowledge to reduce the risk of flooding and other natural disasters and enhance response and recovery efforts when such events do occur. The New Mexico Silver Jackets team is comprised of the: USACE, FEMA, DHSEM, EDAC, and NWS-Albuquerque.

4.4.2.8 USGS Debris Flow Models and Predictive Models

USGS produced several debris flow models for individual wildfire burned areas. The debris flow model reports for the Track Wildfire (2011) and Las Conchas Wildfire (2011) were issued in 2011. The debris flow model for the Whitewater-Baldy Complex Wildfire (2012) was issued in 2012. The debris flow model for the Little Bear Wildfire (2012) was issued in 2013. A report on the pre-wildfire evaluation for the Sandia and Manzano Mountains and surrounding areas was issued in 2014. A report on the pre-wildfire evaluation for the Jemez Mountains was issued in 2016. Summaries of these reports can be found in the Hazard Identification and Risk Assessment section of this Plan.

Additionally, the USGS conducts post-fire debris-flow hazard assessments for select fires in the Western U.S. https://landslides.usgs.gov/hazards/postfire_debrisflow/

4.4.2.9 National Flood Hazard Layer (NFHL)

The National Flood Hazard Layer (NFHL) provides users with the ability to determine the flood zone, base flood elevation, and floodway status for a particular geographic location. This information can be used for planning purposes, to understand insurance requirements, and to inform mitigation actions. It also provides information relating to: NFIP communities, FIRMs, cross sections and hydraulic structures, Coastal Barrier Resource System (CBRS) information (if applicable), and base map information, such as road, stream, and public land survey data. The NFHL dataset represents the current effective flood risk data for those parts of the country where maps have been modernized. It is a compilation of effective FIRM and LOMR data. The NFHL is updated as new data reaches its designated effective date and becomes valid for regulatory use under the NFIP.

4.4.2.10 National Levee Database (NLD)

The National Levee Database (NLD) is a congressionally authorized database that documents levees in the United States. The NLD is maintained and published by the US Army Corps of Engineers (USACE). It recently underwent a refresh making more tools available to data managers to keep information updated and provides an improved dashboard that makes finding and understanding levee information easier than ever. NLD information includes the location, general condition, and risks associated with the levees.

The U.S. Army Corps of Engineers (USACE)is conducting an inventory and review of non USACE levees that will be added to the National Levee Database (NLD). The inventory and review will identify the condition and analyze the flood risks associated with each location. As part of the nation-wide inventory and review, USACE will;

- Conduct a one-time inspection and risk assessment on levees that are identified;
- Provide information to state agencies related to the condition, benefits, and flood risks associated with levees; and
- Offer information on best practices and tools for levee inspections and risk assessments to interested state agencies.

Participation in this effort by the state is "voluntary and does not create a federal responsibility to operate, maintain, repair, or replace levees assessed by USACE."

4.4.3 Other Federal Databases and Applications

4.4.3.1 Hazus Estimated Annual Earthquake Losses for the United States

In April 2023, an updated assessment of the nationwide earthquake risk was published by FEMA in an update of FEMA P-366, Hazus Estimated Annualized Earthquake Losses for the United States. Informed decision-making on mitigation policies, priorities, strategies, and funding levels in the public and private sector rely on estimating the degree of earthquake risk in the country. According to the report, steadily increasing damages and losses are primarily due to three factors on a national level: 1) increased building value, 2) incorporation of the latest hazard data, and 3) improvements to the Hazus modelling software's building inventory.

The results of the study are useful in the following ways:

- Improving understanding of seismic risk in the nation.

- Providing a baseline loss estimate for earthquake policy development, the promotion of state and local risk awareness, and comparison of mitigation action in states and high-risk local communities.
- Supporting the adoption and enforcement of seismic provisions of building codes.
- Comparing the seismic risk with that of other natural hazards.
- Supporting pre-disaster planning for earthquake response and recovery.

4.4.3.2 National Risk Index (NRI) for Natural Hazards

FEMA developed the National Risk Index (NRI) as a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards. It was designed and built in close collaboration with various stakeholders and partners in academia; local, state, and federal government; and private industry.

The NRI leverages available source data for natural hazard and community risk factors to develop a baseline risk measurement for each United States county and Census tract. The NRI's interactive mapping and data-based interface enables users to visually explore individual datasets to better understand what is driving a community's natural hazard risk with minimal technical expertise. Users may also create reports to capture risk details on a community or conduct community-based risk comparisons, as well as export data for analysis using other software.

As noted in Section 61.2, the HMPC reviewed NRI data for risk ratings, anticipated losses, and social vulnerability, but determined that the data from Local and Tribal HMPs more accurately reflected the State's risk to hazards.

4.4.3.3 Homeland Security Information Program (HSIP) Gold Database

The National Geospatial-Intelligence Agency (NGA) and the Homeland Infrastructure Foundation-Level Data (HIFLD) working group have assembled the Homeland Security Information Program (HSIP) Gold database of critical facilities and critical infrastructure. HSIP Gold data may only be used during Presidential Disaster or Emergency Declarations or by personnel in the New Mexico All Source Intelligence Center (NMASIC) via the DH1View. The HIFLD Open Data Portal provides National foundation-level geospatial data within the open public domain, this data is available for download in a variety of geospatial file formats.

4.4.3.4 Climate and Economic Justice Screening Tool

In January of 2021, President Biden issued Executive Order 14008. The order directed the Council on Environmental Quality (CEQ) to develop a new tool. This tool is called the Climate and Economic Justice Screening Tool. It utilizes an interactive map and uses datasets that are indicators of burdens in eight categories: climate change, energy, health, housing, legacy pollution, transportation, water and wastewater, and workforce development. The tool uses this information to identify communities that are experiencing these burdens and are determined to be disadvantaged.

Federal agencies will use the tool to help identify disadvantaged communities that will benefit from programs included in the Justice40 Initiative. The Justice40 Initiative seeks to deliver 40% of the overall benefits of investments in climate, clean energy, and related areas to disadvantaged communities.

4.4.3.5 Resilience Analysis and Planning Tool (RAPT)

The Resilience Analysis and Planning Tool (RAPT), developed by FEMA, provides access to powerful data and GIS mapping that can help everyone understand their community.

RAPT includes over 100 preloaded layers including community resilience indicators from peer-reviewed research, the most current US Census demographic data, infrastructure data, and data on weather, hazards and risk. RAPT also includes easy to use analysis tools, the ability to add in data from other sources, and print and download functions.

4.5 Funding Capabilities

4.5.1 State Programs and Funding Opportunities

4.5.1.1 New Mexico Capacity Building Grant

The New Mexico Capacity Building Grant is managed by the New Mexico Department of Finance and Administration (DFA). This funding supports Council of Governments and local and tribal governments in building capacity and obtaining experienced personnel to help local entities pursue grant funding opportunities.

4.5.1.2 New Mexico Forest Health Initiative Program

The New Mexico Forest Health Initiative assists private landowners, state managed lands, municipalities, and tribes with improving forest health by increasing resilience to forest pests such as bark beetles, pathogens, and drought. The New Mexico Energy, Minerals, and Natural Resources Department (EMNRD) Forestry Division manages and directs the Forest Health Initiative via funding from the US Department of Agriculture (USDA) Forest Service, state, and private forestry. The Forest Stewards Guild is proud to partner with the New Mexico Forestry Division on this important program to improve the health of New Mexico's forests.

The Forest Health Initiative Program provides cost share funds for the reduction of insect and pathogen (disease) risk through forest improvement. The objective is to improve degraded (e.g., overcrowded, infested, and/or infected) forestland to a healthier, more resilient state. Approved practices involve thinning and slash treatments to prevent future losses by increasing tree and forest health. Landowners who have a minimum of 10 acres of forestland and a stewardship/management plan in place are eligible to apply. Forest Health Initiative funds can also be used to help landowners develop long-term forest management plans where none presently exist.

4.5.2 FEMA Funding Resources and Programs

The State of New Mexico relies upon federal mitigation grant programs available through FEMA to fund the state's mitigation program. Local jurisdictions, tribes, and state agencies may pursue other funding sources at their discretion.

FEMA's Hazard Mitigation Assistance (HMA) grant program provides funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages. DHSEM acts as the grantee for available programs, evaluates and recommends projects to FEMA for funding, and passes federal grant funds through to sub-grantees (municipal government, county government, state government, and tribal entities). The non-federal share is usually borne by the sub-grantee. Sub-grantees may meet their match by cash, in-kind services, or a combination of the two.

The HMA program consists of:

- Hazard Mitigation Grant Program (HMGP)
- Hazard Mitigation Grant Program Post-Fire (HMGP Post-Fire)
- Building Resilient Infrastructure and Communities (BRIC) grant program
- Flood Mitigation Assistance (FMA) grant program
- Pre-Disaster Mitigation (PDM) grant program

The following pages describe these grant programs, along with other FEMA grants that can also be used to fund mitigation activities. A list of HMA grants awarded to New Mexico as grantee and sub-grantees can be found in Appendix H. A summary of grant funds awarded by Preparedness Area is shown in Table 4-8.

Table 4-8 FEMA HMA Funds Awarded by Preparedness Area as of June 1, 2023

PA	HMA Funds Awarded
1	$1,429,093
2	$1,019,798
3	$3,447,658
4	$444,955
5	$18,969,394
6	$1,791,832
Statewide Projects	$3,489,875
TOTAL	**$30,592,584**

4.5.2.1 Hazard Mitigation Grant Program (HMGP)

Assists in implementing long-term hazard mitigation measures following Presidential disaster declarations; funding is available to implement projects in accordance with state, tribal, and local priorities.

Section 404 of the Robert T. Stafford Disaster Relief Emergency Assistance Act (Stafford Act) created the Hazard Mitigation Grant Program (HMGP) in November 1988. The HMGP assists states and local communities in implementing long-term hazard mitigation measures following a major disaster declaration. On October 30, 2000, the Stafford Act was amended by Public Law 106-390 and Section 404, referred to as the Disaster Mitigation Act of 2000 (DMA2K). The state administers the HMGP and is responsible for selecting projects for funding from the applications submitted by tribes and local communities. The state then forwards selected applications to FEMA for an eligibility determination.

Objectives of the HMGP are:

- To prevent future losses of lives and property due to disasters;
- To implement state or local hazard mitigation plans;
- To enable mitigation measures to be implemented during immediate recovery from a disaster; and
- To provide funding for previously identified mitigation measures that benefit the disaster area and state.

As of June 1, 2023, New Mexico and its subrecipients have received $21,725,126 in HMGP funding, to include HMGP Post-Fire funds.

4.5.2.2 Hazard Mitigation Grant Program Post-Fire (HMGP Post-Fire)

Assists in implementing long-term hazard mitigation measures following wildfires that have received a Fire Management Assistance declaration; funding is available to implement projects in accordance with state, tribal, and local priorities.

The Disaster Recovery Reform Act (DRRA), Public Law 115-254, was enacted on October 5, 2018, and made numerous legislative changes to the Robert T. Stafford Relief and Emergency Assistance Act (Stafford Act). Section 1204 of the DRRA amended Section 404 of the Stafford Act to allow FEMA to provide HMGP assistance for hazard mitigation measures that substantially reduce the risk of future damage, hardship, loss, or suffering in any area affected by a major disaster, or any area affected by a fire for which assistance was provided under Section 420 Fire Management Assistance Grant (FMAG). The state administers the HMGP and is responsible for selecting projects for funding from the applications submitted by tribes and local communities. The state then forwards selected applications to FEMA for an eligibility determination.

Objectives of the HMGP Post Fire are:

- To prevent future losses of lives and property due to disasters;
- To implement state or local hazard mitigation plans;
- To enable mitigation measures to be implemented during immediate recovery from a disaster; and
- To provide funding for previously identified mitigation measures that benefit the disaster area and state.

4.5.2.3 Building Resilient Infrastructure and Communities (BRIC) Grant Program

Provides state set-aside and nationally competitive funds on an annual basis so that measures can be taken to reduce or eliminate the risk of natural hazards.

The Disaster Recovery Reform Act (DRRA), Public Law 115-254, was enacted on October 5, 2018, and made numerous legislative changes to the Robert T. Stafford Relief and Emergency Assistance Act (Stafford Act). Section 1234 of the DRRA amended Section 203 of the Stafford Act to allow FEMA to establish the BRIC grant program. The BRIC program is made available to states on an annual basis as a competitive grant and through state-specific set-aside dollars. The state administers the BRIC program and is responsible for selecting projects for funding from the applications submitted. The state then forwards selected applications to FEMA for national competitive selection and eligibility determination.

Objectives of the BRIC grant program are:

- To support state, local, and tribal governments through capability- and capacity-building;
- To encourage and enable innovation while allowing flexibility, consistency, and effectiveness;
- To promote partnerships and enable high-impact investments to reduce risk from natural hazards with a focus on critical services and facilities, public infrastructure, public safety, public health, and communities;
- To reduce future losses and minimize impacts on the Disaster Relief Fund (DRF);
- To promote equity, including helping members of disadvantaged groups and prioritizing 40 percent of the benefits to disadvantaged communities; and
- To support the adoption and enforcement of building codes, standards, and policies that will protect the health, safety, and general welfare of the public, taking into account future conditions, prominently including the effects of climate change, and have long-lasting impacts on community risk reduction, including for critical services and facilities and for future disaster costs.

As of June 1, 2023, New Mexico and its subrecipients have received $388,122 in BRIC funding.

4.5.2.4 Flood Mitigation Assistance (FMA) Grant Program

Provides nationally competitive funds on an annual basis so measures can be taken to reduce or eliminate the risk of flood damage to buildings insured under the National Flood Insurance Program (NFIP).

The FMA program was created as part of the National Flood Insurance Reform Act of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the NFIP. This program is made available to states on an annual basis as a competitive grant. There is no state-specific set-aside. The FMA program provides grants to tribes and communities for mitigation projects that reduce the risk of flood damage to structures that have NFIP coverage. The state administers the FMA program and is responsible for prioritizing projects for funding from the applications submitted by tribes and local communities. The state then submits selected applications to FEMA for national competitive selection and eligibility determination.

As of June 1, 2023, New Mexico and its subrecipients have received $42,559 in FMA funding.

4.5.2.5 Pre-Disaster Mitigation (PDM) Grant Program

Provides funds for hazard mitigation planning and the implementation of mitigation projects prior to a disaster; the goal is to reduce overall risk to the population and structures.

The PDM program was authorized by Section 203 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (Stafford Act), 42 USC, as amended by Section 102 of the Disaster Mitigation Act of 2000. Funding for the program had previously been provided through the Pre-Disaster Mitigation Program to assist tribal, local, and state communities in implementing cost-effective hazard mitigation activities that complement a comprehensive mitigation program. Funding for PDM must be allocated by Congress.

The PDM program was phased out in 2020 and replaced by the BRIC program described above. However starting in FY2022 the PDM program was partially revived as a way to fund congressionally directed projects.

As of June 1, 2023, New Mexico and its subrecipients have received $7,385,412 in regular PDM funding, and an additional $1,051,365 in congressionally directed PDM funding.

4.5.2.6 Rehabilitation of High Hazard Potential Dams (HHPD) Grant Program

While not technically a part of the HMA program, FEMA's 4.5.2.6 Rehabilitation of High Hazard Potential Dams (HHPD) grant program provides technical, planning, design, and construction assistance for eligible rehabilitation activities that reduce dam risk and increase community preparedness. Eligible rehabilitation projects include technical, planning, design, and construction activities toward the repair, removal, or structural/non-structural rehabilitation of eligible High Hazard potential dams. Eligible dams include non-federal high hazard potential dams that fail to meet minimum dam safety standards and pose unacceptable risk to life and property.

As of June 1, 2023, New Mexico and its subrecipients have not yet received any HHPD funding.

4.5.2.7 Public Assistance (PA) and 406 Mitigation

Under the Stafford Act Section 406, FEMA PA funding can cover the cost of mitigation measures that are implemented in conjunction with the repair of disaster-damaged facilities. The funding is limited to federally declared counties/tribes and to the eligible damaged facilities. Mitigation measures must directly reduce the potential of future, similar disaster damages to the eligible facility.

Examples of reasonable 406 mitigation measures include:

- Construction of flood protection around damaged facilities;
- Installation of new drainage facilities (including culverts) along damaged roads;
- Slope stabilization to protect facilities;
- Retaining walls, rip rap, or gabion baskets; and
- Geotextile fabric for erosion control

4.5.2.8 Emergency Management Performance Grant (EMPG) Program

The EMPG program is a comprehensive funding mechanism whereby FEMA funds a variety of state emergency management functions. The funding formula is 50% federal and 50% non-federal. Many of the local and county emergency managers are funded through this program.

4.5.2.9 National Dam Safety State Assistance Grant Program

The New Mexico Office of the State Engineer's Dam Safety Bureau has been the recipient of grant funding from the National Dam Safety Program of FEMA for a number of years. The NM Dam Safety Bureau has applied this grant funding to support training of dam safety engineers, education and outreach to dam owners, and other tasks in New Mexico. Specific focus has been to promote the development of Emergency Action Plans (EAP) for High and Significant Hazard potential dams.

4.5.2.10 Community Assistance Program – State Support Services Element (CAP-SSSE)

FEMA's CAP-SSSE program helps states proactively identify, prevent, and resolve floodplain management issues in participating communities before a flood event occurs. The primary benefit of this grant is that it provides funding for a full-time State Floodplain Coordinator.

The 2018 NM SHMP noted that a challenge with this grant program was that the funding cycle does not allow for sufficient time to expend all of the available funds. Since then, FEMA has been much more flexible in allowing DHSEM to roll-over funds into multiple federal fiscal years, making it much easier to take advantage of this funding source.

New directions for the State Floodplain Management Program include increase in the number of CAVs conducted each year and an increase in the number of CACs conducted each year. Starting with FFY23, the goal will be for each NFIP community will have a CAV every five years and a CAC every three years.

4.5.2.11 National Earthquake Hazard Reduction Program (NEHRP)

NEHRP is FEMA's earthquake program that focuses on risk reduction. Eligible activities include seismic mitigation planning; property inventory and seismic inspection of critical structures and lifelines; updates to local building codes, zoning codes, and ordinances to enhance seismic safety; and earthquake awareness and education.

Although New Mexico took advantage of this grant in the past, as of 2020 New Mexico was no longer eligible for NEHRP funding as only states with high or very high earthquake risk were deemed to be eligible.

4.5.3 Other Federal Funding Programs

As part of the 2023 planning process, the SHMT reviewed a wide range of available federal grant programs that have been used or could be used to fund mitigation. The most significant of these are listed below. A more complete list of available grant programs is included in Appendix E.

4.5.3.1 Community Wildfire Defense Grant (CWDG) Program

The CWDG Program, managed by the U.S. Forest Service, is intended to help at-risk local communities and tribes plan for and reduce the risk of wildfire. This program, which was authorized by the 2022 Bipartisan Infrastructure Law, prioritizes at-risk communities in an area identified as having high or very high wildfire hazard potential, are low-income, or have been impacted by a severe disaster that affects the risk of wildfire.

The program provides funding to communities for two primary purposes:

- Develop and revise Community Wildfire Protection Plans (CWPP).
- Implement projects described in a Community Wildfire Protection Plan that is less than ten years old.

The Community Wildfire Defense Grant Program also helps communities in the wildland urban interface (WUI) implement the three goals of the National Cohesive Wildland Fire Management Strategy.

- Restore and Maintain Landscapes: Landscapes across all jurisdictions are resilient to fire-related disturbances, in accordance with management objectives.
- Create Fire Adapted Communities: Human populations and infrastructure can better withstand a wildfire without loss of life and property.
- Improve Wildfire Response: All jurisdictions participate in making and implementing safe, effective, efficient risk-based wildfire management decisions.

In 2023, New Mexico communities received over $11M from the first year of this grant:

- **Cimarron Watershed Alliance Inc., Colfax Collaborative Wildland Urban Interface Project:** $8,048,150 to create defensible space around homes and structures of value, thin forests to reduce hazardous fuel loadings, maintain existing fuel breaks, and create new fuel breaks. The project will treat about 150-175 properties per year and approx. 3,400 acres over the next five years.
- **Cimarron Watershed Alliance Inc., Flying Horse Ranch Fuel Break Project:** $1,821,254 to maintain and widen an existing four-mile fuel break and then expand it approximately 10.2 miles covering 702 acres. This 14.2-mile fuel break project is a small but critical piece of approximately 75 miles of fuel breaks that are currently being planned and implemented in the Enchanted Circle Priority Landscape within Taos and Colfax Counties.
- **International Association of Fire Chiefs, Exercise and Project Implementation of Community Wildfire Protection Plan:** $235,404 to provide peer-to-peer guidance, subject-matter expertise, and funding to aid in the exercise and implementation of projects within the San Miguel County Community Wildfire Protection Plan (2018) over a 24-month period. The CWPP identifies high priority projects including training, community education and outreach, and evacuation planning projects all aimed at reducing wildfire risk to the community. Unification of stakeholders will support capacity and sustainable actions, evacuation, and recovery operations.
- **Sandoval County, Sandoval CWPP Update:** $63,000 to update the CWPP and make it a useful document for both first responders and community members that live within the wildland urban interface. This will be done through outreach meetings with a wide array of key community stakeholders to determine priorities for the impacted areas.
- **Forest Stewards Guild, Community Wildfire Mitigation in the Greater Santa Fe Fire Shed:** $1,314,366 to deliver accomplishments in measurable timely outcomes over the next five years; 500+ home hazard assessments (HHAs) completed, 125+ of high-priority acres treated through fuels mitigation treatments, increasing the number and geographic coverage of Fire shed ambassadors, and the number of education and outreach events.

4.5.3.2 State Fire Assistance – Wildland Urban Interface (SFA-WUI) Program

This U.S. Forest Service grant program is administered by the Forestry Division of the NM EMNRD, and is funded 50:50 by various federal agencies. SFA-WUI seeks to benefit local communities where the wildland urban interface (WUI) is a concern through fuel reduction and the creation of defensible space. Local governments are the grant recipients and projects may be done on private land in conjunction with landowners.

4.5.3.3 Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation Program (PROTECT)

The Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation Program provides funding to ensure surface transportation resilience to natural hazards including climate change, sea level rise, flooding, extreme weather events, and other natural disasters through support of planning activities, resilience improvements, community resilience, and evacuation routes. The PROTECT discretionary program offers two types of awards: planning grants and Competitive Resilience Improvement Grants.

4.5.3.4 Tornado Shelters Act (TSA)

The Tornado Shelters Act enables local governments to utilize Community Development Block Grant (CDBG) funds from the US Department of Housing and Urban Development (HUD) to create community tornado shelters (“safe rooms”) in manufactured housing communities.

4.5.3.5 Rural Fire Assistance (RFA) Program

The Rural Fire Assistance Program provides funds to smaller communities that may not be able to compete favorably for other funding. RFA funds the acquisition of firefighting equipment by rural fire departments, which are mostly volunteer. This program is coordinated through EMNRD and funded by the US Department of the Interior (DOI).

4.5.3.6 Volunteer Fire Assistance (VFA) Program

The Volunteer Fire Assistance Program is similar to the RFA program, but it provides for the placement of “Wildland Coordinators” in rural counties that do not have a county fire marshal or countywide supervision of rural fire departments. This program increases the capability of rural volunteer fire departments to meet wildland firefighting requirements and provides continuity in training, certification, and leadership. VFA is a program of the US Forest Service, administered by EMNRD.

4.5.3.7 Collaborative Forest Restoration Program (CFRP)

The USFS CFRP provides grants to stakeholders for forest restoration projects that are designed through a collaborative process. Projects can be up to four years in length and can be located on or any combination of federal, tribal, state, county, or municipal forest land. Projects must address the following objectives: wildfire threat reduction, ecosystem restoration (including non-native species reduction), re-establishment of historic fires regimes, reforestation, preservation of old and large trees, small diameter tree utilization, and creation of forest-related local employment.

Since 2001, the CFRP has funded over 200 projects, including close to 600 partners, in planning and implementing collaborative forest restoration and small diameter utilization projects in 20 counties across New Mexico. These projects have restored over 33,000 acres and created over 750 jobs.

4.5.3.8 Wildfire Risk Reduction for Rural Communities Program

The Wildfire Risk Reduction for Rural Communities Program provides seed money through the Bureau of Land Management (BLM). In cooperation with the New Mexico Association of Counties (NMAC), the program supports at-risk communities to help offset the costs of reducing wildland fire risk to non-federal WUI areas in New Mexico. Funding is intended to directly benefit communities that may be impacted by wildland fire originating on or spreading to BLM public land. The program supports outreach and education projects such as Fire Adapted Communities, Firewise, and Ready, Set, Go, as well as encourages CWPP updates for plans that are more than five years old. Eligible applicants include a county government or municipality, a 501(c)(3) organization in the State of New Mexico, a statutorily recognized political subdivision such as a soil and water conservation district, or a Native American tribe working on behalf of one or more communities at risk of wildfires in the State of New Mexico.

4.5.3.9 Rural Community Assistance Economic Action Program (RCA-EAP)

The RCA-EAP is administered directly by the USFS to local governments. Its focus is to utilize local forest products to produce value-added materials for resale, or for the conversion of biomass materials (waste wood) to energy for heating of public buildings or other uses. It serves the interests of wildfire mitigation by reducing the fuel load in forests. A more direct benefit is that it provides employment and boosts the local economy.

4.5.3.10 Small Business Administration (SBA) Mitigation Loan Program

The SBA utilizes the Mitigation Loan Program to provide low-interest loans to small businesses for the mitigation of natural hazards.

4.6 Mitigation Capability Summary

4.6.1 Strengths

As part of this Plan's update, the State Hazard Mitigation Team (SHMT) identified a number of strengths relating to the state's mitigation efforts and capabilities. These are highlighted below and will be leveraged by the state as New Mexico continues to expand its hazard mitigation efforts. These strengths include:

- The proposed reorganization of DHSEM's Mitigation Unit into its Response and Recovery Bureau will help elevate the mitigation program's visibility and coordination with other DHSEM programs.
- Lessons learned, capabilities expanded, and relationships fostered through recovery efforts following the devastating 2022 wildfires and COVID-19.
- Increased coordination and engagement with FEMA Region VI.
- The multitude of available state data viewers / application and hazard-related data resources, provided by EDAC and other state organizations.
- The broad and diverse participation of the SHMT during this Plan's update.
- Increased statewide understanding and support of hazard mitigation efforts.
- Multiple state efforts focused on reducing climate change's effects on New Mexico's population and built environment.
- The state's broad and collective planning and outreach efforts addressing a number of New Mexico's high-risk hazards.
- Increased utilization of private sector resources to address the mitigation programs needs through the DHSEM New Mexico Technical Assistance Contract which has been in place since 2015.

4.6.2 Obstacles, Challenges, and Proposed Solutions

The following section identifies those obstacles and challenges facing the State of New Mexico's hazard mitigation program. Some potential strategies for overcoming these issues are provided and have been evaluated by the SHMT for inclusion into this Plan's updated mitigation strategy.

Statute 3-18-6 is beneficial to serve as evidence that the state legislature believes floodplain regulation is important and could ease the way into the NFIP for communities that are considering this action. Unfortunately, as there is no provision of a penalty for non-compliance, this statute is not particularly effective.

4.6.2.1 Staffing Challenges

The DHSEM Mitigation Section has been plagued by insufficient staffing as well as high rates of personnel turnover from the SHMO on down. DHSEM has been leveraging contractor resources to make up the difference. The proposed reorganization of DHSEM's Mitigation Unit into its Response and Recovery Bureau is expected to help address this problem.

4.6.2.2 Building & Land Use Codes

Each county and municipality across the state is responsible for monitoring its own building codes, zoning, and development; the state does not have oversight on this. The state will continue to support and provide local education on the mitigation benefits of adopting the latest building codes.

4.6.2.3 Geospatial Data

As noted previously in this section, there are a number of different geospatial data sources available for mitigation planning in New Mexico. The state's E911 program has statewide addressing, however it is better/more complete in some areas than others. Current efforts are being directed at identifying available funding to complete statewide addressing/mapping.

4.6.2.4 Information Resources

Providing broadband availability to all state communities is important to ensure hazard warning systems are able to disseminate data and communicate with the public. The NM Office of Broadband Access and Expansion (OBAE) has an active grant program, along with the NM PRC, the FCC, and NTIA, to expand broadband access statewide.

4.6.2.5 Outreach & Training

The state recognizes the need to continually educate local and tribal governments on planning for and implementing hazard mitigation. DHSEM is in the process of developing a sub-applicant engagement program, to expand state support for local communities to leverage available mitigation funding and programs.

The lack of available local resources and the capacity needed to develop fully eligible project applications is a hindrance to many communities. The state new Capacity Building Grants are a potential solution for interested local and tribal governments.

4.6.2.6 National Flood Insurance Program

The CRS is highly effective in reducing flood insurance premium rates for participating communities. However, smaller communities with limited staff have difficulty implementing new flood risk reduction activities and maintaining the required documentation. Those larger communities with a higher number of NFIP policies have more incentive to get a lower CRS rating (thusly resulting in more dollar savings for policy holders). Because the dollar savings is to the policy holders and not the community, many communities do not provide the resources necessary to obtain and maintain the CRS rating.

In March of 2022, DHSEM developed and promulgated a CRS Recertification Guide to assist CRS communities with recertification and to help them improve their rating with minimal effort. In July of 2022, DHSEM conducted a virtual workshop for CRS Communities, presenting the Recertification Guide and explaining available CRS credits. In 2023-2024, DHSEM plans to launch a similar program aimed at communities who are not in the CRS program but might benefit from joining.

4.6.2.7 Flood Hazard Mapping Program

The wildfires of 2022 again highlighted the need for adequate post-wildfire flood and debris mapping. The state is coordinating with numerous federal agencies to create this necessary data that will allow the state to identify mitigation efforts that will assist and protect local communities.

In more remote locations, communities may be eager to encourage development and be less prepared to mitigate and educate the public about the risks from natural hazards ahead of an event. Historically floodplain mapping for the NFIP Flood Insurance Rate Maps (FIRM) has not covered the entire state. The flood hazard in rural areas, in particular, has not been completely mapped. FEMA Region 6 is investing extensively in BLE mapping across the state. The BLE flood hazard data will provide expanded flood risk information for unmapped areas. The state continues to support and coordinate new and updated floodplain mapping with FEMA Region VI.

4.6.2.8 Funding Capabilities

The successful utilization of federal funding is oftentimes limited by a lack of local/state funding for the required non-federal match. The state is currently tracking other state efforts at utilizing FEMA's Safeguarding Tomorrow Revolving Loan Fund Program, funded by the recent Safeguarding Tomorrow through Ongoing Risk Mitigation (STORM) Act.

In regard to FEMA's FMA program, the state has not submitted because this is a nationally competitive grant. There has not been requests from eligible applicants to take advantage of FMA funding because there has been sufficient funding through HMGP (which is specific to New Mexico), state set-aside from BRIC, and state set-aside from PDM. The state will continue to monitor opportunities to utilize the FMA program and may submit for this nationally competitive grant if there is demand from sub-grantees.

4.6.2.9 Rehabilitation of High Hazard Potential Dams (HHPD) Grant Program

As of June 1, 2023, the State of New Mexico has not met all the requirements of the Rehabilitation of High Hazard Potential Dams (HHPD) Grant Program, making the state ineligible for funding under that program. This has been identified as an area for improvement and added to the State's Mitigation Action Plan. The state intends to address this deficiency in the coming year(s) and issue an interim Plan update prior to the regular 5-year update cycle.

5 Local and Tribal Coordination and Capability Building

44 CFR Part 201.4
This section shall include: *[A] general description and analysis of the effectiveness of local mitigation policies, programs, and capabilities.* *A description of the State process to support, through funding and technical assistance, the development of local mitigation plans.* *A description of the State process and timeframe by which the local plans will be reviewed, coordinated, and linked to the State Mitigation Plan.* *Criteria for prioritizing communities and local jurisdictions that would receive planning and project grants under available funding programs, which should include consideration for communities with the highest risks, repetitive loss properties, and most intense development pressures. Further, that for non-planning grants, a principal criterion for prioritizing grants shall be the extent to which benefits are maximized according to a cost benefit review of proposed projects and their associated costs.*

Coordination between government organizations is not only a top-down venture. Mitigation planning is reciprocal; crucial risk data is available at all levels of government and information sharing increases numerous capacities. Local planning is foundational for hazard educated, safer communities and the state supports this planning through training, technical assistance, and available funding. This provides opportunities to mutually share mitigation priorities and obstacles which is essential to building capacity at both the local and state level.

Collaboration between the state, local governments, and tribes can lead to mitigation successes at all levels. The state can share solutions from one jurisdiction to another, especially utilizing the Local Preparedness Coordinators (LPCs), and can be more efficient, effective, and encouraging. This type of capacity building has a positive effect on the sustainability and overall strength of mitigation planning, which helps plans more easily navigate through the review and approval process.

An understanding of local mitigation plans is also an important input into the State mitigation plan. Given a shortage of good statewide data for many hazards, local plans often provide the best information on local hazard impacts. Section 5.3 provides a summary of hazards profiled in local and tribal plans, the priorities given to them by the local and tribal planning teams, and exposure estimates where available. This data was reviewed by the SHMT and used to inform hazard identification and prioritization for this SHMP update. As described in Section 4.4.3.2, the HMPC reviewed National Risk Index (NRI) data for risk ratings, anticipated losses, and social vulnerability, but determined that the data from local and tribal HMPs more accurately reflected the State's risk to hazards.

A review of the mitigation capabilities and strategies found in local and tribal plans helps ensure that the State's mitigation strategy and activities reflects the reality at the local and tribal level. Section 5.4 provides an overview of mitigation capabilities and an assessment of the effectiveness of mitigation activities reported in local and tribal plans. This data was also reviewed by the SHMT to provide insight into the larger mitigation obstacles, challenges, and opportunities at the local/tribal level. This provided the planning team with an opportunity to assess ways for the state to support investments in local mitigation efforts., and used to inform the State's mitigation strategy in Section 7.

A detailed roll up of data from the local and tribal plans reviewed can be found in Appendix F.

5.1 Local Preparedness Area Program

The purpose of DHSEM's Local Preparedness Area Program is to provide technical assistance for local emergency management programs. This is achieved by LPCs through a continuous cycle of planning, training, equipping, exercising, evaluating, and taking action to mitigate hazards. A map depicting Preparedness Areas (PAs) is shown in Figure 5-1 and a listing of the counties and tribal entities located in each PA is in Table 5-1.

Figure 5-1 New Mexico Preparedness Areas

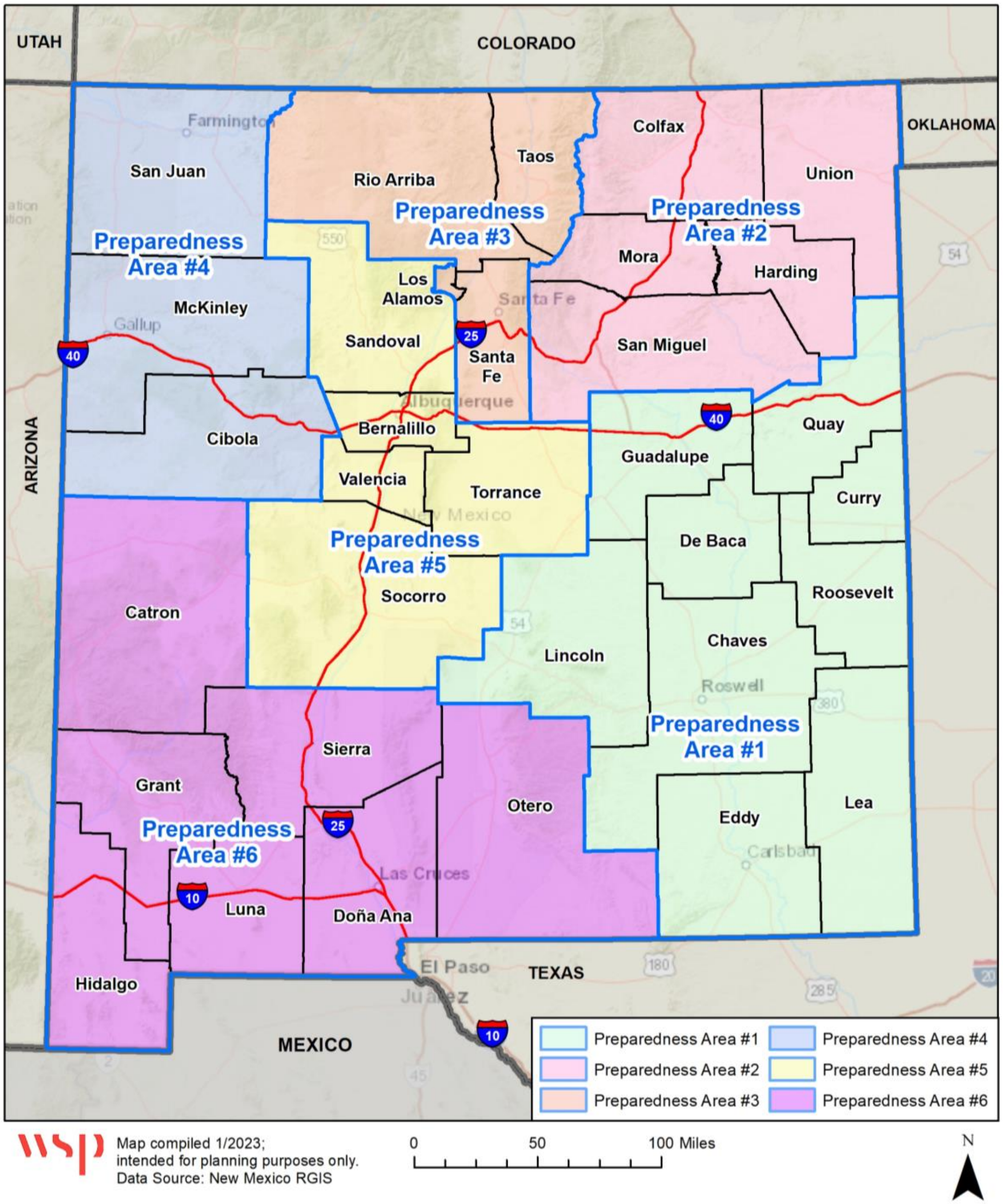


Table 5-1 Preparedness Areas

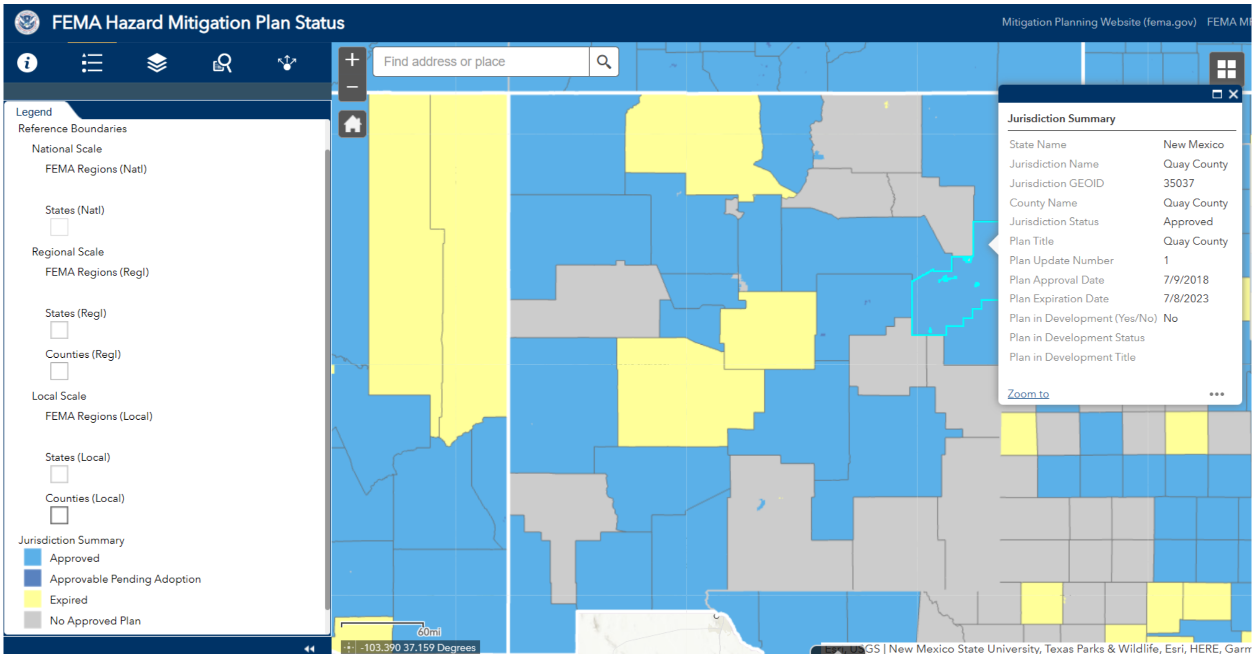
Preparedness Area	Counties	Tribes
1	Chaves, De Baca, Dona Ana, Grant, Hidalgo, Lincoln, Los Alamos, Quay,	None
2	Curry, San Miguel, Union	None
3	Santa Fe, Rio Arriba, Taos	Jicarilla Apache, Nambe Pueblo, Ohkay Owingeh Pueblo, Picuris Pueblo, Pojoaque Pueblo, San Ildefonso Pueblo, Santa Clara Pueblo, Tesuque Pueblo, Taos Pueblo
4	Cibola, McKinley, San Juan,	Acoma Pueblo, Laguna Pueblo, Navajo Nation, Ramah Navajo, Tojajiilee Navajo Ute Mountain, Zuni Pueblo,
5	Bernalillo, Sandoval, Socorro, Torrance, Valencia	Alamo Navajo, Cochiti Pueblo, Isleta Pueblo, Jemez Pueblo, Sandia Pueblo, San Felipe Pueblo, Santa Ana Pueblo, Santo Domingo Pueblo, Zia Pueblo,
6	Catron, Eddy, Guadalupe, Lea, Luna, Otero, Sierra,	Mescalero Apache

5.2 Local Government Hazard Mitigation Plan Status

Current information on local hazard mitigation plans (LHMP) in the state can be seen in the FEMA Hazard Mitigation Plan Status interactive map viewer.

The viewer shares information on the status of the plan including whether a plan is approved, approvable pending adoption, expired, or the jurisdiction does not have a plan. It also shows the expiration date of active plans and how many times a plan has been updated. The viewer is able to zoom to local government level, including villages.

Figure 5-2 New Mexico Local Hazard Mitigation Plans



As part of the 2023 SHMP update, local and tribal HMPs were reviewed, and certain elements have been compiled at a State and Preparedness Area (PA) level for inclusion in the SHMP. The most recent HMP for a jurisdiction was used, even if that plan was expired, as being the best available data. Table 5-2 lists the local HMPs analyzed.

Table 5-2 Local Hazard Mitigation Plans

Jurisdiction	PA	Date of Plan		Jurisdiction	PA	Date of Plan
Albuquerque-Bernalillo County	5	1/19/2022		Luna County	6	10/17/2022
Catron County	6	1/2/2020		McKinley County	4	2/24/2021
Chaves County	1	2/14/2022		Otero County	6	11/22/2012
Cibola County	4	11/24/2015		Quay County	1	7/10/2018
City of Alamogordo	6	12/3/2019		Rio Arriba County	3	4/13/2015
City of Santa Fe	3	1/12/2021		San Juan County	4	2/4/2021
Curry County	2	8/22/2022		San Miguel County	2	10/19/2021
De Baca County	1	7/6/2015		Sandoval County	5	11/22/2019
Dona Ana County	1	6/14/2021		Santa Fe County	3	5/30/2018
Eddy County	6	9/23/2007		Sierra County	6	5/22/2019
Grant County	1	3/28/2008		Socorro County	5	3/20/2018
Guadalupe County	6	12/16/2022		Taos County	3	1/2/2019
Hidalgo County	1	5/21/2020		Torrance County	5	12/13/2017
Lea County	6	6/7/2008		Union County	2	8/30/2022
Lincoln County	1	7/25/2018		Valencia County	5	3/31/2022
Los Alamos County	1	3/20/2016				

The information from these local plans has been aggregated at the Preparedness Area level. More detailed information on the individual plans can be found in Appendix XX.

5.3 Hazard Profiles

A total of 14 natural hazards, shown below, are profiled in the state hazard mitigation plan. In local hazard mitigation plans (LHMPs) specific hazards are profiled based on the risk and importance to communities, and may not include all of those profiled by the state.

- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Expansive Soil
- Flood
- High Wind
- Landslide
- Land Subsidence
- Severe Winter Storm
- Thunderstorm
- Tornado
- Volcano
- Wildfire

Assessing those hazards profiled in the 31 LHMPs illustrated a commonality in risk perception at the local level. Review of the LHMPs determined there are five hazards that most concern all communities across the state:

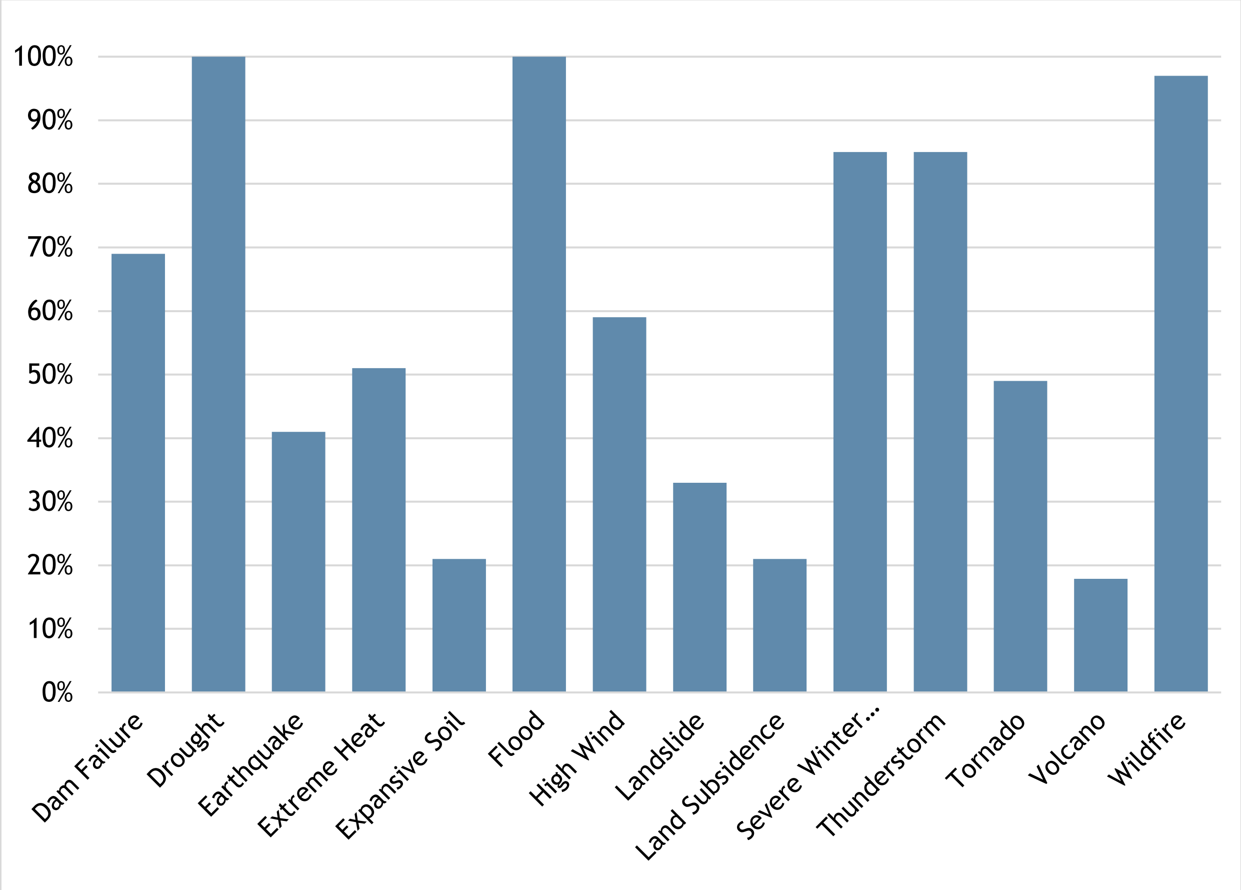
- Drought
- Flood
- Severe Winter Storm
- Thunderstorm
- Wildfire

These five hazards are profiled in most of the LHMPs with minimal exceptions. The presence of hazard profiles for the other nine hazards varied widely.

Figure 5-3 shows the percentage of LHMPs that profile each hazard.

- Drought and flood were included in 100% of the LHMPs.
- Wildfire was included in 97% of LHMPs.
- Thunderstorm and Severe Winter Storm were included in 85% of LHMPs.
- On the other end on the scale, only 18% of LHMPs profiles Volcano and 21% profiled expansive soil and land subsidence.

Figure 5-3 Statewide Percent of LHMPs Profiling Individual Hazards



The inclusion of hazards in the LHMPs illustrate the individual priorities of these communities. Geography plays a part in selecting which hazards to profile, as some hazards may not present a risk to the planning area. For example, areas with no exposure to expansive soil or land subsidence are unlikely to include these hazards among those profiled in the plan. However, many hazards cross large geographical areas, including extreme heat, which was profiled in 51% of the LHMPs. The lack of local attention regarding extreme heat is a notable gap, as climate change has increased the likelihood of extreme heat hazard events occurring across the state will increase.

5.3.1 Risk Rankings

Hazard risk rankings are generally reported in LHMPs using a scale of high / moderate / low risk. Three of the state's LHMPs do not currently rank hazards. These local rankings were compiled from 31 LHMPs and a quantitative range was assigned to this data. Overall hazard risk rankings were then calculated based on the number of responses and the ranking values for each response. Table 5-3 presents the hazard risk rankings for each PA and statewide. It should be noted that LHMPs only rank those hazards that are profiled within each document, therefore LHMPs do not include rankings for all of the state-profiled hazards.

Table 5-3 Hazard Risk Rankings by Preparedness Area

Hazards	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
Dam Failure	5	1	4	4	3	5	4
Drought	8	8	6	9	9	7	7
Earthquake	5	6	3		2	1	3
Extreme Heat	6	5	3	10	5	1	5
Expansive Soil	5	1	2	1			2
Flood	8	3	7	9	7	8	8
High Wind	10	10	4	8	6	7	7
Landslide		1	4	1	5	1	3
Land Subsidence	10		1	1	5		2
Severe Winter Storm	7	8	4	4	7	7	6
Thunderstorm	10	8	4	7	6	7	7
Tornado	6	5	3	1	2		4
Volcano		1	2		1	1	2
Wildfire	9	10	10	8	8	8	9

An overall picture of which hazards are most concerning across the state is paramount to prioritization of resources, funding, and support. When assessing those hazards ranked as presenting the highest risk across the state, the LHMPs identified the following hazards:

- Drought
- Flood
- High Wind
- Thunderstorm
- Wildfire

Comparison of the statewide versus PA risk rankings illustrates the similarities and differences of perceived risk and should further focus priorities to those areas with the greatest concern.

In the case of wildfire, there was consensus across the PAs of the high risk posed by this hazard. Flood and drought, also high risk at the state level, both have outlying rankings with all but one PA determining the risk to be high for each hazard. PA 2 assigned a low risk to flood while PA 3 reported moderate risk for high wind. The last statewide high risk hazard, thunderstorm, also had varied rankings, but these were reported between moderate and high.

The remaining hazards have mostly moderate and low rankings across the different PAs with the exception of volcano. Volcano was ranked the lowest risk by all PAs reporting.

5.3.2 Hazard Exposure

Many LHMPs include hazard exposure data for structures/parcels within areas of risk for multiple hazards. These hazards included dam failure, flood (including levee inundation), land subsidence, landslide, and wildfire. Exposure data from those LHMPs is included in the relevant hazard profiles below.

5.4 Local Government Mitigation Effectiveness

The effectiveness of local hazard mitigation is vital for the State of New Mexico to continue its path towards increased statewide resiliency. Effective mitigation is an ever-evolving process based on variables of local mitigation capabilities, as well as policies and programs. Capabilities are used to set priorities and achieve goals in communities, highlighting strengths to leverage and bringing awareness to areas in need of improvement. Understanding both the gaps and available resources in a community is critical to building a sustainable foundation for effective mitigation.

Policies and programs are where capabilities are able to become effective tools. Community buy-in, accountability, future planning, policies to guide the interests of projects, and programs to carry out successful implementation are paramount to effective strategy.

5.4.1 Local Government Mitigation Policies, Programs, and Capabilities

The mitigation capability assessment examines the ability of jurisdictions to implement and manage a comprehensive mitigation strategy. The strengths, weaknesses, and resources identified here are a means for evaluating and informing the state hazard mitigation program.

Mitigation capabilities are the foundation for developing plans and implementing mitigation actions in communities. These are classified into the following categories and types:

Planning & Regulatory
- Plans
- Building Code, Permitting, & Inspection
- Land Use Planning & Ordinances

Administrative & Technical
- Administration
- Staff
- Technical

Financial
- Funding Resources

Education & Outreach
- Programs & Organizations

The LHMPs were reviewed to identify reported mitigation capabilities across each respective PA. This data illustrates the areas in the state which possess resources to successfully implement mitigation in communities, as well as highlighting those areas with gaps. This detailed information presents opportunities to target specific areas to provide support for capabilities, reinforce community engagement, and utilize resources efficiently.

An overview of all capabilities assessed and the percent of PAs and the state with each capability is shown in the set of tables, Table 5-4 through Table 5-12.

The identified capability percentages are symbolized into quartiles, which show the percentage of the PA reporting as possessing the capability. The capabilities for each PA are wide-ranging and in some cases there are capabilities which none of the LHMPs reported having.

The number of active LHMPs reporting in each PA is listed in the tables for reference, as well as the state total of LHMPs.

The following sections highlight the positive trends reflected in mitigation capability reporting at the local level.

Legend - Percent with Capability
25% and below
26% to 49%
50% to 75%
76% to 100%
Number of LHMPs assessed in each PA is shown in parentheses in the header
32 LHMPs Assessed Total in State

5.4.1.1 Planning & Regulatory

The Planning & Regulatory category reporting features strengths across multiple types of capabilities. Table 5-4 shows the mitigation capability types of plans and building codes that are well utilized across the state.

Table 5-4 Planning & Regulatory Capabilities Highlights – Plans and Building Codes

Percentage of PA LHMPs Reporting Mitigation Capability								
Category	Capabilities	PA 1 (7)	PA 2 (2)	PA 3 (5)	PA 4 (5)	PA 5 (6)	PA 6 (7)	State (32)
Planning & Regulatory	Building Codes	100%		80%	20%	83%	86%	72%
Planning & Regulatory	Comprehensive, Master, or General Plan	71%	50%	100%	40%	67%	57%	66%
Planning & Regulatory	Capital Improvements Program or Plan (CIP)	71%	100%	40%	20%	67%	43%	53%
Planning & Regulatory	Community Wildfire Protection Plan (CWPP)	71%	50%	60%	20%	50%	71%	56%

Building codes are an example of considerable variation in capability distribution across the PAs. Overall, 72% of the LHMPs identified as having building codes. Four (4) of the PAs reported 80% and above of the LHMPs utilizing this capability, while two (2) PAs reported 0-20% of LHMPs identifying them as a capability.

Table 5-5 shows capability successes by PA of the land use planning & ordinances type including zoning, subdivision ordinance, and floodplain related capabilities.

Table 5-5 Planning & Regulatory Capabilities Highlights – Land Use Planning and Ordinances

Percentage of PA LHMPs Reporting Mitigation Capability								
Category	Capabilities	PA 1 (7)	PA 2 (2)	PA 3 (5)	PA 4 (5)	PA 5 (6)	PA 6 (7)	State (32)
Planning & Regulatory	Zoning Ordinance (Land Use)	57%	50%	60%	60%	100%	43%	63%
Planning & Regulatory	Subdivision Ordinance	86%	50%	40%	40%	100%	57%	66%
Planning & Regulatory	National Flood Insurance Program (NFIP) Participant	86%	50%	60%	60%	67%	86%	72%
Planning & Regulatory	Flood Insurance Study / Flood Insurance Rate Map / DFIRM	86%	50%	60%	60%	67%	71%	69%
Planning & Regulatory	Floodplain Ordinance	86%	50%	60%	40%	67%	86%	69%

5.4.1.2 Administrative & Technical

The Administrative & Technical capability reporting highlights strength in the capability type of staffing, shown below in Table 5-6. Overall, more than 55% of LHMPs report having these mitigation capabilities.

Table 5-6 Administrative & Technical Capability Highlights –– Staff

Percentage of PA LHMPs Reporting Mitigation Capability								
Category	Capabilities	PA 1 (7)	PA 2 (2)	PA 3 (5)	PA 4 (5)	PA 5 (6)	PA 6 (7)	State (32)
Administrative & Technical	Emergency Manager	71%	100%	60%	60%	67%	71%	69%
Administrative & Technical	Floodplain Administrator	71%		60%	40%	67%	86%	63%
Administrative & Technical	Community Planner	43%	50%	100%	20%	100%	29%	56%
Administrative & Technical	GIS Capability	29%	50%	80%	20%	100%	57%	56%

GIS and community planning resources are examples of the diverse availability of capabilities across the state. PAs reported a range of 20% to 100% of LHMPs confirming access to these capabilities. Similarly, the availability of floodplain administrators ranges from a PA without this capability to one with 86% of LHMPs utilizing this capability.

5.4.1.3 Financial

Mitigation funding resources are minimally utilized across the state, with less than half of LHMPs reporting leveraging most of these capabilities. Capital Improvement Project funding is reported as being available by 50% of the LHMPs and Community Development Block Grants (CDBG) are used by 59%.

5.4.1.4 Education & Outreach

Education & Outreach program capabilities are reported as being minimally utilized across the state, with the exception of PA 2.

5.4.1.5 Mitigation Capabilities Detailed Summary

Table 5-7 - Table 5-12 present the full results of the LHMP capability assessment as reported in local plans.

Table 5-7 Planning & Regulatory Capabilties – Building Codes, Permitting, and Inspection & Plans

Percentage of PA LHMPs Reporting Mitigation Capability									
Category	Type	Capabilities	PA 1 (7)	PA 2 (2)	PA 3 (5)	PA 4 (5)	PA 5 (6)	PA 6 (7)	State (32)
Planning & Regulatory	Building Code, Permitting, and Inspection	Building Codes	100%		80%	20%	83%	86%	**72%**
Planning & Regulatory	Building Code, Permitting, and Inspection	BCEGS							
Planning & Regulatory	Building Code, Permitting, and Inspection	Site Plan Review Requirements	29%		60%		50%		**25%**
Planning & Regulatory	Plans	Comprehensive, Master, or General Plan	71%	50%	100%	40%	67%	57%	**66%**
Planning & Regulatory	Plans	Capital Improvements Program or Plan (CIP)	71%	100%	40%	20%	67%	43%	**53%**
Planning & Regulatory	Plans	Floodplain Management Plan	14%	50%		20%	17%	14%	**16%**
Planning & Regulatory	Plans	Stormwater Program / Plan	29%		40%		17%	14%	**19%**
Planning & Regulatory	Plans	Community Wildfire Protection Plan (CWPP)	71%	50%	60%	20%	50%	71%	**56%**
Planning & Regulatory	Plans	Erosion / Sediment Control Plan			40%		17%		**9%**
Planning & Regulatory	Plans	Economic Development Plan	29%	50%	60%		67%	29%	**38%**

Table 5-8 Planning & Regulatory Capabilties – Land Use Planning & Ordinances

Percentage of PA LHMPs Reporting Mitigation Capability									
Category	Type	Capabilities	PA 1 (7)	PA 2 (2)	PA 3 (5)	PA 4 (5)	PA 5 (6)	PA 6 (7)	State (32)
Planning & Regulatory	**Land Use Planning & Ordinances**	Zoning Ordinance (Land Use)	57%	50%	60%	60%	100%	43%	**63%**
Planning & Regulatory	**Land Use Planning & Ordinances**	Subdivision Ordinance	86%	50%	40%	40%	100%	57%	**66%**
Planning & Regulatory	**Land Use Planning & Ordinances**	National Flood Insurance Program (NFIP) Participant	86%	50%	60%	60%	67%	86%	**72%**
Planning & Regulatory	**Land Use Planning & Ordinances**	Flood Insurance Study / Flood Insurance Rate Map / DFIRM	86%	50%	60%	60%	67%	71%	**69%**
Planning & Regulatory	**Land Use Planning & Ordinances**	Floodplain Ordinance	86%	50%	60%	40%	67%	86%	**69%**
Planning & Regulatory	**Land Use Planning & Ordinances**	Elevation Certificates for Floodplain Development			40%		17%	14%	**13%**
Planning & Regulatory	**Land Use Planning & Ordinances**	Community Rating System (CRS)				20%	17%	29%	**13%**
Planning & Regulatory	**Land Use Planning & Ordinances**	Open Space / Conservation Program						14%	**3%**
Planning & Regulatory	**Land Use Planning & Ordinances**	Growth Management Plan			60%	20%	17%		**16%**
Planning & Regulatory	**Land Use Planning & Ordinances**	Stormwater Ordinance							
Planning & Regulatory	**Land Use Planning & Ordinances**	Other Hazard Ordinance (e.g., Steep Slope, Wildfire, Snow Load)			60%		17%		**13%**

Table 5-9 Administrative & Technical Capabilties – Administration and Staff

Percentage of PA LHMPs Reporting Mitigation Capability									
Category	Type	Capabilities	PA 1 (7)	PA 2 (2)	PA 3 (5)	PA 4 (5)	PA 5 (6)	PA 6 (7)	State (32)
Administrative & Technical	Administration	Planning Commission	14%		20%		17%		9%
Administrative & Technical	Administration	Mitigation Planning Committee			20%		17%		6%
Administrative & Technical	Administration	Maintenance Programs (tree trimming, clearing drainage, etc.)	29%		20%		33%		16%
Administrative & Technical	Staff	Emergency Manager	71%	100%	60%	60%	67%	71%	69%
Administrative & Technical	Staff	Building Official	14%		40%		33%	14%	19%
Administrative & Technical	Staff	Floodplain Administrator	71%		60%	40%	67%	86%	63%
Administrative & Technical	Staff	Community Planner	43%	50%	100%	20%	100%	29%	56%
Administrative & Technical	Staff	Transportation Planner		50%					3%
Administrative & Technical	Staff	Civil Engineer	43%		40%	20%	67%	29%	38%
Administrative & Technical	Staff	GIS Capability	29%	50%	80%	20%	100%	57%	56%
Administrative & Technical	Staff	Resiliency Planner							

Table 5-10 Administrative & Technical Capabilties – Technical

Percentage of PA LHMPs Reporting Mitigation Capability									
Category	Type	Capabilities	PA 1 (7)	PA 2 (2)	PA 3 (5)	PA 4 (5)	PA 5 (6)	PA 6 (7)	State (32)
Administrative & Technical	Technical	Warning Systems/Services (Flood)	29%	100%	60%		50%	14%	**34%**
Administrative & Technical	Technical	Warning Systems / Services (Other / Multi-hazard)	29%	100%	60%		50%	14%	**34%**
Administrative & Technical	Technical	Grant Writing/ Management	29%	100%	40%	40%	83%	29%	**47%**

Table 5-11 Financial Capabilities

Percentage of PA LHMPs Reporting Mitigation Capability									
Category	Type	Capabilities	PA 1 (7)	PA 2 (2)	PA 3 (5)	PA 4 (5)	PA 5 (6)	PA 6 (7)	State (32)
Financial	**Funding Resources**	Levy for Specific Purposes with Voter Approval	57%		60%	20%	67%	43%	**47%**
Financial	**Funding Resources**	Utilities Fees			40%	20%	17%	29%	**19%**
Financial	**Funding Resources**	System Development / Impact Development Fee			40%		17%	29%	**16%**
Financial	**Funding Resources**	General Obligation Bonds to Incur Debt	43%	50%	60%		50%	43%	**41%**
Financial	**Funding Resources**	Special Tax Bonds to Incur Debt	43%	50%	40%		50%	29%	**34%**
Financial	**Funding Resources**	Withhold Spending in Hazard-Prone Areas					17%		**3%**
Financial	**Funding Resources**	Open Space / Conservation Fund							
Financial	**Funding Resources**	Stormwater Utility Fees							
Financial	**Funding Resources**	Capital Improvement Project Funding	57%	100%	60%	20%	67%	29%	**50%**
Financial	**Funding Resources**	Community Development Block Grants (CDBG)	43%	100%	60%	60%	67%	57%	**59%**

Table 5-12 Education & Outreach Capabilities

Percentage of PA LHMPs Reporting Mitigation Capability										
Category	Type	Capabilities	PA 1 (7)	PA 2 (2)	PA 3 (5)	PA 4 (5)	PA 5 (6)	PA 6 (7)	State (32)
Education & Outreach	**Program / Organization**	Public Hazard Education / Outreach Program		50%			33%		**9%**
Education & Outreach	**Program / Organization**	Local Citizen Groups that Communicate Hazard Risk		100%			17%	29%	**16%**
Education & Outreach	**Program / Organization**	Firewise		50%	20%			14%	**9%**
Education & Outreach	**Program / Organization**	StormReady		50%			17%		**6%**

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5.4.2 Effectiveness of Local Government Mitigation

The effectiveness of the plans is evidenced by state agencies, tribes, and local communities implementing mitigation actions across PAs. Often it can be difficult to see the extent of community successes across the state when each LHMP is the individual focus and awareness of overall achievement can be lost. The concept of collaboration between the state, tribes, and local governments is illustrated in the focus of these projects, the number of actions the PAs identify in the mitigation strategy, and the successful implementation of mitigation.

The status of all mitigation actions included in the LHMPs was reviewed and is presented in the following tables.

Table 5-13 illustrates the number of actions reported by PA, how many actions were reported complete, and how many actions were reported as deferred / in progress. Note that some of the LHMPs assessed were the first plan written for these communities and therefore did not have reporting on prior action status. As the state encourages and supports mitigation capacity building through LHMP development, the successful creation and approval of new plans is important to acknowledge.

PA 5 reported on the highest number of actions and had the highest number of deferred / in progress actions. PA 1 and PA 6 reported the highest number of actions completed, respectively. These areas, along with PA 2, also reported over 100 deferred / in progress actions each.

Table 5-13 Mitigation Action Status by Preparedness Area

	PA 1 (7)	PA 2 (2)	PA 3 (5)	PA 4 (5)	PA 5 (6)	PA 6 (7)	State (32)
Number of Actions Reported On	168	149	105	18	182	179	**801**
Total Complete Actions	25	1	8	8	11	24	**77**
Percent Complete Actions	15%	> 1%	8%	44%	6%	13%	**10%**
Total Deferred / In Progress	143	148	97	10	171	155	**724**

5.4.2.1 Complete Actions

Mitigation implementation achievement across the state is evidenced by the number of actions completed. Actions reported as complete for each PA are broken down by the type of mitigation action in Table 5-14. There are four (4) types of mitigation which are detailed below.

Structure and Infrastructure

- Modifying existing structures and infrastructure for protection from a hazard or complete removal of structures and infrastructure from a hazard area

Local Planning and Regulations

- Identify current and future development patterns and trends to determine safe development areas
- Include policies and ordinances that steer development away from hazard-prone areas, as well as influence the way land and buildings are developed and built

Education and Awareness

- Inform and educate citizens, elected officials, and property owners about hazards and potential ways to mitigate them
- Awareness of hazards and risk among local officials, stakeholders, and the public is more likely to lead to direct actions

Natural Systems Protection

- Minimize damage and losses while also preserving or restoring the functions of natural systems

Over half of completed actions, 55%, in the state are typed as Local Planning and Regulations and the majority of these actions were completed in PAs one (1) and six (6). Approximately 36% of the completed actions are categorized as Structure and Infrastructure.

Only seven (7) of the completed actions are typed under Education and Awareness and no completed actions were characterized as Natural Systems Protection.

Table 5-14 Complete Mitigation Actions by Type and Preparedness Area

	PA 1 (7)	PA 2 (2)	PA 3 (5)	PA 4 (5)	PA 5 (6)	PA 6 (7)	State (32)
Structure and Infrastructure	5		6	4	5	8	**28**
Local Planning and Regulations	16		1	4	6	15	**42**
Education and Awareness	4	1	1			1	**7**
Natural Systems Protection							
Total Complete Actions	**25**	**1**	**8**	**8**	**11**	**24**	**77**

Across the state a variety of actions were represented in the Local Planning and Regulations category. Numerous actions showed themes in focus and goals including:

Drought

- Plans and participation in state management plan
- Landscape regulations
- Water conservation regulations

Flood / Stormwater

- Drainage plans
- FIRM / DFIRM new and updated mapping

Future Development

- Building code evaluation, revision, and adoption
- Increase inspection staff capacity
- Building permit review process improvement

Warning / notification systems, GIS capability improvement, and interagency coordination highlight other types of completed actions.

5.4.3 Implementation Obstacles & Challenges

Implementation of a hazard mitigation strategy requires staff, funding, time, and grant management experience, among other things. For small communities in the state, these resources are problematic to obtain and tend to be unreliable. Time is a critical resource for successful implementation, even before being awarded, as grant applications, project development, and administrative considerations can take weeks of full-time efforts. Staff already working full-time in other positions are unable to fill the gap, especially in underserved communities that may have limited ability to operate from the start.

Many communities have no grant management resources and therefore can struggle to develop applications, complete benefit-cost analyses (BCA), or manage the detailed reporting required to maintain grant funding. Staff turnover can be a challenge if there is no option to replace the person who was managing a grant.

Funding presents a large issue when communities are unable to provide the local match, but may not qualify for programs with reduced match. The type of grant availability and stability matters to communities also, who may only see funding after a disaster and are not able to get projects approved through FEMA's BRIC or FMA programs.

The impacts of climate change on implementation are complex. Communities that may have had a minimal need for mitigation initially can see risk and vulnerability increase as evolving hazards are introduced to areas, such as flooding in new areas, or events becoming more severe. This leads to an increased need for support and resources to develop an updated mitigation strategy before being able to look ahead to the details of coordinating implementation. The importance of having climate change subject matter experts to assist in mitigation strategy development can make the difference in sustainable implementation of mitigation actions or uninformed projects which may be short term solutions requiring work be redone at some point.

As part of more sustainable implementation, communities need to know the level of exposure to an area at risk of a hazard. Hazard mitigation planning must be informed to the greatest degree to be the most effective. If communities are unable to show the risk of a hazard accurately, it can impact the development and potential approval of grant funding application. This can be a limiting issue for underserved communities that may not have the resources to complete studies of hazard areas.

A lack of floodplain mapping in some areas creates a challenge, as communities are unable to identify where flooding may occur and what is at risk. Project development will be hindered by incomplete information. This type of data gap leaves communities at a large disadvantage for funding application or out of the grant cycle completely.

In addition, communities that have not been mapped are limited in their ability to participate in the National Flood Insurance Program (NFIP) and the Community Rating System (CRS). Communities are unable to take advantage of lower insurance rates, as well as the benefit of participation in both programs when applying for funding. Some communities participate in the NFIP, but do not have the capacity or resources to meet the CRS requirements.

5.4.4 Implementation Opportunities

Current changes to DHSEM's organization and staffing present an opportunity to develop a new sub-applicant engagement program. The intent of this program is to increase local pursuits of mitigation funding, while fostering continued momentum around hazard mitigation. The State Mitigation Program provides information to all potential sub-applicants across the state announcing the availability of FEMA HMA funding opportunities. This includes explaining the grant program details, application process, general program eligibility, and key deadlines.

Revolving loan programs can be a solution for communities with difficulty identifying local match funding. The state is assessing the Safeguarding Tomorrow through Ongoing Risk Mitigation (STORM) Act funding and has been closely monitoring other states implementing the program. This funding program was approved in 2021 and offers low interest rates for 20-to-30-year loans. The funds can be used as local match which is required for many mitigation grants.

This type of funding presents a solution to one of the most critical obstacles to implementation in communities, especially small or underserved communities, which is providing local match funds to meet grant award requirements.

As building codes continue to be a focus in sustainable mitigation implementation, the state continues to support locals in the development and improvement of local building codes. Many of the PAs have a notable number of jurisdictions identifying building codes as a capability and these can be examples for other communities without formal code adoption. The State's Construction Industries Division (CID) supports these efforts and provides education on updates to code standards, ensuring local governments implement the most effective mitigation measures.

Approximately three-quarters of the LHMPs identified as participants in the National Flood Insurance Program (NFIP), however just over one-tenth identified participating in the Community Rating System (CRS). This presents an opportunity for local governments and tribes to work with the DHSEM NFIP Coordinator, as well as local and state floodplain managers to implement the CRS requirements and increase capabilities in floodplain management.

A little over half of the LHMPs stated GIS capabilities were available for use and utilizing these resources to benefit mitigation efforts is a way to increase the effectiveness, accuracy, and feasibility of projects. GIS can provide an understanding to a project that can assist in scoping, grant applications, and public awareness.

Out of the LHMPs, half identified having a Community Wildfire Protection Plan (CWPP) as a capability, which can assist in implementation of fuel management, evacuation planning, and community risk assessment. In addition, having a CWPP, less than ten years old, qualifies for funding to implement projects through the national Community Wildfire Defense Program (CWDG). The same program funds the development and update of CWPPs, which is an opportunity for local governments and tribes to bolster this capability and future wildfire mitigation efforts.

It is also worth noting that requirements for a CWPP align well with those for LHMPs. Considering combining these planning efforts can ensure that both documents remain updated and may make sense from a funding perspective.

5.4.5 High Hazard Potential Dams

Information on high hazard potential dams can be found in Section 6.3 of the HIRA.

During the 2023 Plan update, staffing shortages and other challenges prevented the State from fully complying with the requirements of the Rehabilitation of High Hazard Potential Dams (HHPD) Grant Program. This has been identified as an area for improvement. The state intends to address this deficiency in the coming year(s) and issue an interim Plan update prior to the regular 5-year update cycle.

5.5 Local Government Mitigation Planning Support

A FEMA approved LHMP is one of the eligibility requirements for a project to be funded through FEMA's Hazard Mitigation Assistance (HMA) grants. The State of New Mexico provides local government mitigation planning support through a number of avenues, including training, technical assistance, and funding.

5.5.1 Training

Mitigation Program presentations are provided at quarterly New Mexico Emergency Management Association (NEMA) meetings, New Mexico Floodplain Managers Association (NMFMA) meetings, and Local Preparedness Area meetings, along with other meetings or venues where appropriate. The presentations include information on the status of mitigation plans throughout the State, funding opportunities, sub-grant application process, applicant eligibility, and project eligibility.

DHSEM typically provides the FEMA course G318 Mitigation Planning for Local and Tribal Communities at least once each year. If enough interest is expressed, the training is offered a second time. However for the last few years, staffing shortages and turnover have made it difficult to keep to this schedule.

5.5.2 Technical Assistance

Technical assistance (TA) is provided to state agencies, tribes, and local governments by the DHSEM Mitigation Program staff and its consultants. TA is given to potential sub-applicants in the form of review and feedback on Notice of Interests (NOI) and applications. DHSEM also gives TA through orientation meetings, mitigation planning training, project oversight, and sub-grant management support.

One of the outreach and assistance programs unique to the state is the Local Preparedness Areas Program and its LPCs. They assist in the coordination of the local emergency management community and the Mitigation Program staff. LPCs are responsible for the following technical assistance activities:

- Liaison between the local communities, tribes, and state Mitigation Program;
- Dissemination of relevant mitigation planning and project reference material;
- Capability development based on emergency management shortfalls;
- National Incident Management System (NIMS) compliance for local jurisdictions;
- Supporting planning, training and exercise, grant applications, statements of work, and performance reporting;
- Promoting exercise design, assessments, and After-Action Reports (AAR)/improvement plans;
- Coordination with DHSEM Training and Exercise Officers for training and exercise needs assessments;
- Development of emergency operations plans (EOP); and
- Coordination and maintenance of dam Emergency Action Plans (EAP) for DHSEM.

LPCs also provide technical assistance to local contacts on mitigation plan reviews, sub-applicant agreement requirements, and field inspections.

5.5.3 Funding

Section 4.5 details a variety of state and federal grant streams used to fund mitigation at the local level. Most local HMPs are funded through FEMA's HMA programs, although some jurisdictions have funded LHMP updates out of their own budgets when necessary.

5.5.4 Barriers to Local Mitigation Planning, Adoption & Implementation

Local mitigation planning requires time, staff, detailed research, funds, and engagement from the community. Many communities have very little in the way of these resources. Without each of them planning, adoption, and implementation are unlikely to be successful.

Some communities may have the engagement, or buy-in, for completing the intricate planning process and while this is crucial to an effective and informed plan, enthusiasm cannot carry the whole process. This engagement must have multiple facets including political will, public involvement, and local champions to move through the process efficiently and with a robust plan as the outcome. A planning team needs familiarity with the vast topic of hazard mitigation and in many communities, small, large, or underserved alike, there are not many people with that expertise. Lack of education and understanding of hazard mitigation is a continual issue in all communities, as people tend to gravitate toward response and recovery concepts. Engagement falters if knowledge is not shared, including about available grant opportunities, and it is difficult to implement mitigation if people are not clear on the purpose.

The funding needed to work through the planning process can be prohibitive, even with a grant available. The local match is oftentimes too high for community budgets. While some programs for underserved, low-income, or disadvantaged communities and tribes help to lower or negate the match, some communities in need may not qualify. If a match is available, the barriers of grant management can create concerning situations with compliance, with the potential of having to return the funding.

Grant funding poses other challenges in availability and reliability. Communities, especially those rural, low population, are too often unable to compete for funds in programs such as BRIC and FMA, going against larger jurisdictions nationally, who likely have grant writers or consultants at their disposal. This is further compounded by the lack of building codes in some areas which puts projects at a disadvantage in the grant evaluation scoring. Often the most approachable funding is post-disaster declaration monies, which are unpredictable and can be confusing to navigate, especially with staff turnover at the local or state level. Turnover can be detrimental to the institutional knowledge of an organization and COVID exacerbated this capacity loss.

Capacity and capability losses add to difficulties for communities developing project applications. Reviewing the Notice of Funding Opportunity and building the basis of an application based on the requirements can be defeating to local governments, tribes, and small communities that have not been through the process before. Responding to Requests for Information from the State or FEMA may put an otherwise well-developed project on hold if information or funding to gather information is unavailable. Taking the time and staff to complete the application, and the multiple components within, can again be prohibitive if these resources are not readily available.

The Flood Mitigation Assistance (FMA) program serves a critical role funding projects for communities to implement a variety of flood mitigation project types. However, FMA funds may only be used by those participating in the NFIP with an approved LHMP. FMA funds can be used for community flood mitigation projects, individual structure / property-level flood mitigation projects, project scoping, technical assistance, and flood mitigation planning activities. So far for the state, this funding has not been applicable, as no flood mitigation projects submitted for FMA consideration have met the requirements. In general, projects submitted have not specifically benefited NFIP-insured structures.

5.5.5 Solutions to Removing Barriers

Education on scoping and application development, grant programs and management, and how to utilize local and state resources to successfully fund and implement actions is imperative. The continued technical assistance from the state and LPCs is the foundation for building understanding and awareness of mitigation programs, funding, and lessons learned. Expanding on this involves approachable education on the details that make each grant program, project, application, and award unique.

This education involves public awareness of mitigation, risk and vulnerability, and how to communicate action ideas to community leadership. Public safety is the priority and the public will be able to inform the mitigation strategy if there is an understanding of mitigation and their role in helping to identify opportunities in the community.

Leveraging programs which require lower local match funds, utilizing in-kind to meet match requirements, and collaborating with other governments, agencies, or organizations can help to minimize cost share burden. Loans can also help to meet the requirements and can come from programs like the Small Business Administration or the STORM Act.

The barrier for FMA, NFIP participation, can be overcome by working with state and local floodplain management to qualify and enroll in the program. The state has encouraged tribes and local governments to include a description of the FMA in their mitigation plans and to identify projects that would meet requirements for funding. If eligible mitigation projects are identified and documented in the LHMPs, including the NFIP-insured structures, the mitigation priority is demonstrated when applying for grant funds. Utilizing FMA funding for scoping, technical assistance, and flood mitigation planning activities saves time and lowers costs when it comes time to develop an application. The more groundwork that can be laid using grant funding, the stronger the project is to apply in the next FMA cycle and / or to other grant programs. Lower local cost shares may be applicable for projects addressing Repetitive Loss and Severe Repetitive Loss properties.

Project scoping and phased projects are potential solutions for communities in the state to achieve mitigation goals. Both types have benefits that can support the level of mitigation implementation communities have the capacity to achieve.

Project scoping involves working to develop concepts, gather data needed to prioritize projects, and develop complete applications that can be submitted in future grant cycles. The goal in project scoping is to improve the capability for a community to identify appropriate mitigation projects or develop application-ready projects. Scoping allows communities to explore solutions for mitigation issues, determine feasibility and achievability, and make collective decisions on prioritization and next steps.

Phased projects are further along in development and lacking technical pieces to fulfill FEMA requirements. These are generally limited to complex projects that require data beyond what is typical for BRIC or FMA projects. This can include data collection through a hydrologic and hydraulic (H&H) study, engineering studies, or a feasibility analysis, among others. In addition, preparing a BCA, and documentation coordination, such as an Environmental Planning and Historic Preservation (EHP) review are included. In New Mexico, this has also included completion of final construction drawings and final cost estimation. Phased projects are separated into Technical Data, Analysis and Design (Phase I), and Construction Process (Phase II).

Utilizing Phase I funds, a community will fill any needs in technical data, analyses, BCA, EHP, and other FEMA requirements. The Phase I deliverables are reviewed and if approved Phase II funding is awarded for construction.

One benefit of phased projects is the reservation of funds for both phases in the same grant cycle, which eliminates concerns of designing a project but not having funding for construction. For small communities, having access to funds for data collection, research, and documentation management is an opportunity to build the most beneficial project with available resources and assistance. The security and space this provides to better understand the requirements, utilize state TA, and adapt a project if needed is encouraging to communities, especially those that are small and underserved.

5.6 Local Funding Prioritization

If the grant sub-application requests exceed the amount of available funding, the state will prioritize projects that maximize benefits. In general, all projects that meet the minimum criteria and deadlines will be submitted to FEMA for funding consideration. However, the following addresses how applicants are solicited and the selection process when more applications are submitted than there is funding available.

The State Hazard Mitigation Officer (SHMO) will prioritize proposed projects based upon criteria established in the State Natural Hazard Mitigation Plan, although other factors may be considered.

See Section 4.5 for more detail on these funding sources.

5.6.1 Building Resilient Infrastructure and Communities (BRIC)

The SHMO will review submitted mitigation applications and consult with the State Coordinating Officer (SCO), state, and federal agencies, as needed. All projects must meet the minimum requirements of 44 CFR 206.434 (b) and 44 CFR 206.435 (b).

Funds will be prioritized for:

1. Project Scoping
2. Planning Activities
3. Capability- and Capacity-Building projects
4. Construction projects with a total project cost over what is allocated under HMGP or HMGP-PF or warranting high scores, if submitted to the BRIC National Competition

5.6.2 Hazard Mitigation Grant Program (HMGP)

The SHMO will review submitted mitigation applications and consult with the State Coordinating Officer (SCO), state, and federal agencies, as needed. All projects must meet the minimum requirements of 44 CFR 206.434 (b) and 44 CFR 206.435 (b).

If more applications are submitted than there is available funding, all applications will be submitted to an application review panel for priority ranking by committee (link to Competitive Section).

5.6.3 Hazard Mitigation Grant Program – Post Fire (HMGP – Post Fire)

Funding will first be made available to the county, or counties, that received a Fire Mitigation Assistance Grant (FMAG) declaration. Funding will first be prioritized in the declared or burned area(s). If funding cannot be used in the affected area, downstream communities at risk of post fire flooding will be given next consideration. From there, it may be available statewide regardless of whether it benefits a declared county.

Planning funds will be prioritized for:

1. Communities impacted by the FMAG
2. State-wide planning efforts
3. Entities with LHMPs that will expire first
4. New mitigation plans for multi-jurisdictional and tribal entities
5. All other plans or planning activities

Project funds will be prioritized for:

1. Projects in communities impacted by the FMAG (even if the project is not wildfire related)

2. Projects that will provide risk reduction benefits to the FMAG impacted communities (even if the activity is not implemented in an impacted community)
3. Projects in communities that could be impacted by FMAG post-wildfire damages (e.g., downstream debris or flood flows)
4. Wildfire mitigation, post-wildfire debris or flood flow anywhere in the State.
5. Any natural hazard mitigation project anywhere in the State

Funds will not be held for any prioritized communities or project types that do not meet all established deadlines and minimum application criteria. For example, sub-applicants must submit Notice of Interests (NOI) and applications by the deadline, ensure submission of complete application packets, and respond to Requests for Information (RFI) by established deadlines for the prioritization ranking to be taken into consideration. In addition, the entity's mitigation plan must be approved and adopted by the time FEMA is ready to award funds. If the milestones for a mitigation plan creation or update are not met, causing a delay in meeting the mitigation plan eligibility requirement, a project that relies on the plan approval will not be prioritized for funding.

5.6.4 Flood Mitigation Assistance Grant Program (FMA)

At a minimum to be eligible for FEMA review, FMA projects must:

- Be cost effective
- Be located in a participating NFIP Community (In good standing)
- Align with the applicable hazard mitigation plan
- Meet all environmental and historic preservation (EHP) requirements

5.6.5 Overarching Criteria

When selecting a project for submission to FEMA, the SHMO considers the following criteria which include, but are not limited to:

- The entity has a FEMA approved mitigation plan
- The entity is in good financial standing via UEI or Sam.gov verification
- A completed application was submitted by the deadline
- The project accomplishes multiple objectives including damage reduction, environmental enhancement, and economic recovery, when appropriate
- The project includes multi-jurisdictional cooperation
- The measures fit within an overall plan for development, and/or hazard mitigation in the community or disaster area, as described in the local Natural Hazard Mitigation Plan
- The project describes measures that, if not taken, will have a severe detrimental impact on the sub-applicant, such as potential loss of life, loss of essential services, or economic hardship in the community
- Measures that have the greatest potential impact on reducing future disaster losses
- Measures that are designed to accomplish multiple objectives for damage reduction, environmental enhancement, and economic recovery
- The project solves a problem independently or constitutes a functional portion of a solution, where there is assurance that the project as a whole will be completed

5.6.6 Competitive Selection

Based upon applications submitted and available funding, plans and projects may need to be prioritized for funding. The primary goal in the prioritization process is to ensure the projects with the greatest benefits for communities are able to be successful. DHSEM sees the importance of reviewing each project as an opportunity to learn of ongoing risk reduction ideas, support innovative mitigation efforts, and develop an awareness of the benefits a project can bring to a community. As part of the process, special consideration is taken for the population being served by the project, underserved communities and socially vulnerable populations are a crucial aspect in these decisions. Also important to this process is a forward-thinking mitigation lens as the state sees development, rapid in some counties, and the consequence of increased hazard exposure. Advancing projects which address climate change and community growth helps to maximize the benefits, for many facets of a community, when applying these funds to projects.

The SHMO and DHSEM staff will form a Ranking Committee to review competitive applications, utilizing formalized criteria established in this State Natural Hazard Mitigation Plan, the State Mitigation Administrative Plan, and the criteria below. The Administrative Services Bureau will contribute a non-voting member of the panel to act as an observer. The Ranking Committee shall produce a report. The Observer shall certify that all entities selected for project recommendation in the report are in good financial standing via UEI or Sam.gov verification. The Ranking Committee recommendations are provided to the Governor's Authorized Representative (GAR) for approval. After the GAR provides approval, the SHMO contacts each applicant to notify them if their project was selected or not. If a project is withdrawn or is determined to be ineligible, the project with the next highest ranking will be funded up to the maximum amount of federal dollars remaining.

Points may be given for the following categories. Selection of the relevant categories will be determined by the Ranking Committee:

- Completeness of the application material
- Prevents harm to human life
- Reduces amount of property damage, both public and private, from natural hazards
- A real-world event has had severe detrimental impact on the applicant, such as potential loss of life, loss of essential services, or economic hardship in the community
- Reduces the number of necessary evacuations
- Leverages innovation
- The project is included in the sub-applicant's General Plan, Comprehensive Plan or Infrastructure Capital Improvement Plan, and/or the project is identified as a high priority in an adopted plan of the sub-applicant
- The project effectively reduces risk and increases resilience, realizes ancillary benefits, and/or shortens recovery time (community function, natural environment, other)
- The project anticipates future conditions (population/demographic/climate changes, etc.).
- The project sub-application demonstrates community-wide benefits and identifies the proportion of the population that will be impacted. The application also describes how impacts to socially vulnerable populations (positive or negative) informed project selection and design
- The project benefits a disadvantaged community (all geographic areas within Tribal jurisdictions, low income, high and/or persistent poverty, high unemployment and underemployment, racial and ethnic segregation, linguistic isolation, high housing cost burden and substandard housing, distressed neighborhoods, limited water and sanitation access and affordability)

- The sub-application describes outreach activities, identifies the level of public support, outlines the types of community planning processes leveraged, and/or incorporates state, tribal, private, and local community partnerships, communication, and collaboration which will enhance the project outcome (increased non-federal cost share, multi- jurisdictional projects, etc.)

In the future, the State may prioritize projects that have a non-federal share exceeding the minimum match requirement or have the highest cost-benefit ratio. Discussions have also centered on prioritizing the highest priority hazards such as wildfire, flooding, and thunderstorms. However, to date, no formal determination has been made to prioritize mitigation actions according to these additional potential criteria.

5.6.7 Project Scoping Selection

Project scoping is the successor to Advance Assistance, which was previously used in other Hazard Mitigation Assistance (HMA) programs. This change was made to align the name of the activity with the purpose of this project type. Activities previously eligible under Advance Assistance will remain eligible for project scoping under BRIC.

Project scoping activities are designed to develop mitigation strategies and obtain data to prioritize, select, and develop complete applications in a timely manner, resulting in improvement of the capability to identify appropriate mitigation projects or develop application-ready mitigation projects.

Priority is given in the following order:

1. Entity has not received HMA funding in the past
2. Multi-jurisdictional cooperation
3. Multiple objectives
4. Experienced a real-world event
5. Anticipates future conditions
6. Fits within overall plan for development
7. Describes outreach activities
8. Project is included in other Plans

5.6.8 Socially Vulnerable Populations & Underserved Communities

Multiple national social vulnerability indexes are available to utilize, each leveraging differing data sources and indicators. Use of specific indexes will sometimes be dictated by a funding program, else local communities are encouraged to utilize the index that best defines their vulnerable populations and underserved communities.

The vast amounts of social vulnerability data available, as well as the innumerable ways to analyze, visualize, and deliver the information, creates an opportunity for multiple indexes to share similar data with different focuses and purposes. The benefit of this is the ability to fill gaps in categories of social vulnerability that may not be covered by a specific index.

Indicators that may be relevant to hazard mitigation could include:

1. Density and ages of populations
    a. Age 65 years and older
    b. Age 17 years and under
    c. Under 5 years of age
2. Minority status and language
    a. Minority

   b. Limited English (speaks less than well)
3. Access and functional needs (AFN)
   a. Disability
   b. Use of electricity dependent medical equipment
   c. Population with chronic health conditions
4. Household Characteristics
   a. Crowding (households with more people than room)
   b. Living alone
   c. Group quarters
      i. Institutionalized housing: college dorms, correctional facilities, long-term care facilities, military barracks
   d. Single parent households with children under 18 years old
5. Socioeconomic status
   a. Poverty, persons living below poverty level
   b. Unemployed, ages 16 years and older
   c. Income, per capita
   d. High school diploma status, persons age 25+ without a diploma
   e. No vehicle available
6. Housing Characteristics
   a. Housing units
   b. Households
   c. Influx (households moving)
   d. Multi-unit housing structures with 10 units or more
   e. Mobile homes
7. Information and healthcare access
   a. Broadband availability
   b. Hospitals per capita
   c. Population without health insurance
   d. Employment by industry type

Indexes to consider utilizing can include, but not be limited to the following:

- CDC Social Vulnerability Index
  - The Social Vulnerability Index (SVI): Interactive Map | CDC
- ATSDR's Environmental Justice Index
  - EJI Explorer
- My Community Explorer – US Census
  - My Community Explorer
- FEMA National Risk Index
  - National Risk Index | FEMA.gov
- American Community Survey (ACS) US Census Data Tables
  - Data Profiles | American Community Survey | U.S. Census Bureau

5.7 Local Mitigation Plan Coordination

5.7.1 Local Mitigation Plan Review and Submission

DHSEM works closely with local emergency managers to facilitate the creation and updating of LHMPs. The Mitigation Section tracks when LHMPs are due to expire, and works with the jurisdictions to secure funding at least a year prior to plan expiration. DHSEM has developed a generic scope of work that jurisdictions can use when seeking contractor support.

Local HMPs – and tribal HMPs at the tribe's discretion – are submitted to DHSEM electronically for state review. (As of June 2023, DHSEM uses contractor support to conduct LHMP reviews.) DHSEM mitigation staff keep track of where each plan is within the review process. Plans are typically reviewed in the order they are received and are completed within 30 days of receipt, unless there are circumstances requiring an expedited review.

Once an LHMP or update has been completed, DHSEM reviews them to ensure they meet FEMA requirements and provides feedback to the jurisdictions when revisions are needed; technical assistance is also provided when requested. DHSEM may recommend additional revisions to improve the plan's usefulness and readability, however these recommendations are not required to be addressed. Once all required revisions have been addressed, DHSEM submits the LHMP to FEMA Region VI for their review and provides technical assistance if needed to address any FEMA comments. DHSEM continues to work with the jurisdictions to facilitate local adoption, final FEMA approval, and grant close out.

As sovereign nations, New Mexico's tribal nations can submit their tribal HMPs directly to FEMA if they wish. If a tribe elects to submit their plan for state review, DHSEM follows the same review and support process described above.

5.7.2 Risk Data and Mitigation Priorities

The state sees value in ensuring open information exchange, especially risk data and mitigation priorities. The exchange is reciprocal, as the state collects data and information from LHMPs and LPCs, information from the state level is made available to the locals.

The state accomplishes this sharing through multiple tools and outreach. The State Hazard Mitigation Plan five-year updates are the most comprehensive method since the process brings together agencies, organizations, and communities from across the state to present, discuss, and collaborate on mitigation concepts, programs, and projects.

The risk assessment data from this detailed planning process is made available to local communities for use and LPCs provide technical assistance on understanding and leveraging relevant data. This assistance may be during an LHMP update, while determining priorities for mitigation strategies, and while developing strong, detailed grant applications.

There are a variety of tools and programs available to local governments and tribes to focus on area specific features that may not be highlighted at the state level. This includes the Flood Hazard Mapping Program, detailed in Section 4.4.2, which takes advantage of multiple programs, partnerships, and subject matter experts to deliver comprehensive support and information. Also accessible are numerous geospatial data / viewers / applications, described in Section 4.3.7, which devote resources to disseminating information for diverse topics.

A critical piece of hazard mitigation planning is developing a mutual understanding of mitigation priorities at the local, tribe, and state level. This assists in finding commonalities where resources can be most effectively distributed and utilized. The LPCs play a key role in this information sharing and act as conduits to identify specific priorities, including addressing gaps in resources to promote successful implementation of mitigation strategies. Large projects may not be a priority for a community, as the need to fill a capability must be prioritized to bolster any future project planning. The LPCs can assist in moving local communities forward by leveraging State mitigation priorities at a more pointed level.

In addition, the State often highlights priorities to consider when applying for specific grant programs. As opportunities for FEMA HMA funding are announced, potential sub-applicants may be given information on mitigation significant to the State.

6 HAZARD IDENTIFICATION AND RISK ASSESSMENT (HIRA)

44 CFR Part 201.4
The Risk assessments that provide the factual basis for activities proposed in the strategy portion of the mitigation plan. Statewide risk assessments must characterize and analyze natural hazards and risks to provide a statewide overview. This overview will allow the State to compare potential losses throughout the State and to determine their priorities for implementing mitigation measures under the strategy, and to prioritize jurisdictions for receiving technical and financial support in developing more detailed local risk and vulnerability assessments. The risk assessment shall include the following: ▪ *(i) An overview of the type and location of all natural hazards that can affect the State, including information on previous occurrences of hazard events, as well as the probability of future hazard events, using maps where appropriate;* ▪ *(ii) An overview and analysis of the State's vulnerability to the hazards described in this paragraph (c)(2), based on estimates provided in local risk assessments as well as the State risk assessment. The State shall describe vulnerability in terms of the jurisdictions most threatened by the identified hazards, and most vulnerable to damage and loss associated with hazard events. State owned or operated critical facilities located in the identified hazard areas shall also be addressed;* ▪ *(iii) An overview and analysis of potential losses to the identified vulnerable structures, based on estimates provided in local risk assessments as well as the State risk assessment. The State shall estimate the potential dollar losses to State owned or operated buildings, infrastructure, and critical facilities located in the identified hazard areas.*

The risk assessment lays the foundation for the New Mexico State Hazard Mitigation Plan. It sets the stage for identifying mitigation goals and activities to help the state become disaster resilient and keep South Dakota residents safe. The major components of this risk assessment include a hazard identification/analysis and a vulnerability analysis that answer the following questions: What are the hazards that could affect New Mexico? What can happen as a result of those hazards? How likely is each of the possible outcomes? When the possible outcomes occur, what are the likely consequences and losses, and how does this vary across the state? This section attempts to answer these questions on a hazard by hazard basis based on best available data.

The Federal Emergency Management Agency (FEMA) defines risk assessment terminology as follows:

- **Hazard**—A hazard is an act or phenomenon that has the potential to produce harm or other undesirable consequences to a person or thing.
- **Vulnerability**—Vulnerability is susceptibility to physical injury, harm, damage, or economic loss. It depends on an asset's construction, contents, and economic value of its functions.
- **Exposure**—Exposure describes the people, property, systems, or functions that could be lost to a hazard. Generally, exposure includes what lies in the area the hazard could affect.
- **Risk**—Risk depends on hazards, vulnerability, and exposure. It is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. It refers to the likelihood of a hazard event resulting in an adverse condition that causes injury or damage.
- **Risk Assessment**—Risk assessment is the process of measuring the potential loss of life, personal injury, economic injury, and property damage resulting from hazards.

This Hazard Identification and Risk Assessment (HIRA) is an update to the 2018 New Mexico State Hazard Mitigation Plan and the foundation upon which the state mitigation strategies and actions are based.

6.1 Hazard Identification

The geographic area of the State of New Mexico is exposed to a number of natural hazards that have sufficient likelihoods of occurrence to warrant discussion. Information about potential hazards was obtained in a number of ways, including reviewing past State and Federal Declarations of disasters; conducting searches of State and Federal resources, such as the NOAA's National Centers for Environmental Information (NCEI/NCDC), and US Army Corps of Engineers (USACE); reviewing historic records; and reviewing archived newspaper articles.

The State Hazard Mitigation Team (SHMT) considered the 14 natural hazards profiled in the 2018 Plan, and determined to keep the same hazards for the 2023 Plan. The 14 hazards profiled in this plan are:

- Dam Failure
- Drought
- Earthquake
- Extreme Heat
- Expansive Soils
- Flood/Flash Floods
- High Wind
- Landslide
- Land Subsidence
- Severe Winter Storms
- Thunderstorms (including Lightning & Hail)
- Tornadoes
- Volcanoes
- Wildfire

6.1.1 Past Disaster Declarations

An important step in hazard identification is to review past disasters that have impacted the State. The President of the United States has authority under the Robert T. Stafford Disaster Relief and Emergency Assistance Act to declare a disaster or emergency for major incidents that exceed the state's capability to respond. Table 6-1 summarizes the presidential disaster declarations (DR), emergency declarations (EM), and fire management assistance declarations (FM) for New Mexico since 1954. New Mexico has had a total of 64 disasters that received federal declarations. (Note that some disasters can receive multiple declarations, so the total number of declarations received by the state is 113.)

The 65 federal disasters included:

- 34 major disaster declarations (DR)
- 5 emergency declarations (EM)
- 26 fire management assistance declarations (FM)

Of the non-fire disasters, 30 have been for some combination of severe storms and flooding.

Table 6-1 Federal Disaster and Emergency Declarations in New Mexico, 1954 – May 2023

Year	Disaster Number	Disaster Type
2023	FM-5465	Las Tulas Fire
2023	FM-5461	Echo Ridge Fire
2022	DR-4652	Wildfires, Flooding, Mudflows, and Straight-line Winds
2022	FM-5438	Calf Canyon
2022	FM-5437	Cook's Peak Fire
2022	FM-5432	Mcbride Fire

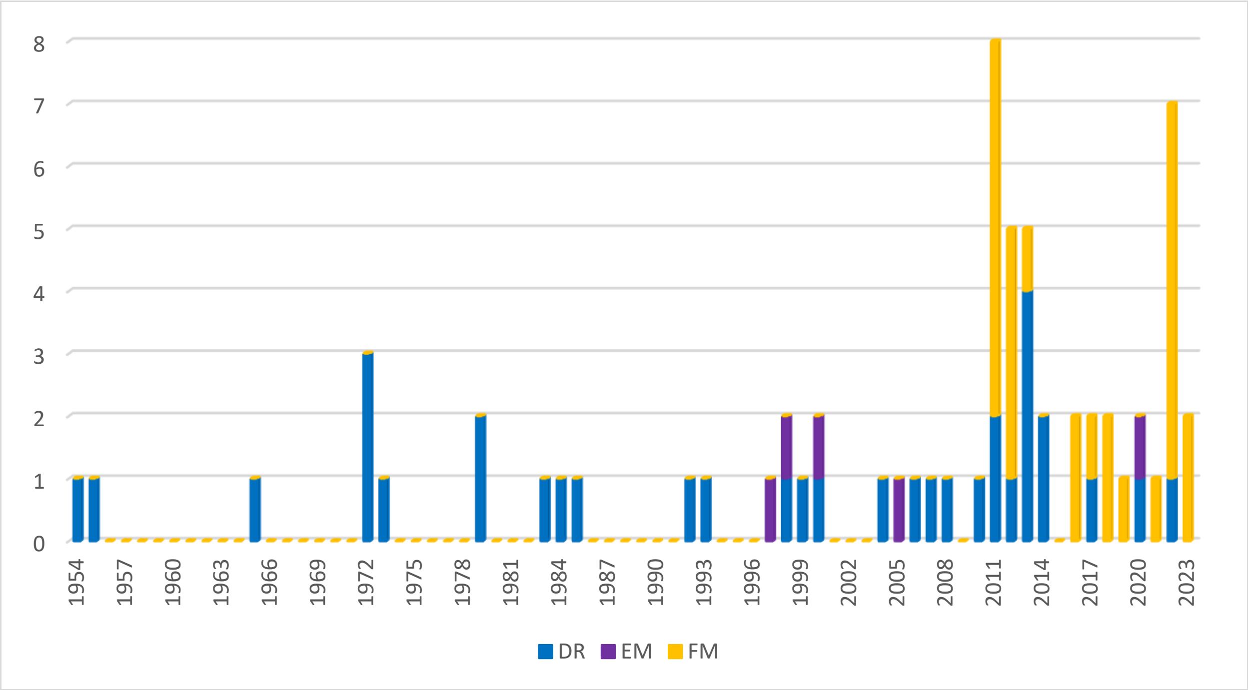
Year	Disaster Number	Disaster Type
2022	FM-5431	Hermit's Peak Fire
2022	FM-5433	Nogal Canyon Fire
2022	FM-5430	Big Hole Fire
2021	FM-5386	Three Rivers Fire
2020	DR-4529 & 12 EMs	COVID-19 Pandemic
2019	FM-5281	Ironworks Fire
2018	FM-5240	Soldier Canyon Fire
2018	FM-5239	Ute Park Fire
2017	DR-4352	Severe Storms, Flooding
2017	FM-5184	El Cajete Fire
2016	FM-5134	Timberon Fire
2016	FM-5127	Dog Head Fire
2014	DR-4199	Severe Storms, Flooding
2014	DR-4197	Severe Storms, Flooding
2013	DR-4152	Severe Storms, Flooding, Mudslides
2013	DR-4151	Severe Storms, Flooding
2013	DR-4148	Severe Storms, Flooding
2013	DR-4147	Severe Storms, Flooding
2013	FM-5026	Tres Lagunas Fire
2012	DR-4079	Flooding
2012	FM-2982	Romero Fire
2012	FM-2981	Blanco Fire
2012	FM-2979	Little Bear Fire
2012	FM-2978	Whitewater-Baldy Fire
2011	DR-4047	Flooding
2011	FM-2935	Donaldson Fire
2011	FM-2933	Little Lewis Fire
2011	FM-2933	Las Conchas Fire
2011	FM-2918	Track Fire
2011	FM-2917	Wallow Fire
2011	FM-2934	Little Lewis Fire
2011	DR-1962	Severe Winter Storms and Extreme Cold Temperatures
2010	DR-1936	Severe Storms, Flooding
2008	DR-1783	Severe Storms, Flooding
2007	DR-1690	Severe Storms, Tornadoes
2006	DR-1659	Severe Storms, Flooding
2005	EM-3229	Hurricane Katrina Evacuation
2004	DR-1514	Severe Storms, Flooding
2000	DR-1329	New Mexico Wildfire
2000	EM-3154	New Mexico Fire
1999	DR-1301	Severe Storms, Flooding
1998	EM-3128	Extreme Fire Hazard

Year	Disaster Number	Disaster Type
1998	DR-1202	Severe Winter Storms
1993	DR-992	Flooding, Severe Storm
1992	DR-945	Flooding, Hail, Thunderstorms
1985	DR-731	Severe Storms, Flooding
1984	DR-722	Severe Storms, Flooding
1983	DR-692	Severe Storms, Flooding
1979	DR-589	Severe Storms, Snowmelt, Flooding
1979	DR-571	Flooding
1997	EM-3034	Drought
1973	DR-380	Severe Storms, Snow Melt, Flooding
1972	DR-361	Heavy Rains, Flooding
1972	DR-353	Heavy Rains, Flooding
1972	DR-346	Severe Storms, Flooding
1965	DR-202	Severe Storms, Flooding
1955	DR-38	Flooding
1954	DR-27	Flooding

Source: FEMA

Figure 6-1 displays those 65 disasters by year. The upward trend in recent decades is obvious and mirrors national trends.

Figure 6-1 Federal Disaster and Emergency Declarations in New Mexico, 1954 – May 2023



Source: FEMA

The Governor of New Mexico also has the authority to declare a state disaster or emergency via Executive Order. From January 2019 through July 2023, the Governor has issued 99 state disaster declarations, as shown in Table 6-2.

Table 6-2 Governor of New Mexico State Disaster Declarations, January 2019 – July 2023

Year	EO Number	Location	Disaster type
2023	2023-081	Luna County	Flood
2023	2023-080	City of Farmington	Mass shooting
2023	2023-079	San Miguel County	Wildland Fire
2023	2023-060	State of New Mexico	Drought and Severe Fire Conditions
2023	2023-040	Sandoval County	Flood
2023	2023-036	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2023	2023-018	Guadalupe County	Wildland Fires, multiple
2023	2023-017	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2023	2023-001	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2022	2022-165	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2022	2022-149	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2022	2022-148	Mora County	Severe Winter Weather
2022	2022-147	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2022	2022-143	Sierra County	Flood
2022	2022-134	Catron County	Flood
2022	2022-131	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2022	2022-129	Hidalgo County	Flood
2022	2022-128	Grant County	Flood
2022	2022-124	Sandoval County	Water Shortage
2022	2022-120	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2022	2022-119	Rio Arriba County	Flood
2022	2022-115	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2022	2022-114	City of Las Vegas	Flood, Drinking Water Shortage
2022	2022-113	City of Las Vegas	Flood, Drinking Water Shortage
2022	2022-112	City of Las Vegas	Flood, Drinking Water Shortage
2022	2022-109	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2022	2022-106	Rio Arriba County	Water Shortage
2022	2022-087	Sierra County	Wildland Fire
2022	2022-077	San Miguel County	Ash and Fire Debris
2022	2022-067	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2022	2022-025	Sandoval County	Wildland Fire
2022	2022-024	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2022	2022-022	State of New Mexico	Drought and Severe Fire Conditions

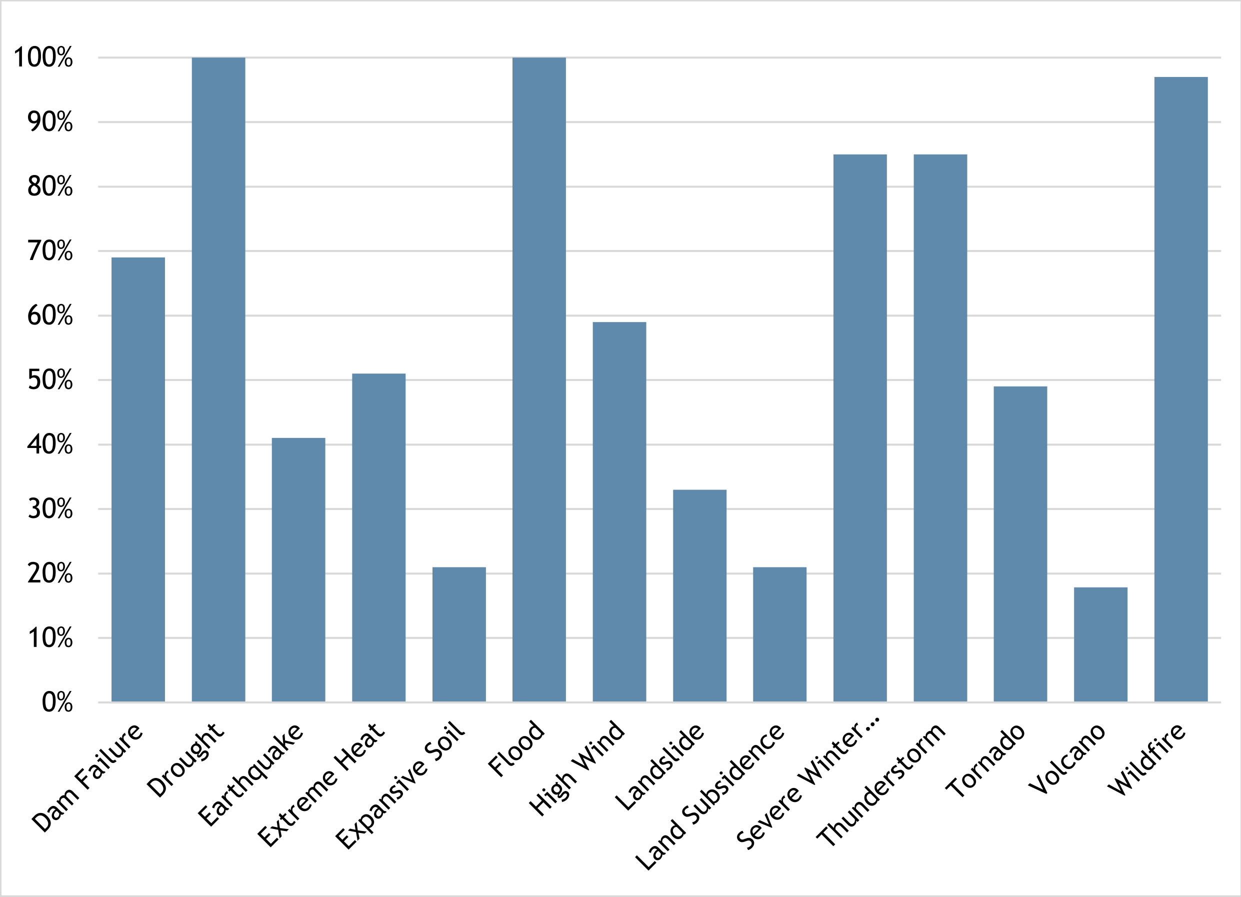
Year	EO Number	Location	Disaster type
2022	2022-021	Mora County	Wildland Fires, multiple
2022	2022-020	Lincoln County	Wildland Fire
2022	2022-019	Colfax County	Wildland Fire
2022	2022-018	Valencia County	Wildland Fire
2022	2022-017	San Miguel County	Wildland Fire
2022	2022-016	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2022	2022-014	Colfax County	Snow
2022	2022-012	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2022	2022-007	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2022	2022-004	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2022	2022-003	Pueblo of Laguna	Flood
2022	2022-002	Rio Arriba County	Snow
2022	2022-001	Socorro County	Flood
2021	2021-067	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2021	2021-065	Socorro County	Flood
2021	2021-064	Catron County	Flood
2021	2021-061	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2021	2021-058	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2021	2021-056	Doña Ana County	Flood
2021	2021-054	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2021	2021-053	Rio Arriba County	Flood
2021	2021-051	Village of Ruidoso	Flood
2021	2021-050	Mora County	Flood
2021	2021-049	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2021	2021-047	Doña Ana County	Flood
2021	2021-044	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2021	2021-042	City of Belen	Flood
2021	2021-041	Eddy County	Flood
2021	2021-040	Valencia County	Flood
2021	2021-030	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2021	2021-028	State of New Mexico	Drought and Severe Fire Conditions
2021	2021-027	City of Roswell	Flood
2021	2021-026	Lincoln County	Flood
2021	2021-025	Chaves County	Flood
2021	2021-023	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2021	2021-012	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2021	2021-011	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2021	2021-010	State of New Mexico	Renewal of Public Health Emergency, COVID-19

Year	EO Number	Location	Disaster type
2021	2021-004	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2021	2021-002	State of New Mexico	Threat of Riots and Insurrection
2021	2021-001	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2020	2020-085	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2020	2020-084	State of New Mexico	Drought
2020	2020-083	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2020	2020-080	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2020	2020-079	Socorro County	Flood
2020	2020-078	Truth or Consequences	Flood
2020	2020-077	Village of Williamsburg	Flood
2020	2020-073	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2020	2020-064	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2020	2020-059	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2020	2020-055	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2020	2020-053	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2020	2020-040	State of New Mexico	Drought and Severe Fire Conditions
2020	2020-036	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2020	2020-033	Curry and Eddy Counties	Flood
2020	2020-032	Roosevelt County	Flood
2020	2020-030	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2020	2020-027	City of Gallup	Public Health Emergency, COVID-19
2020	2020-026	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2020	2020-022	State of New Mexico	Renewal of Public Health Emergency, COVID-19
2020	2020-004	State of New Mexico	Public Health Emergency, COVID-19
2019	2019-035	Hidalgo, Luna, and Socorro Counties	Flood
2019	2019-014	Rio Arriba and Sandoval Counties	Flood
2019	2019-009	State of New Mexico	Severe Wind, Tornados, Hail, and Power Outages
2019	2019-008	State of New Mexico	Severe Winter Storms

6.1.2 Local Risk Assessments

The SHMT then reviewed information on hazards contained in local hazard mitigation plans (LHMPs) throughout the state, as described in Section 5. Figure 6-2, repeated here from Section 5.3, shows the percentage of LHMPs that included each of the 14 natural hazards in the SHMP.

Figure 6-2 Statewide Percent of LHMPs Profiling Individual Hazards



Of further interest is the risk rankings given to those hazards and how they vary across the State. Hazard risk rankings are generally reported in LHMPs using a scale of high / moderate / low risk. Three of the state's LHMPs do not currently rank hazards. These local rankings were compiled from 31 LHMPs and a quantitative range was assigned to this data. Overall hazard risk rankings were then calculated based on the number of responses and the ranking values for each response. Table 6-3, repeated here from Section 5.3, presents the hazard risk rankings for each PA and statewide. It should be noted that LHMPs only rank those hazards that are profiled within each document, therefore LHMPs do not include rankings for all of the state-profiled hazards.

Table 6-3 Hazard Risk Rankings by Preparedness Area

Hazards	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
Dam Failure	5	1	4	4	3	5	4
Drought	8	8	6	9	9	7	7
Earthquake	5	6	3		2	1	3
Extreme Heat	6	5	3	10	5	1	5
Expansive Soil	5	1	2	1			2
Flood	8	3	7	9	7	8	8

Hazards	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
High Wind	10	10	4	8	6	7	7
Landslide		1	4	1	5	1	3
Land Subsidence	10		1	1	5		2
Severe Winter Storm	7	8	4	4	7	7	6
Thunderstorm	10	8	4	7	6	7	7
Tornado	6	5	3	1	2		4
Volcano		1	2		1	1	2
Wildfire	9	10	10	8	8	8	9

6.1.3 Hazard Ranking

Ranking hazards helps the State prioritize limited resources for not just mitigation, but also for preparedness and response activities. The 2018 Plan gave a numerical ranking of the 14 hazards, with wildfire ranking highest and volcano ranking lowest. Comparing those rankings to the statewide average of risk rankings from the State's LHMPs in Table 6-4 shows that the State's perception of hazards aligns very well with the perception of those hazards at the local level.

Table 6-4 Hazard Risk Rankings in 2018 SHMP Compared to LHMP Rankings

Hazard	2018 SHMP	LHMPs
Wildfires	1	9
Floods	2	8
Thunderstorm	3	7
Drought	4	7
Winter Storm	5	6
High Wind	6	7
Extreme Heat	7	5
Dam Failure	8	4
Tornado	9	4
Earthquake	10	3
Landslide	11	3
Land Subsidence	12	2
Expansive Soil	13	2
Volcanoes	14	2

The SHMT therefore decided to keep the same risk rankings for the 2023 Plan update. However the SHMT felt that there was not enough good statewide data to justify a precise numerical ranking and instead chose to mirror the high-medium-low rankings used in most of the State's LHMPs. The updated rankings for 2023 are shown in Table 6-5.

Table 6-5 2023 Hazard Risk Rankings

Hazard	Ranking
Wildland/Wildland Urban Interface Fires	High
Floods	High
Thunderstorm	High
Drought	High
Winter Storm	Medium
High Wind	Medium
Extreme Heat	Medium
Dam Failure	Medium
Tornado	Medium
Earthquake	Low
Landslide	Low
Land Subsidence	Low
Expansive Soil	Low
Volcanoes	Low

While prioritization of hazards is important for prioritizing mitigation efforts, it does not mean that lower-risk hazards should be neglected completely. The SHMT remains committed to mitigating the impacts of all hazards that threaten the State.

6.1.4 National Risk Index

As noted previously in Section 4.4.3, FEMA has developed the National Risk Index (NRI) as a dataset and online tool to help illustrate the United States communities most at risk for 18 natural hazards. It was designed and built in close collaboration with various stakeholders and partners in academia; local, state, and federal government; and private industry. The NRI provides a consistent set of nationwide data on hazards, to include

- Annualized frequency of hazard events
- Historic loss ratios
- Expected annual losses
- Social vulnerability
- Community resilience
- Risk index ratings

The SHMT reviewed a series of maps showing NRI data at the county and census tract level. However, the SHMT felt the NRI rankings did not accurately reflect the distribution of risk in New Mexico, based on the information contained in the State's LHMPs and the analysis conducted for the 2023 Plan update.

Maps showing NRI data for New Mexico are included in Appendix F.

6.1.5 Hazard Profiles

Hazard profiles describe different hazard characteristics. In some cases, hazards affect specific geographic areas, i.e. floods and landslides. When this is the case, the hazard profile includes a map identifying areas of the State where the hazard could occur. For hazards that could occur anywhere, such as tornadoes and winter storms, the hazard profile identifies which portions of the State may be more vulnerable to the hazard.

Sections 6.3 through 6.16 present profiles for the 14 hazards identified at the beginning of this chapter, listed in alphabetical order. Each profile includes a description of the hazard, a review of historical hazard occurrences in the State, estimates of future occurrence, and assessments of vulnerability to that hazard, as well as notes on data limitations and the type of mitigation activities applicable to that hazard.

6.1.6 Drought – Wildfire – Flood Cycle

Of particular concern to the SHMT is how three of the State's highest hazards relate to and reinforce one another. The following information is adapted from a number of other plans and reports, as referenced below. See also Section 6.8.9 for a detailed discussion of post-wildfire flooding and debris flow.

2004 New Mexico Forest and Watershed Health Plan:

> Many of New Mexico's ecosystems are in an unhealthy state. This condition has reached a critical state in many ecosystems, including 1) unnaturally high density of woody vegetation in some forest types, in woodlands and grasslands, and in riparian communities, 2) a degradation of biodiversity, including an increase of invasive species and noxious weeds such as salt cedar and thistles, and 3) fragmentation and deterioration of wildlife habitat. Results of these trends include susceptibility to catastrophic wildfire, compromised watersheds, and decreased water supply, accelerated erosion, desertification, and other unwanted symptoms of ecological degradation. These unhealthy conditions have been created over time by factors including changes in settlement patterns, disruption by human intervention of natural processes such as fire and flooding, unsustainable use, and natural climatic variation. As a result, New Mexico faces greater susceptibility to catastrophic wildfire and drought, compromised watersheds, and decreased water supply, accelerated erosion, and desertification.

NM National Disaster Resilience Competition Application:

> Past land management activities and fire suppression have led to conditions in the forests, grasslands, and riparian areas that are significantly departed from reference conditions. Reference conditions are resilient to wildfire, drought, and the increased water stress expected to accompany changing climate patterns in the Southwest. Historically, the native ponderosa pine and dry mixed conifer forests were dominated by large fire-resistant tree species. These arid forests were maintained by frequent low-intensity fires moving across the landscape, leaving stands less dense than they are today. The biodiversity needed to keep the forest resilience has been lost with the decline in mature, old growth structures, open meadows, understory shrubs, and ground cover. Most of the forests proposed for treatment are now dominated by relatively young, dense, homogeneous closed-canopy stands that are extremely susceptible to severe damage by wildfire. When vegetation is consumed by high-intensity wildfire, the exposed forest floor becomes highly vulnerable to erosion. Runoff can carry away topsoil, duff, woody material,

and ash from the burn scar, intensifying the impacts of post-fire flooding on downstream communities, infrastructure, and water quality.

[During flood events, the force of the water washed out roads and transported sediment into arroyos, drainage ways and irrigation ditches. In addition to flood damages, sediment is] "a source of non-point source pollution that damages the downstream ecosystem. As soil lost upstream settles in ditches and flood control infrastructure, it necessitates expensive dredging operations for downstream communities. In this way, large-scale erosion caused by the wildfire/flood cycle leads to the degradation of the natural resources of the entire region.

Extreme soil damage also occurs in watersheds that experience a wildfire. Soil damage usually occurs where burn intensities are severe to moderate. The loss of organic components in the soil and burned organic material decreases the ability of rain to infiltrate resulting in hydroponic soils; in some areas there is a four- to hundred-fold increase in runoff and debris flow. In these burned areas, large floods result from average monsoon rainstorms. In combination with the damaged soil, the destruction of vegetation by wildfires has created high potential for floods. In general, coniferous trees intercept more rainfall than deciduous trees in full leaf. New Mexico forests are predominantly coniferous and the risk for flooding is increased when these forest types and others are drastically reduced and destroyed by wildfires.

In addition to the increased long-term risk of flooding years after a watershed has experienced a burn, these watersheds are also at risk to destructive flows of sediment and water (debris flows). The US Geologic Survey created a series of studies on the probability and volume of debris flows stemming from the worst extreme fires in New Mexico. Dramatic changes in runoff, erosion, and deposition have been documented by the USACE in watersheds affected by wildfire. These changes have led to loss of life, damage to property, and significant impacts on infrastructure. Ongoing concerns are the increased potential for flooding and debris flow, plus large amounts of sediment being transported from the burn scar areas. Additionally, debris flows could create temporary dams or sediment plugs along drainage courses that could fill and breach, sending flood waves downstream. Life safety concerns are higher in those communities located downstream of burned watersheds.

Walter Chermak: Cost of Wildfire:

Healthy forests function properly to capture snow and release it slowly during the spring melting period. This watershed regulation function… has been compromised by the scorched, denuded state of the soils in burned areas, leaving the land subject to erosion and the watershed subject to repetitive flood losses and excess sedimentation.

NM National Disaster Resilience Competition Application:

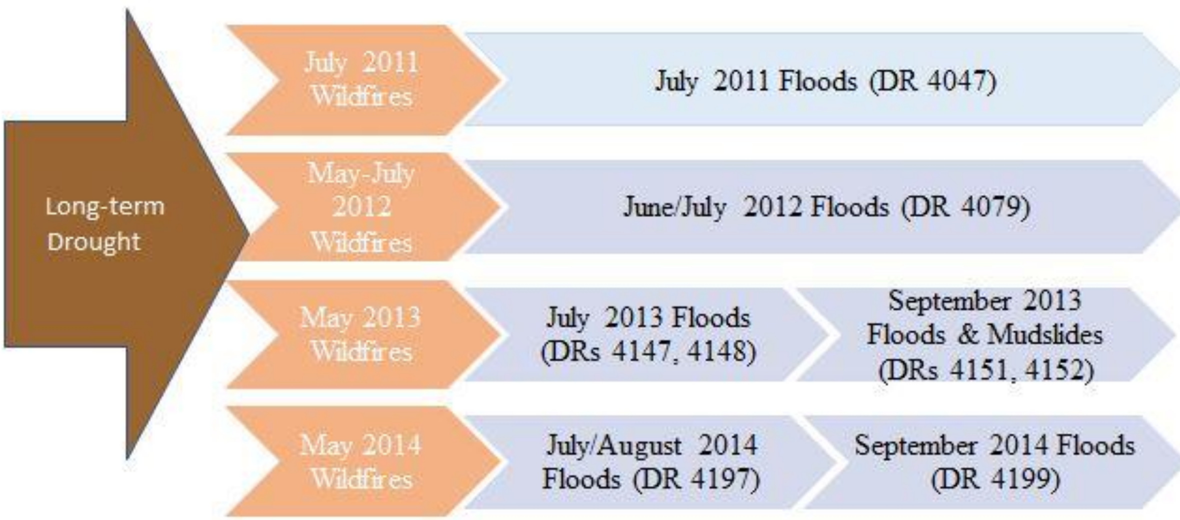
The impacts of wildfire include not just the direct impacts of burned timber, homes, businesses, and infrastructure, but also the impact to the landscape. Freshly burned landscapes are at risk of damage from post-wildfire erosion hazards such as those caused by flash flooding and debris flows. Burn scar areas have a tremendous impact on flood and debris flow following short duration, high intensity rainfall. These high-volume flash floods result from typical monsoon summer rains and occur in and downstream of the burn scar areas. For instance, July and August

2012 brought intense flooding with burn scar areas producing up to 400% greater flows than the calculated 1% chance storm event.

The USACE's *Post Flood Report: Record Rainfall and Flooding Events During September 2013 in New Mexico* reported climate trends over recent decades that show a decrease in monsoon precipitation frequency but increased intensity. [Since 2010, the State experienced] nine flood, severe storm, and mudslide events severe enough to receive federal disaster declarations, along with 14 FMAG declarations. In addition, more than 30% of the State's water supply is affected adversely by debris-laden runoff throughout the Upper Rio Grande watershed.

Damages due to floods originating in areas burned during wildfire, lead to cascading impacts to ecosystems, infrastructure, and water quality downstream. Flooding is exacerbated by post-fire conditions such as loss of protective vegetative cover, large volumes of ash and burn debris, and hydrophobic soils." A description of the drought-wildfire-flood cycle is shown below in Figure 6-3.

Figure 6-3 Drought, Wildfire, Flood Cycle



2004 New Mexico Forest and Watershed Health Plan:

A problem a century in the making will not be solved overnight. Thus, improving the outlook for New Mexico's forests and watersheds will require a long-term commitment of many decades by all those who share responsibility for restoring these ecosystems.

A wide range of efforts are already underway in New Mexico to reverse the symptoms of ecosystem decline. Millions of dollars are spent each year on ecological restoration, yet the impact on ecosystem health is still just a fraction of what needs to be accomplished. This New Mexico Forest and Watershed Health Plan was developed to facilitate, strengthen and streamline current on-the-ground work so as to achieve the greatest impact for every dollar spent. The Plan is an integrated collaborative approach to ecological restoration.

New Mexico's ecological and community health depends on the recognition of the inseparability of ecological, social, and economic sustainability. [New Mexico Forest and Watershed Health Plan] identifies a three-part vision of New Mexico's forest and watershed health:

- diverse ecosystems are characterized by integrity and resiliency;
- diverse human communities are sustained by ecologically healthy landscapes that provide resources and amenities; and
- economies thrive by using the inherent productivity of healthy ecosystems.

To carry out this vision… a landscape approach [was adopted that requires] working across agency jurisdictions, ownership boundaries, cultural divides, and ecosystem types. This ambitious landscape approach will give New Mexico the use of the most sophisticated methods of ecological restoration and will require collaboration, teamwork, persistence, and continual learning.

The Plan calls for actions "that will transform the way ecological restoration is accomplished in New Mexico, strengthening on-the-ground efforts, eliminating unnecessary barriers to this work, and in the end realizing much greater impact for the dollars invested [… The] State is uniquely positioned to lead this effort, and to establish an integrated ecological restoration strategy that will guide New Mexico.

6.2 Exposure and Vulnerability of the Built Environment

As noted above, risk is the estimated impact that a hazard would have on people, services, facilities, and structures in a community. Hazards are only a threat when they impact people, the built environment, the environment, or the economy. The first step in determining vulnerability is to look at the total exposure of people, property, systems, or functions in the State. Table 6-6, repeated here from Section 5.3, summarizes the exposure of general property to hazards as reported in Local HMPs.

Table 6-6 Statewide Exposure to Hazards

Preparedness Areas	Total Dollar Value Exposure	Total Exposed Structures/Parcels
Dam Failure	**$8,469,535,000**	**66,531**
PA 1	$1,919,741,000	14,074
PA 4	$638,715,000	7,243
PA 5	$1,390,222,000	7,172
PA 6	$4,520,857,000	31,160
Flood	**$5,839,470,000**	**35,339**
PA 1	$1,660,074,000	11,625
PA 2	$1,380,000	-
PA 3	$468,309,000	1,676
PA 4	$659,203,000	5,883
PA 5	$1,126,757,000	8,467
PA 6	$1,923,747,000	7,688
Levee Inundation	**$4,166,419,000**	**32,658**
PA 5	$4,166,419,000	32,658
Landslide	**$1,435,909,000**	**7,964**
PA 4	$157,782,000	1,277
PA 5	$1,278,096,887	6,687

Preparedness Areas	Total Dollar Value Exposure	Total Exposed Structures/Parcels
PA 6	$30,000	-
Land Subsidence	**$7,662,696,000**	**34,017**
PA 1	$558,105,000	3,763
PA 4	$244,166,000	1,173
PA 5	$6,860,425,004	29,081
Wildfire	**$56,971,683,000**	**194,108**
PA 1	$1,993,826,000	16,404
PA 3	$33,935,456,000	33,388
PA 4	$2,432,598,000	15,570
PA 5	$17,584,408,000	108,922
PA 6	$1,025,395,000	19,824
Grand Total	**$84,545,712,000**	**370,617**

6.2.1 State Assets

An updated inventory of state assets was provided by the General Services Department. A total of 49 facilities were identified. Figure 6-4 shows the location of these assets by county and Preparedness Area.

State assets and critical facilities were classified into the seven FEMA community lifelines shown below. A lifeline enables the continuous operation of critical government and business functions and is essential to human health and safety or economic security. Table 6-7 lists the 49 state-owned assets by county and Lifeline category, along with estimated replacement values.

Figure 6-4 State-Owned Facilities by County

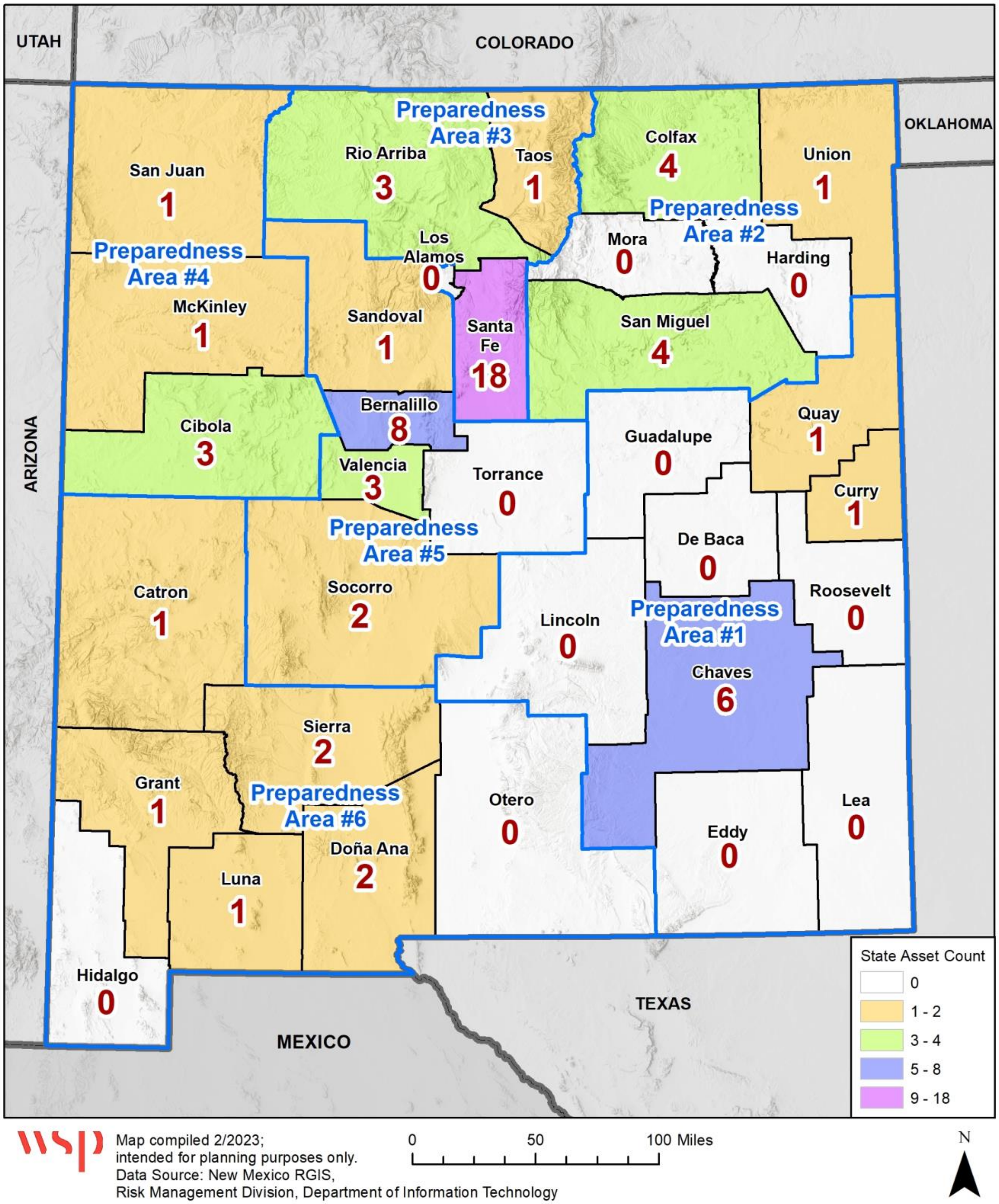


Table 6-7 State Assets Summary by County and Lifeline

County	Total	Health and Medical	Safety and Security	Transportation	Replacement Value	Content Value	Total Value
PA 1							
Chaves	**5**	1	3	1	$40,427,000	$7,770,000	**$48,197,000**
Curry	**1**	-	1	-	$805,000	$128,000	**$933,000**
PA 2							
Colfax	**3**	1	2	-	$75,308,000	$14,002,000	**$89,310,000**
San Miguel	**3**	1	1	1	$131,098,000	$21,867,000	**$152,965,000**
PA 3							
Rio Arriba	**1**	-	1	-	$508,985	$50,000	**$558,985**
Santa Fe	**16**	-	14	2	$555,487,704	$47,425,000	**$602,912,704**
Taos	**1**	-	1	-	$432,000	$69,000	**$501,000**
PA 4							
Cibola	**2**	-	1	1	$35,634,000	$3,468,000	**$39,102,000**
McKinley	**1**	-	1	-	$2,447,000	$360,000	**$2,807,000**
PA 5							
Bernalillo	**6**	3	2	1	$182,746,167	$210,598,000	**$393,344,167**
Sandoval	**1**	-	1	-	$14,053,000	$3,032,000	**$17,085,000**
Socorro	**1**	-	1	-	$2,081,668	$944,583	**$3,026,251**
Valencia	**3**	1	2	-	$138,852,000	$9,768,000	**$148,620,000**
PA 6							
Dona Ana	**2**	-	2	-	$71,270,000	$4,980,000	**$76,250,000**
Grant	**1**	1	-	-	$0	$0	**$0**
Luna	**1**	-	-	1	$7,965,000	$1,588,000	**$9,553,000**
Sierra	**1**	1	-	-	$19,357,000	$5,171,000	**$24,528,000**
Total	**49**	**9**	**33**	**7**	**$1,278,472,524**	**$331,220,583**	**$1,609,693,107**

Source: NM RGIS, HIFLD, Risk Management Division, Department of Information Technology

The largest concentrations of state assets are in Santa Fe and Bernalillo Counties, followed by Chaves County.

6.2.2 Critical Facilities

Not all critical facilities are owned by the State. 75% of the country's critical infrastructure is privately owned and operated. But these assets are no less critical for being privately owned. Therefore the SHMT decided to include a basic analysis of critical facilities beyond state assets.

Critical facilities include:

- Essential facilities vital to the response effort (emergency service facilities, such as police stations, fire stations, rescue squads, public works facilities, hospitals, evacuation shelters, etc.)
- Facilities that house populations requiring special consideration (nursing homes, prisons, juvenile detention centers, schools, secondary education facilities, childcare centers, state hospitals and facilities, health clinics, and the Office of Medical Investigation, etc.)
- Locations where public health and safety functions are performed or coordinated (State Police District Offices, National Guard Facilities, Emergency Operations Centers, Office of Medical Investigator, State Laboratory, housing for communications and computer systems, food/medical distribution centers, etc.)
- Communications networks (telephones, emergency medical radio communication system, emergency service radio systems, towers and repeater sites and base stations, television, and radio stations, etc.)
- Water supply system/facilities, to include wastewater treatment
- Utilities (power plants, substations, power lines, etc.)
- Transportation networks (roads, bridges, airports, rail terminals, etc.)
- Facilities that can create secondary hazards, such as nuclear power plants and hazardous materials production or storage facilities

Critical facilities were identified using data from NM RGIS, DPS, HIFLD, HSIP, NMBB, NMED, the National Bridge Inventory, and the USWTDB. A total of 15,291 facilities were identified and classified into FEMA Lifelines. Table 6-8 identifies those facilities by county and Preparedness Area.

Table 6-8 Critical Facilities Summary by County and FEMA Lifeline

County	Communications	Energy	Food, Water, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation	Total
PA 1	**1067**	**1477**	**14**	**100**	**160**	**618**	**625**	**4061**
Chaves	184	113	2	13	22	128	119	**581**
Curry	57	233	-	9	20	89	21	**429**
De Baca	19	63	2	-	1	17	24	**126**
Eddy	205	58	4	23	38	89	95	**512**
Guadalupe	39	133	2	1	5	30	87	**297**
Lea	359	147	-	40	21	107	15	**689**
Lincoln	92	36	2	-	23	62	136	**351**
Quay	54	195	2	3	18	54	118	**444**
Roosevelt	58	499	-	11	12	42	10	**632**
PA 2	**249**	**50**	**14**	**5**	**65**	**189**	**487**	**1059**
Colfax	84	27	8	2	18	52	141	**332**
Harding	9	2	-	-	7	16	12	**46**

County	Communications	Energy	Food, Water, Shelter	Hazardous Materials	Health and Medical	Safety and Security	Transportation	Total
Mora	40	3	2	-	4	22	79	**150**
San Miguel	90	11	4	3	27	69	182	**386**
Union	26	7	-	-	9	30	73	**145**
PA 3	**484**	**68**	**20**	**12**	**121**	**457**	**507**	**1669**
Los Alamos	32	7	4	3	10	34	4	**94**
Rio Arriba	171	16	4	1	30	103	158	**483**
Santa Fe	193	31	6	6	55	238	251	**780**
Taos	88	14	6	2	26	82	94	**312**
PA 4	**697**	**159**	**46**	**42**	**99**	**387**	**582**	**2012**
Cibola	103	74	-	-	20	68	141	**406**
McKinley	230	24	34	11	36	141	271	**747**
San Juan	364	61	12	31	43	178	170	**859**
PA 5	**703**	**774**	**24**	**113**	**157**	**986**	**994**	**3751**
Bernalillo	352	110	2	98	94	657	494	**1,807**
Sandoval	138	25	12	10	32	145	188	**550**
Socorro	75	2	2	1	10	43	192	**325**
Torrance	63	623	-	-	5	42	70	**803**
Valencia	75	14	8	4	16	99	50	**266**
PA 6	**901**	**185**	**22**	**40**	**137**	**570**	**884**	**2739**
Catron	50	37	2	-	9	26	106	**230**
Doña Ana	196	33	10	26	46	255	265	**831**
Grant	108	20	4	3	19	65	102	**321**
Hidalgo	26	13	-	2	7	29	59	**136**
Luna	58	49	-	2	7	45	107	**268**
Otero	401	25	4	7	40	115	133	**725**
Sierra	62	8	2	-	9	35	112	**228**
Total	**4,101**	**2,713**	**140**	**312**	**739**	**3,207**	**4,079**	**15,291**

Visualizing the location of critical facilities through mapping can contribute to more robust understanding of both vulnerability and capability in the event of a disaster. Figure 6-5 through Figure 6-13 show counts of each lifeline category of critical facilities by county.

Figure 6-5 Critical Facilities by County

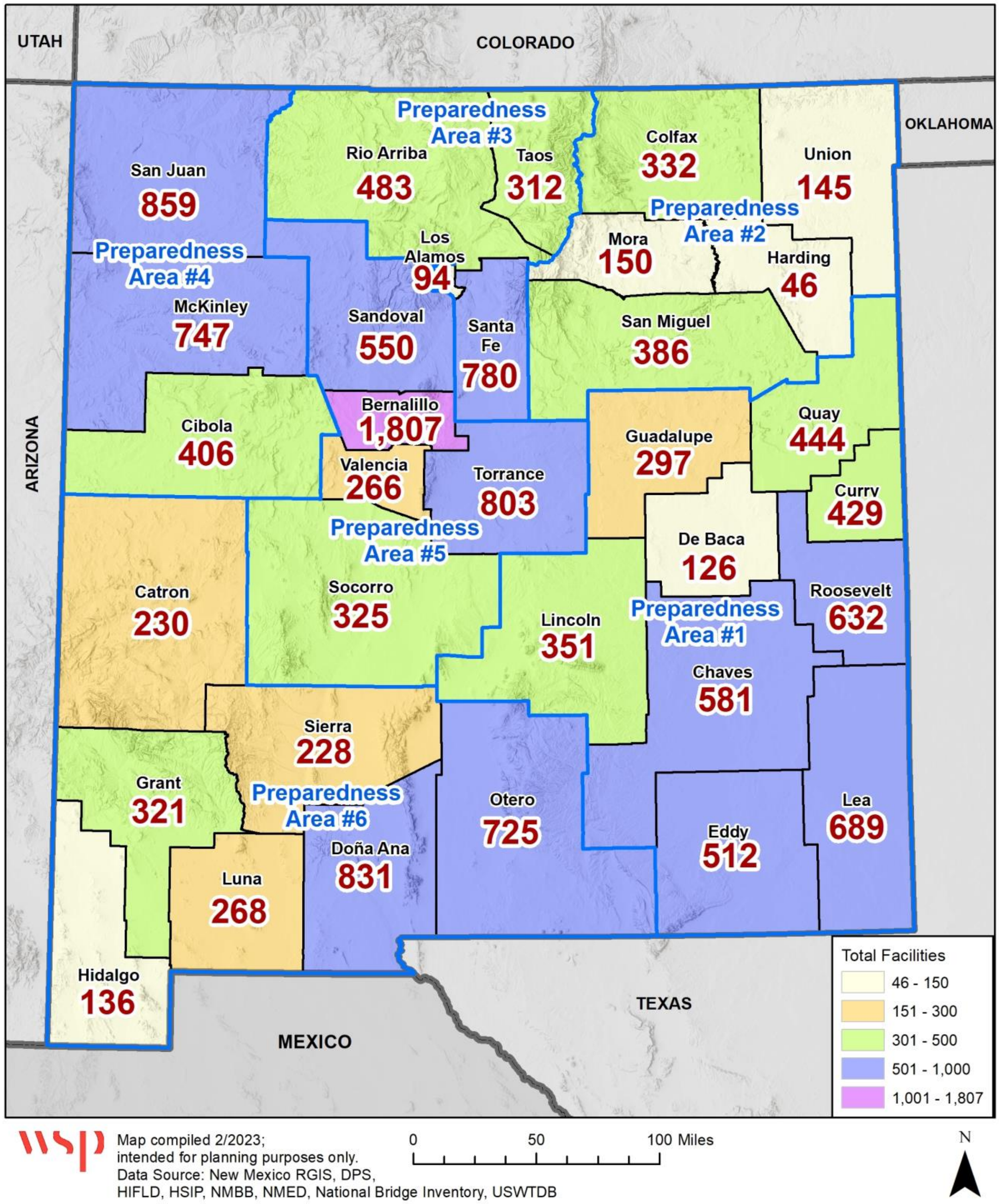


Figure 6-6 Critical Communications Facilities by County

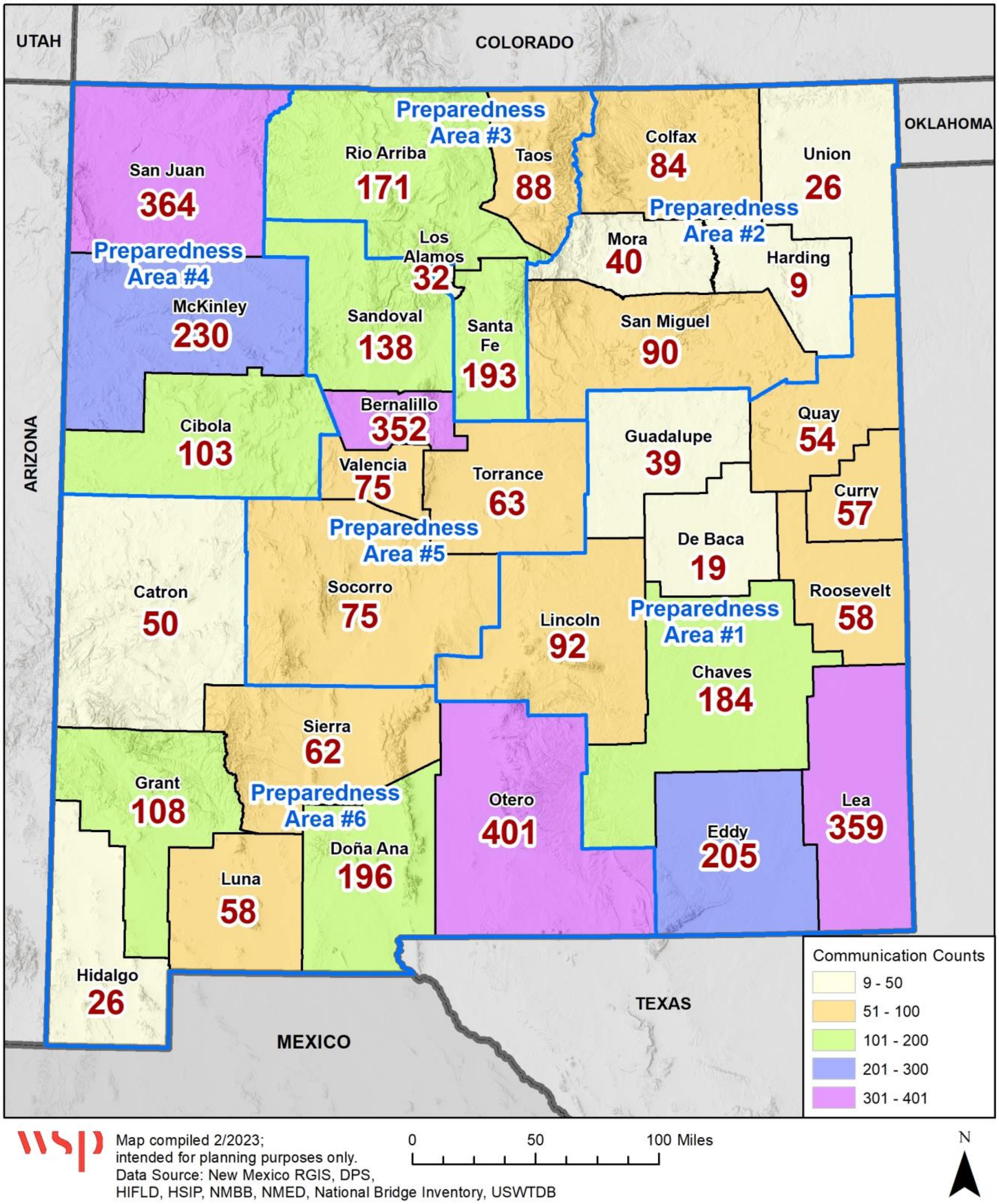


Figure 6-7 Critical Energy Facilities by County

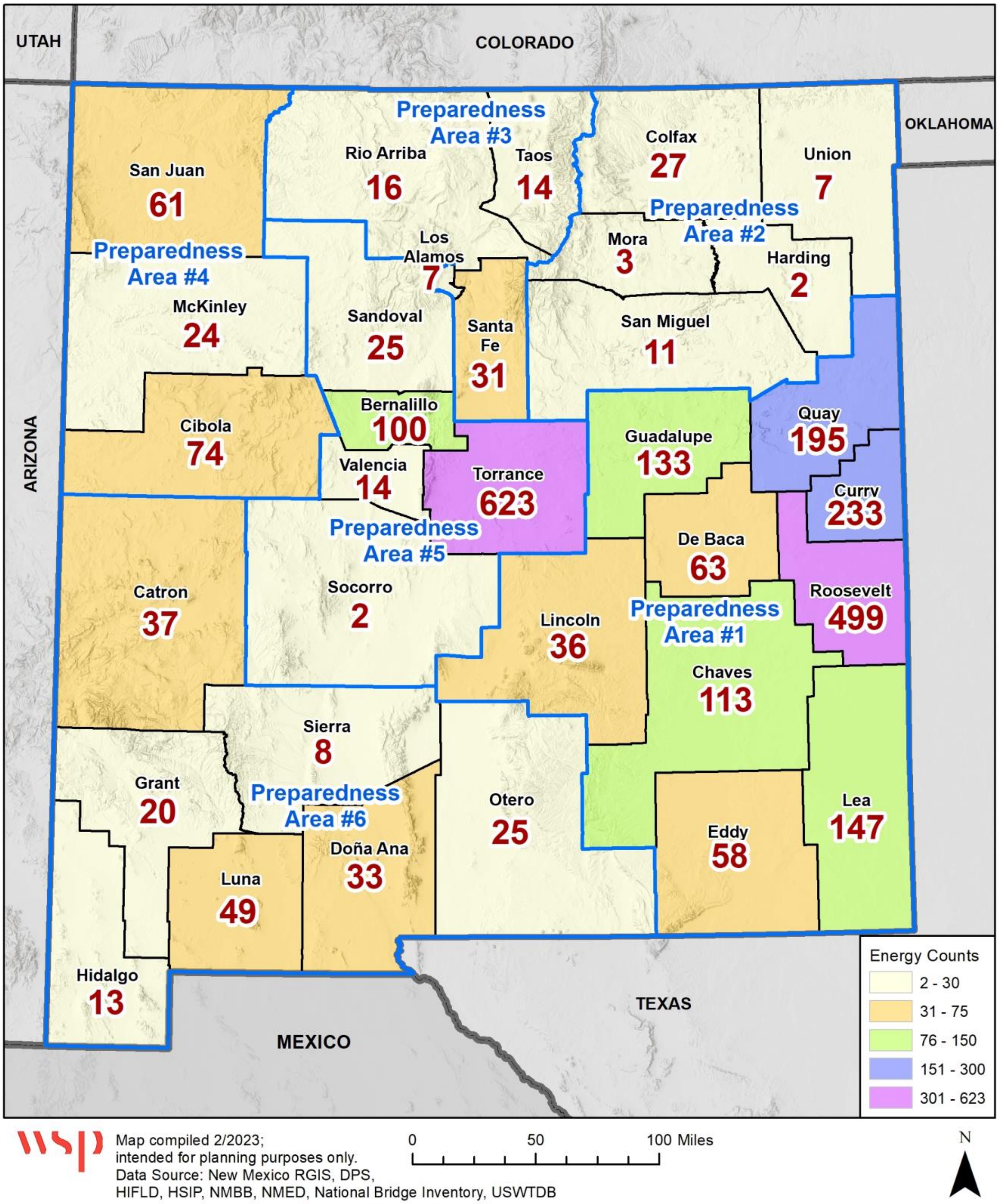


Figure 6-8 Critical Food, Water & Shelter Facilities by County

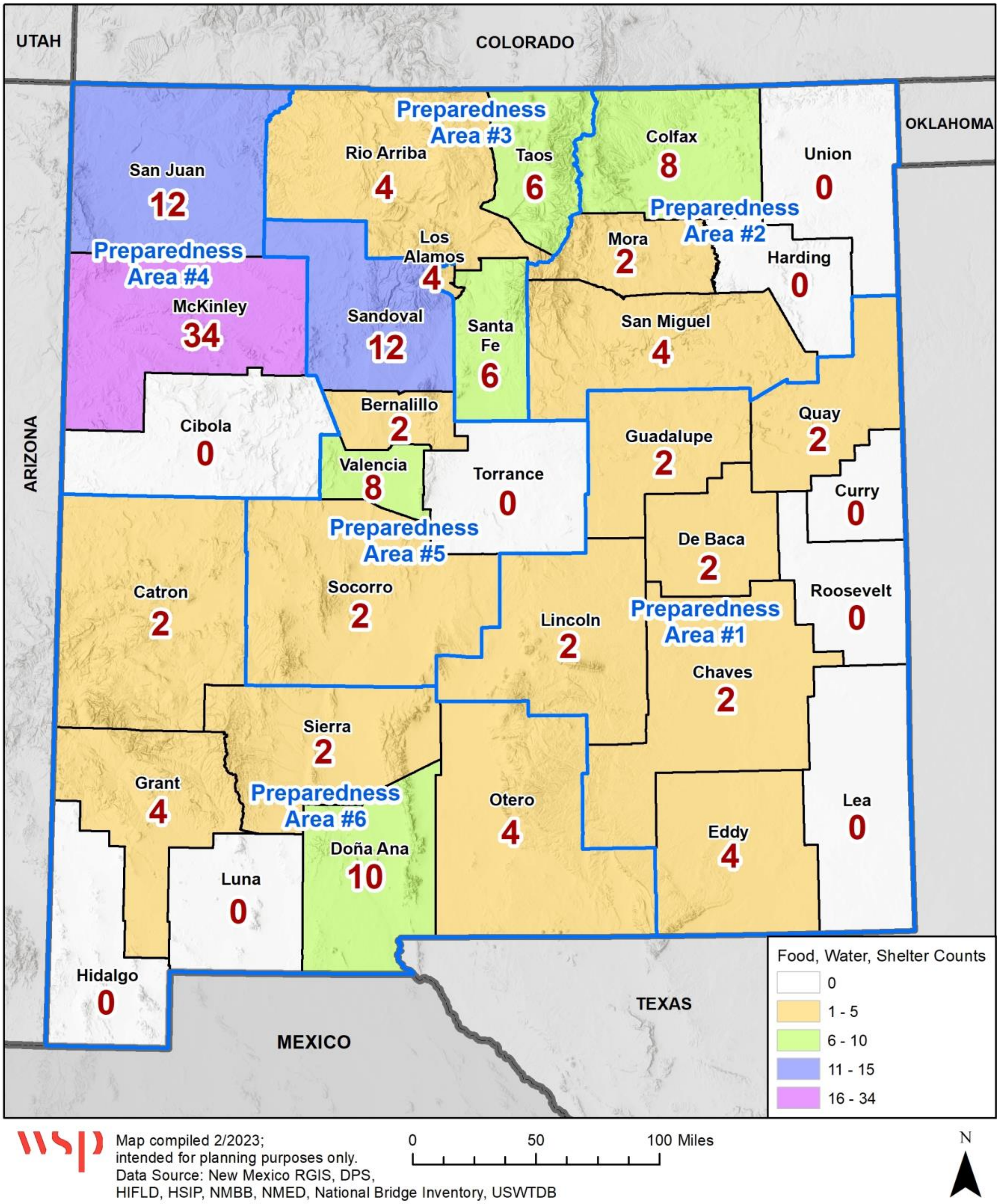


Figure 6-9 Critical Hazardous Materials Facilities by County

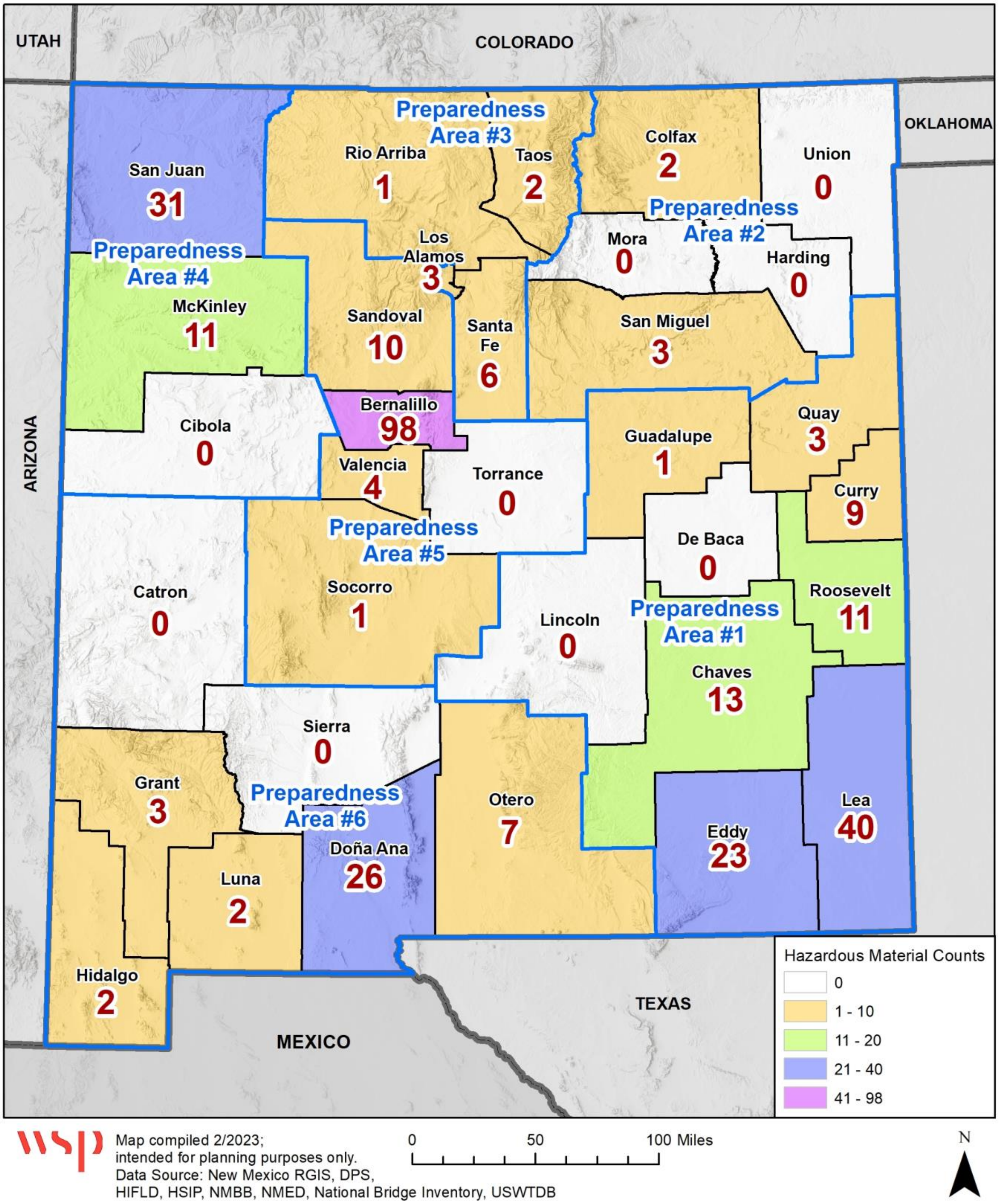


Figure 6-10 Critical Health and Medical Facilities by County

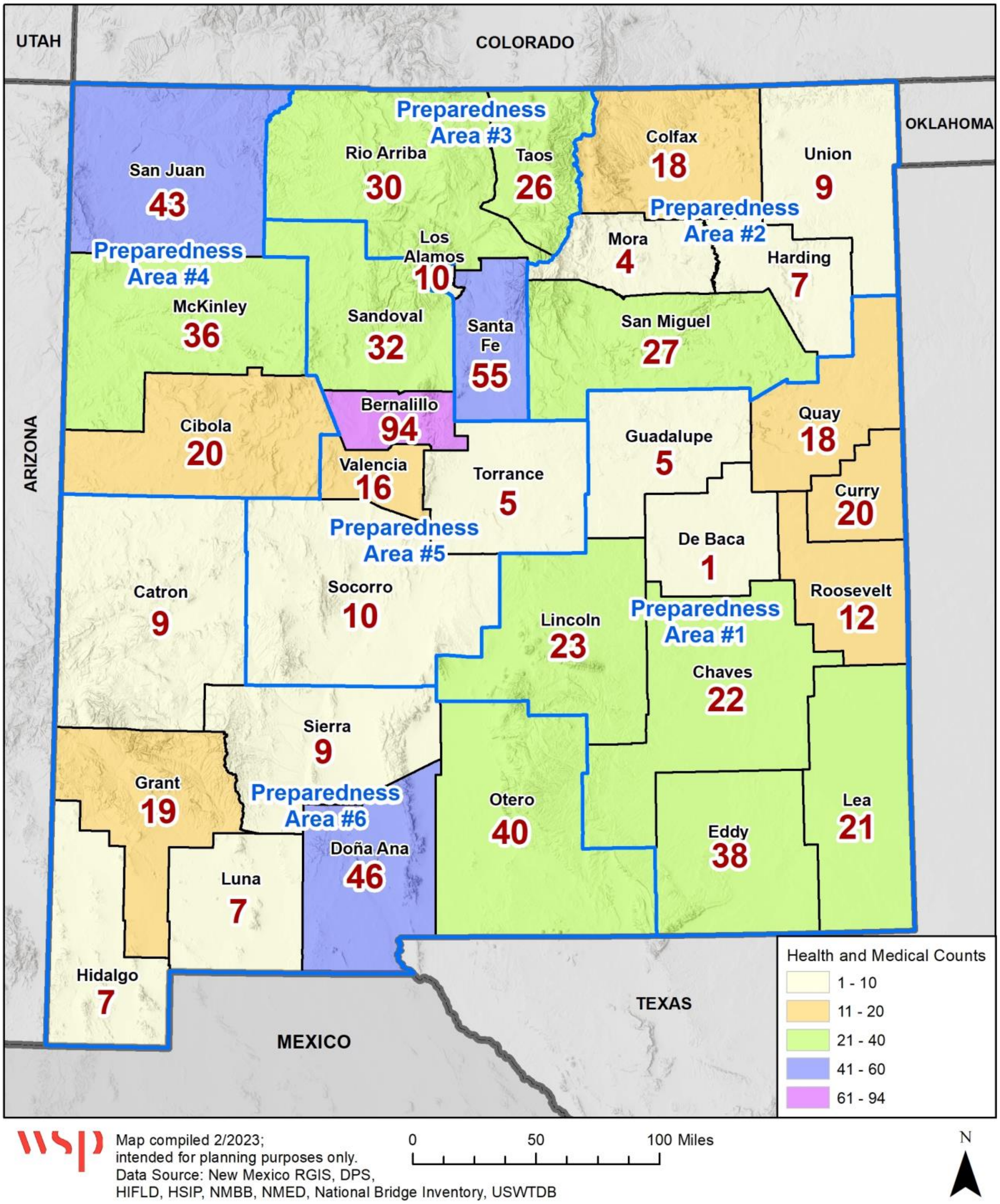


Figure 6-11 Critical Safety and Security Facilities by County

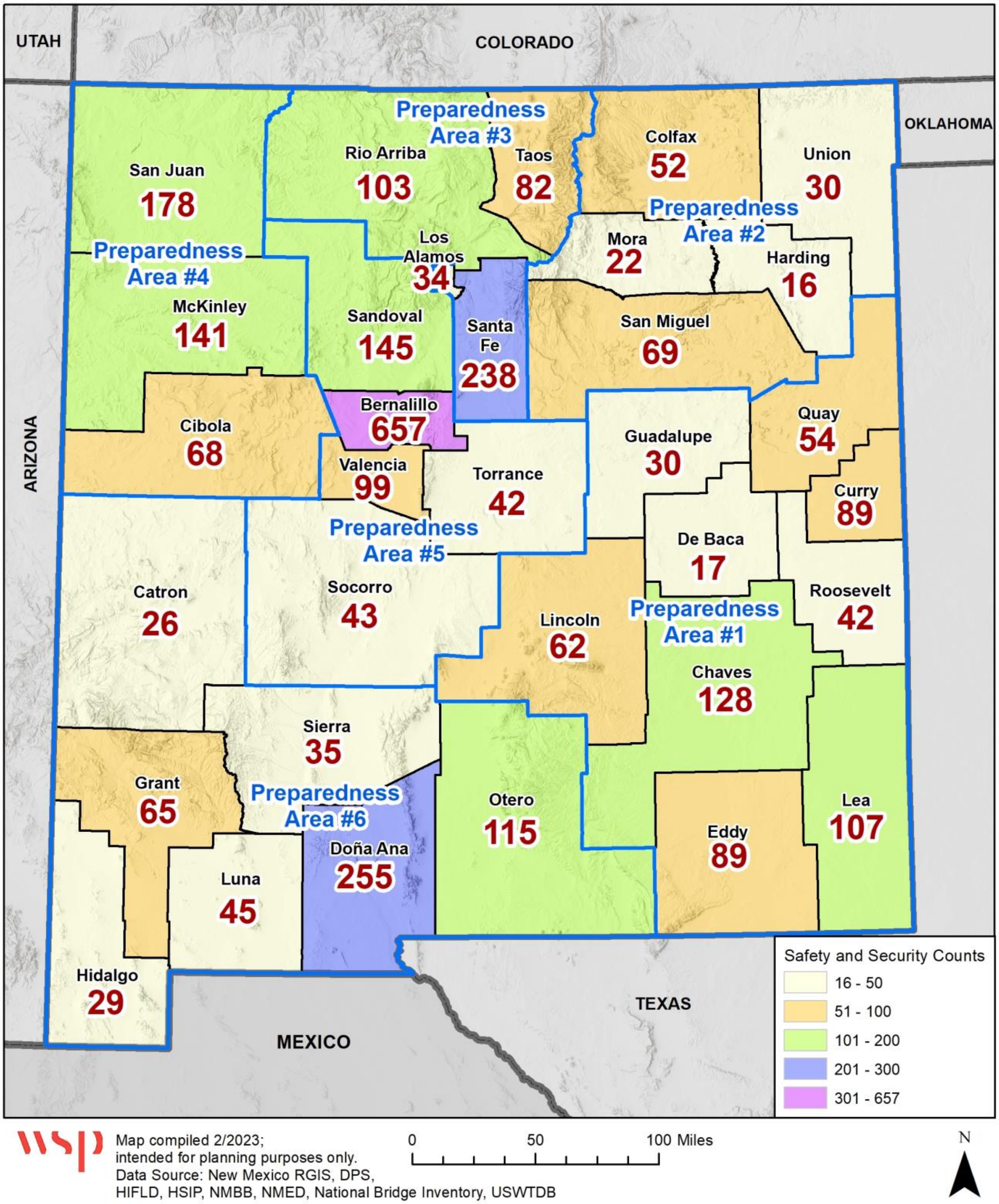


Figure 6-12 Critical Transportation Facilities by County

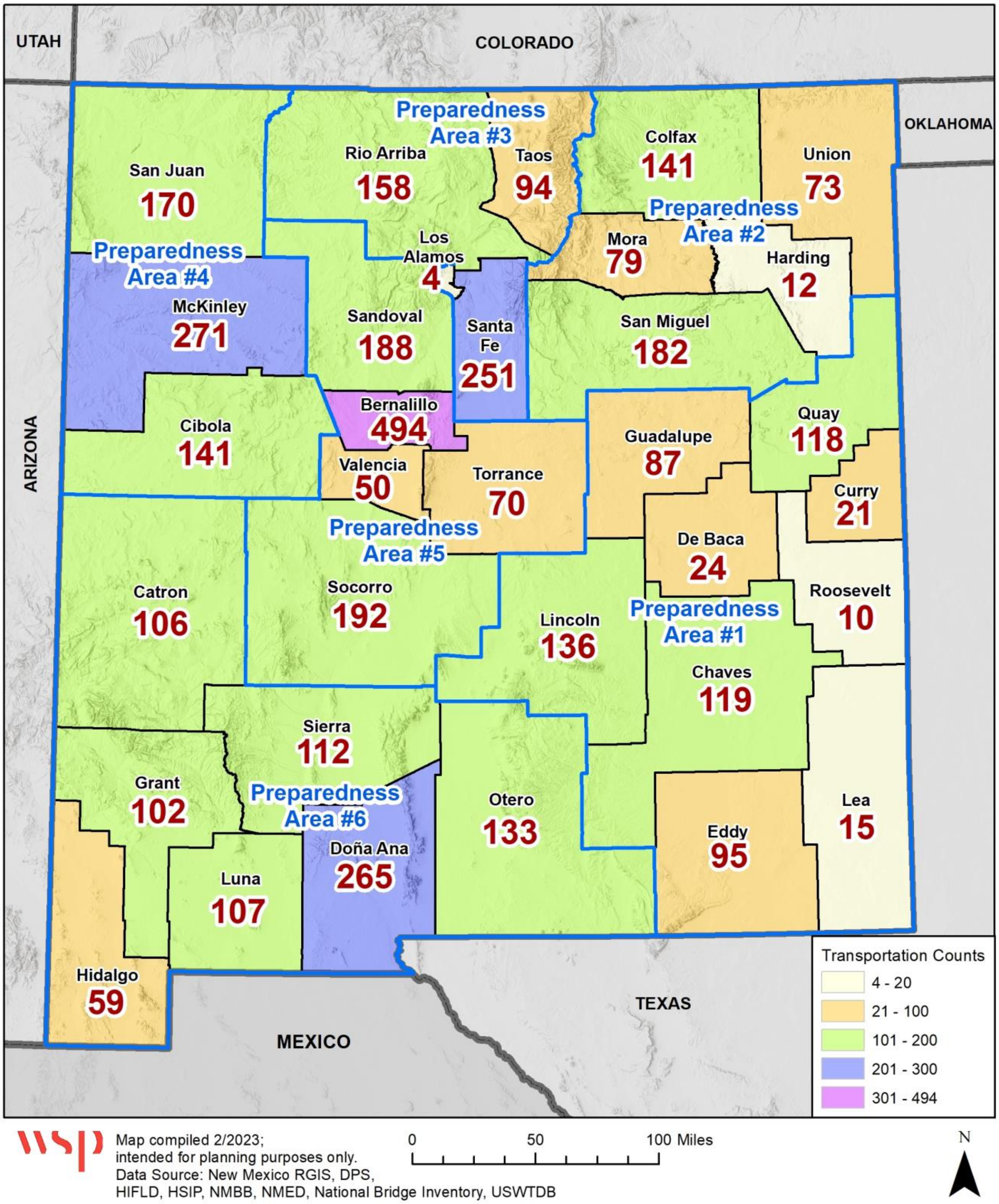
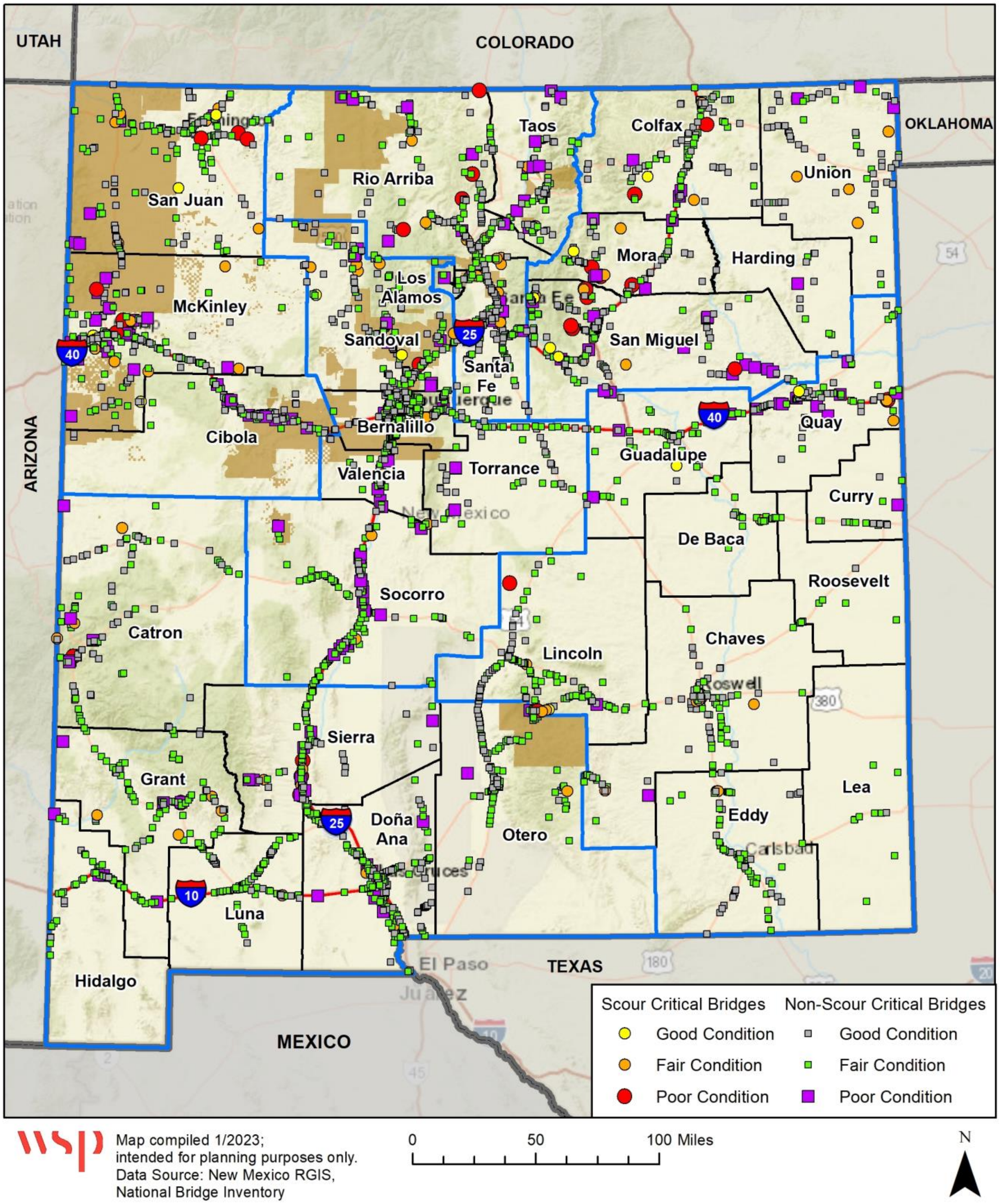


Figure 6-13 Bridges Statewide



6.3 Dam Failure

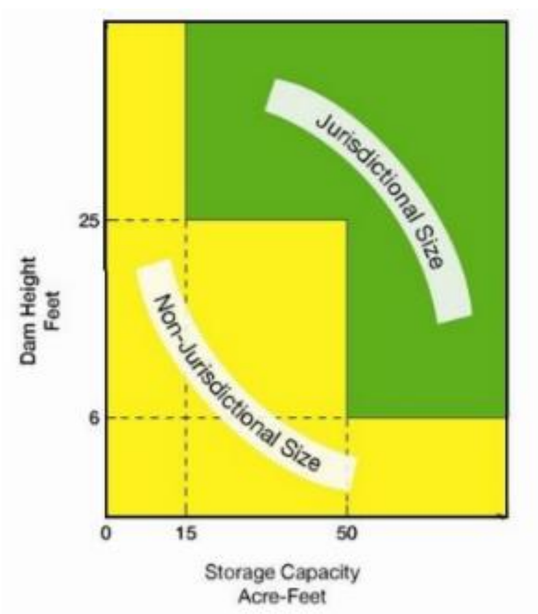
Hazard	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
Dam Failure	**Medium**	**Low**	**Medium**	**Medium**	**Low**	**Medium**	**Medium**

6.3.1 Hazard Characteristics

Any malfunction or abnormality outside the design assumptions and parameters that adversely affects a dam's primary function is considered a dam failure. A catastrophic dam failure is characterized by a sudden, rapid, and uncontrolled release of impounded water. The sudden release of water may result in downstream flooding affecting life, property, and agriculture. Flooding, earthquakes, blockages, landslides, lack of maintenance, improper operation, poor construction, vandalism, or acts of terrorism can cause dam failures. The sudden release of the impounded water can occur during a flood that overtops or damages a dam, or it can occur on a clear day if the dam has not been properly constructed or maintained. Dam failures can occur anywhere there is a dam, but the threat from dam failures can increase as existing dams age. In New Mexico, floodplain maps do not include dam breach inundation areas, because the probability of occurrence is not the same. Therefore, downstream residents can be unaware of the potential dangers.

The Office of the State Engineer (OSE) Dam Safety Bureau regulates the design, construction, reconstruction, modification, removal, abandonment, inspection, operation, and maintenance of dams 25 feet or greater in height with more than 15 acre-feet of storage or dams that store 50 acre-feet or more with at least six feet in height. Dams that fall below these height and storage criteria are considered non-jurisdictional dams. The jurisdictional size chart is shown in Figure 6-14. While the Office of the State Engineer does not regulate non-jurisdictional dams, the Office of the State Engineer can exercise authority over a non-jurisdictional dam if it is considered unsafe and a threat to life or property. Federal dam owners are required to obtain a permit for new dams, although the Office of the State Engineer does not ensure the continued safety of Federal dams.

Figure 6-14 Jurisdictional Dam Size



Standard practice among Federal and State dam safety offices is to classify a dam according to the potential impact a dam failure (breach) or mis-operation (unscheduled release) would have on downstream areas. The hazard potential classification system categorizes dams based on the probable loss of human life and the impacts on economic, environmental and lifeline facilities. The Dam Hazard Potential Classification definitions are shown in Table 6-9 and are based on the probable loss of human life and the impacts of economic, environmental, and lifeline facilities. These classifications were provided by the OSE and may be used as a tool to exercise authority over non-jurisdictional dams to determine safety and potential threat to life.

Table 6-9 Dam Hazard Potential Classification

Category	Impacts
High	Failure or mis-operation will probably cause loss of human life.
Significant	Failure or mis-operation will probably not result in loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but may be located in populated areas with significant infrastructure.
Low	Failure or mis-operation results in no probable loss of life but may result in low economic or environmental losses. Losses would be principally limited to the dam owner's property

According to the National Inventory of Dams, as of January 1, 2023 there are 401 dams in the State classified as follows:

- 222 high hazard potential
- 45 significant hazard potential
- 128 low hazard potential
- 6 undetermined

Ownership of the dams is distributed as follows:

- 166 are owned by local government
- 102 are federally owned
- 96 are privately owned
- 15 are owned by the State
- 15 are owned by public utilities
- 7 have ownership is not listed

Of the 401 dams in the state, 292 come under the jurisdiction of the State Dam Safety Bureau.

The high and significant hazard dams in the State are mapped in Figure 6-15. Figure 6-16 summarizes the number of high and significant hazards dams in each county.

Figure 6-15 High and Significant Hazard Dams in New Mexico

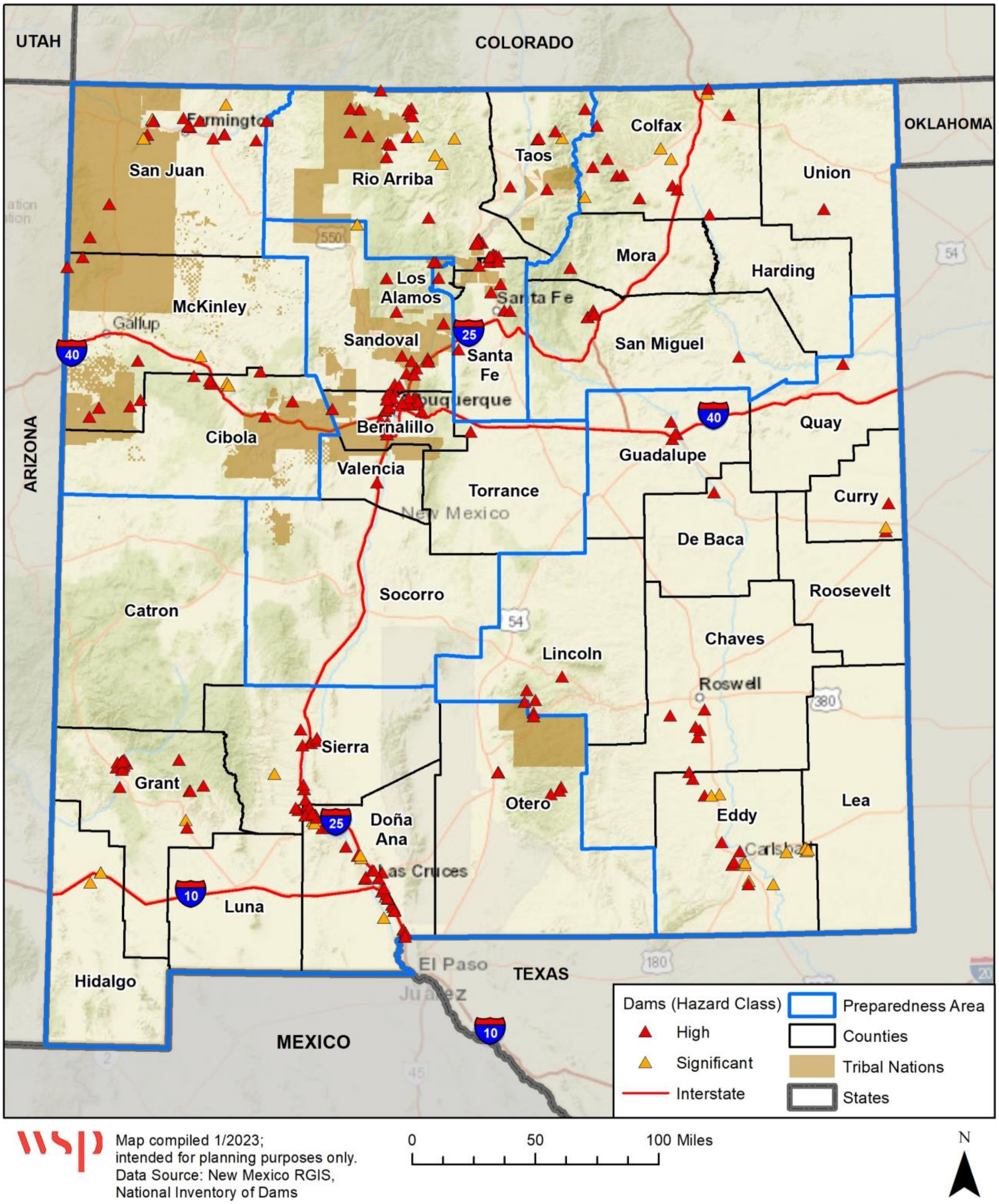


Figure 6-16 High and Significant Hazard Dams by County

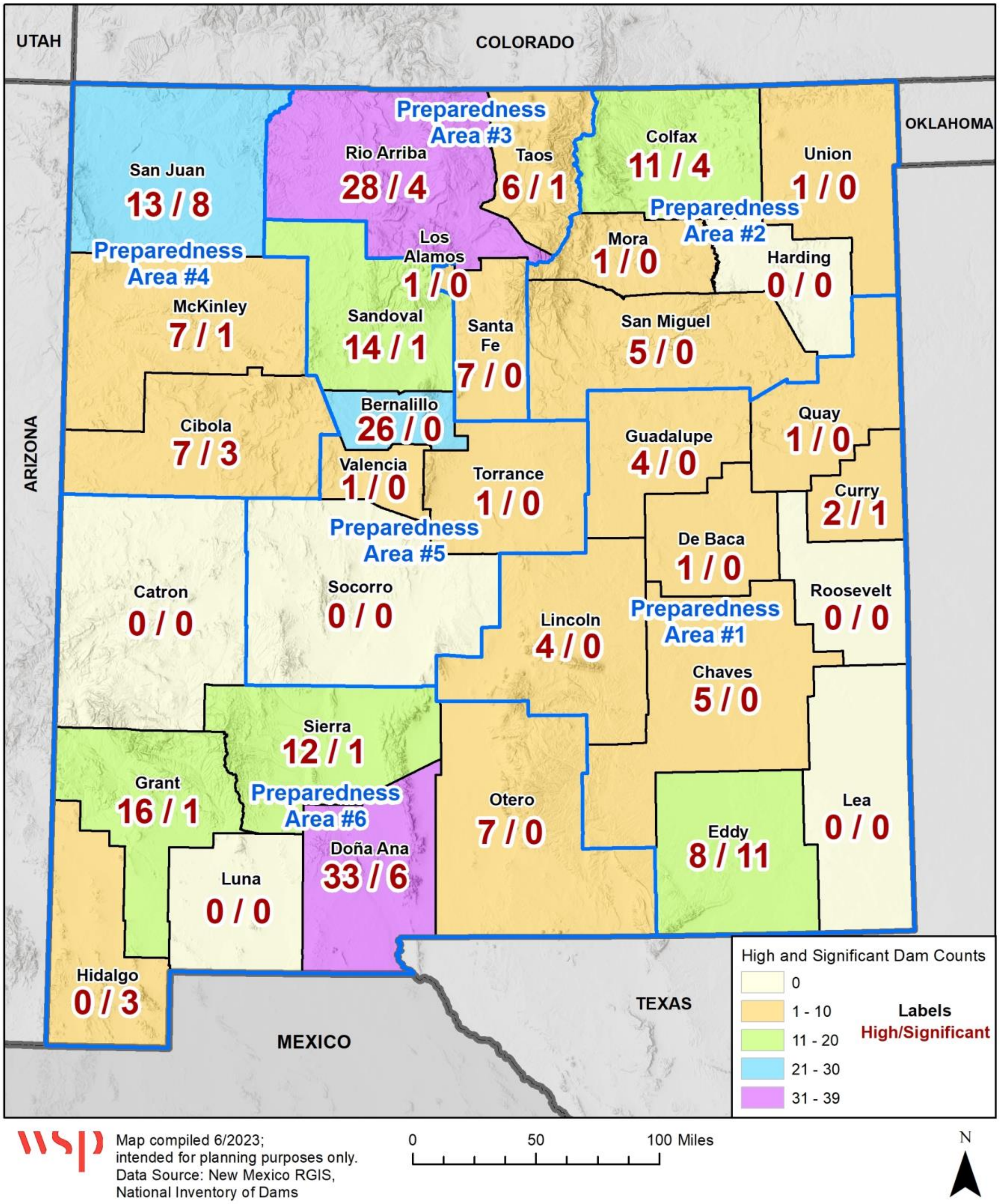
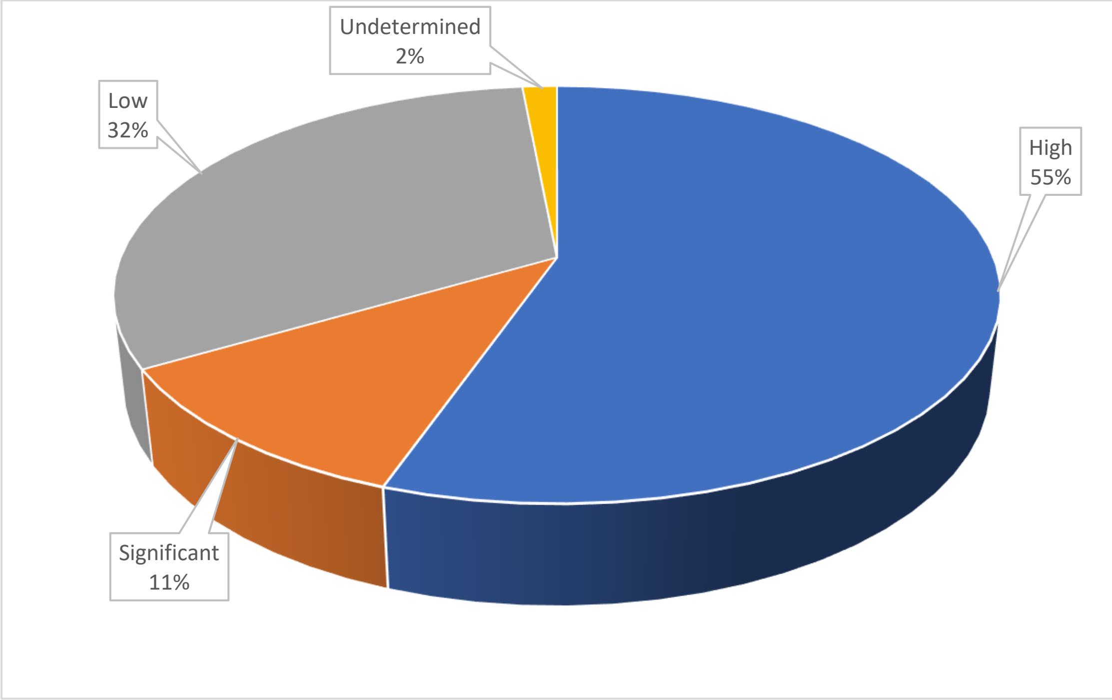
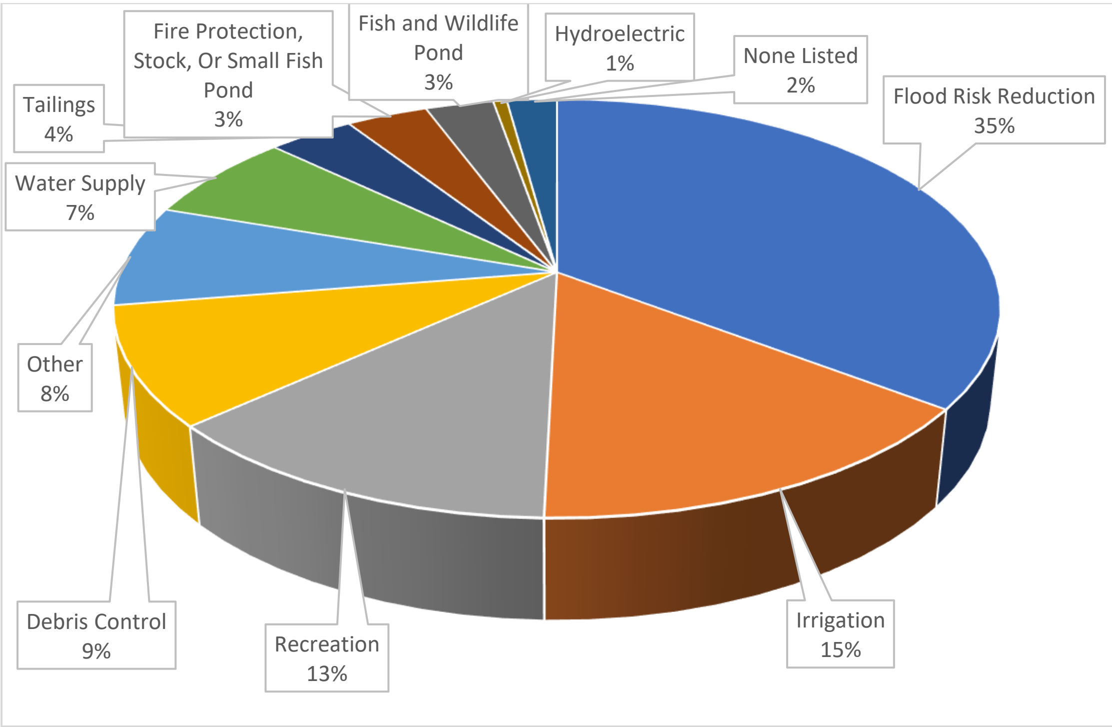


Figure 6-17 New Mexico Dams by Hazard Potential



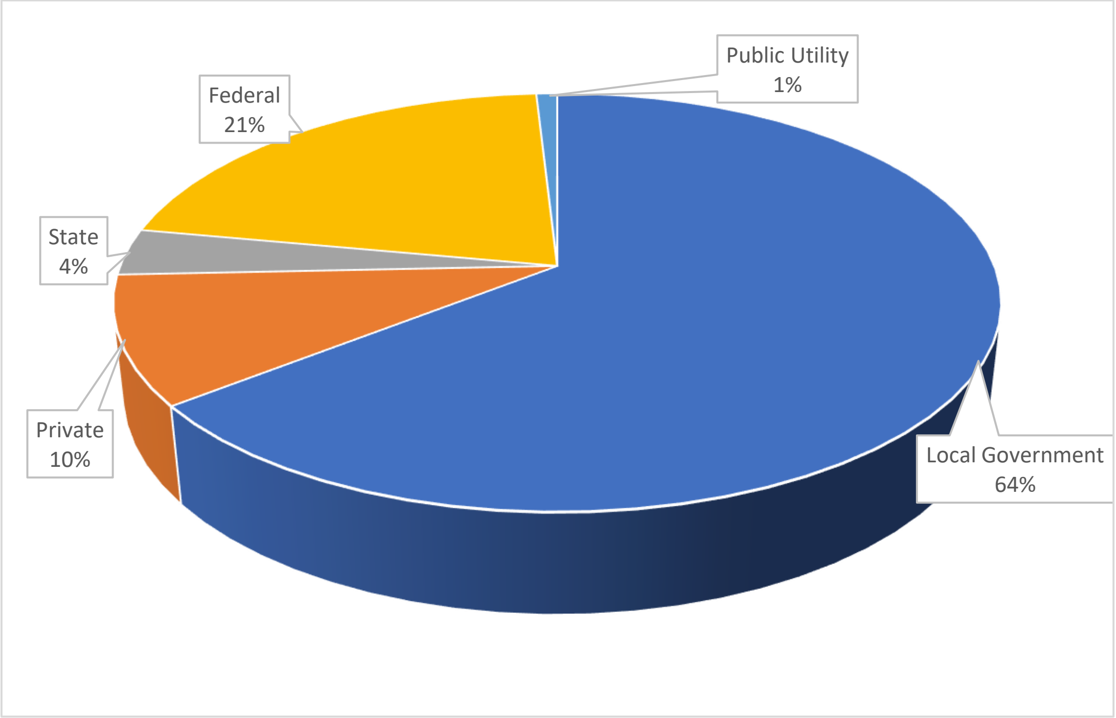
Source: National Inventory of Dams, 1/1/2023

Figure 6-18 Dams by Purpose



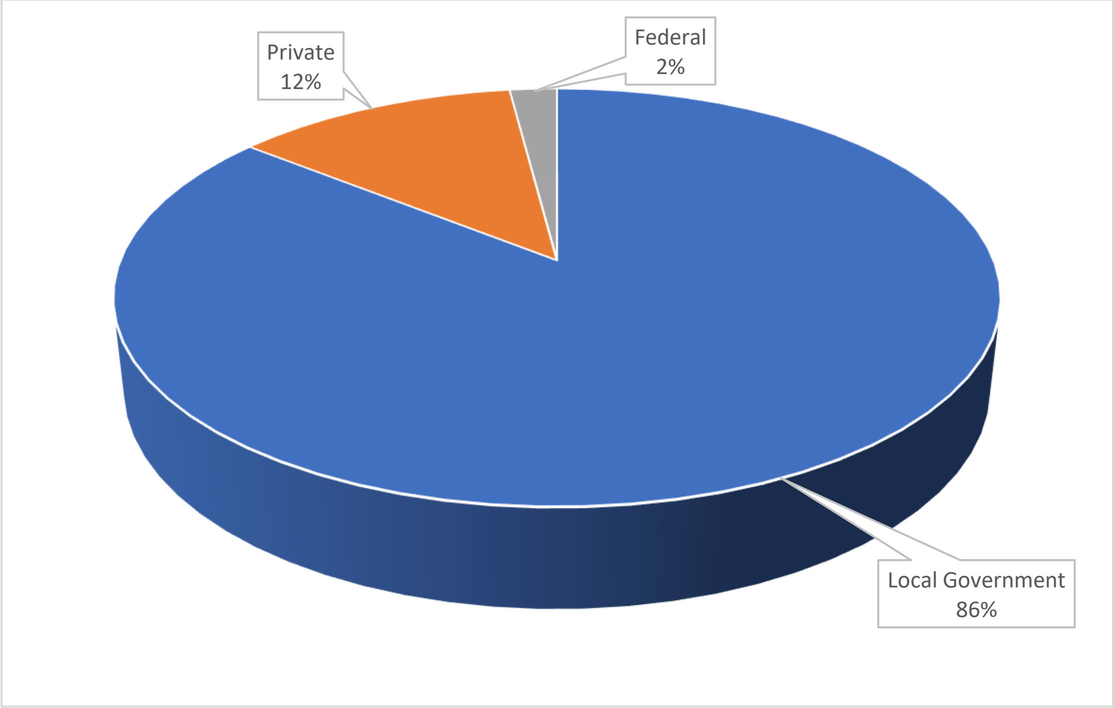
Source: National Inventory of Dams, 1/1/2023. Numbers add up to more than 401 because many dams serve multiple purposes.

Figure 6-19 Ownership of High Hazard Potential Dams



Source: National Inventory of Dams, 1/1/2023

Figure 6-20 Ownership of High Hazard Dams Without an Emergency Action Plan (EAP)



Source: National Inventory of Dams, 1/1/2023

Dams classified as high or significant hazard potential are required to prepare, maintain, and exercise of an Emergency Action Plan (EAP). The EAP identifies defensive action to prevent or minimize property damage, injury, or loss of life due to an emergency at the dam. Each EAP has inundation maps based on modeling the dam failure under various operational conditions. Of the State's 22 high hazard potential dams, 124 (56%) are reported as having an EAP in place, while 98 (44%) do not have an EAP on record. This has increased significantly from 34% in 2018. This continues to be a significant improvement from past years. Of the 98 high hazard dams that do have not developed an EAP, 84 (86%) are owned by local government, 12 (12%) are privately owned, and 2 (2%) are Federally owned.

Providing assistance to dam owners in development of EAPs was addressed as a Mitigation Action in the 2018 Plan, and I still underway.

Since 2005, the OSE Dam Safety Bureau has been assessing whether dams are deficient under the new Dam Safety Regulations. In 2008 the US Army Corps of Engineers introduced a condition assessment field for the National Inventory of Dams. The OSE adopted the definitions by the USACE in FY 2009, and during FY 2015 the OSE Dam Safety Bureau inspected 101 dams. According to the OSE Interstate Stream Commission Annual Report, as of 2015, a total of 224 dams are considered deficient, 122 of which are high hazard dams and 38 are significant hazard dams. One-hundred and sixty dams total, ranked as high or significant, are considered deficient. Many of these deficiencies can be corrected with an engineering evaluation. Table 6-10 below provides the definitions for the condition assessment classification along with the OSE Spillway Risk Guidelines associated with each condition.

Table 6-10 Dam Condition Classifications

Condition Assessment	USACE Criteria	OSE Spillway Risk Guidelines
Satisfactory	No existing or potential dam safety deficiencies are recognized. Acceptable performance is expected under all loading conditions in accordance with State Engineer rules and regulations for dams or tolerable risk guidelines.	Spillway capacity ≥ 70% of the spillway design flood (SDF).
Fair	No existing dam safety deficiencies are recognized for normal loading conditions. Rare or extreme hydrologic and/or seismic events may result in a dam safety deficiency. Risk may be in the range [for the owner] to take further action.	Spillway capacity < 70% but ≥ 25% of the SDF.
Poor	A dam safety deficiency is recognized for loading conditions, which may realistically occur. Remedial action is necessary. A poor condition is also used when uncertainties exist as to critical analysis parameters that identify a potential dam safety deficiency. In such cases further investigations and studies are necessary.	Spillway capacity < 25% of the SDF.
Unsatisfactory	A dam safety deficiency is recognized that requires immediate or emergency remedial action for problem resolution.	NA

Since the 2018 HMP, a two-year study by The Associated Press presented information that New Mexico leads the nation with the largest amount, nearly 50% of its high hazard dams being in a poor condition. This can be in part due to some of these dam's being decades old and lacking the necessary construction builds and other designs necessary to provide better certainty about their stability. Other ones have insufficient spillways that are incapable of withstanding a historical dam breaching event.

To counteract this in 2019 The Office of the State Engineer was awarded a special appropriation of $200,000 for a dam safety risk assessment project. As older infrastructure is a major priority for New

Mexico counties. New Mexico lawmakers have asked for more funding for dam design and restoration projects during legislative sessions.

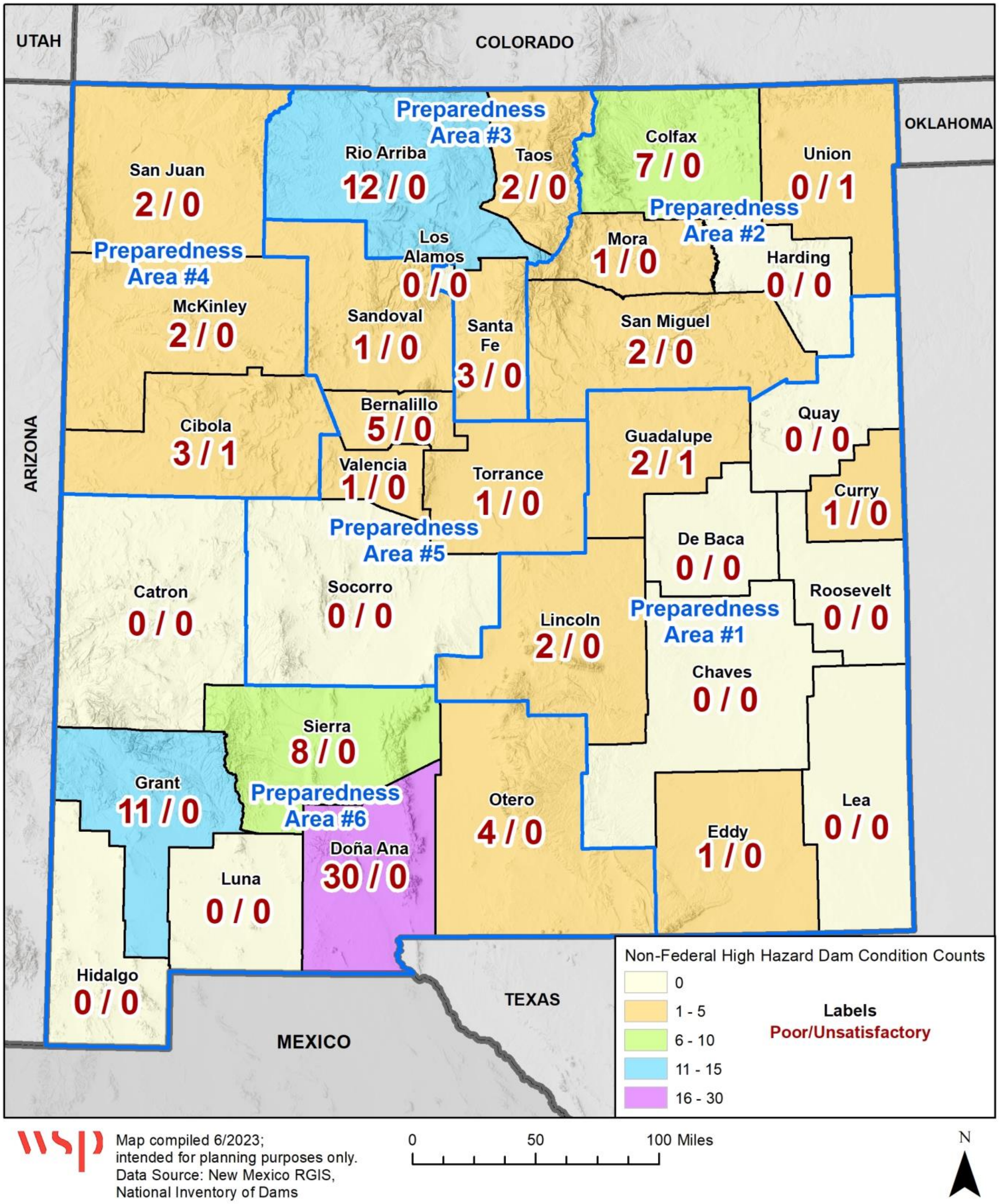
The State Engineer has taken action against unsafe water storage dams that pose an immediate threat to life and property by ordering storage restrictions. Unfortunately, storage restrictions are not an option for flood control dams because the normal operating condition of the reservoir is empty. Safety deficient flood control dams still offer some flood protection but will likely fail and cause catastrophic consequences during extreme storm events. Where owners are unwilling or unable to upgrade their flood control dams a dilemma exists whether to order the dam breached resulting in flooding or allow the unsafe dam to remain knowing that an extreme storm will fail the dam.

Evaluating the age and year built of New Mexico's dams will help with preventing any potential dam failures. Shown in Figure 6-22 below are the dams over 50 and 100 years old. Older dams can or may lack design and other construction documents that would provide more certainty about their stability. Others can have inadequate spillways that would be incapable of withstanding a severe weather-related event. Dams that are higher in age are present statewide. With a higher concentration around Albuquerque, Los Alamos, Dona Ana, Santa Fe and Sandoval. Areas where there is a higher population and property density, which puts both at a higher risk due to any possible dam failures.

Figure 6-21 gives the number of non-federal dams in poor or unsatisfactory condition for each county.

Figure 6-22 shows the number of 50 and 100-year old dams by county.

Figure 6-21 Non-Federally Owned Dams in Poor/Unsatisfactory Condition by County



Map compiled 6/2023;
intended for planning purposes only.
Data Source: New Mexico RGIS,
National Inventory of Dams

Figure 6-22 Aging Non-Federally Owned Dams by County

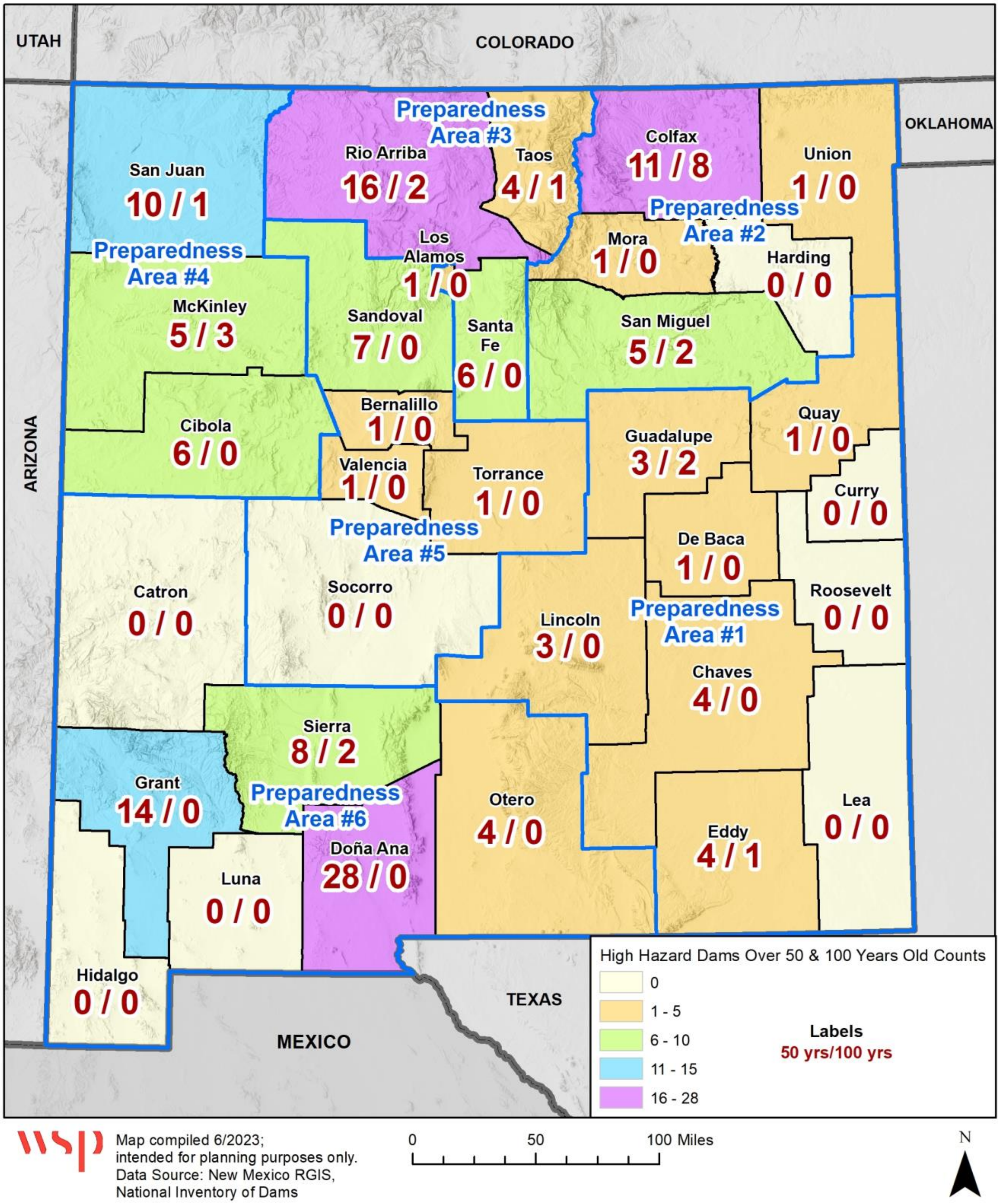
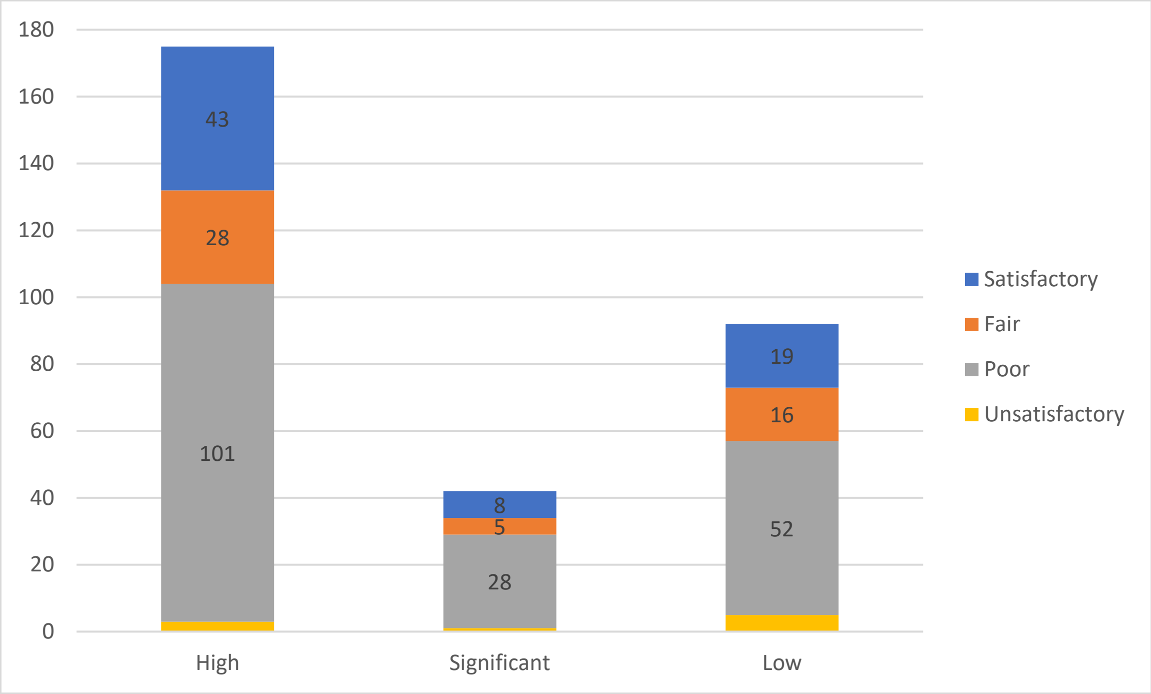


Figure 6-23 summarizes the condition rating of dams in the State by hazard class.

Figure 6-23 Dam Condition Rating by Hazard Potential



Source: National Inventory of Dams, 1/1/2023

6.3.2 Previous Occurrences

There have been 43 Dam Incident Notifications in New Mexico from 1890 to 2022, with 18 total failures. Of those 18 failures, 13 were at dams ranked as high hazard, two were at medium hazard dams, two were at low hazard dams, and one was at a dam that no longer exists. Table 6-11 summarizes all 43 incidents.

Table 6-11 Previous Occurrence - Dam Incidents, 1890 - 2022

Year	Preparedness Area	County	Dam Name	Type of Incident	Dam Failure
2021	PA 6	Dona Ana	La Union Dam	Overtopping	No
2013	PA 6	Dona Ana	Earthen Dam	Overtopping	Yes
2011	PA 3	Los Alamos	Los Alamos Canyon Dam	Potential Overtopping	No
2007	PA 6	Dona Ana	Little Halla Wilson Dam	Spillway Unsafe	No
2005	PA 3	Taos	Cabresto Dam	Seepage	No
2001	PA 2	Cibola	San Mateo Lake Dam	Crack & Seepage	No
1999	PA 6	Grant	Cobre Main Tailings Dam	Uncontrolled Release	Yes
1999	PA 2	Colfax	Miami Lake Dam No. 2	Crack	No
1994-95	PA 2	Colfax	McCrystal Dam	Seepage	No
1988	PA 2	Colfax	Throttle Dam No. 2	Overtopping	No
1987	PA 5	Bernalillo	Renaissance Detention Basin	Piping	Yes
1987	PA 6	Dona Ana	Mclead Flood Control Dam	Piping	Yes
1982	PA 2	Colfax	Ute Creek Dam	Slope Failure	No
1981	PA 6	Dona Ana	Caballo Arroyo Dam No. 4	Crack	No
1980s	PA 6	Grant	Phelps Dodge Tailings Dam No. 3	Uncontrolled Release	Yes

Year	Preparedness Area	County	Dam Name	Type of Incident	Dam Failure
1980s	PA 6	Dona Ana	Little Halla Wilson Dam	Spillway Failed	No
1980s	PA 2	San Miguel	Bradner Dam	Seepage	No
1980s	PA 4	San Juan	Beeline Farmington Dam	Seepage	No
1979	PA 2	Colfax	Lake Maloya Dam	Conduit Failed	No
1975	PA 1	Eddy	Hackberry Draw Site No. 3	Sinkholes	No
1970s	PA 4	Cibola	United Nuclear Homestake	Overtopping	Yes
1967	PA 6	Luna	Merrell Dam	Unknown	
1965	PA 2	Colfax	Cimarroncito Dam	Overtopping	No
1950s	PA 3	Taos	Cabresto Dam	Spillway Failed	No
1942	PA 2	Colfax	Lake Alice Dam	Overtopping	No
1942	PA 2	Colfax	Lake Maloya Dam	Overtopping	No
1941	PA 3	Rio Arriba	Crowley Irrigation System	Overtopping	Yes
1941	PA 2	Colfax	Throttle Dam No. 2	Overtopping	No
1940	PA 2	Colfax	Rito Del Plano Reservoir	Failed	Yes
1937	PA 2	Colfax	Springer Dam No. 1	Failed	Yes
1937	PA 4	McKinley	Ramah Dam	Failed	Yes
1936	PA 4	McKinley	Black Rock Dam	Seepage	Yes
1935	PA 3	Taos	Carson Dam	Sinkhole	No
1932	PA 4	McKinley	Black Rock Dam	Seepage	Yes
1930	PA 1	Lincoln	Bonito Dam	Overtopping	Yes
1928-29	PA 2	Colfax	Springer Lake Dam	Dam Failed	Yes
1913	PA 2	Colfax	Ute Creek Dam	Outlet Failure	No
1910	PA 4	McKinley	Ramah Dam	Slope Failure	No
1909	PA 4	McKinley	Black Rock Dam	Seepage	Yes
1909	PA 4	Cibola	Bluewater Dam	Breach	Yes
1907	PA 3	Taos	Cabresto Dam	Overtopping	Yes
1890	PA 3	Taos	Cabresto Dam	Overtopping	Yes
-	PA 5	Sandoval	Nacimiento Dam	Unknown	Yes

Since the 2013 Plan there has been on non-failure dam incident, an overtopping event in 2021 at the La Union Dam in Dona Ana County.

6.3.3 Past Frequency

Looking at the last 50 years, from 1973 through 2022 there have been 20 dam incidents in the state, 5 of which have resulted in dam failure. This equates to a past frequency of a dam incident happening every 2.5 years on average, with a dam failure every 10 years.

6.3.4 Climate Change Impacts

The potential for climate change to affect the likelihood of dam failure has been incorporated into the 2020 Rules and Regulations for Dam Safety and Dam Construction. The climate change-related Rule is based on a state-of-the-practice regional extreme precipitation study completed in 2018. This study determined a very high likelihood of temperature increases, resulting in increased moisture availability to extreme storms. As such, an atmospheric moisture factor of 7% is required to be added to estimates of extreme rainfall for spillway design.

With a potential for increases in extreme precipitation events due to climate change, dam failure and dam incidents could become a larger issue if increased rainfall events result in large floods that stress dam infrastructure. Dams are designed partly based on assumptions about a river's flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. If the hydrograph changes, it is conceivable that the dam can lose some or all of its designed margin of safety, also known as freeboard. If freeboard is reduced, dam operators may be forced to release increased volumes earlier in a storm cycle in order to maintain the required margins of safety. Such early releases of increased volumes can increase flood potential downstream. Throughout the west, communities downstream of dams have historically experienced increases in stream flows from earlier dam releases.

6.3.5 Probability of Future Occurrence

To determine the probability of each Preparedness Area experiencing future dam failure, the probability or chance of occurrence was calculated based on historical data provided by local authorities. Probability was determined based on the number of events that have occurred over the past 50 years. This gives the percent chance of the event happening in any given year. Table 6-12 identifies the probability that each Preparedness Area experiencing a Dam Failure event annually.

Table 6-12 Probability of Occurrence - Dam Incident

Preparedness Area	# of Dam Incidents 1973-2022	Annual Probability of a Dam Incident
PA 1	1	2%
PA 2	7	14%
PA 3	2	4%
PA 4	1	2%
PA 5	1	2%
PA 6	8	16%

Of the 5 dam failures in the past 50 years, 4 were in PA 6 and one was in PA 5. As noted above, this gives a likely future probability of 1 dam failure every 10 years, or a 10% annual chance of failure somewhere in the state. While the data indicates dam failures may be more likely in PA 6, the low number of incidents does not allow us to predict future occurrences by PA.

The SHMT will continue to monitor the availability of dam and levee data, and will base future probability estimates on updated, more robust data.

6.3.6 Vulnerability Assessment

Property Exposure from LHMPs

Dam failure was analyzed in nine LHMPs across four Preparedness Area. According to the data, the overall total number of structures/parcels exposed within dam inundation areas is approximately 66,000 structures/parcels with a value of over is $8.4 billion. Three jurisdictions in PA Six indicate that over 31,000 structures/parcels exposed in inundation areas across the state or 47% of structures/parcels have a value of over $4.5 billion. PA One has approximately 21% of the total structures/parcels exposed to inundation areas and 23% of the overall structure value, $1.9 billion, reported in two LHMPs. PA 5 has 11% of exposed structures/parcels, identified in a single LHMP. No exposure data was reported for PAs 2 or 3.

Table 6-13 Exposure to Dam Failure Inundation Areas by Preparedness Area

PAs and Jurisdictions	Total Dollar Value Exposure	Total Exposed Structures/Parcels
PA 1	**$1,919,741,000**	**14,074**
Lincoln County	$59,392,000	1,529
Eddy County	$1,860,349,000	12,545
PA 4	**$638,715,000**	**7,243**
McKinley County	$44,607,000	242
Laguna Pueblo	$59,391,000	4,586
Zuni Pueblo	$534,717,000	2,415
PA 5	**$1,390,222,000**	**7,172**
Sandoval County	$1,390,222,000	7,172
PA 6	**$4,520,394,000**	**31,160**
Otero County	$463,000	-
Sierra County	$79,380,000	-
Dona Ana County	$4,441,014,000	31,160
Grand Total	**$8,469,535,000**	**66,531**

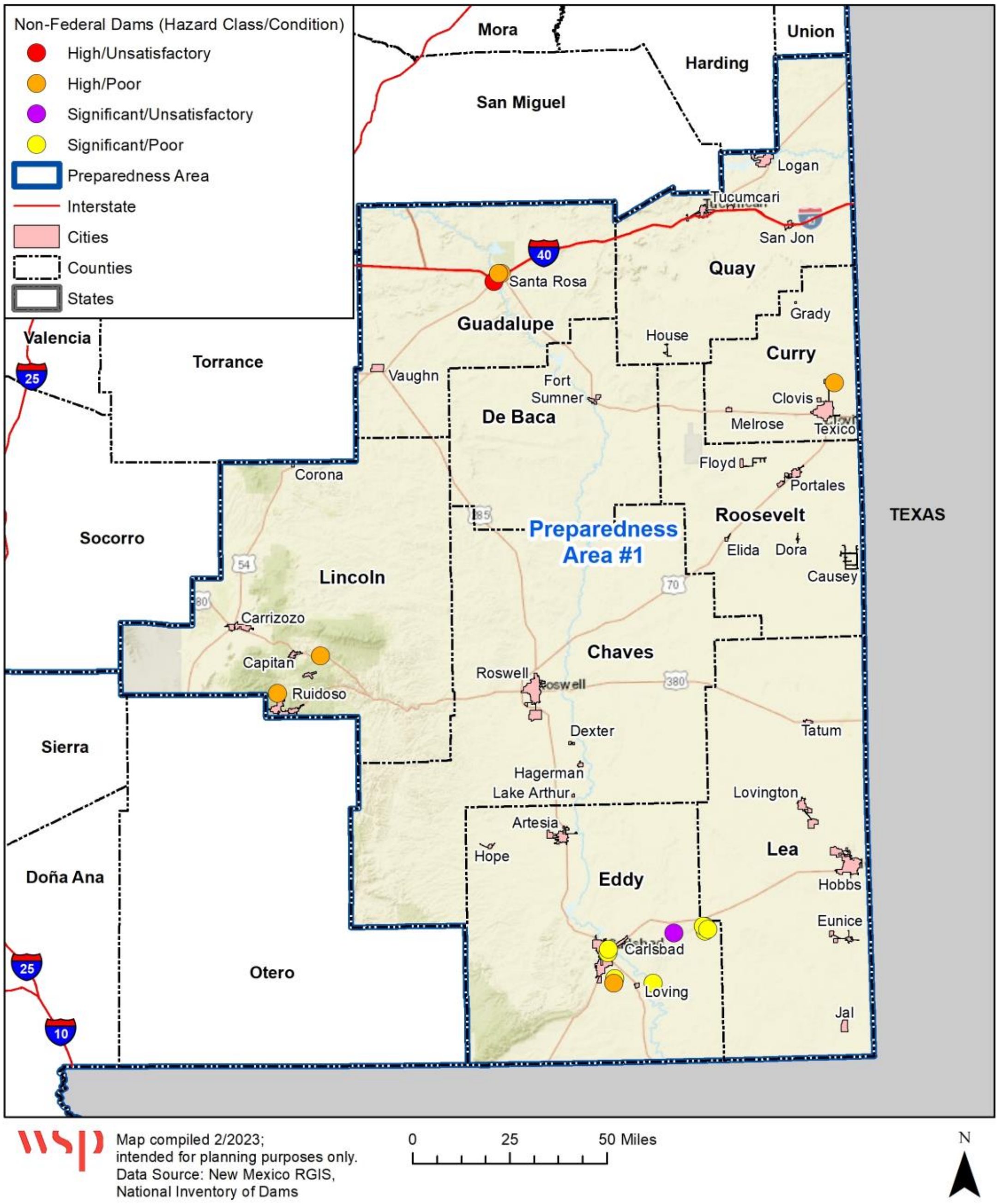
State Assets

Due to a lack of good statewide data on dam inundation areas, a spatial analysis of state assets at risk to this hazard could not be conducted. Given the low number of state owned facilities in floodplains (see Section 6.8), it is possible that the risk of dam inundation to state assets is relatively low, but that cannot be confirmed at this time. The State will work on addressing this data deficiency prior to the next State Plan update.

Preparedness Area 1

GIS data was utilized to map the high and significant hazard dams within New Mexico's Preparedness Area 1. Along with the condition for each dam. As shown in Figure 6-24 below. There is a total of three non-federal high hazard dams in Preparedness Area 1. Two are in Guadalupe County near the city of Santa Rosa. As illustrated below there are two high hazard dams, one being unsatisfactory and one rated as being in poor condition. There also is one in Curry County, located northeast of the City of Clovis. This high hazard dam is ranked as in poor condition.

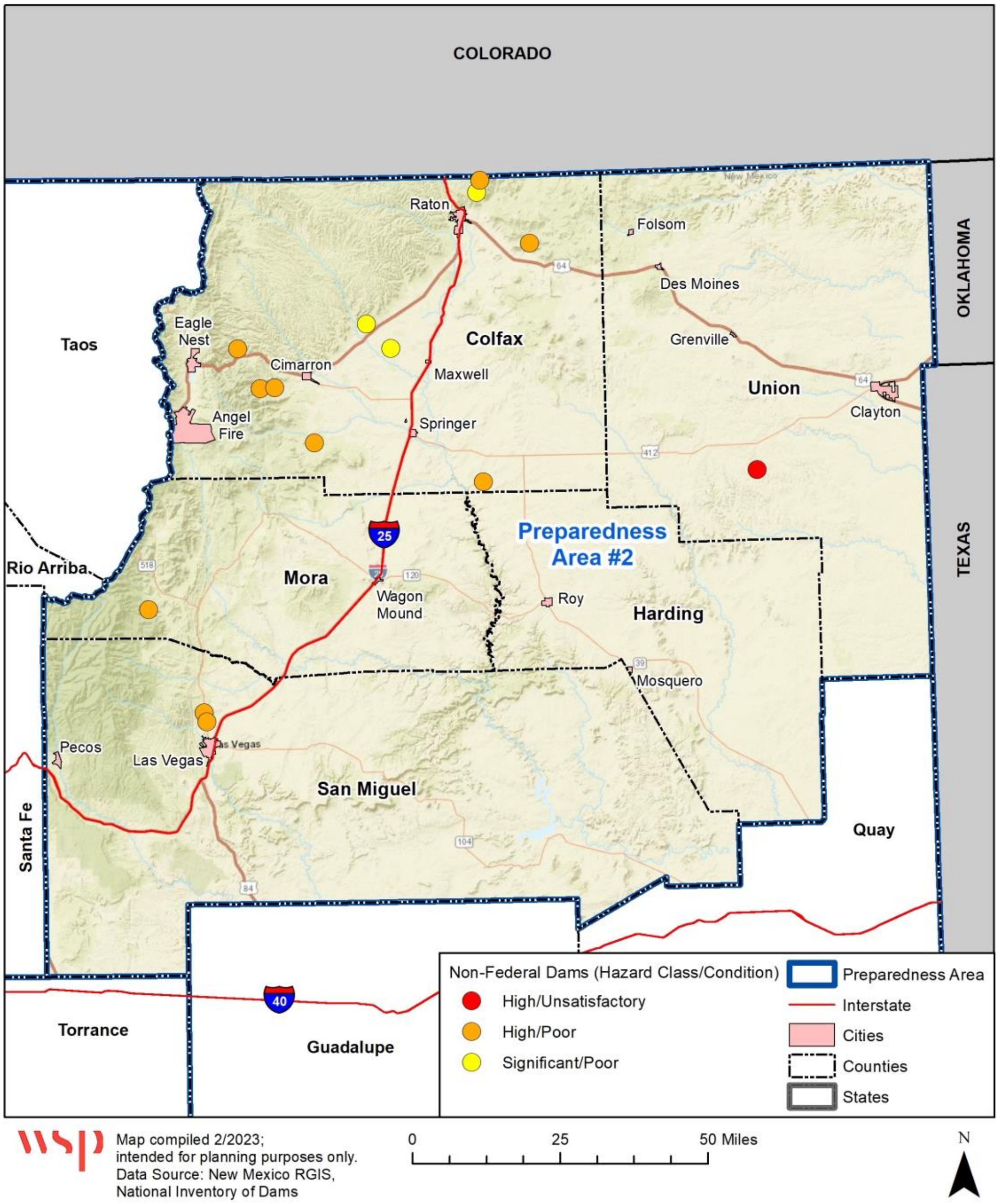
Figure 6-24 New Mexico Preparedness Area 1 Non-Federal Dams by Hazard/Class and Conditions



Preparedness Area 2

GIS data was utilized to map the high and significant hazard dams within New Mexico's Preparedness Area 2. Along with the condition for each dam. As shown in Figure 6-25 below. There is a total of 14 high or significant non-federal dams within the preparedness area. 10 of which are located in Colfax County. Located west and southwest of Cimarron are four high hazard dams in poor condition. Within central Colfax County there are two significant hazard dams in poor condition. There are two high hazard dams in poor condition and one significant hazard dam in poor condition. These three dams are located northeast of Raton. There is also a high hazard dam in poor condition located south of highway 412.

Figure 6-25 New Mexico Preparedness Area 2 Non-Federal Dams by Hazard/Class and Conditions

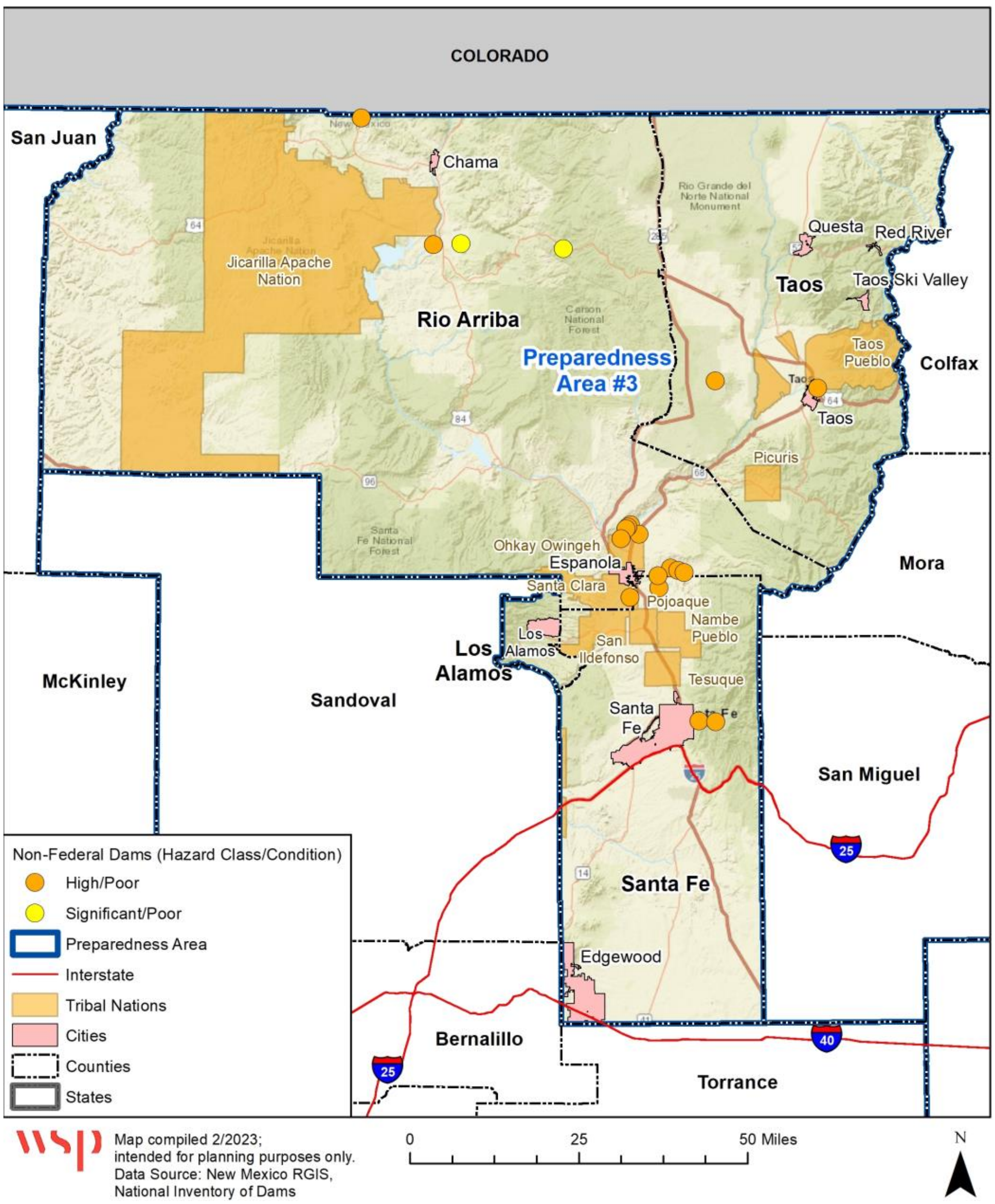


Preparedness Area 3

GIS data was utilized to map the high and significant hazard dams within New Mexico's Preparedness Area 3. Along with the condition for each dam. As shown in Figure 6-26 below. New Mexico's Preparedness Area 3 has some of the highest concentration of hazardous dams within its area. There are several high hazard dams all of which are in poor condition located on the county line of Santa Fe and Taos County. Many of these counties are in close proximity to Espanola and also tribal lands. There are also an additional two high hazard dams in poor condition located east of Santa Fe.

Taos has a high hazard dam in poor condition within its city limits and one that is west of its city limits that is also in the same condition. Rio Arriba County has four dams two are high hazard in poor condition and two are significant hazard in poor condition.

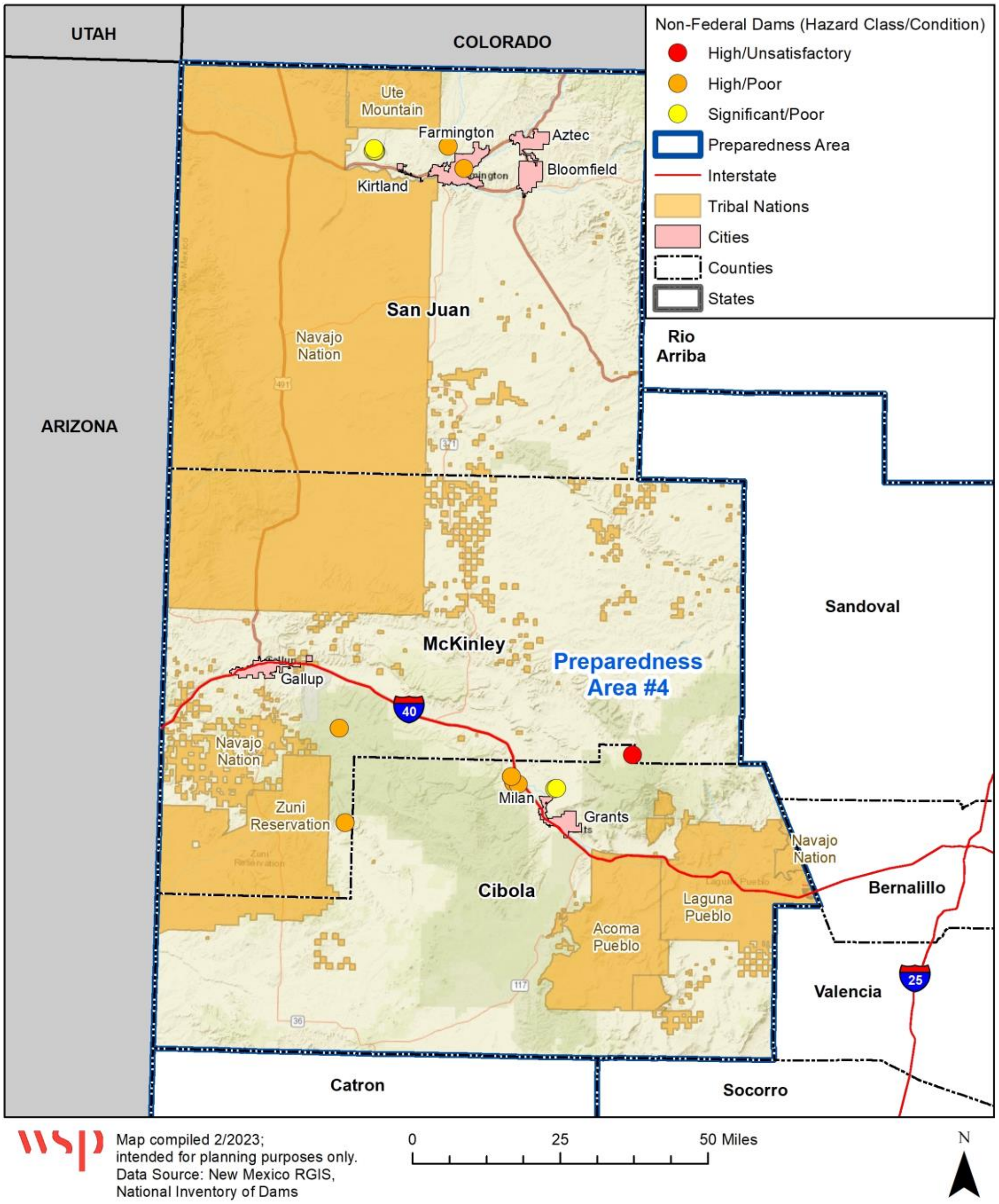
Figure 6-26 New Mexico Preparedness Area 3 Non-Federal Dams by Hazard/Class and Conditions



Preparedness Area 4

GIS data was utilized to map the high and significant hazard dams within New Mexico's Preparedness Area 4. Along with the condition for each dam. As shown in Figure 6-27 below. Cibola county has one high hazard dam that is in an unsatisfactory condition. Three high hazard dams that are north of Milan and two significant hazard dams in poor condition. McKinley County has two high hazard dams in poor condition. San Juana county has several significant hazard dams in poor condition that are located in close proximity to the Navajo Nation and two high hazard dams in poor condition located next to Farmington.

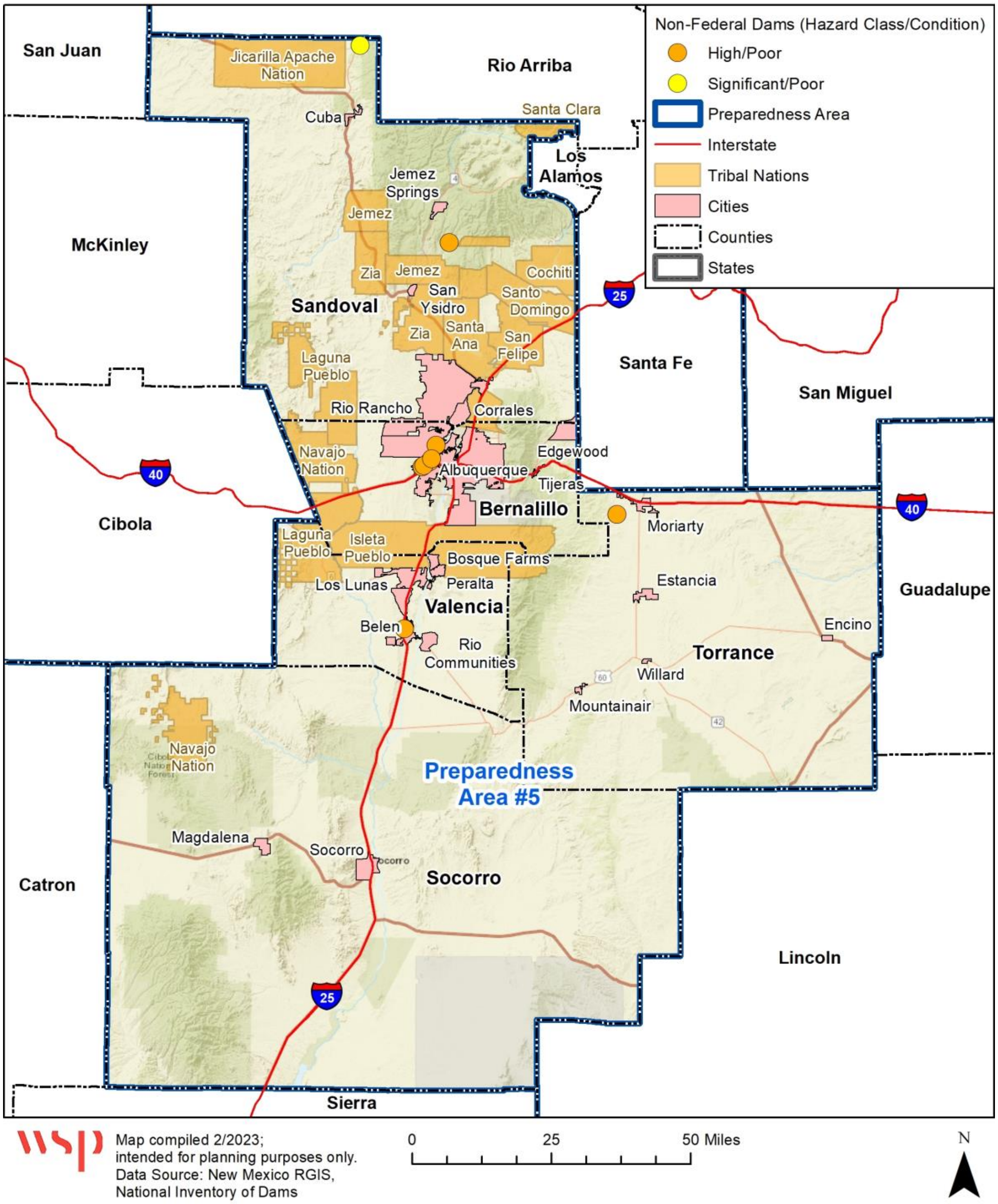
Figure 6-27 New Mexico Preparedness Area 4 Non-Federal Dams by Hazard/Class and Conditions



Preparedness Area 5

GIS data was utilized to map the high and significant hazard dams within New Mexico's Preparedness Area 5. Along with the condition for each dam. As shown in Figure 6-28 below. Bernalillo County and the City of Albuquerque has several high hazard dams in poor condition within its city limits. Along with one near the town of Belen. Sandoval County has one high hazard dam near the city of San Ysidro and one significant hazard dam in poor condition near the Jicarilla Apache Nation.

Figure 6-28 New Mexico Preparedness Area 5 Non-Federal Dams by Hazard/Class and Conditions

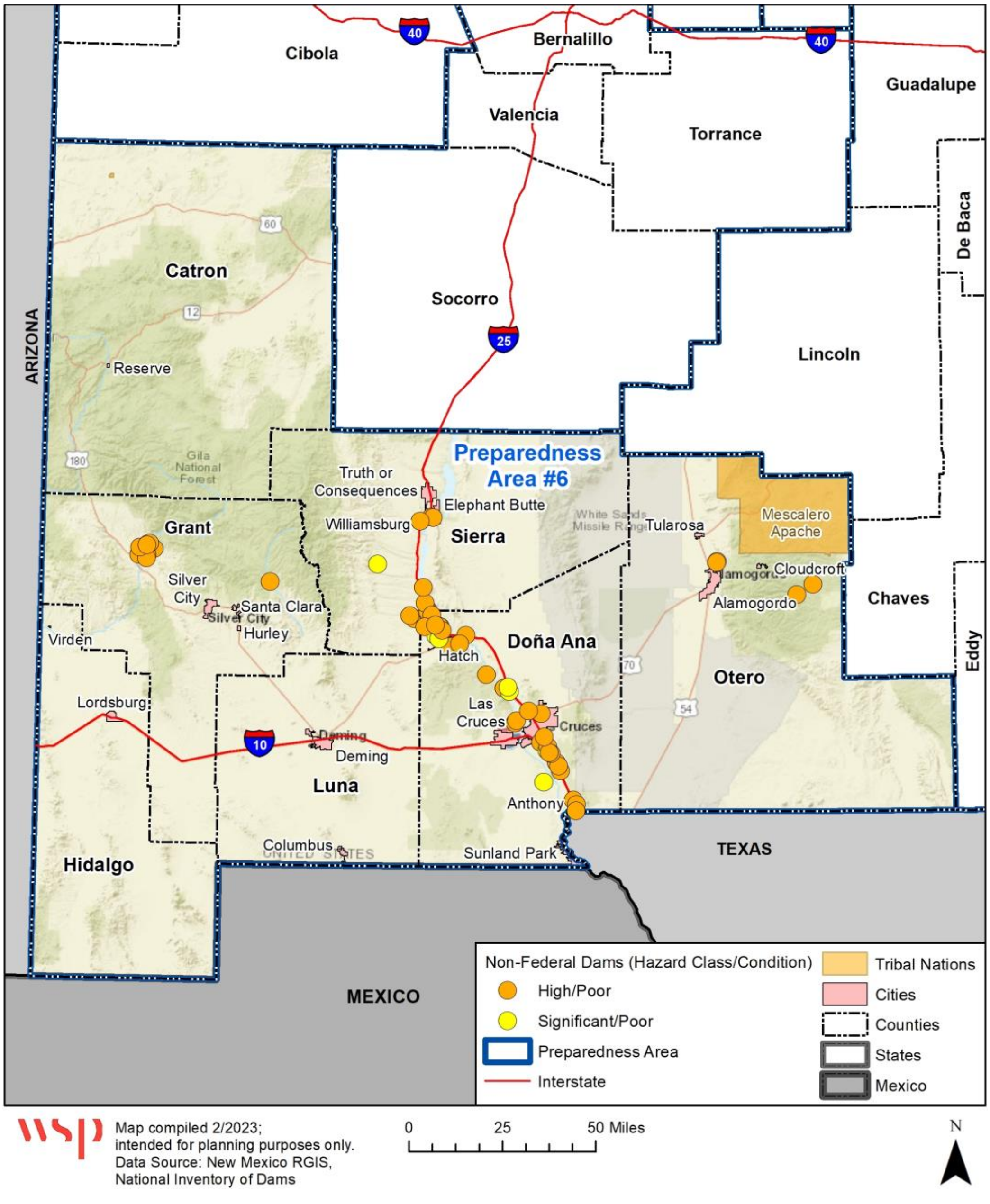


Preparedness Area 6

GIS data was utilized to map the high and significant hazard dams within New Mexico's Preparedness Area 6. Along with the condition for each dam. As shown in Figure 6-29 below. Dona Ana County has the highest concentration of non-federal high and significant hazard dams within its county lines. Many are located near Cruces and Las Cruces and along interstates. If a dam failure was to occur this would have substantial impacts on these roadways.

Many of these dams also are on the county-line with Sierra County. There are multiple high hazard dams in poor condition near the City of Williamsburg. Grant County also has a high concentration of high hazard dams in poor condition as well.

Figure 6-29 New Mexico Preparedness Area 6 Non-Federal Dams by Hazard/Class and Conditions



6.3.7 Data Limitations

The lack of inundation maps impacts the ability to evaluate the consequences of dam failure which is used to define the risk related to dams. All high hazard dams should have an EAP in order to better prepare the dam operators and the downstream public in case there is a breech. Data from the EAPs will contribute to risk reduction.

6.3.8 What Can Be Mitigated?

Potential areas for mitigation activities include identifying tools for evaluating uncertainties in dam data, preparation of EAPs for all high hazard dams, rehabilitation of dams in unsatisfactory or poor conditions, and public education about the risks of living with dams. Public warning systems are also a possibility. Many of the flood mitigation actions listed in Section 6.8.11 can also be used to reduce the risk of dam inundation.

6.3.9 Risk Summary

Table 6-14 identifies impacts from Dam Failures in New Mexico.

Table 6-14 Dam Failure Impacts

Subject	Potential Impacts
Agriculture	Sudden failure of a dam can cause significant short-term damage and long-term damage. Short term, crops, livestock and agriculture infrastructure can be destroyed. Long term a water supply for irrigation and livestock water can be eliminated. The potential also exists that an approved irrigation water supply in compliance with the Food Safety and Modernization Act can be contaminated from floodwaters causing the crops to not be certified for market or consumption.
Health and Safety of the Public	A large dam failure may wipe out everything and everyone downstream for many miles. Drowning is likely.
Health and Safety of Responders	Same as for the public.
Continuity of Operations	A dam failure may shut down normal operations and can impact other critical infrastructure which may impact other operations.
Delivery of Services	Service delivery may be impossible.
Property, Facilities, Infrastructure	Total loss of the entire built environment is possible depending on the size of the dam and the severity of the failure.
Environment	Environmental effects from a dam failure would be similar to those of a flash flood: erosion, downed vegetation, loss of habitat. Certain dams associated with mining activities could have environmental impacts that may need to be considered.
Economic Condition	A dam failure may cause severe impacts as residences and businesses may be entirely destroyed. The survivors may not remain in the area to bolster the local economy.
Public Confidence	Public confidence would likely be severely impacted. The public expects the government to regulate the safety of dams.

6.4 Drought

Hazard	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
Drought	**High**	**High**	**Medium**	**High**	**High**	**High**	**High**

6.4.1 Hazard Characteristics

Drought is a regular event in New Mexico. Experts predict that periodic drought conditions are likely to continue for the foreseeable future. Drought increases the probability and severity of wildfire. Drought also increases the severity of flash flooding due to soils becoming hydrophobic, repelling or incapable of dissolving in water, resulting in increased runoff and erosion. Economically, prolonged drought can have devastating effects on agriculture and the food supply.

The State of New Mexico most recently recorded periods of drought from approximately 2011 through 2014. In every drought, agriculture is adversely impacted, especially in non-irrigated areas such as dry land farms and rangelands. Droughts impact individuals (farm owners, tenants, and farm laborers), the agricultural industry, other agriculture related sectors, and other industries such as tourism and recreation. Drought also has the potential to increase the incidences and severity of other hazard events such as wildfire and flooding. There is increased danger of forest and wildland fires. Loss of forests and trees increases erosion, causing serious damage to aquatic life, irrigation, and power development by heavy silting of streams, reservoirs, and rivers.

Drought is nature's way of reminding us that we live in a desert. Being in a drought magnifies the challenge of balancing limited water supplies with growing demand. A drought is caused by a variety of factors. Climate scientists believe that conditions in the North Atlantic Ocean and the Eastern Pacific Ocean play a significant role in determining the amount of precipitation that New Mexico and the rest of the country receive.

Drought is a condition of climatic dryness that reduces soil moisture, water or snow levels below the minimum necessary for sustaining plant, animal, and economic systems. Drought conditions are usually not uniform over the entire State. Local and regional differences in weather, soil condition, geology, vegetation, and human influence need to be considered when assessing the impact of drought on any particular location.

The most commonly used drought definitions are based on meteorological, agricultural, hydrological, and socio-economic effects.

- **Meteorological** drought is defined by a period of substantially diminished precipitation duration and/or intensity. The commonly used definition of meteorological drought is an interval of time, generally on the order of months or years, during which the actual moisture supply at a given place consistently falls below the climatically appropriate moisture supply.
- **Agricultural** drought occurs when there is inadequate soil moisture to meet the needs of a particular crop at a particular time. Agricultural drought usually occurs after or during meteorological drought, but before hydrological drought and can affect livestock and other dry-land agricultural operations.
- **Hydrological** drought refers to deficiencies in surface and subsurface water supplies. It is measured as stream flow, snowpack, and as lake, reservoir, and groundwater levels. There is

usually a delay between lack of rain or snow and less measurable water in streams, lakes, and reservoirs. Therefore, hydrological measurements tend to lag behind other drought indicators.

- **Socio-economic** drought occurs when physical water shortages start to affect the health, well-being, and quality of life of the people, or when the drought starts to affect the supply and demand of an economic product.

Although different types of drought can occur at the same time, they can also occur independently of one another. Drought differs from other natural hazards in three ways. First, the onset and end of a drought are difficult to determine due to the slow accumulation and lingering of effects of an event after its apparent end. Second, the lack of an exact and universally accepted definition adds to the confusion of its existence and severity. Third, in contrast with other natural hazards, the impact of drought is less obvious and may be spread over a larger geographic area. These characteristics have hindered the preparation of drought contingency or mitigation plans by many governments.

Given that drought is a slow-moving hazard without an event to mark its arrival, a one-time drought can be difficult to define. However, the consequences of a severe to extreme drought in the State pose significant challenges. Long-term solutions for coping with a limited water supply will require increased cooperation between urban users and agricultural use.

The Palmer Drought Index is used to assess the extent of drought by measuring the duration and intensity of long-term drought-inducing circulation patterns. Long-term drought is cumulative, with the intensity of drought during the current month dependent upon the current weather patterns plus the cumulative patterns of previous months. The hydrological impacts of drought (e.g., reservoir levels, groundwater levels, etc.) take longer to develop. Table 6-15 depicts magnitude of drought while Table 6-16 describes the classification descriptions.

Table 6-15 Palmer Drought Index

DROUGHT INDEX	DROUGHT CONDITION CLASSIFICATIONS						
	Extreme	Severe	Moderate	Normal	Moderately Moist	Very Moist	Extremely Moist
Z Index	-2.75 and below	-2.00 to -2.74	-1.25 to -1.99	-1.24 to +.99	+1.00 to +2.49	+2.50 to +3.49	n/a
Meteorological	-4.00 and below	-3.00 to -3.99	-2.00 to -2.99	-1.99 to +1.99	+2.00 to +2.99	+3.00 to +3.99	+4.00 and above
Hydrological	-4.00 and below	-3.00 to -3.99	-2.00 to -2.99	-1.99 to +1.99	+2.00 to +2.99	+3.00 to +3.99	+4.00 and above

Table 6-16 Palmer Drought Category Descriptions

CATEGORY	DESCRIPTION	POSSIBLE IMPACTS	PALMER DROUGHT INDEX
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures; fire risk above average. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered.	-1.0 to -1.9
D1	Moderate Drought	Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low, some water shortages developing or imminent, voluntary water use restrictions requested.	-2.0 to -2.9
D2	Severe Drought	Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed.	-3.0 to -3.9
D3	Extreme Drought	Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions.	-4.0 to -4.9
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; exceptional fire risk; shortages of water in reservoirs, streams, and wells, creating water emergencies.	-5.0 or less

Drought is monitored nationwide by the National Drought Mitigation Center (NDMC). Indicators are used to describe broad scale drought conditions across the U.S. Indicators correspond to the intensity of drought.

Water Use in New Mexico

As the population of the State increases so does water usage/withdrawal, which is distributed among nine categories including public water supply, domestic, irrigated agriculture, livestock, commercial, industrial, mining, power, and reservoir evaporation. The New Mexico Office of State Engineer collects water use data for these nine categories. According to the Office of the State Engineer, irrigated agriculture accounts for more than 78% of water usage. The changes in population and increased awareness over drought conditions and climate variability are addressed in the New Mexico State Water Plan, which was last updated in 2018.

6.4.2 Previous Occurrences

According to the New Mexico Drought Plan, the State has experienced droughts since prehistoric times. Extended drought conditions in the region evidently led to the collapse of many early civilizations. Periods of drought since 1950 have been documented during 1950-1957, 1963-1964, 1976-1978, 1989, 1996, 1998-1999, 1999-2003, 2003-2006, 2011-2013, 2017-2018, and 2020-2022.

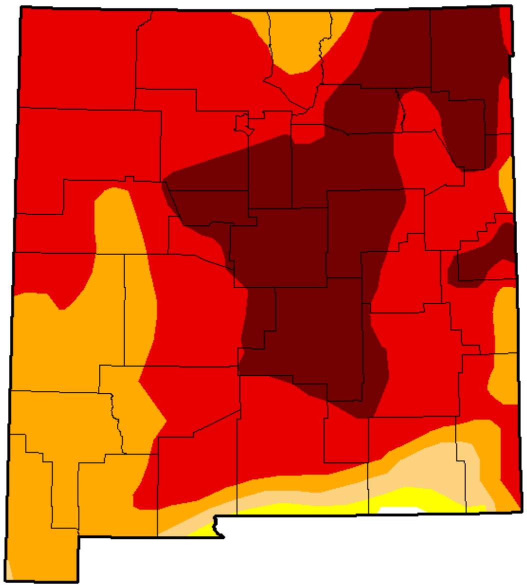
All Preparedness Areas in New Mexico have experienced drought conditions over the last 16 years, but much of the State experienced exceptional drought in 2021.

The National Drought Mitigation Center provides a snapshot of drought per month. As July is typically the hottest and driest month of the year, Figure 6-30 through Figure 6-37 provide a comparison for drought conditions in New Mexico for the 2013 drought, and for each July from 2017 to 2023. Ten years is a relatively short time period in drought terms, so these should be seen as snapshots only.

Figure 6-30 Drought Conditions – July 2013

U.S. Drought Monitor
New Mexico

July 30, 2013
(Released Thursday, Aug. 1, 2013)
Valid 7 a.m. EST



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.14	99.86	98.49	95.50	73.55	24.84
Last Week 7/23/2013	0.00	100.00	100.00	97.29	80.07	35.14
3 Months Ago 4/30/2013	0.00	100.00	99.04	97.75	81.82	24.89
Start of Calendar Year 1/1/2013	0.00	100.00	98.83	94.05	31.88	0.97
Start of Water Year 9/25/2012	0.00	100.00	100.00	62.56	12.25	0.66
One Year Ago 7/31/2012	0.00	100.00	99.93	78.00	24.89	0.00

Intensity:
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

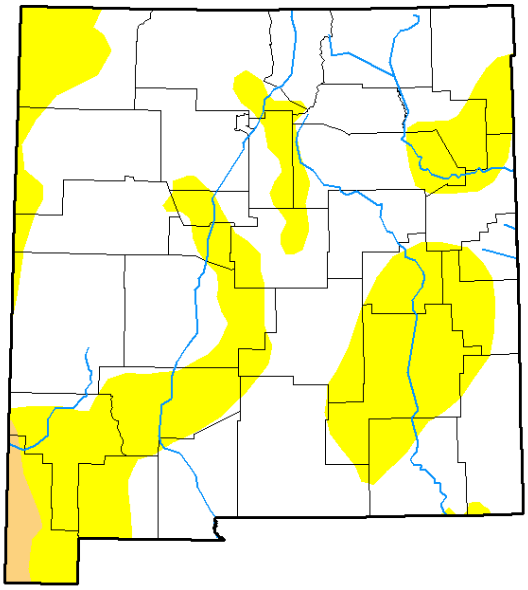
Author:
Brian Fuchs
National Drought Mitigation Center

http://droughtmonitor.unl.edu/

Figure 6-31 Drought Conditions – July 2017

U.S. Drought Monitor
New Mexico

July 25, 2017
(Released Thursday, Jul. 27, 2017)
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	66.49	33.51	1.34	0.00	0.00	0.00
Last Week 07-18-2017	72.95	27.05	6.56	0.00	0.00	0.00
3 Months Ago 04-25-2017	58.57	41.43	0.00	0.00	0.00	0.00
Start of Calendar Year 01-03-2017	66.20	33.80	4.28	0.00	0.00	0.00
Start of Water Year 09-27-2016	53.33	46.67	3.85	0.00	0.00	0.00
One Year Ago 07-26-2016	4.00	96.00	21.46	0.00	0.00	0.00

Intensity:
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Richard Heim
NCEI/NOAA

http://droughtmonitor.unl.edu/

Figure 6-32 Drought Conditions – July 2018

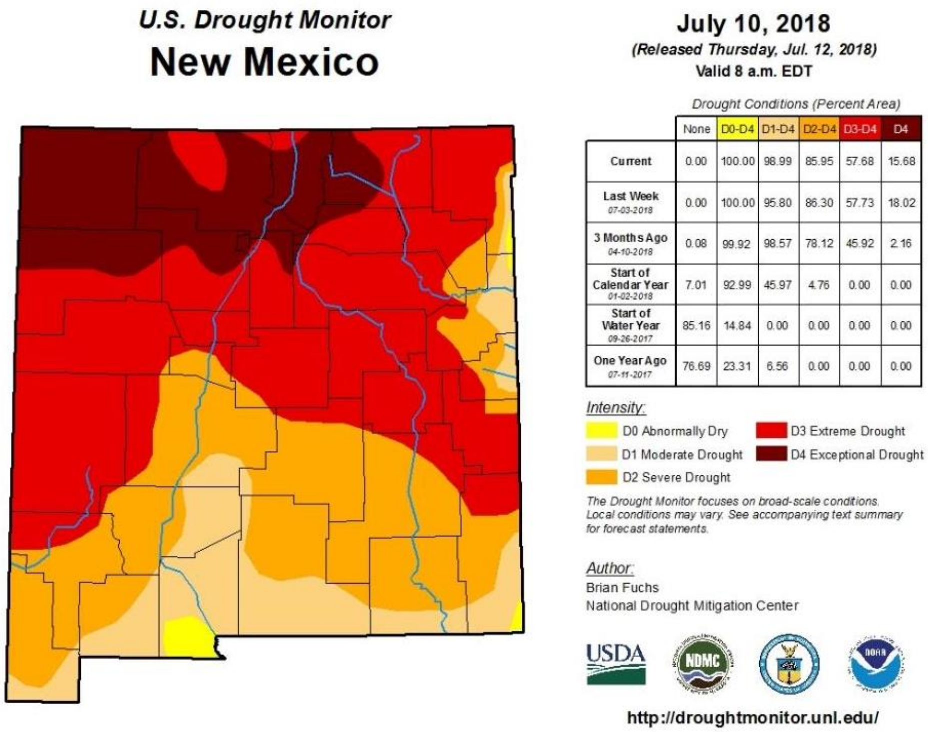


Figure 6-33 Drought Conditions – July 2019

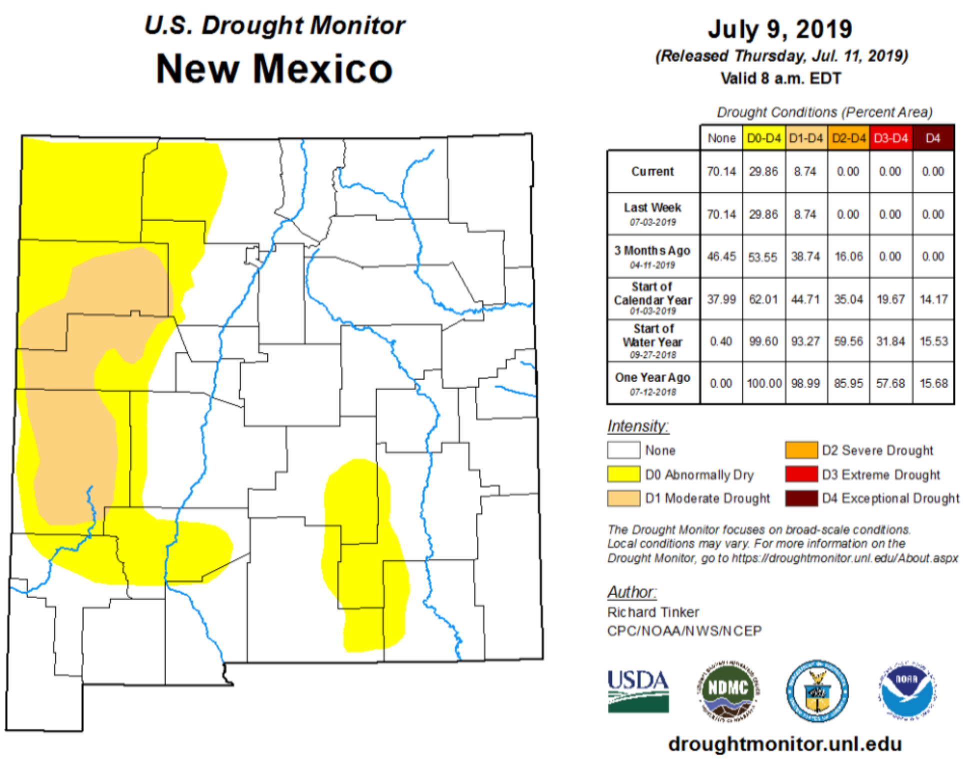


Figure 6-34 Drought Conditions – July 2020

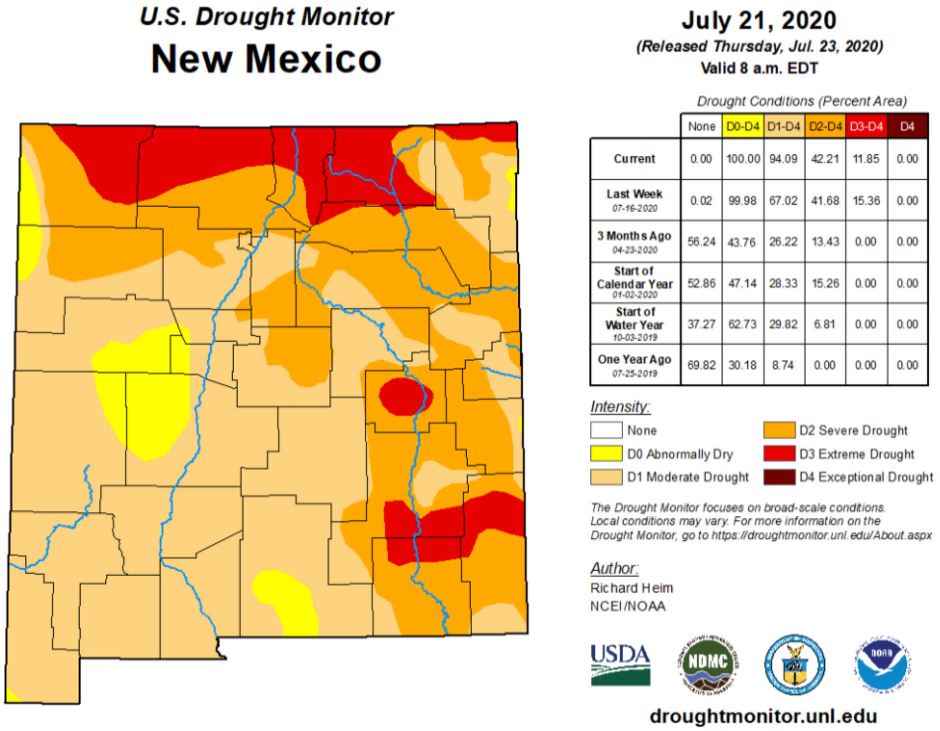


Figure 6-35 Drought Conditions – July 2021

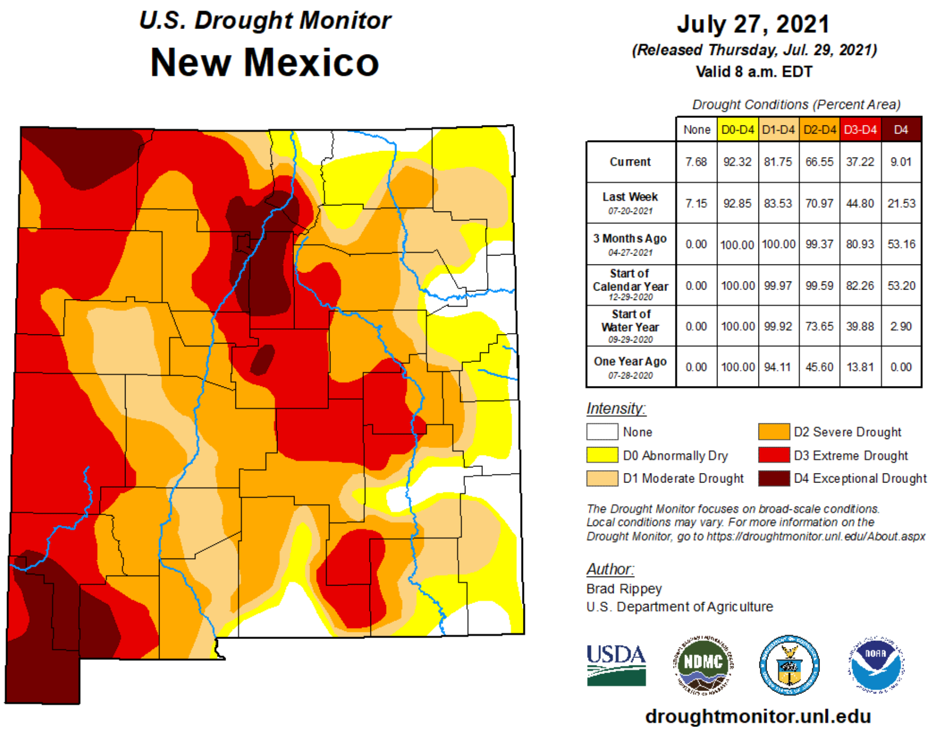
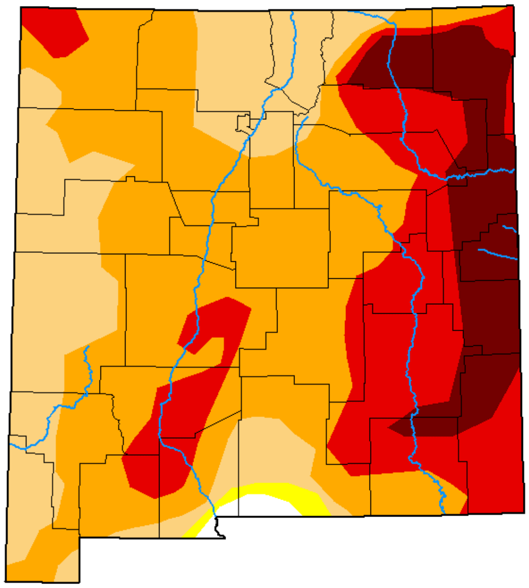


Figure 6-36 Drought Conditions – July 2022

U.S. Drought Monitor

New Mexico

July 26, 2022
(Released Thursday, Jul. 28, 2022)
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.68	99.32	98.51	76.22	32.58	11.08
Last Week 07-19-2022	0.68	99.32	98.51	85.47	32.76	11.08
3 Months Ago 04-26-2022	0.00	100.00	98.94	95.79	67.99	15.74
Start of Calendar Year 01-04-2022	0.00	100.00	97.83	75.86	20.91	0.00
Start of Water Year 09-28-2021	10.70	89.30	79.47	49.33	19.12	0.00
One Year Ago 07-27-2021	7.68	92.32	81.75	66.55	37.22	9.01

Intensity:
None
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

Author:
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National Drought Mitigation Center

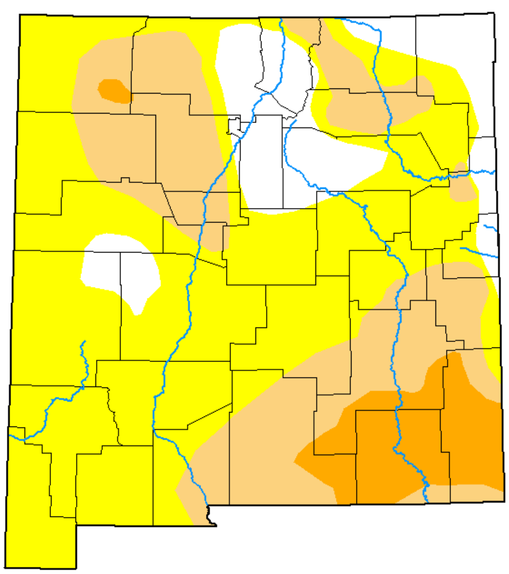
droughtmonitor.unl.edu

Figure 6-37 Drought Conditions – July 2023

U.S. Drought Monitor

New Mexico

July 25, 2023
(Released Thursday, Jul. 27, 2023)
Valid 8 a.m. EDT



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	13.64	86.36	34.04	8.22	0.00	0.00
Last Week 07-18-2023	37.11	62.89	18.25	6.41	0.00	0.00
3 Months Ago 04-25-2023	46.63	53.37	32.14	16.19	4.18	0.21
Start of Calendar Year 01-03-2023	7.03	92.97	41.30	18.55	3.74	0.19
Start of Water Year 09-27-2022	0.99	99.01	76.80	31.46	6.99	0.00
One Year Ago 07-26-2022	0.68	99.32	98.51	76.22	32.58	11.08

Intensity:
None
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to https://droughtmonitor.unl.edu/About.aspx

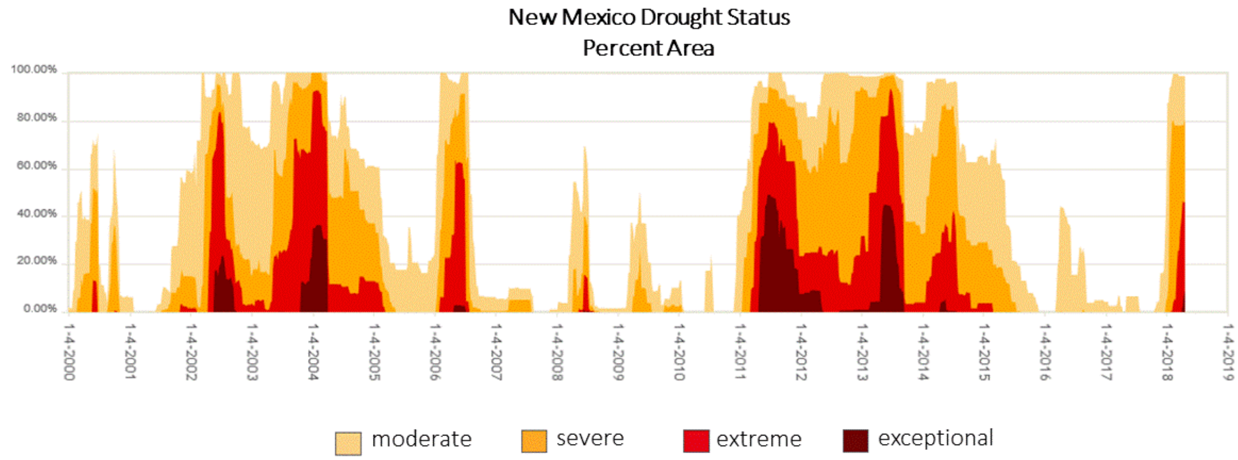
Author:
Brian Fuchs
National Drought Mitigation Center

droughtmonitor.unl.edu

Note that the portions of the State affected by the most severe drought vary, but the entire state is at risk.

Another way to show drought over time is using the U.S. Drought Monitor Statistic Graph shown in Figure 6-38 below.

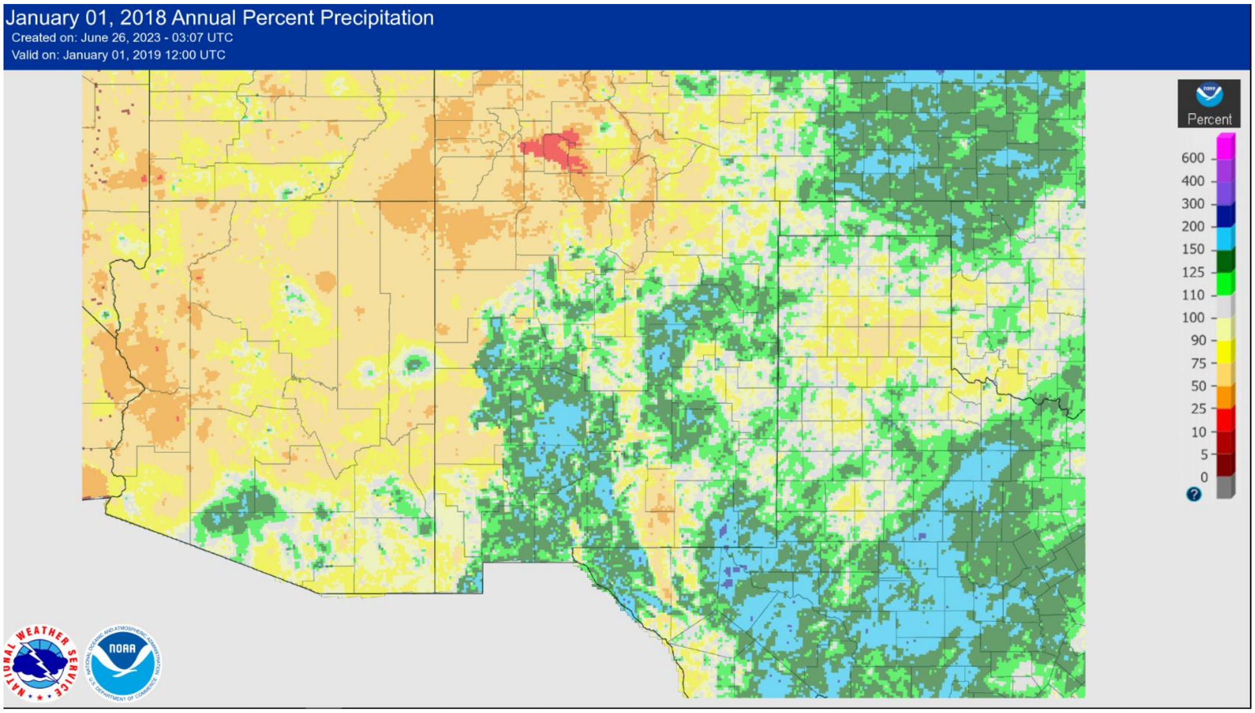
Figure 6-38 Drought Monitor Statistic Graph



In comparing drought for the State from 2011 to 2017, the summers of 2011 and 2013 were the most extreme with significant areas of the State in the category of exceptional drought. While there were some occurrences of exceptional drought in 2014, there were no occurrences in 2015-2017, whereas the State experienced months of exceptional drought in 2013.

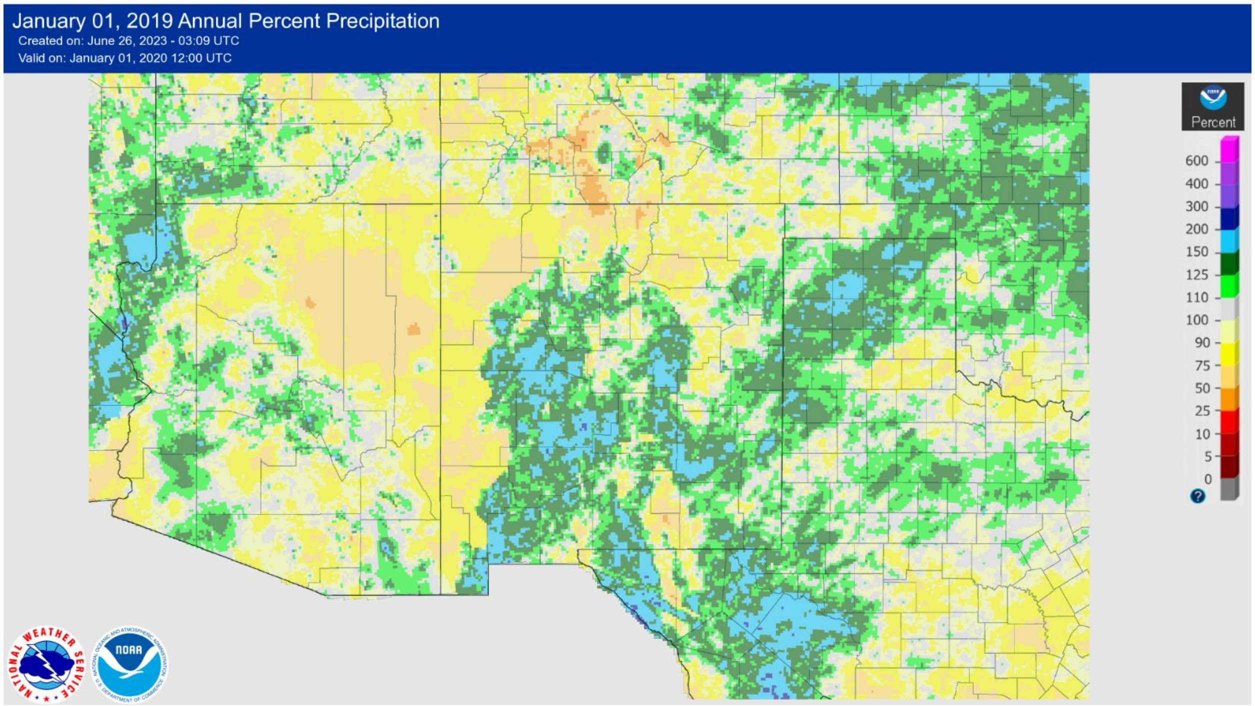
Figure 6-39 to Figure 6-43 illustrate observed precipitation for New Mexico as a percentage of normal from 2018 to 2022. The trend for drought for the State had been decreasing from 2013 to 2017 (as shown in the 2018 State HMP), but the images illustrate that has not continued. They also show that even in a year where parts of the state receive more than average precipitation, other parts of the state can remain very dry.

Figure 6-39 Observed Precipitation as a Percentage of Normal – 2018



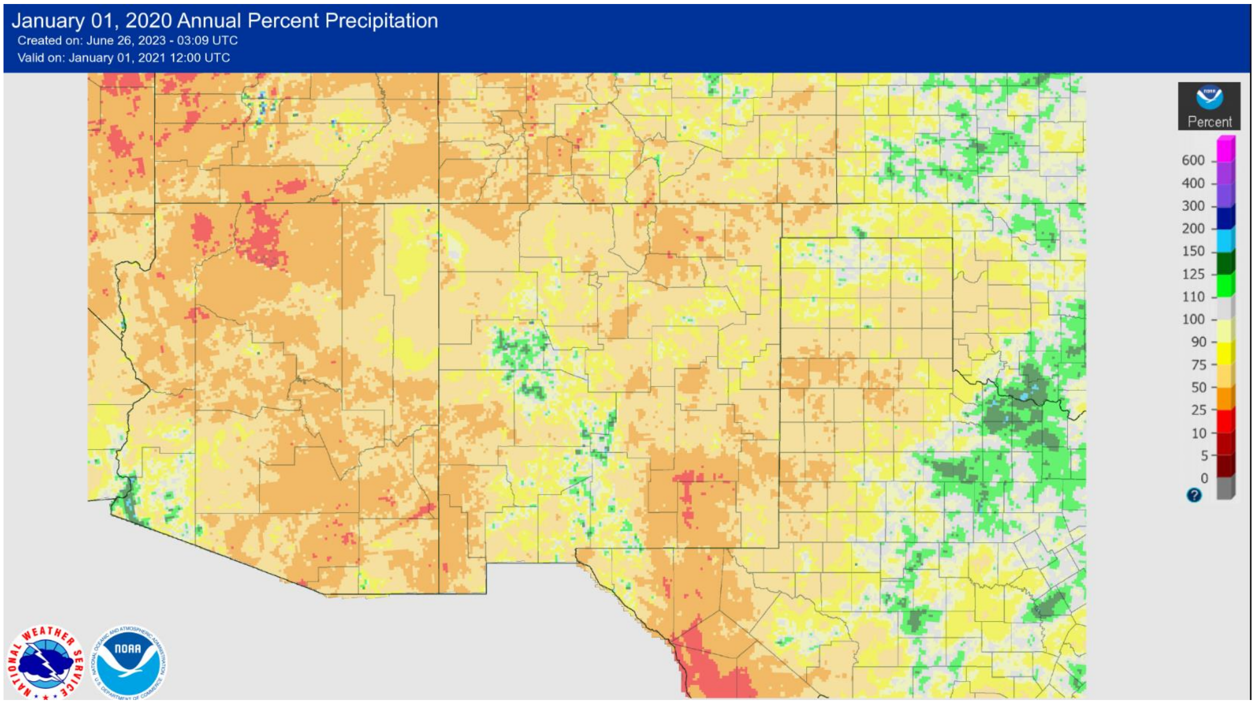
Source: National Weather Service

Figure 6-40 Observed Precipitation as a Percentage of Normal – 2019



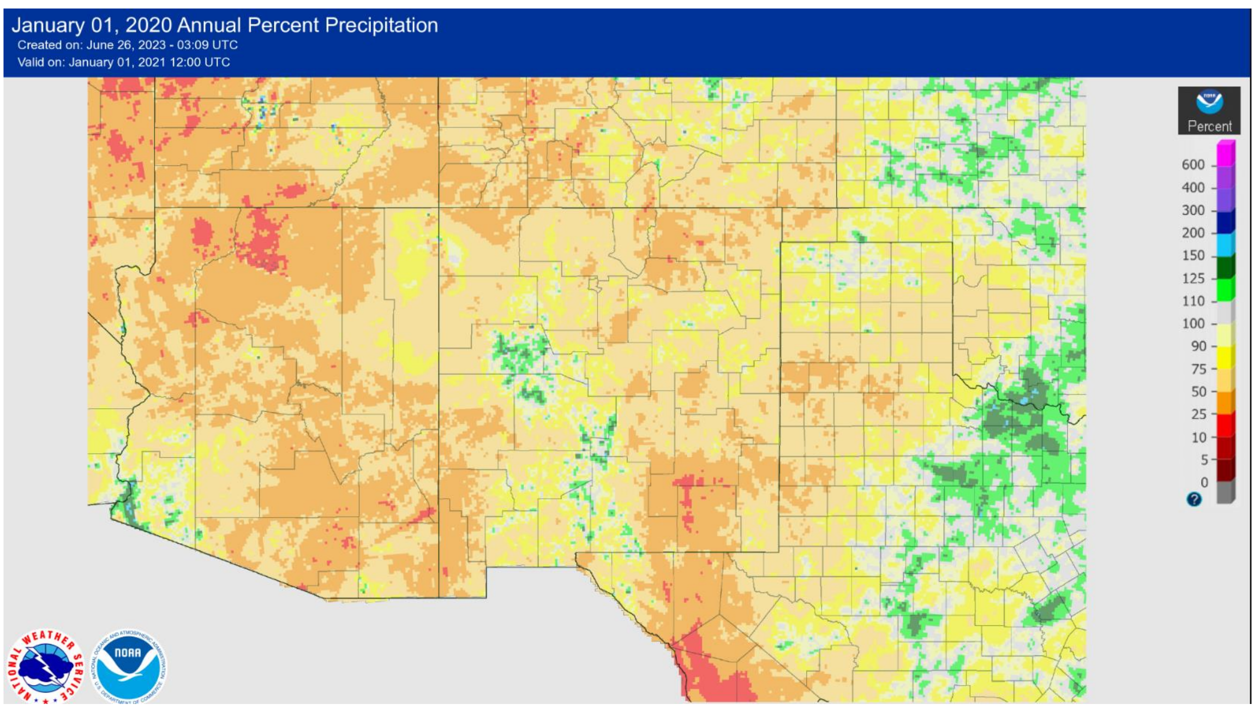
Source: National Weather Service

Figure 6-41 Observed Precipitation as a Percentage of Normal – 2020



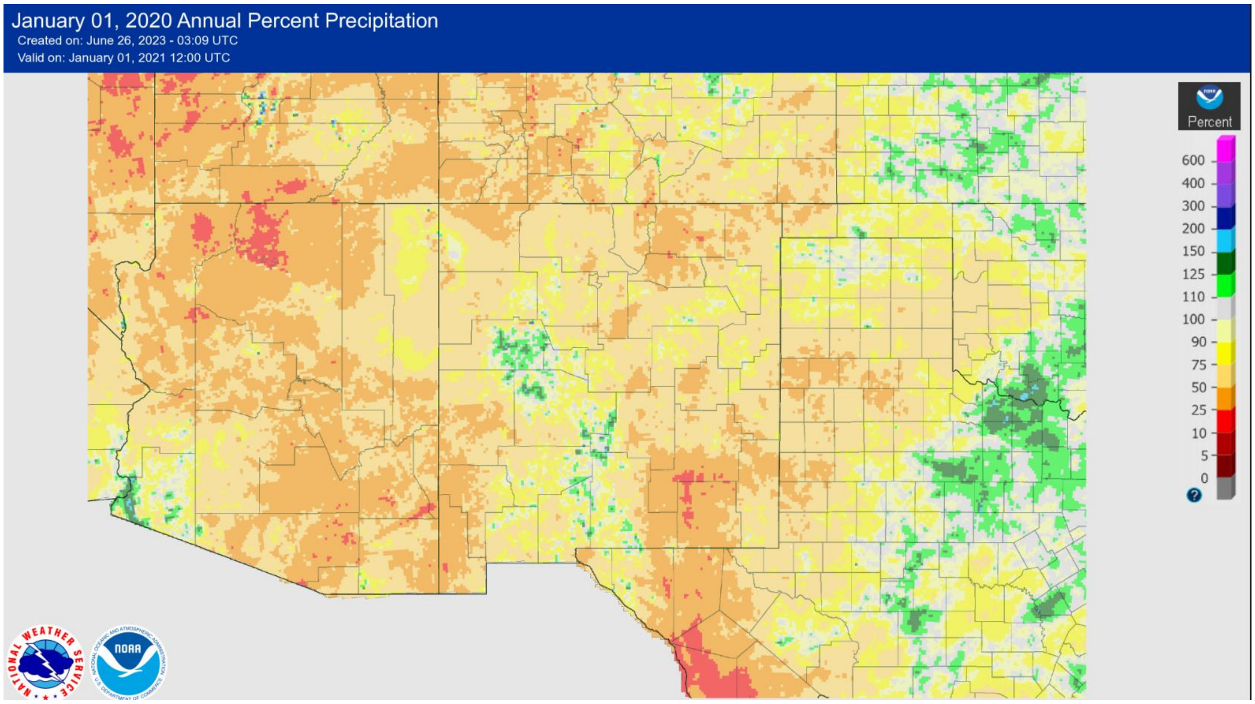
Source: National Weather Service

Figure 6-42 Observed Precipitation as a Percentage of Normal – 2021



Source: National Weather Service

Figure 6-43 Observed Precipitation as a Percentage of Normal – 2022



Source: National Weather Service

The current online NCEI database contains data from March 1996 to November 2022, entered by NOAA's National Weather Service (NWS). Referencing this online database, NCEI shows that there have been 2,950 recorded drought events Statewide. These events have caused $2 million in property damage and over $14 million in crop damage. In addition, between 1995 and May 2007, there were three State declared disasters for effects related to drought, primarily for loss of domestic drinking water: May 1996, May 2000, and June 2002. The total cost estimated due to these events for this time period is $279,459. However, indirect costs are estimated to be between $50-100 million. Table 6-17 highlights significant past droughts by Preparedness Area.

Table 6-17 Significant Past Occurrences - Drought

Date	Location	Significant Event
Winter 2021	Bernalillo, Catron, Chaves, Cibola, Colfax, Curry, De Baca, Dona Ana, Eddy, Grant, Guadalupe, Harding, Hidalgo, Lea, Lincoln, Los Alamos, Luna, McKinley, Mora, Otero, Quay, Rio Arriba, Roosevelt, Sandoval, San Juan, San Miguel, Santa Fe, Sierra, Socorro, Taos, Torrance, Union, Valencia (PAs 1, 2, 3, 4, 5, and 6)	The US Department of Agriculture designated 33 counties statewide as natural disaster areas due to drought
Spring 2019	Bernalillo, Catron, Chaves, Cibola, Colfax, De Baca, Dona Ana, Eddy, Grant Guadalupe, Harding, Hidalgo, Lea, Lincoln, Los Alamos, Luna, McKinley, Mora, Otero, Quay, Rio Arriba, Roosevelt, Sandoval, San Juan, San Miguel, Santa Fe, Sierra, Socorro, Taos, Torrance, Union, Valencia	The US Department of Agriculture designated 32 counties statewide as natural disaster areas due to drought.

Date	Location	Significant Event
	(PAs 1, 2, 3, 4, 5, and 6)	
Winter 2018	Colfax, Dona Ana, Harding, Hidalgo, Los Alamos, Luna, McKinley, Mora, Quay, Rio Arriba, San Juan, Taos, Union, Catron, Cibola, De Baca, Grant, Guadalupe, Lea, Otero, Roosevelt, San Miguel, Sandoval, Valencia, Bernalillo, Chaves, Eddy, Lincoln, Santa Fe, Sierra, Socorro, Torrance (PAs 1, 2, 3, 4, 5, and 6)	Every Preparedness Area experienced at least one USDA natural disaster designations due to drought, with counties in Areas 1, 3, 5, and 6 receiving three separate disaster declarations.
January 2015	Bernalillo, Catron, Cibola, Colfax, De Baca, Grant, Guadalupe, Harding, Hidalgo, Lincoln, Los Alamos, Luna, McKinley, Mora, Quay, Rio Arriba, San Juan, San Miguel, Sandoval, Santa Fe, Sierra, Socorro, Taos, Torrance, Union, and Valencia (PAs 1, 2, 3, 4, 5, and 6)	The US Department of Agriculture designated 26 counties statewide as natural disaster areas due to drought.
Winter 2014	Catron, Chaves, Colfax, Curry, De Baca, Dona Ana, Grant, Guadalupe, Harding, Hidalgo, Lea, Lincoln, Los Alamos, Luna, Mora, Otero, Quay, Rio Arriba, Roosevelt, San Juan, San Miguel, Sandoval, Santa Fe, Sierra, Socorro, Taos, Torrance, Union, and Valencia (PAs 1, 2, 3, 4, 5, and 6)	The US Department of Agriculture designated 29 counties statewide as natural disaster areas due to drought.
Summer 2013	Bernalillo, Chaves, Eddy, Luna, Sierra, Catron, Hidalgo, Otero, Socorro, Dona Ana, Lincoln, Sandoval, Valencia, McKinley, Sante Fe, Cibola, Guadalupe, Rio Arriba, Torrance, De Baca, Los Alamos, and San Juan (PAs 1,3, 4, and 5)	The US Department of Agriculture designated 19 counties, from Union and San Juan in the north to Eddy County in the southeast, as natural disaster areas due to heat and drought.
May 2010	Colfax and Harding County (PA 3)	The US Department of Agriculture designated Colfax and Harding counties as natural disaster areas due to drought and high winds.
Summer 2008	Northern New Mexico (PAs 2 and 3)	The agriculture community became concerned as the State was dealing with the endangered silvery minnow. Farmers were faced with a low snowpack that feeds irrigation reservoirs and low rainfall with forecasted continuing dry conditions cut irrigation supplies dramatically. Compounding issues more, legal issues were being considered ordering farmers to share the river supply to save the silvery minnow. This impact financial capabilities in the agricultural community and decreases agricultural supply.

Emergency Management Agency Declared Disasters from Drought

New Mexico Department of Homeland Security and Emergency Management (DHSEM) reports five State Declared Disaster for drought between 2003 and 2022, which had State reimbursement funds available. Research into locations for each disaster would need to be completed prior to breaking-out the figures by

Preparedness Area. In the State of New Mexico, there were no Federal Disaster Declarations for drought from 2003 through 2022, as shown in Table 6-18. From 2012 to 2021, there were 112 USDA Secretarial Disaster designations due to drought in New Mexico, as shown in Table 6-19. All Preparedness Areas have experienced an USDA Secretarial designation due to drought.

Table 6-18 State Disaster Event Information 2003 through 2022

Event Type	State Executive Order	Dollar Loss
Drought	2012-006	$500,000.00
Drought	2018-031	
Drought and Severe Fire Conditions	2020-040	
Drought	2020-084	
Drought and Fire Conditions	2022-022	
Total	**5**	**$500,000.00**

Table 6-19 USDA Secretarial Drought Designations, 2012 - 2021

Crop Year	Designation Numbers	Counties	Preparedness Areas
2012	S3260, S3267, S3282, S3284, S3288	Statewide	1, 2, 3, 4, 5, 6
	S3289	San Juan	4
	S3295	Bernalillo, Catron, Cibola, McKinley, Sandoval, Socorro, Valencia	4, 5, 6
	S3331	Bernalillo, Cibola, Los Alamos, McKinley, Rio Arriba, San Juan, Sandoval, Santa Fe	3, 4, 5
	S3466	San Juan	4
	S3461	Statewide	1, 2, 3, 4, 5, 6
	S3465, S3456	Colfax, Union, Curry, Doña Ana, Eddy, Lea, Otero, Quay, Roosevelt, Union	1, 2, 6
	S3463, S3474	Union, Bernalillo, Guadalupe, Lincoln, San Miguel, Santa Fe, Socorro, Torrance, Valencia	1, 2, 3, 5
2013	S3455, S3490, S3494	Statewide, minus the northeast corner	1, 3, 4, 5, 6
	S3681	Curry, Dona Ana, Eddy, Lea, Otero, Quay, Roosevelt, Union	1, 2, 6
	S3546	Eddy	1
	S3514	Hidalgo	6
	S3518, S3548	Colfax, Taos, Rio Arriba	2, 3
	S3539, S3541	San Juan, Lea	1, 4
	S3545	Rio Arriba, San Juan	3, 4
	S3634	San Juan	4
	S3630	Statewide, minus the northwest corner	1, 2, 3, 5, 6
	S3627, S3633	Colfax, Union, Curry, Lea, Quay, Roosevelt, Union	1, 2
	S3632	Union	2
	S3646	Chaves, Eddy, Lea, Roosevelt	1
2014	S3651, S3653, S3781	Statewide	1, 2, 3, 4, 5, 6
	S3645	Statewide, minus the southwest	1, 2, 3, 4, 5
	S3649	Hidalgo	6
	S3678	Catron, Dona Ana, Grant, Lincoln, Luna, Otero, Sierra, Socorro	1, 5, 6
	S3658	Dona Ana, Grant, Hidalgo, Luna, Otero, Sierra	6

Crop Year	Designation Numbers	Counties	Preparedness Areas
	S3715	Rio Arriba, San Juan	3, 4
	S3735	Dona Ana, Otero	6
	S3740	Lea	1
	S3792	San Juan	4
	S3788	Statewide, minus the southwest	1, 2, 3, 4, 5
	S3790	Union	2
	S3785, S3791	Colfax, Union, Quay	1, 2
2015	S3783, S3798, S3802	Statewide	1, 2, 3, 4, 5, 6
2016	S4005	Hidalgo	6
	S4145, S4152	Union	2
2017	S4270	Hidalgo	6
	S4287	Curry, Lea, Quay, Roosevelt, Union	1, 2
	S4286	Union	2
2018	S4279	Catron, Cibola, Grant, Hidalgo, McKinley, San Juan	4, 6
	S4289, S4291	Colfax, Union, Chaves, Curry, De Baca, Guadalupe, Harding, Lea, Quay, Roosevelt, San Miguel	1, 2
	S4294	Catron, Grant, Hidalgo, Luna, Sierra	6
	S4300	Statewide	1, 2, 3, 4, 5, 6
	S4280, S4307	Union, Lea	1, 2
	S4285	Colfax, Harding, Mora, Taos, Union	2, 3
	S4316	Statewide, minus the northeast corner	1, 3, 4, 5, 6
	S4306	Bernalillo, Catron, Chaves, Cibola, De Baca, Guadalupe, Lincoln, McKinley, Quay, Roosevelt, Sandoval, Socorro, Valencia	1, 4, 5, 6
	S4308	San Juan	4
	S4310	Statewide, minus the northwest corner	1, 2, 3, 5, 6
	S4320	Colfax, San Juan, Taos	2, 3, 4
	S4329	Rio Arriba, San Juan, Taos	3, 4
	S4335	Lea	1
2019	S4466	Catron, Cibola, Grant, Hidalgo, McKinley, San Juan	4,6
	S4468	Colfax, Union	2
	S4469	Statewide	1, 2, 3, 4, 5, 6
	S4481	Colfax, Rio Arriba, San Juan, Taos	2, 3, 4
	S4569	San Juan	4
	S4579	Hidalgo	6
2020	S4646	Catron, Cibola, McKinley, San Juan	2,4
	S4648	Colfax, Rio Arriba, San Juan, Taos, Union	2, 3, 4
	S4651	Bernalillo, Cibola, Colfax, Harding, Los Alamos, McKinley, Mora, Quay, Rio Arriba, Sandoval, San Juan, San Miguel, Santa Fe, Taos, Union	1, 2, 3, 4, 5
	S4652, S4654	Union	2
	S4655	San Juan	4
	S4701	Quay, Union	1, 2
	S4705	Curry, De Baca, Guadalupe, Harding, Quay, Roosevelt, San Miguel, Union	1, 2
	S4707	Lea, Quay	1
	S4724	Guadalupe, Harding, Mora, Quay, San Miguel, Santa Fe, Torrance	1, 2, 3, 5
	S4725	Curry, Quay, Roosevelt	1
	S4736	Chaves, Curry, De Baca, Eddy, Guadalupe, Lea, Lincoln, Otero, Quay, Roosevelt	1, 6,

Crop Year	Designation Numbers	Counties	Preparedness Areas
	S4744, S4771	Lea	1
	S4749	Chaves, Curry, De Baca, Guadalupe, Lea, Lincoln, Quay, Roosevelt, San Miguel, Torrance	1, 2, 5
	S4751	Eddy, Lea, Otero	1, 6
	S4757	Chaves, De Baca, Guadalupe, Lincoln, Otero, Sierra, Socorro, Torrance	1, 5, 6
	S4766	Otero	6
	S4774	Catron, Grant, Hidalgo	6
	S4779	Bernalillo, Catron, Cibola, Dona Ana, Grant, Hidalgo, Los Alamos, Luna, McKinley, Mora, Rio Arriba, Sandoval, San Miguel, Santa Fe, Sierra, Socorro, Torrance, Valencia	2, 3, 4, 5, 6
	S4790	Los Alamos, Rio Arriba, Sandoval, Santa Fe	3, 5
	S4792	Lea, Roosevelt	1
	S4800	Bernalillo, Cibola, Guadalupe, Lincoln, Sandoval, San Miguel, Santa Fe, Socorro, Torrance, Valencia	1, 2, 3, 4, 5
	S4813	Curry, Quay	1
	S4818	Chaves, Dona Ana, Eddy, Lincoln, Otero, Sierra	1, 6
	S4850	Bernalillo, Cibola, Dona Ana, Luna, Otero, Sierra, Socorro, Torrance, Valencia	4, 5, 6
	S4855	Catron, Cibola, Lincoln, Sierra, Socorro, Torrance, Valencia	1, 4, 5, 6
	S4872	Dona Ana, Otero	6
	S4890	Sierra, Catron, Dona Ana, Grant, Lincoln, Luna, Otero, Socorro	1, 5, 6
2021	S4915	Catron, Cibola, Grant, Hidalgo, McKinley, San Juan	4, 6
	S4917	Colfax, Rio Arriba, San Juan, Taos, Union	2, 3, 4
	S4920	Statewide	1, 2, 3, 4, 5, 6
	S4922	Union	2
	S4924	Curry, Dona Ana, Eddy, Lea, Otero, Quay, Roosevelt, Union	1, 2, 6
	S4925	San Juan	4
	S5127	Quay, Union	1, 2

Due to the extreme drought of the 2012 season, the Governor established a Drought Task Force, comprised of representatives from multiple State agencies, including the Office of the State Engineer, Interstate Stream Commission, Environment Department, Economic Development Department, Department of Health, Tourism Department, Department of Agriculture, Finance Authority, Department of Finance and Administration, Homeland Security and Emergency Management, Energy Minerals and Natural Resources Department, and the Office of the Governor.

The most recent Drought Executive Order was signed by Governor Michelle Lujan Grisham on April 25, 2022 (Executive Order 2022-022). This order declared a State of emergency Statewide due to drought and fire conditions and urged the ban of fireworks. The Executive Order further directed the continuation of the New Mexico Drought Task Force and for them to meet once a quarter.

6.4.3 Climate Change Impacts

Projections show a decline in snowpack across western states by the mid-21st century, including severe declines at lower elevations and modest declines at high elevations. Additionally, warming temperatures have been resulting in earlier onset of streamflow from melting snow, which may cause a reduction in late summer flows.

The Fourth National Climate Assessment reports that throughout the southwest region, increased temperatures are resulting in decreases in snowpack and its water content, an earlier peak of snow-fed streamflow, and increases in the proportion of rain to snow, all of which exacerbate hydrological drought. Additionally, drought risk is being exacerbated by the depletion of groundwater.

With a warmer climate, droughts could become more frequent, more severe, and longer lasting. From 1987 to 1989, losses from drought in the U.S. totaled $39 billion (Congressional Office of Technology Assessment [OTA] 1993). More frequent extreme events such as droughts could end up being more cause for concern than the long-term change in temperature and precipitation averages. In addition, drought conditions can greatly increase the likelihood and severity of wildfire.

In all likelihood, the direct impacts of climate change on water resources will be hidden beneath natural climate variability. With a warmer climate, droughts and floods could become more frequent, severe, and longer lasting. The potential increase in these hazards is a great concern given the stresses being placed on water resources and the high costs resulting from recent hazards. The best advice to water resource managers regarding climate change is to start addressing current stresses on water supplies and build flexibility and robustness into any system. Flexibility helps to ensure a quick response to changing conditions, and robustness helps people prepare for and survive the worst conditions. With this approach to planning, water system managers will be better able to adapt to the impacts of climate change.

Note that in addition to the effects of climate change, global water resources are already experiencing a number of non-climate stresses:

- Growing populations
- Increased competition for available water
- Poor water quality
- Environmental claims
- Uncertain reserved water rights
- Groundwater overdraft
- Aging urban water infrastructure

6.4.4 Past Frequency

Drought is a regular event in all areas of New Mexico and visits the State in recurring cycles. Experts predict that drought conditions are likely to continue for the foreseeable future. Periods of recent extreme meteorological drought, as defined by a Palmer drought index of -4.0 or lower, have been noted in the mid-1930's in the Northeastern Plains and Central Highlands, in 1947 in the Central Highlands, in the 1950's throughout the State, in 1963-64 in the Northern Mountains, in 1964 in the Southeastern Plains, and in 1967 in the Northern Mountains. Drought again started in 1999 and continued until 2021. The longest general drought since 1930 was in the 1950's. According to a study published in Nature, the 2000-2021 drought is the driest 22-year period since 800 CE.

6.4.5 Probability of Future Occurrence

Based on the above data, the odds of some part of the state experiencing drought conditions are nearly 100% per year, even before taking into account the impacts of climate change. As shown in Table 6-19, in the past decade every Preparedness Area has averaged 2-3 USDA Drought Declarations per year. Going forward we can expect more extreme drought conditions to occur more frequently across more of the state.

6.4.6 Vulnerability Assessment

Drought conditions can create serious problems for many New Mexico communities, farms, ranches, and open spaces. Fire danger is high, water reservoirs run low, and in some cases, towns have taken dramatic steps to reduce basic water consumption in their residents' homes and businesses. Vulnerability can be higher in areas where reservoirs and other water supplies are already stressed under 'normal' conditions, and where soils exist that resist infiltration when extremely dry.

Methods for quantifying drought impact do not exist, beyond disaster declarations and associated expenses. The following sections attempt to assess drought impacts qualitatively. There are many unmeasured impacts and the numbers presented should be interpreted only as an indicator of the true impacts.

State Assets

While drought typically has minimal direct impact on buildings and critical facilities, some economic impact to state assets can be assumed. Due to the regional nature of drought, all state assets are assumed to be at risk (see Table 6-7). For purposes of this analysis, the State assumed losses up to 10% of total asset value for assets at high risk of drought, 5% for assets at medium risk, and 1% for assets at low risk; risk ratings were based on the ratings in Table 6-3 Hazard Risk Rankings by Preparedness Area. Table 6-20 shows estimated losses for state assets from drought; these estimates are for planning purposes only and should not be used for insurance purposes.

Table 6-20 Potential Losses to State Assets From Drought

County	Total	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
PA 1						
Chaves	**5**	1	3	1	$48,197,000	**$4,819,700**
Curry	**1**	-	1	-	$933,000	**$93,300**
PA 2						
Colfax	**3**	1	2	-	$89,310,000	**$8,931,000**
San Miguel	**3**	1	1	1	$152,965,000	**$15,296,500**
PA 3						
Rio Arriba	**1**	-	1	-	$558,985	**$27,949**
Santa Fe	**16**	-	14	2	$602,912,704	**$30,145,635**
Taos	**1**	-	1	-	$501,000	**$25,050**
PA 4						
Cibola	**2**	-	1	1	$39,102,000	**$3,910,200**
McKinley	**1**	-	1	-	$2,807,000	**$280,700**
PA 5						

County	Total	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
Bernalillo	**6**	3	2	1	$393,344,167	**$39,334,417**
Sandoval	**1**	-	1	-	$17,085,000	**$1,708,500**
Socorro	**1**	-	1	-	$3,026,251	**$302,625**
Valencia	**3**	1	2	-	$148,620,000	**$14,862,000**
PA 6						
Dona Ana	**2**	-	2	-	$76,250,000	**$7,625,000**
Grant	**1**	1	-	-	$0	**$0**
Luna	**1**	-	-	1	$9,553,000	**$955,300**
Sierra	**1**	1	-	-	$24,528,000	**$2,452,800**
Total	**49**	**9**	**33**	**7**	**$1,609,693,107**	**$11,033,100**

Preparedness Area 1

Drought was ranked below flooding in a number of local hazard mitigation plans in Preparedness Area 1. However, the monetary loss estimates for drought far exceed those for flooding. A large portion of the land mass of Preparedness Area 1 is experiencing extended extreme drought conditions. The region is also vulnerable to extreme heat conditions. Together, these conditions elevate regional wildfire vulnerability and create high estimated potential losses for future wildfire disasters. Prolonged drought can also contribute to flash flooding events if the soil is unable to absorb moisture quickly after a rain event.

Reservoir levels throughout New Mexico are at their lowest levels since the mid-1970s and drought has a high risk, high vulnerability rating in Preparedness Area 1. A number of counties located in Preparedness Area 1 are home to generational ranching operations. In the last decade, an influx of entrepreneurs has led to the diversification of agriculture and horticulture in this region of the State. These agricultural and ranching sectors are highly vulnerable to drought.

No standard methodology exists for estimating losses due to drought, which generally does not have a direct impact of the built environment. Losses should instead be measured by potential impacts to various systems, such as: agriculture, water supplies, recreation/tourism, and natural systems. Of these, the only system that has any quantifiable loss information relates to funding from the USDA's disaster related assistance funding. The following Table 6-21 presents the best available Farm Service Agency's recent Emergency Loan program funding to the State.

Table 6-21 Preparedness Area 1 FSA Disaster Assistance Funding

Fiscal Year	Amount
FY 2010	$418,000
FY 2011	$76,000
FY 2012	$307,000
FY 2013	$1,374,420

Preparedness Area 2

Drought, thunderstorm, wildfire, and winter storms were all ranked equally as top hazards in Preparedness Area 2. Preparedness Area 2 is one of the most vulnerable Preparedness Areas to drought. This area reported drought conditions from 2003 to 2014. As drought conditions persist (coupled with the extreme heat events the region is susceptible to) wildfire risk also increases. In populated areas that are already struggling with limited water resources, fighting fires becomes more difficult. Additionally, in rural communities resources to fight wildfires may be limited. As a result, the vulnerability of people and structures within the region increase significantly. Wood frame construction makes up 52% of the Preparedness Area's building inventory, elevating vulnerability even further as well as the risk of catastrophic losses of life and property. Prolonged drought can also contribute to flash flooding events if the soil is unable to absorb moisture quickly after a rain event. Additionally, reservoir levels throughout New Mexico are at their lowest levels since the mid-1970s.

No standard methodology exists for estimating losses due to drought, which generally does not have a direct impact of the built environment. Losses should instead be measured by potential impacts to various systems, such as: agriculture, water supplies, recreation/tourism, and natural systems.

Preparedness Area 3

Based on local mitigation plans, drought ranked below both wildfire and flood in Preparedness Area 3. Areas of Preparedness Area 3 have experienced extended drought conditions, and at least one county has been experiencing drought conditions for the past 10 years. As drought conditions persist (coupled with the extreme heat events the region is susceptible to) wildfire risk also increases. In populated areas that are already struggling with limited water resources, fighting fires becomes more difficult. As a result, the vulnerability of people and structures within the region increases significantly. Wood frame construction makes up 57% of the Preparedness Area's building inventory, elevating vulnerability even further as well as the risk of catastrophic losses of life and property. Prolonged drought can also contribute to flash flooding events if the soil is unable to absorb moisture quickly after a rain event. Additionally, reservoir levels throughout New Mexico are at their lowest levels since the mid-1970s.

No standard methodology exists for estimating losses due to drought, which generally does not have a direct impact of the built environment. Losses should instead be measured by potential impacts to various systems, such as: agriculture, water supplies, recreation/tourism, and natural systems.

Preparedness Area 4

Drought was ranked equally with wildfire as the second top priority hazard in Preparedness Area 4. At least one county in Preparedness Area 4 has been experiencing drought since 2004, and one county declared extreme/severe drought conditions in June 2013. As drought conditions persist (coupled with the extreme heat events the region is susceptible to) wildfire risk also increases. In populated areas that are already struggling with limited water resources, fighting fires becomes more difficult. Additionally, in rural communities resources to fight wildfires may be limited. As a result, the vulnerability of people and structures within the region increase significantly. Wood frame construction makes up 50% of the Preparedness Area's building inventory, elevating vulnerability even further as well as the risk of catastrophic losses of life and property. Prolonged drought can also contribute to flash flooding events if the soil is unable to absorb moisture quickly after a rain event. Drought also has contributed to reservoir levels throughout New Mexico being at their lowest levels since the mid-1970s.

No standard methodology exists for estimating losses due to drought, which generally does not have a direct impact of the built environment. Losses should instead be measured by potential impacts to various systems, such as: agriculture, water supplies, recreation/tourism, and natural systems.

Preparedness Area 5

Drought, flood, and wildfire were ranked equally as the top priority hazards in local hazard mitigation plans in Preparedness Area 5. Portions of the region have been experiencing drought conditions since the early 2000s. These conditions elevate regional wildfire vulnerability and create a perfect storm for future wildfire disasters. Prolonged drought can also contribute to flash flooding events if the soil is unable to absorb moisture quickly after a rain event. Additionally, reservoir levels throughout New Mexico are at their lowest levels since the mid-1970s.

No standard methodology exists for estimating losses due to drought, which generally does not have a direct impact of the built environment. Losses should instead be measured by potential impacts to various systems, such as: agriculture, water supplies, recreation/tourism, and natural systems.

Preparedness Area 6

Drought was ranked as the second top priority hazard in Preparedness Area 6. A large portion of the land mass of Preparedness Area 6 is experiencing extended extreme drought conditions. The region is also vulnerable to extreme heat conditions. Together, these conditions elevate regional wildfire vulnerability and create a perfect storm for future wildfire disasters. Prolonged drought can also contribute to flash flooding events if the soil is unable to absorb moisture quickly after a rain event. Additionally, reservoir levels throughout New Mexico are at their lowest levels since the mid-1970s.

No standard methodology exists for estimating losses due to drought, which generally does not have a direct impact of the built environment. Losses should instead be measured by potential impacts to various systems, such as: agriculture, water supplies, recreation/tourism, and natural systems.

6.4.7 Data Limitations

It is difficult to determine when a drought hazard event starts. In most cases, the dry weather conditions that cause droughts will need to persist for a while before it becomes clear that drought conditions exist. There are also data limitations in determining the available quantity and quality of groundwater. The costs associated with the drought are difficult to quantify. Crop losses are relatively straightforward, but losses from tourism dollars due to drought and uncertainty about availability of water are more difficult to define. Given that drought is a significant statewide problem, more research needs to be done to better understand what makes a given community vulnerable, and what can be done to decrease vulnerability.

6.4.8 What Can Be Mitigated?

Continuous monitoring of the drought situation is ongoing through the Governor's Drought Task Force Monitoring Working Group. The New Mexico Office of State Engineer continues to engage in various Federal drought groups such as the National Integrated Drought Information System (NIDIS) Drought Early Warning System and remains committed to drought assessment. In December 2016, the NIDIS published the Implementation Plan Update, which provides a comprehensive, interagency approach for drought monitoring, forecasting, and early warning planning and preparing.

Identifying the first phases of the drought and reacting with water conservation at the earliest time will help to mitigate drought later. Mitigation management for drought is a proactive process. The best practices include early assessment, public education, water conservation programs, and diversifying sources of water. However, most of the progress has been at the Local and State level since there is no Federal water conservation or drought policy.

Drought can have lasting impacts on a community, including contributing to the risk of other hazards such as wildfire and flooding. To prevent the cycle of drought, wildfire, and flooding, a systematic approach is needed that will institute a proactive method of mitigation. Two sources of information, developed by the USACE, to be evaluated include the Burn Scar Hydrology, and the Debris Flow Impact, which helps to establish non-regulatory corridors in areas where development is discouraged due to risk from increases of debris flow.

Potential mitigation actions can include building and land use codes, water use restrictions, landscaping regulations, management of invasive plant species, forest and vegetation management, improving water system supply efficiency, aquifer recharge, and public education on reducing water use.

The long-term future of water is a fundamental concern to all local governments in the State. Water use projections indicate that depletion of regional water resources will continue unless actions are taken to conserve and utilize water more efficiently with the ideal goal of balancing supply with demand.

6.4.9 Risk Summary

The entire State of New Mexico is susceptible to some type of drought situation. Given that drought is a slow-moving hazard without an event to mark its arrival, a one-time drought can be difficult to define. However, the consequences of a moderate to severe drought in the State pose significant challenges. Long-term solutions for coping with a limited water supply will require increased cooperation between urban users and agricultural use. Critical facilities in rural parts of the State may need to increase or diversify their sources of water.

A prolonged drought also increases the probability of other hazards. Forests become more susceptible to wildfires and native vegetation dies, leaving exposed soils susceptible to erosion, flash flooding, and dust storms. The SHMT has identified drought as a priority hazard for each Preparedness Area in the State.

Table 6-22 identifies potential impacts from drought.

Table 6-22 Potential Impacts from Drought

Subject	Potential Impacts
Agriculture	Drought is one of the most devastating conditions to the agriculture industry. Food and fiber production is adversely affected in every way during a drought. Compounding that many agriculture crops are annual, and one season lost is often times bankrupting.
Health and Safety of The Public	Increased number of wildfires; health problems related to low water flows and poor water quality; health problems related to dust.
Health and Safety of Responders	Increased wildfire risk coupled with limited water supply makes it more challenging for responders to fight fires and puts responders at greater risk.
Continuity of Operations	Impacts expected for operations that are dependent on water (hydro power).
Delivery of Services	Impacts expected for operations that are dependent on water.
Property, Facilities, Infrastructure	Potential impacts due to increase in dust and land subsidence.

Subject	Potential Impacts
Environment	Animal habitat and food supply can dwindle causing species die-off; poor soil quality; loss of wetlands; increased soil erosion; migration of wildlife.
Economic Condition	Decreased tourism; crop loss; decreased land prices; unemployment from drought-related declines in production; increased importation of food; rural population loss.
Public Confidence	Reduced incomes; fewer recreational activities; Increase in food costs due to loss of crops and livestock; loss of aesthetic values; loss of cultural sites.

6.5 Earthquake

Hazard	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
Earthquake	Medium	Medium	Low	NR	Low	Low	Low

6.5.1 Hazard Characteristics

Earthquake hazards principally arise from ground motions due to seismic waves (elastic waves traveling through the earth). Such ground motions can be generated by explosions or by other phenomena that apply forces to the surface or interior of the earth. However, earthquakes are most commonly due to rapid slip along a zone of weakness in the Earth's crust (i.e., a fault). This process releases tectonic stress and converts a small portion (a few percent) of the associated strain energy into seismic waves that can propagate for great distances. Although earthquakes in the United States during the past few decades have caused less economic loss annually than other hazards, they have the potential to cause great and sudden losses. Within one to two minutes, an earthquake can devastate a city through ground shaking, surface-fault ruptures, and ground subsidence.

Earthquakes occur most frequently near tectonic plate boundaries, but may also occur within plate interiors. Tectonic plates include the Earth's crust and shallow mantle (lithosphere) that slowly move on top of a more ductile layer in the underlying mantle (aesthenosphere). High amounts of shearing occur where plates slide past each other near plate boundaries, and earthquakes are a consequence of the accompanying fault slip and release of elastic strain. However, damaging earthquakes can also occur within plate interiors in regions where elastic strain accumulates, or where the frictional properties of faults are perturbed due to volcanic, tectonic, or anthropogenic processes (e.g., fluid withdrawal or injection).

The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties typically result from falling objects and debris, or from forces that damage or demolish buildings and other structures. Disruption of communications, electrical power supplies, and gas, sewer, and water lines should be expected in a large earthquake. Earthquakes can also trigger widespread fires, dam or levee failures, landslides, or releases of hazardous material.

The vibration or shaking of the ground during an earthquake is described by the time history of its ground motion (when recorded, this record is called a seismogram). The severity of ground motion generally increases with the amount of energy released and decreases with distance from the earthquake hypocenter (the geographic location and depth of the earthquake source). Earthquakes generate elastic waves, both in earth’s interior (body waves, including P and S waves) and along the earth’s surface (surface waves). P (primary) waves, also known as pressure waves, in the earth’s interior are physically similar in character to sound waves in air. P waves have a back-and-forth (longitudinal) motion along their direction of travel. They move through the shallow earth at speeds between approximately 1 to 4 km/s (roughly 2000 to 9000 miles/hour). P waves typically produce predominantly vertical forces on buildings. S (secondary) waves, also known as shear waves, have a transverse (side-to-side relative to their propagation direction) motion and travel more slowly (by about a factor of 0.6) than P waves. S waves can cause significantly more damage than P waves because their amplitudes are typically larger and their shear motion produces horizontal forces, which structures are typically much less able to sustain without damage. Surface waves generate both shear and vertical forces. Surface waves can be highly damaging in areas where development has occurred in basins whose geometries and weakly consolidated sediment can cause amplification of these waves (the extensive damage to Mexico City in 1985 is a type example of this).

Earthquakes are commonly described in terms of magnitude and intensity. Magnitude is a fixed property of the earthquake source estimated from seismograms, and is proportional to the logarithm of the total energy released (an increase of one in earthquake magnitude indicates an approximately 32-fold increase in energy). Intensity, in contrast, varies spatially and with local geology, and describes the strength of ground motion at specific locations. Thus, a large, distant earthquake can generate the same intensity at a given site than a much smaller, local earthquake.

There are several generally consistent magnitude scales in use by the scientific and hazard community, based on different observable characteristics of seismic waves. The Richter Scale (also known as local magnitude, M_L) is the original magnitude scale, but it is technically applicable only to southern California and is scientifically obsolete. The three extensively quoted scales are the body wave magnitude, m_b, the surface wave magnitude, M_s, and the moment magnitude, m. Body and surface wave magnitudes vary because they are based on the amplitudes of observed body and surface waves, respectively. These components of the seismic wavefield can vary in relative size for a given earthquake (for example, earthquakes with shallower hypocenters generally produce corresponding larger surface waves than those with deeper hypocenters). The moment magnitude is based on the fundamental forces produced by the earthquake fault motion, and is coming into increasing use as the de facto measure of earthquake size. All three magnitudes usually agree to within 0.5 of a magnitude unit, with larger departures only commonly occurring for very large earthquakes (magnitudes in excess of 7.5) or earthquakes of magnitudes less than 5.7.

Empirical relationships suggest that earthquake magnitude is well-correlated (via log-linear regressions) to some rupture parameters (Wells and Coppersmith, 1994). These parameters include rupture length, downdip rupture width (i.e. along the fault plane), and rupture area. For example, estimated moment magnitudes (m) for earthquakes with surface rupturing lengths of 10 and 50 km are 6.24 and 7.05, respectively. Correlations between these parameters and magnitude are statistically significant across different tectonic and geographic areas.

The commonly used Modified Mercalli Intensity (MMI) Scale is expressed in Roman numerals. It is based on the amount of shaking and specific kinds of damage to man-made objects or structures. This scale has 12 classes and ranges from I (not felt) to XII (total destruction). A quantitative method of expressing an earthquake’s severity is to compare its acceleration history (commonly the peak acceleration) to the normal acceleration due to gravity (g=9.8 meters per second squared, or 980 cm/sec/sec). Peak ground acceleration (PGA) measures the rate of change of motion relative to the rate of acceleration due to gravity and is proportional to the forces exerted on a structure. For example, an acceleration of the ground surface of 244 cm/sec/sec equals a PGA of 25.0 percent. A higher PGA means a higher level of ground acceleration and a higher probability of structural damage. Ordinary structures typically begin to be damaged structurally at about 10% PGA. Table 6-23 illustrates the comparison for scales of magnitude and intensity.

Table 6-23 Richter Scale and Felt Effects of Earthquakes

Magnitude	Mercalli Intensity	Effects	Frequency Worldwide
Less than 2.0	I	Microearthquakes, not felt or rarely felt; recorded by seismographs.	Continual
2.0-2.9	I to II	Felt slightly by some people; no damage to buildings.	Over 1M per year
3.0-3.9	II to IV	Often felt by people; rarely causes damage; shaking of indoor objects noticeable.	Over 100,000 per year
4.0-4.9	IV to VI	Noticeable shaking of indoor objects and rattling noises; felt by most people in the affected area; slightly felt outside; generally, no to minimal damage.	10K to 15K per year
5.0-5.9	VI to VIII	Can cause damage of varying severity to poorly constructed buildings; at most, none to slight damage to all other buildings. Felt by everyone.	1K to 1,500 per year
6.0-6.9	VII to X	Damage to a moderate number of well-built structures in populated areas; earthquake-resistant structures survive with slight to moderate damage; poorly designed structures receive moderate to severe damage; felt in wider areas; up to hundreds of miles/kilometers from the epicenter; strong to violent shaking in epicentral area.	100 to 150 per year
7.0-7.9	VIII and greater	Causes damage to most buildings, some to partially or completely collapse or receive severe damage; well-designed structures are likely to receive damage; felt across great distances with major damage mostly limited to 250 km from epicenter.	10 to 20 per year
8.0-8.9	VIII and greater	Major damage to buildings, structures likely to be destroyed; will cause moderate to heavy damage to sturdy or earthquake-resistant buildings; damaging in large areas; felt in extremely large regions.	One per year
9.0 and Greater	VIII and greater	At or near total destruction - severe damage or collapse to all buildings; heavy damage and shaking extends to distant locations; permanent changes in ground topography.	One per 10-50 years

Source: US Geological Survey

Table 6-24 Modified Mercalli Intensity (MMI) Scale

MMI	Felt Intensity
I	Not felt except by a very few people under special conditions. Detected mostly by instruments.
II	Felt by a few people, especially those on upper floors of buildings. Suspended objects may swing.
III	Felt noticeably indoors. Standing automobiles may rock slightly.
IV	Felt by many people indoors; by a few outdoors. At night, some people are awakened. Dishes, windows, and doors rattle.
V	Felt by nearly everyone. Many people are awakened. Some dishes and windows are broken. Unstable objects are overturned.
VI	Felt by everyone. Many people become frightened and run outdoors. Some heavy furniture is moved. Some plaster falls.
VII	Most people are alarmed and run outside. Damage is negligible in buildings of good construction, considerable in buildings of poor construction.

MMI	Felt Intensity
VIII	Damage is slight in specially designed structures, considerable in ordinary buildings, and great in poorly built structures. Heavy furniture is overturned.
IX	Damage is considerable in specially designed buildings. Buildings shift from their foundations and partly collapse. Underground pipes are broken.
X	Some well-built wooden structures are destroyed. Most masonry structures are destroyed. The ground is badly cracked. Considerable landslides occur on steep slopes.
XI	Few, if any, masonry structures remain standing. Rails are bent. Broad fissures appear in the ground.
XII	Virtually total destruction. Waves are seen on the ground surface. Objects are thrown in the air.

Source: Multi-Hazard Identification and Risk Assessment, FEMA 1997

6.5.2 Previous Occurrences

The Rio Grande rift is a major tectonic feature of western North America created by crustal stretching over the past 28 million years. It is expressed on the surface of the earth as a series of elongated, north-south trending basins that run from central Colorado, through the central parts of New Mexico, into northern Mexico where it merges with the greater Basin and Range Province. Because the rift guides the path of the Rio Grande in New Mexico, it is the most highly populous sector of the State. Much of New Mexico's historical seismicity has been concentrated in the Rio Grande Valley between Socorro and Albuquerque, with about half of the earthquakes of intensity VI or greater (MMI) that occurred in the State between 1868 and 1973 being centered in this region.

Several major fault lines in the Rio Grande rift occur within 10 miles of several New Mexico cities, and studying their past activity is critical to understand their potential for future earthquakes and ground rupture. Paleoseismic studies constrain the age and number of prehistoric earthquakes that rupture the Earth's surface. Such studies incorporate observations and geologic data from outcrops of fault lines or trenches dug across fault lines. Based on these studies, several fault lines have been interpreted to have ruptured in the last 20,000 years and commonly have rupture recurrence intervals of about 10,000 to 40,000 years. These fault lines include the Sangre de Cristo fault near Taos, the Pajarito fault system near Los Alamos, several faults in the Albuquerque area, the Hubbell Spring fault east of Los Lunas and Belen, the Socorro Canyon and La Jencia faults near Socorro and Magdalena, the Alamogordo fault along the foot of the Sacramento Mountains, and the Organ fault near the White Sands Missile Range headquarters 18 miles east of Las Cruces. These faults are considered capable of producing powerful earthquakes in the future.

Historic earthquakes in the southwestern U.S. and northern Mexico region include a magnitude ~7.5 earthquake in northern Mexico in 1887 (the Sonoran Earthquake), numerous magnitude four to six earthquakes in the Socorro areas throughout the 20th century (most notably two earthquakes near magnitude six in 1906), and magnitude four to 5+ events in Cerrillos and Dulce in 1918 and 1966, respectively. The net earthquake threat to the State is considered moderate from a national perspective. However, the Sonoran Earthquake (magnitude of ~7.5) illustrates the damage incurred from an earthquake involving faults which last ruptured >100,000 years ago. This earthquake serves as a worst-case analogue for the hazards posed by Rio Grande rift faults, which also have relatively high rupture recurrence intervals (10,000 to 40,000 years) and similar lengths as the faults involved in the Sonoran Earthquake.

Thousands of recorded earthquakes have been measured in New Mexico and analyzed in recent decades by the New Mexico Institute of Mining and Technology and/or the U.S. Geological Survey. Figure 6-45 depicts the approximate epicenters for past earthquakes in New Mexico and surrounding areas between 1962 and 2012. The Socorro area has been the most active earthquake region of the State during at least the past 150 years. During the past 45 years, approximately 50% of the seismic energy generated by earthquakes in New Mexico has been released in a region centered near Socorro, encompassing only about 2% of the State's total land area. This relatively high rate of earthquake activity in the Socorro region is due to a slowly inflating (~2 mm/year) sill of molten rock (magma) that is roughly 1,300 square miles in area and lies approximately 12 miles beneath the surface of the fault-bounded Rio Grande rift.

Some small earthquakes in New Mexico have also been triggered by human activity. Earthquake-like ground shaking is created by atomic bomb testing, including the explosion of the first atomic bomb at the Trinity Site in 1945 and subsequent underground explosions near Carlsbad in 1961 and east of Farmington in 1967. Many earthquakes in southeastern New Mexico may be related to oil and gas production and fluid reinjection. Earthquakes near Raton, NM and Trinidad, CO, show correlations with water injection associated with natural gas production, and a series of earthquakes recorded near the Heron and El Vado reservoirs in northern New Mexico may have been caused by the weight of the water in the reservoirs.

Figure 6-44 shows the identified faults located in the State of New Mexico. Faults and associated folds are included that are believed to be the source of earthquakes with a magnitude greater than six during the Quaternary Period (the past 1,600,000 years).

Figure 6-44 Preparedness Areas and Fault Lines in New Mexico

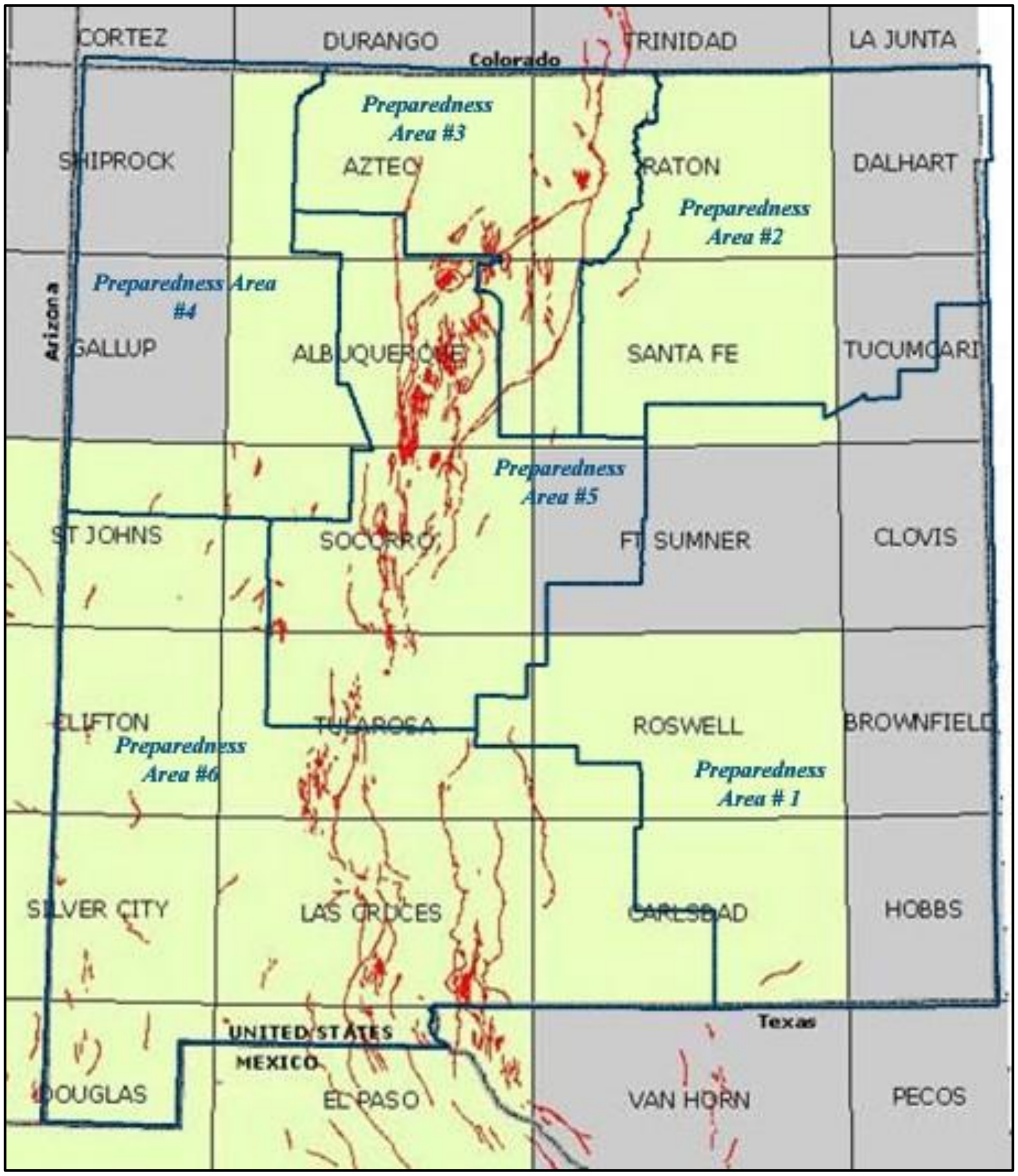
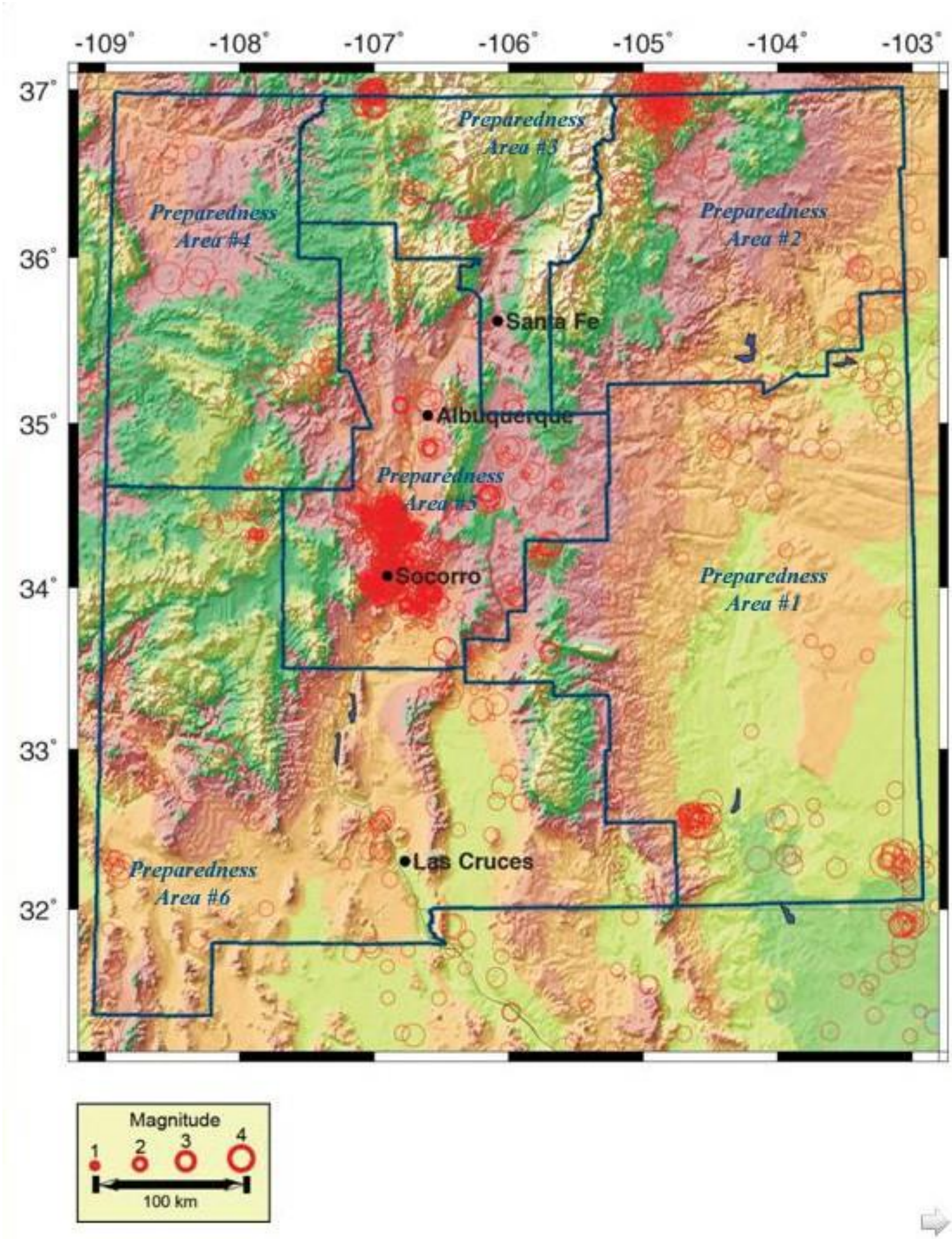


Figure 6-45 illustrates the earthquake hazard areas in the State of New Mexico. There has been a clustering of earthquake activity around the cities of Socorro and Albuquerque (both located in Preparedness Area 5). Additionally, significant amounts of high-magnitude seismic activity have been recorded in the northeast area of the State in Preparedness Areas 2 and 3.

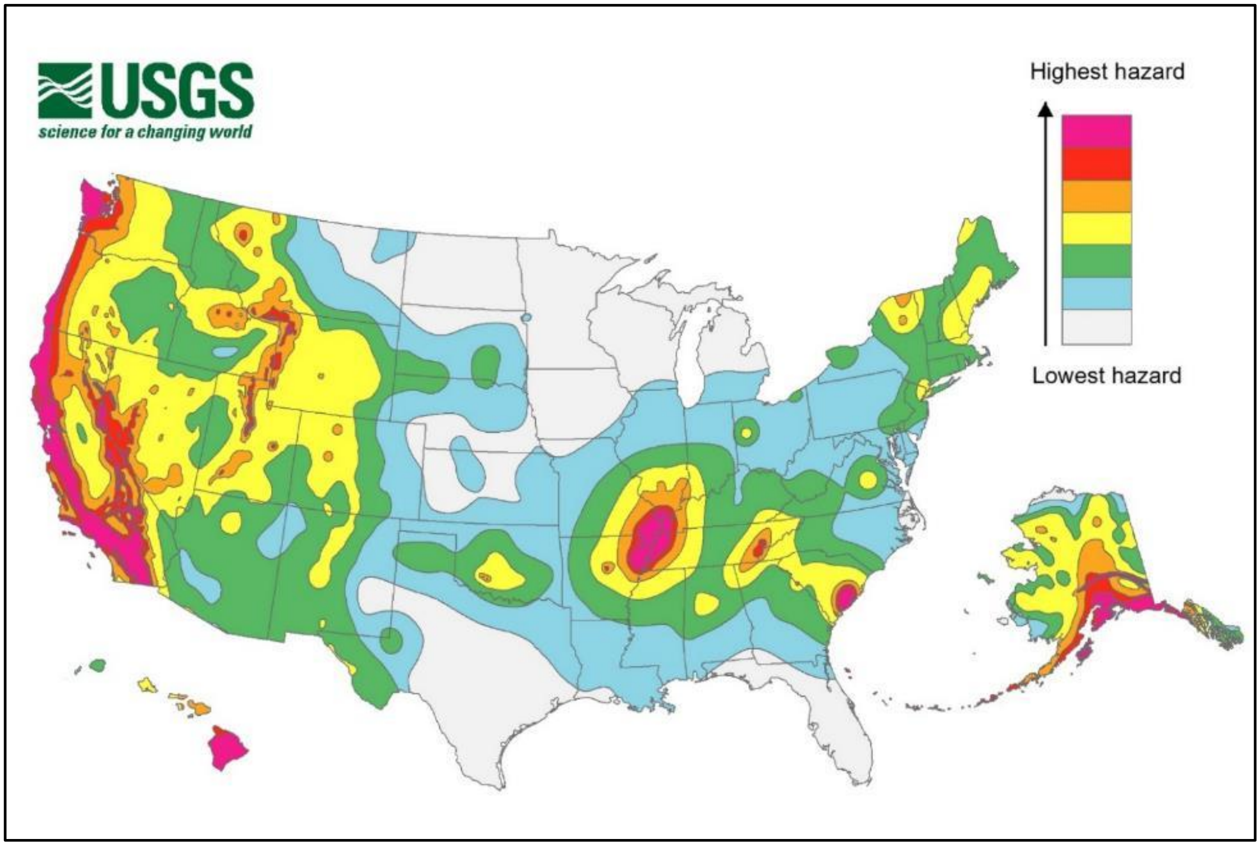
Figure 6-45 Earthquakes in New Mexico, 1962 - 2012



The historic area of seismicity includes most of New Mexico's major population and transportation centers. The record of damaging earthquakes in the State does not support extreme earthquake mitigation measures, as are common in States like California or Nations like Japan. However, the lack of serious earthquake damage in the past should not be interpreted as evidence that such damage will not occur in the future.

Figure 6-46 illustrates the relative seismic risk for New Mexico as compared to the United States overall. While the risk is low to moderate, almost the entire state is potentially at risk of earthquakes.

Figure 6-46 Seismic Risk in the United States



The State of New Mexico Construction Industries and Manufactured Housing Division of the Regulations and Licensing Department uses the following figure (Figure 6-47), which is included in the 2015 International Building Code, to evaluate structural design of buildings. This demonstrates areas in New Mexico that are susceptible to higher levels of ground motion.

Figure 6-47 Ground Motion Response for Western US

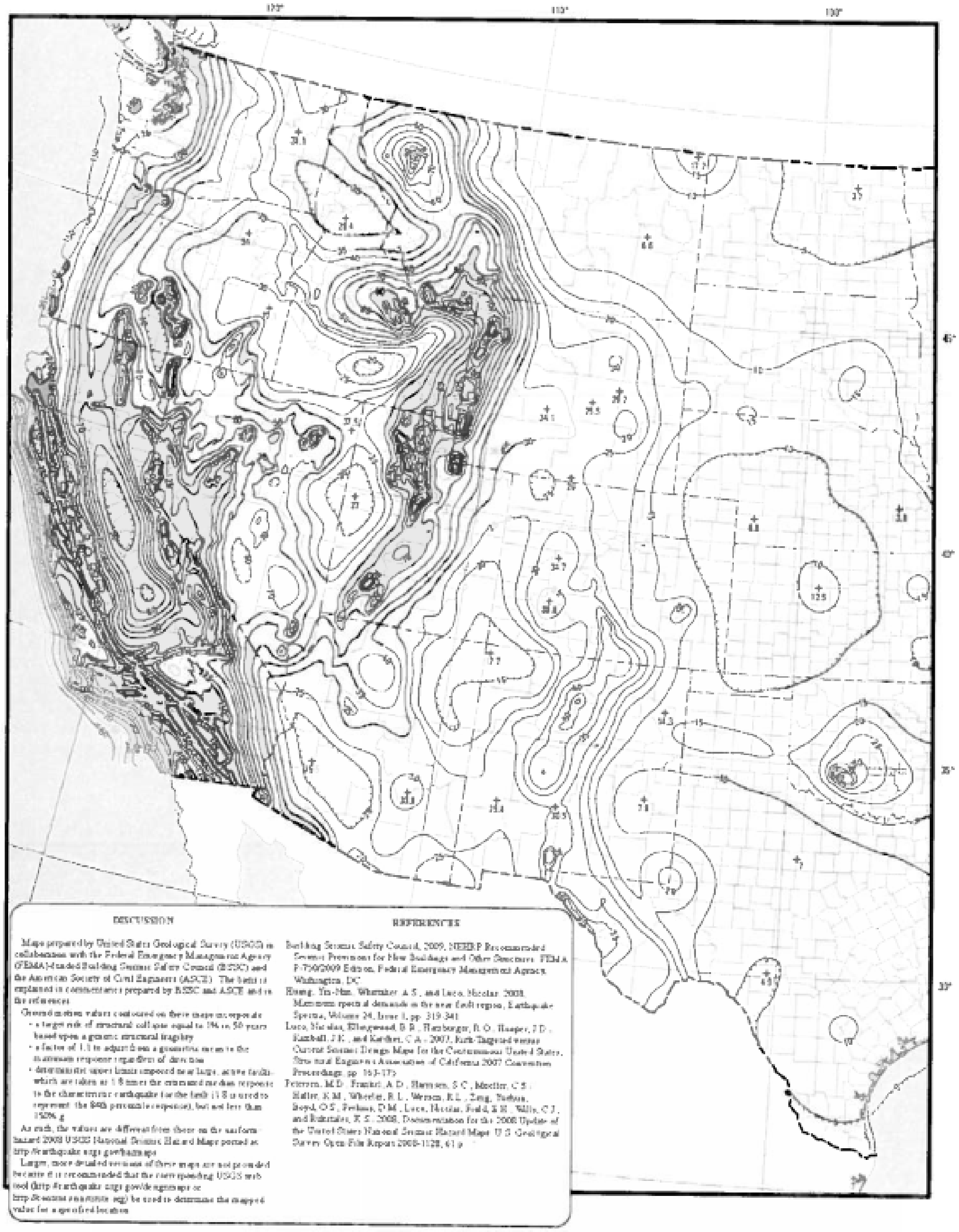


FIGURE 1613.3.1(1)
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS FOR THE CONTERMINOUS UNITED STATES OF 0.2-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING), SITE CLASS B

During October 1, 2010 – September 30, 2011, the New Mexico Bureau of Geology and Mineral Resources and Department of Earth and Environmental Science, both being part of the New Mexico Institute of Mining and Technology, conducted a seismic and geophysical study focused on earthquakes located in or immediately adjacent to New Mexico. The majority of these events were distributed among three main regions: the northeast border of NM near Raton, NM (Preparedness Area 2); the Dagger Draw area in the Delaware Basin, Eddy County (Preparedness Area 1); and the Socorro Magma Body region (Preparedness Area 5). All of these regions are long-standing locations of prolonged seismicity. Events in the Raton area (Preparedness Area 2) include a continuing swarm that began in 2001 a 5.3 earthquake near Trinidad, CO (North of Raton) on August 22nd, 2011. The Dagger Draw area in the Delaware Basin in Eddy County (Preparedness Area 1) area has produced 13 Md > 3.0 (duration magnitude) earthquakes since 2002, and the Socorro Magma Body region has produced continuing activity since at least the mid-19th century, including earthquakes as large as an estimated magnitude six in 1906. The largest events in these regions are the following: Md 3.7 in Raton region south of the Colorado border (Preparedness Area 2); Md 2.3 near Dagger Draw (Preparedness Area 1); and Md 2.3 in the Socorro magma body region (Preparedness Area 5).

The City of Socorro (Preparedness Area 5) is the "earthquake capital" of New Mexico. A 5,000 km^2 (1,931 mi^2) area, less than 2% of New Mexico, surrounding the town has produced nearly 50% of the 30 earthquakes of magnitude 4.5 or greater (up to 5.8) in the State since 1869. Earthquake swarms, defined as a series of earthquakes recurring for days in nearly the same location within minutes of each other, are very common in this region. Historical accounts of these swarms date back to 1849, and they have been recorded on local seismic instruments since the early 1960s. The majority of the earthquakes in these swarms are shallow (three to eight miles beneath the surface) and relatively small (M < 1.0). These small earthquakes are not damaging. However, based on historic seismicity and geologic evidence, there is a chance for a larger, possibly damaging event in the future (Wong, 2009). According to the US Geological Survey, there is an 18% chance of a large earthquake (M > 6.0) in the Socorro region in the next 100 years.

Twelve strongly felt earthquakes with estimated magnitudes of 4.5 or greater occurred in the Socorro area (Preparedness Area 5) from 1869 through 1961. Unlike the instrumental data from 1962 through 2004, nearly all of these strong shocks appear to have had epicenters near Socorro rather than north of San Acacia (Preparedness Area 5). Also, the statistics for earthquakes with magnitudes of 4.5 or greater from 1869 to the present indicated the Socorro-area seismic activity before the 1930s was significantly higher primarily because of prolonged earthquake swarm of 1906-1907. During this swarm, earthquakes were felt as early as July 2, 1906 and continued almost on a daily basis well into 1907. Information on these shocks comes from newspaper accounts and notably from a published paper by the noted seismologist H. F. Reid. His paper on the 1906–1907 swarm in the first issue of the Bulletin of the Seismological Society of America presents Rossi-Forel earthquake intensity observations out to distances of several hundred kilometers for the three strong earthquakes of the swarm.

Three shocks in the 1906-1907 Socorro swarm had likely magnitudes of 5.5 to 6.1, strong enough to significantly damage some adobe and masonry structures. These were the strongest earthquakes in the State from 1869 through present. The most unusual characteristic noted of the swarm was the exceptionally large number of felt earthquakes over a six-month period beginning on July 2, 1906. It is suspected that weak shocks probably related to the swarm continued into 1909. These earthquakes increased the property damage already sustained at Socorro from previous earthquakes. Four rebuilt chimneys were shaken off the Socorro County Courthouse, and two others were cracked severely. Plaster fell at the courthouse, and a cornice on the northwest corner of the two-story adobe Masonic Temple was thrown onto its first floor. Several bricks fell from the front gable on one house. Plaster was shaken from walls in Santa Fe, about 200 kilometers from the epicenter. This earthquake was felt over most of New Mexico and in parts of Arizona and Texas.

The earliest recorded earthquake swarm in Socorro occurred between December 11, 1849, to February 14, 1851. Documentation for this swarm comes from a report by John Hammond, who was an army surgeon stationed in Socorro during that time. He recounts 29 quakes on 18 different days on seven different months. At least earthquakes six could not be felt more than 15 miles away from Socorro. Most were severe shocks and were accompanied by a rumbling noise; he estimates that most probably would have damaged a house of three stories. Two houses were nearly destroyed in a subsequent earthquake on April 19, 1855.

There have been at least eight earthquakes felt by the residents of Los Alamos since its creation during World War II. The largest of these registered a magnitude four that occurred in 1952 and a magnitude 3.3 in 1971; both earthquakes had reported MMIs of V in Los Alamos. More recently, Los Alamos experienced very small magnitude (<2) earthquakes (1991 and 1998) that produced unusually high MMIs (up to V). Recent paleoseismic studies on the Pajarito fault systems indicated that a large earthquake of approximately magnitude seven occurred in recent prehistoric times. An October 17, 2011 magnitude 3.8 earthquake generated MMI levels of III-IV in the Espanola Basin/Pojoaque/Santa Fe region.

Table 6-25 lists the locations and dates of the 31 strongest earthquakes that have occurred in New Mexico since 1869. There have been no earthquakes reported in the State larger than 4.5 since 2014.

Table 6-25 Strongest Earthquakes 4.5 and Greater in New Mexico (1869 - 2022)

Date	Time			Approx. Location		MMI	Moment Magnitude	Nearby City
	Hr.	Min	Sec	Lat.	Long.			
1869	-	-	-	34.1	106.9	VII	5.2	Socorro
7-Sept-1893	-	-	-	34.7	106.6	VII	5.2	Belen
31-Oct-1895	12	-	-	34.1	106.9	VI	4.5	Socorro
1897	-	-	-	34.1	106.9	VI	4.5	Socorro
10-Sep-1904	-	-	-	34.1	106.9	VI	4.5	Socorro
2-Jul-1906	10	15	-	34.1	106.9	VI	4.5	Socorro
12-Jul-1906	12	15	-	34.1	106.9	VII	5.5	Socorro
16-Jul-1906	19		-	34.1	106.9	VII	5.8	Socorro
15-Nov-1906	2	15	-	34.1	106.9	VII	5.8	Socorro
19-Dec-1906	12		-	34.1	106.9	VI	4.5	Socorro
28-May-1918	11	30	-	35.5	106.1	VII	5.5	Cerrillos
5-Feb-1931	4	48	-	35	106.5	VI	4.5	Albuquerque
21-Feb-1935	1	25	-	34.5	106.8	VI	4.5	Bernardo
22-Dec-1935	1	56	-	34.7	106.8	VI	4.5	Belen
17-Sep-1938	17	20	-	33.3	108.5	VI	4.5	Glenwood
20-Sep-1938	5	39	-	33.3	108.5	VI	4.5	Glenwood
29-Sep-1938	23	35	-	33.3	108.5	VI	4.5	Glenwood

Date	Time			Approx. Location		MMI	Moment Magnitude	Nearby City
	Hr.	Min	Sec	Lat.	Long.			
2-Nov-1938	16	0	-	33.3	108.5	VI	4.5	Glenwood
20-Jan-1939	12	17	-	33.3	108.5	VI	4.5	Glenwood
4-Jun-1939	1	19	-	33.3	108.5	VI	4.5	Glenwood
6-Nov-1947	16	50	-	35	106.4	VI	4.5	Albuquerque
23-May-1949	7	22	-	34.6	105.2	VI	4.5	Vaughn
3-Aug-1955	6	39	42	37	107.3	VI	4.5	Dulce
23-Jul-1960	14	16	-	34.4	106.9	VI	4.5	Bernardo
3-Jul-1961	7	6	-	34.2	106.9	VI	4.5	Socorro
23-Jan-1966	1	56	39	37.02	107	VI	4.8	Dulce
5-Jan-1976	6	23	29	35.9	108.5	VI	4.7	Gallup
29-Nov-1989	6	54	39	34.5	106.9	VI	4.7	Bernardo
29-Jan-1990	13	16	11	34.5	106.9	VI	4.6	Bernardo
2-Jan-1992	11	45	35	32.3	103.2	VI	5	Eunice
10-Aug-2005	4	8	17	36.96	104.8	IV	5	Raton
29-June-2014	4	59	35	32.58	109.2	VI	5.2	Lordsburg

Table 6-26 below identifies the number of 4.5 or greater magnitude earthquakes for each Preparedness Area.

Table 6-26 Strongest Earthquakes 4.5 and Greater by Preparedness Area (1869 to 2022)

Preparedness Area	Number of 4.5+ magnitude earthquakes 1869 to present
PA 1	2
PA 2	1
PA 3	3
PA 4	1
PA 5	18
PA 6	7
Total	**32**

Table 6-27 outlines earthquakes where additional information was available regarding damage reports or unique conditions. Source information is from the NCEI and data provided by local authorities.

Table 6-27 Significant Past Occurrences - Earthquakes 1906 – 2022

Date	Location	Significant Event
June 29, 2014	50 km west-northwest of Lordsburg, NM	An earthquake that was felt across southwestern New Mexico as far as Roswell. Shaking reported in the cities of Lordsburg, Deming, Las Cruces, and Albuquerque. The greatest intensities (Intensity IV) occurred in Lordsburg, but there was no reported damage. However, across the border in Arizona in the towns of Duncan and Safford, cracks locally occurred on ceilings and floors, picture frames were knocked off walls, and ceiling tiles fell.
September 1,	Socorro, NM	A felt earthquake of local magnitude (ML) 2.3 occurred

Date	Location	Significant Event
2009	(Socorro County) (Preparedness Area 5)	approximately 3 km NE of Socorro near Escondida. Small events continued to occur during this time with activity beginning near the Lemitar area on August 24, 2009. These events have been numerous with fairly shallow depths of 5.5-6 km. The largest event was ML=2.5 on August 29, 2009 at 18:31:01 MDT (August 30, 2009 at 01:31:01 UTC) and was felt by many residents of Lemitar and Socorro. We have preliminary locations on the largest 53 events (ML range of 0.5 to 2.5); however, over 400 smaller events have also occurred since August 19, 2009. The locations of 53 of the largest earthquakes are very similar, suggesting that this is an earthquake swarm. Earthquake swarms are usually caused in response to tectonic or hydrological pressure changes in the crust. Minor felt earthquakes in this region are not uncommon, and have been documented by Dr. Allan Sanford in the past. However, this was a swarm with unusually frequent, large earthquakes (14 earthquakes with ML > 1.4). For a size comparison, felt reports were noted for 4 events with ML 1.9 and greater.
September 12, 2007	Reserve, NM (Catron, County) (Preparedness Area 6)	A minor felt earthquake (3.5 USGS) occurred on September 8, 2007 at 1:15:40 am MDT (07:15:40 UTC). The event was located approximately 6 miles (10 km) west-southwest of Reserve, the Catron County seat. The Sheriff's Department in Reserve logged felt reports as far away as Luna (20 miles N) and Apache Creek (15 miles east), as well as reports from the Catron County jail. The event was part of a small swarm that lasted several hours. This is an unusual location, historically, for a felt earthquake, although a swarm of felt earthquakes estimated to be as large as 4.5 occurred in the Glenwood Springs, NM region in 1938-1939.
January 4, 1971	City of Albuquerque (Bernalillo County) (Preparedness Area 5)	Maximum Intensity VI earthquake felt within 600 square miles of the City of Albuquerque. Minor damage in the west and northwest of the City with reports of cracked walls/ plaster, broken windows and damage to fallen objects. Most damage reported at University of Albuquerque (now the location of St. Pius X High School) and West Mesa High School, both located on the west side of the City.
January 23, 1966	Dulce, NM (Rio Arriba County) (Preparedness Area 3)	A magnitude 5.5 earthquake centered near Dulce (Rio Arriba County) affected about 39,000 square kilometers of northwestern New Mexico and southwestern Colorado. Nearly every building in Dulce was damaged to some degree; many buildings had exterior and interior damage and considerable chimney damage was noted. The principal property damage was sustained at the Bureau of Indian Affairs School and Dormitory Complex and at the Dulce Independent Schools. Rock falls and landslides occurred along Highway 17, about 15 to 25 km west of Dulce; in addition, some minor cracks appeared in the highway. Minor damage was also reported at Lumberton, New Mexico, and Edith, Colorado. More than $200,000 damage was inflicted on Indian school facilities in Dulce, NM.
November 3, 1954	Albuquerque, NM (Bernalillo County) (Preparedness Area 5)	Plaster cracks, broken windows, and cracked fireplaces have been reported from past earthquakes. Minor structural damage occurred to a bank in Albuquerque from an intensity V earthquake. Barns have collapsed and rooftop air-conditioners shaken loose.
May 28, 1918	Village of Cerrillos (Santa Fe, County)	An earthquake with strong local effects in Santa Fe County, where people in the village of Cerrillos were thrown off their feet and fallen

Date	Location	Significant Event
	(Preparedness Area 3)	plaster was reported (intensity VII - VIII).
November 15, 1906	Socorro, NM (Socorro County) (Preparedness Area 5) Santa Fe, NM (Santa Fe, County) (Preparedness Area 3)	The largest historic earthquake in New Mexico: **(**Mercalli Intensity: VII): This earthquake, which was the culmination of a sustained earthquake swarm between 1904 through 1907, increased the property damage already sustained at Socorro from previous earthquakes. Four rebuilt chimneys were shaken off the Socorro County Courthouse, and two others were cracked severely. Plaster fell at the courthouse, and a cornice on the northwest corner of the two-story adobe Masonic Temple was thrown onto its first floor. Several bricks fell from the front gable on one house. Plaster was shaken from walls in Santa Fe about 200 kilometers from the epicenter. Felt over most of New Mexico and in parts of Arizona and Texas.26F

6.5.3 Past Frequency

New Mexico has experienced eight earthquakes of magnitude 4.5 or larger during the 117 years from 1906 to 2022. This equates to a significant quake roughly every 15 years, or a 6% chance in any given year. The greatest threat is along the Rio Grande rift.

6.5.4 Climate Change Impacts

The best available data does not indicate significant impacts on the frequency or severity of earthquakes due to climate change.

6.5.5 Probability of Future Occurrence

The probability of future earthquakes of magnitude 4.5 or larger is estimated to be **occasional**.

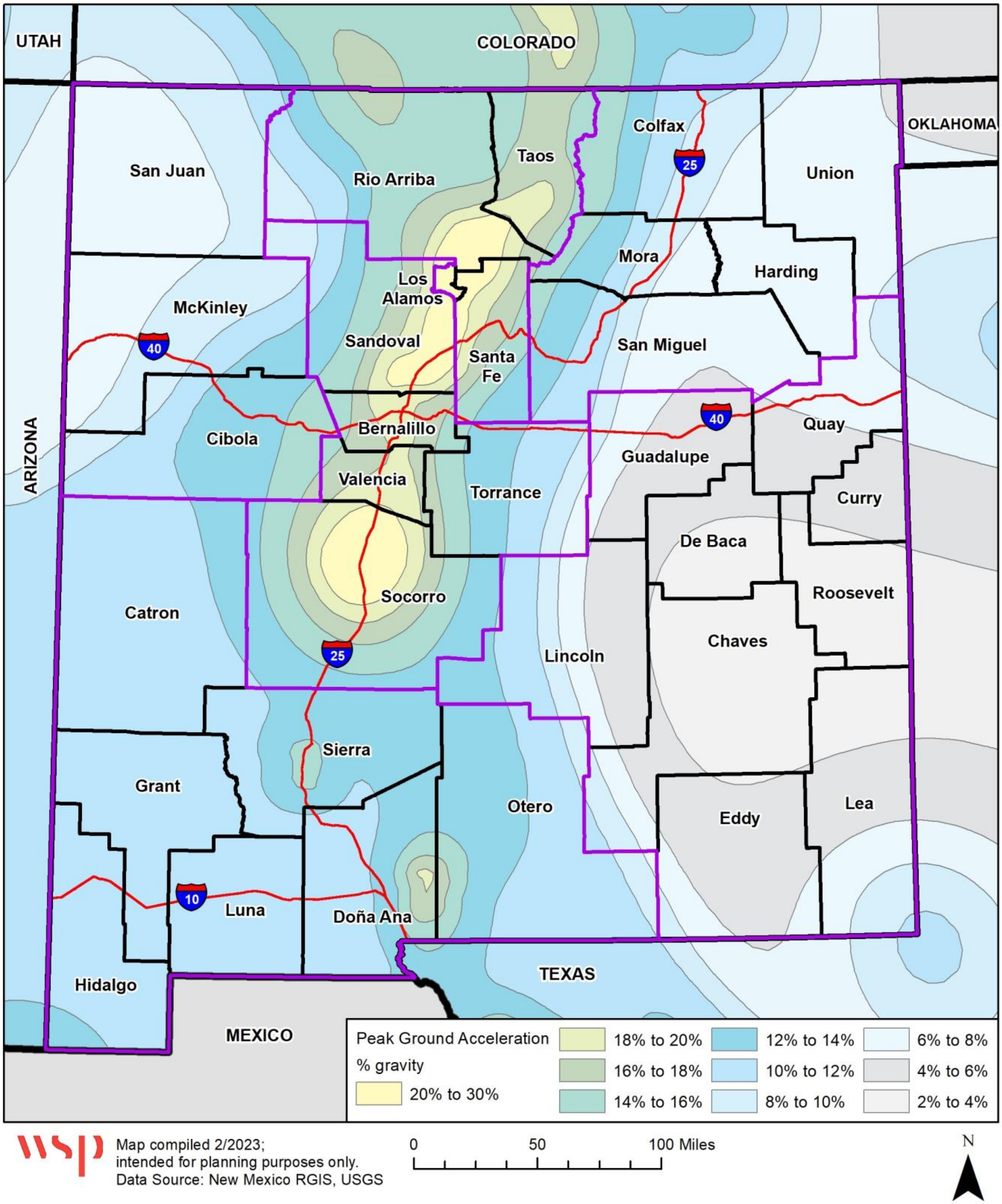
6.5.6 Data Limitations

Present seismic monitoring in New Mexico is conducted by the New Mexico Institute of Mining and Technology and the U.S. Geological Survey National Earthquake Information Center in Golden, CO. Levels of instrumentation and staffing are presently sufficient to generally characterize events anywhere within the State to magnitude levels of approximately 3.0 (and significantly smaller in better- instrumented areas, such as the vicinity of the WIPP/Carlsbad area and the Socorro region. Unusual sequences of exceptional societal or scientific interest can be additionally studied with temporary deployments of portable seismographs through the IRIS PASSCAL Instrument Center at the New Mexico Institute of Mining and Technology and/or using USGS national resources. Los Alamos National Laboratory also operates a regional seismographic network focused on the Pajarito fault zone and Valles Caldera region.

6.5.7 Vulnerability Assessment

The following map depicts the maximum probable earthquake epicenter and peak ground acceleration (PGA) calculations. PGA quantifies what is experienced by a particle on the ground during the event of an earthquake. It is recorded by taking the largest increase in velocity recorded by a particular seismic station during an earthquake.

Figure 6-48 Maximum Probable Earthquake Epicenter and Potential Peak Ground Acceleration



The most likely consequence of earthquakes in New Mexico is partial collapse of unreinforced masonry and old adobe buildings. Roads and bridges are unlikely to suffer damage that would render them unusable.

If a major basin and range earthquake similar to the 1887 Sonoran Earthquake were to occur in New Mexico, the State would suffer high levels of damage, with general losses ranging from 10s to 100s of millions of dollars depending on the location of the event. Furthermore, the area most subject to seismic activity, based on historic occurrence, is the Socorro-to-Albuquerque segment of the Rio Grande valley. This area is densely populated and rapidly developing. Present building codes require construction of certain occupancies (schools, hospitals, public buildings) to high earthquake resistance standards, although seismic mitigating construction is not required for residential buildings.

Hazus modeling runs were done for each Preparedness Area based on the highest magnitude most probable earthquake, as listed in Table 6-28.

Hazus runs were done for earthquake damage estimation based on best expert opinion regarding location and rupture parameters for the most probable maximum magnitude earthquake in each Preparedness Area. The full results of this analysis can be found in the Global Summary Reports located in Appendix C, Hazus Global Summary Reports subsection. Table 6-28 below shows the Hazus parameters used for the most probable maximum magnitude earthquake in each Preparedness Area.

Table 6-28 Hazus Earthquake Parameters for each Preparedness Area

	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6
Location	**Carlsbad**	**Raton**	**Los Alamos**	**Farmington**	**Albuquerque**	**Las Cruces**
Longitude	-104.23	-105.22	-106.31	-108.22	-106.62	-106.41
Latitude	32.42	36.48	35.89	36.72	35.22	32.42
Magnitude	5.5	5.5	7.3	5.5	7.3	7.3
Rupture depth (km)	5	5	15	5	15	15
Rupture length	3	3	78	3	51	71
Rupture orientation	0.00 degrees					
Fault width (km)					16.4	16.2
Note: Albuquerque rupture includes "faults north of Placitas" in addition to the Sandia and Rincon faults. Los Alamos rupture includes the entire Pajarito fault system and the southern Embudo fault system. The Las Cruces rupture includes the southern San Andres Mtns-Organ Mtns-N Artillery Range faults. Nomenclature of faults follows Machette et al. (1998).						

The summary results of the Hazus loss estimations are presented below in Table 6-29, per Preparedness Area. The modeled losses vary greatly across the State, from over $2 Billion in anticipated losses for the most probable maximum magnitude earthquake in Preparedness Area 3 to no measurable anticipated losses for a similar event in Preparedness Area 2.

Table 6-29 Hazus Earthquake Loss Estimates by Preparedness Area

Loss Estimates	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6
Wage	$14.03 M	$8.58 M	$79.05 M	$28.28 M	$46.82 M	$33.35 M
Capital-Related	$10.70 M	$6.19 M	$62.56 M	$19.87 M	$41.20 M	$24.98 M
Rental	$14.03 M	$8.54 M	$78.08 M	$20.38 M	$50.20 M	$35.78 M
Relocation	$33.89 M	$18.11 M	$195.82 M	$49.96 M	$119.09 M	$93.39 M
Income Losses (subtotal)	***$72.65 M***	***$41.42 M***	***$415.51 M***	***$118.50 M***	***$257.31 M***	***$189.49 M***
Structural	$50.36 M	$25.68 M	$339.00 M	$77.01 M	$180.95 M	$139.18 M
Non-Structural	$157.53 M	$80.45 M	$1.093 B	$233.18 M	$542.11 M	$391.32 M
Content	$62.01 M	$29.34 M	$341.03 M	$101.35 M	$194.90 M	$122.50 M
Inventory	$0.95 M	$0.37 M	$4.63 M	$2.72 M	$3.08 M	$2.05 M
Capital Stock Losses (subtotal)	***$270.84 M***	***$135.85 M***	***$1.778 B***	***$414.26 M***	***$921.04 M***	***$655.04 M***
Total Estimated Building-Related Losses	**$343.49 M**	**$177.27 M**	**$2.193 B**	**$532.76 M**	**$1.178 B**	**$844.53 M**
Total Estimated Utility System Losses	**$0.00 M**	**$0.00 M**	**$15.90 M**	**$0.00 M**	**$1.27 M**	**$0.00 M**
Total Estimated Transportation System Losses	**$3.90 M**	**$4.70 M**	**$26.43**	**$4.70 M**	**$8.20 M**	**$8.00 M**
Personal Injury Estimates	**90-155**	**60-84**	**734-1,177**	**125-175**	**281-421**	**460-596**

State Assets

All state assets are assumed to be at risk of earthquake (see Table 6-7), although that risk varies by Preparedness rea. For purposes of this analysis, the State assumed losses to state owned facilities up to 50% of total asset value for assets at high risk of drought, 25% for assets at medium risk, and 10% for assets at low risk; risk ratings were based on the ratings in Table 6-3 Hazard Risk Rankings by Preparedness Area. Table 6-30 shows estimated losses for state assets from earthquake; these estimates are for planning purposes only and should not be used for insurance purposes.

Table 6-30 Potential Losses to State Assets From Earthquake

County	Total	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
PA 1						
Chaves	**5**	1	3	1	$48,197,000	**$12,049,250**
Curry	**1**	-	1	-	$933,000	**$233,250**
PA 2						
Colfax	**3**	1	2	-	$89,310,000	**$22,327,500**
San Miguel	**3**	1	1	1	$152,965,000	**$38,241,250**

County	Total	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
PA 3						
Rio Arriba	**1**	-	1	-	$558,985	**$55,899**
Santa Fe	**16**	-	14	2	$602,912,704	**$60,291,270**
Taos	**1**	-	1	-	$501,000	**$50,100**
PA 4						
Cibola	**2**	-	1	1	$39,102,000	**$0**
McKinley	**1**	-	1	-	$2,807,000	**$0**
PA 5						
Bernalillo	**6**	3	2	1	$393,344,167	**$39,334,417**
Sandoval	**1**	-	1	-	$17,085,000	**$1,708,500**
Socorro	**1**	-	1	-	$3,026,251	**$302,625**
Valencia	**3**	1	2	-	$148,620,000	**$14,862,000**
PA 6						
Dona Ana	**2**	-	2	-	$76,250,000	**$7,625,000**
Grant	**1**	1	-	-	$0	**$0**
Luna	**1**	-	-	1	$9,553,000	**$955,300**
Sierra	**1**	1	-	-	$24,528,000	**$2,452,800**
Total	**49**	**9**	**33**	**7**	**$1,609,693,107**	**$200,489,161**

Preparedness Area 1

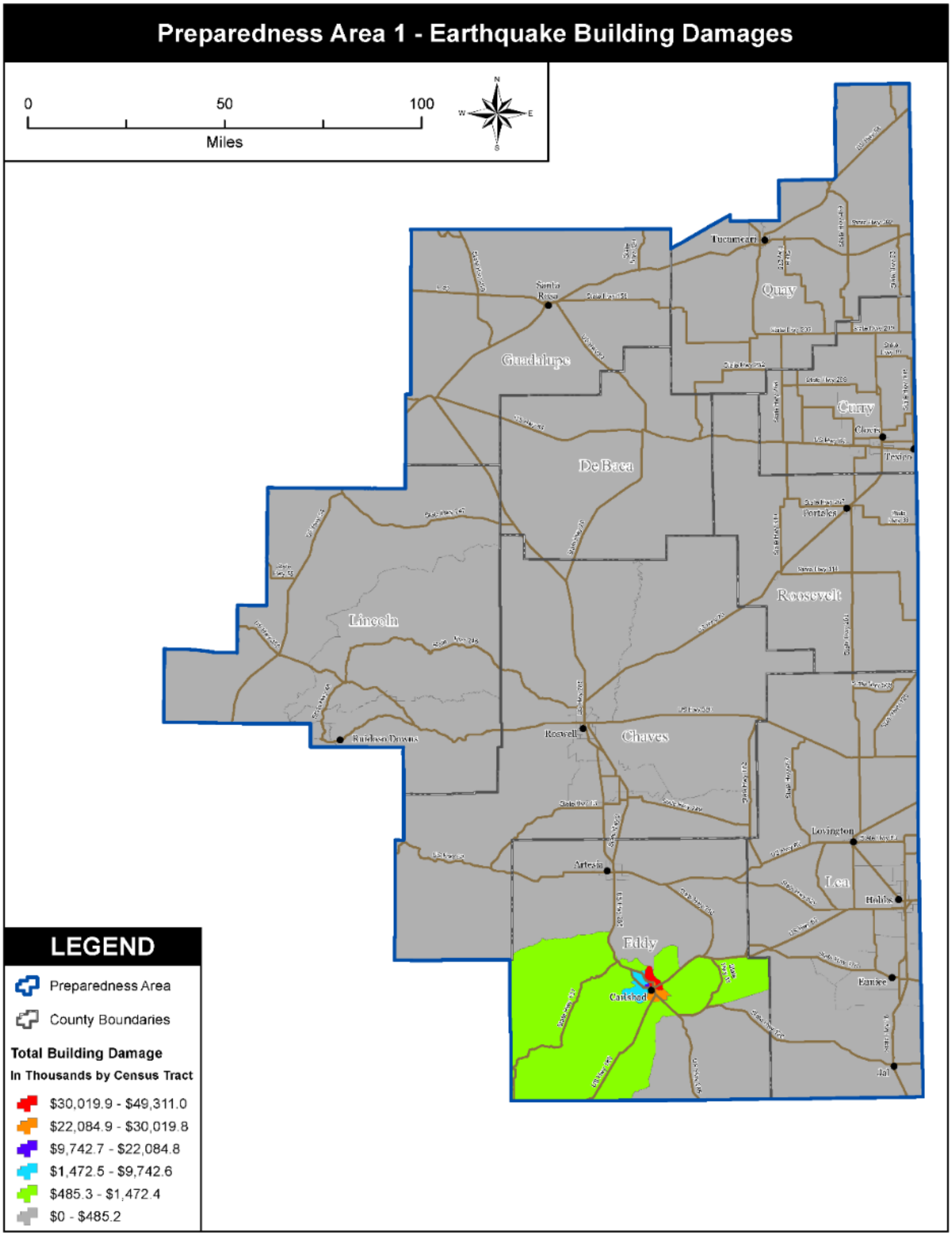
The following Table 6-31 presents the expected building-related economic loss estimates for the most probable maximum magnitude earthquake event modeled in the southwest part of Preparedness Area 1. Figure 6-49 shows building damages by census tract on a map. The southwest corner of the Preparedness Area would experience the most in building damages as a result of the modeled earthquake.

Table 6-31 Hazus Earthquake Building-Related Loss Estimates (Preparedness Area 1)

Loss Estimates	Single Family	Other Residential	Commercial	Industrial	Others	Total
Wage	$0.00 M	$2.19 M	$10.88 M	$0.15 M	$0.82 M	$14.03 M
Capital-Related	$0.00 M	$0.93 M	$9.43 M	$0.10 M	$0.24 M	$10.70 M
Rental	$5.58 M	$2.97 M	$4.97 M	$0.06 M	$0.45 M	$14.03 M
Relocation	19.60 M	$2.33 M	$7.79 M	$0.41 M	$3.76 M	$33.89 M
Income Losses (subtotal)	*$25.18 M*	*$8.43 M*	*$33.06 M*	*$0.72 M*	*$5.26 M*	*$72.65 M*
Structural	$28.08 M	$5.06 M	$11.63 M	$1.12 M	$4.47 M	$50.36 M
Non-Structural	$94.64 M	$21.32 M	$28.65 M	$3.17 M	$9.74 M	$157.53 M
Content	$34.25 M	$5.47 M	$14.80 M	$2.03 M	$5.46 M	$62.01 M
Inventory	$0.00 M	$0.00 M	$0.46 M	$0.33 M	$0.16 M	$0.95 M

Loss Estimates	Single Family	Other Residential	Commercial	Industrial	Others	Total
Capital Stock Losses (subtotal)	*$156.97 M*	*$31.85 M*	*$55.54 M*	*$6.65 M*	*$19.84 M*	*$270.84 M*
Total Estimated Losses	**$182.15 M**	**$40.28 M**	**$88.60 M**	**$7.36 M**	**$25.10 M**	**$343.49 M**

Figure 6-49 Hazus Earthquake Building-Related Loss Estimates by Census Tract (PA1)



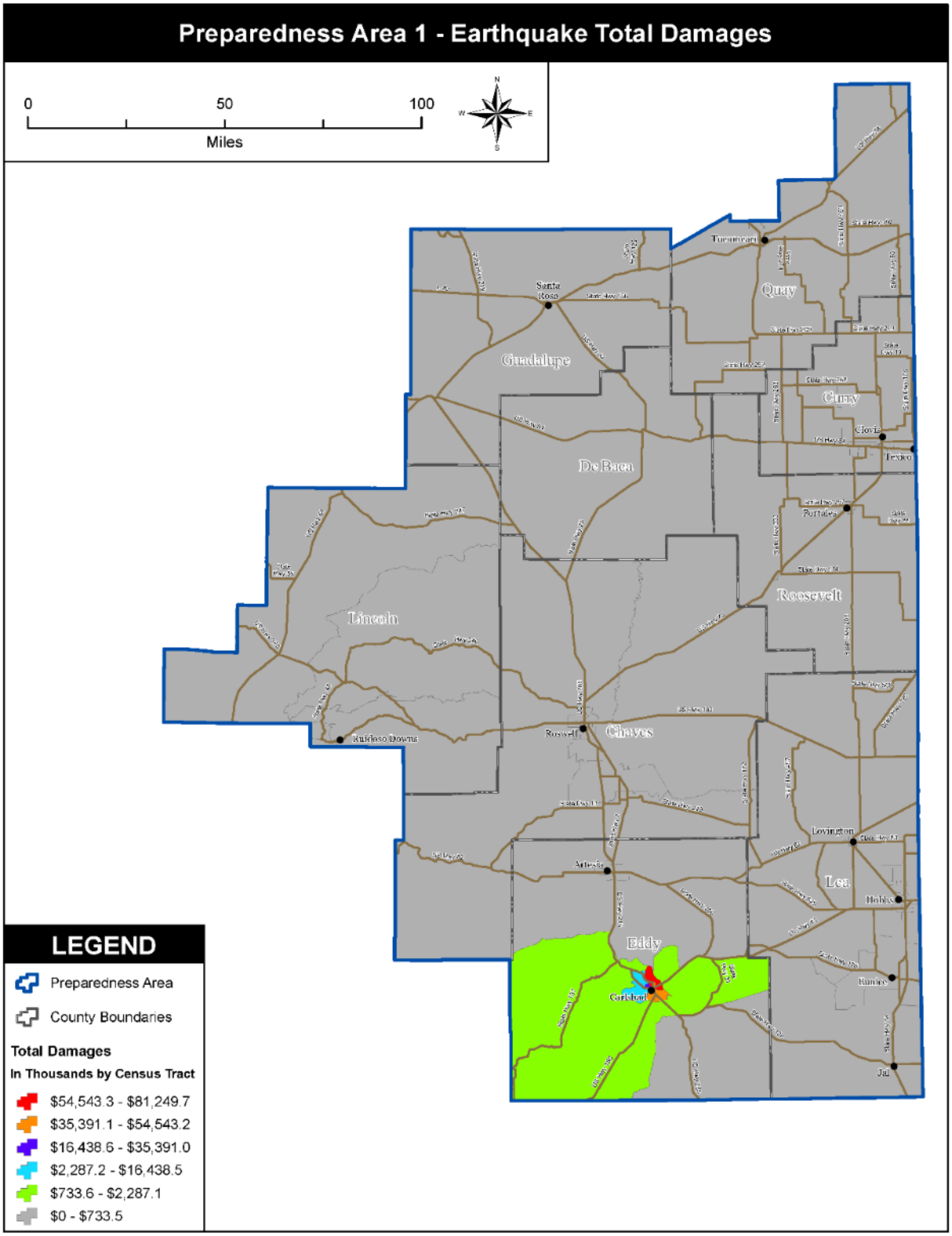
The following Table 6-32 presents additional modeled impacts from this same modeled event. Note that all definitions are taken from the Hazus Global Summary Report (GSR).

Table 6-32 Hazus Earthquake Impacts and Loss Estimates (PA 1)

Impact	Summary of Modeled Impacts
Total Buildings Damaged	Slight: 3,466
	Moderate: 2,498
	Extensive: 1,012
	Complete: 185
Total Economic Losses (includes building and lifeline losses)	$347.35 million
Damage to Schools	0 with at least moderate damage
Damage to Medical Facilities	0 with at least moderate damage
Damage to Fire Stations	0 with at least moderate damage
Damage to Transportation Systems	0 highway bridges, at least moderate damage
	0 highway bridges, complete damage
	0 railroad bridges, moderate damage
	0 airport facilities, moderate damage
Households without Power/Water Service	Power loss, Day 1: 0
	Water loss, Day 1: 0
	Water loss, Day 3: 0
	Water loss, Day 7: 0
	Water loss, Day 30: 0
	Water loss, Day 90: 0
Displaced Households	248
Shelter Requirements	168 people out of 288,670 total population
Debris Generation	0.14 million tons

Figure 6-50 shows total damages resulting from an earthquake in Preparedness Area 1 by census tract. Similar to building damages, the southwest corner of the Preparedness Area would experience the most total damages as a result of an earthquake.

Figure 6-50 Total Earthquake Damages by Census Tract (– Preparedness Area 1)



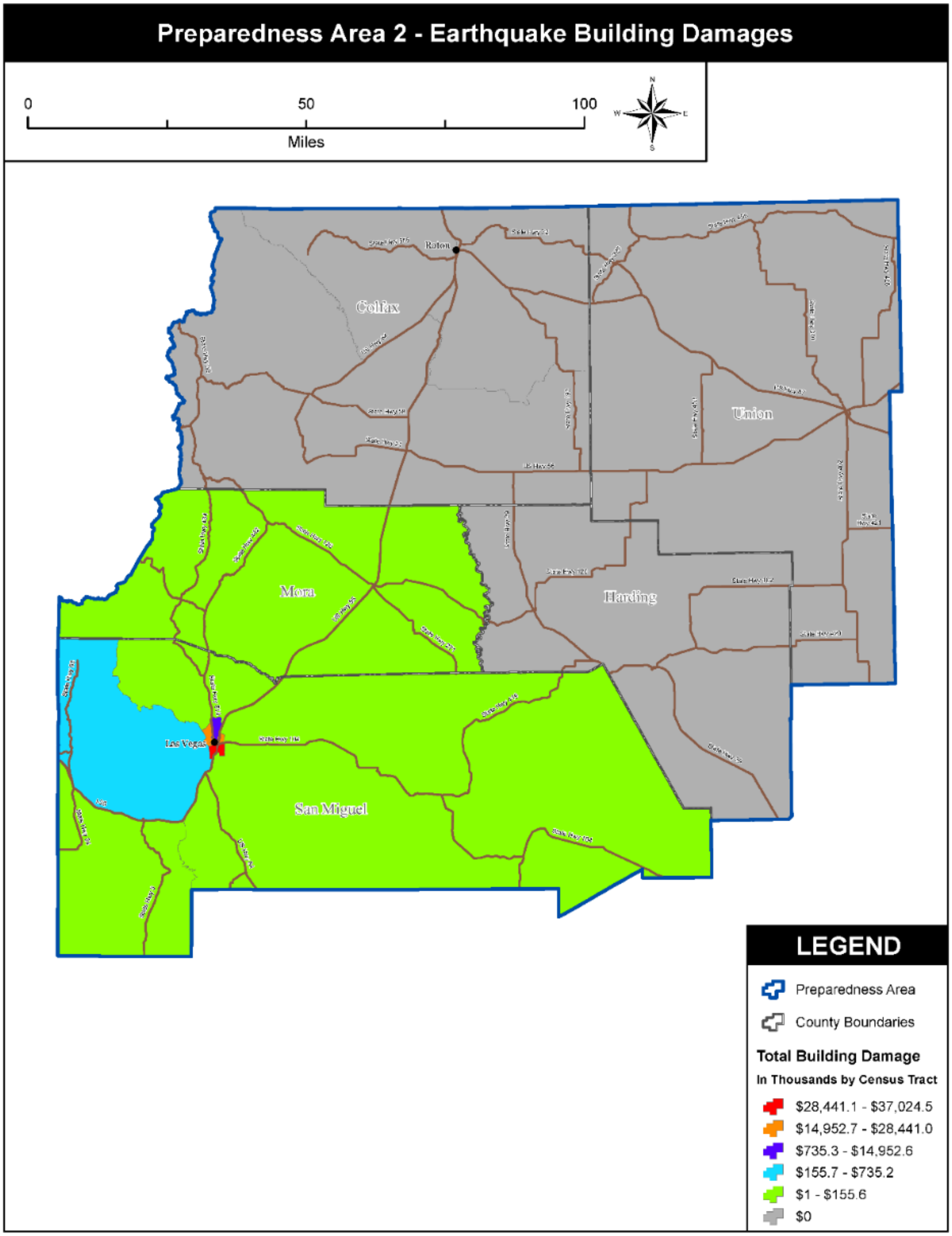
Preparedness Area 2

The following Table 6-33 presents the expected building-related economic loss estimates for a probable maximum earthquake event modeled in Preparedness Area 2. The total building-related losses were $177.27 million; 23% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 63% of the total loss. As shown in Figure 6-51, the southwest portion of the Preparedness Area would experience the most in building damages as a result of the modeled earthquake.

Table 6-33 Hazus Earthquake Building-Related Loss Estimates (PA 2)

Loss Estimates	Single Family	Other Residential	Commercial	Industrial	Others	Total
Wage	$0.00 M	$1.09 M	$6.71 M	$0.05 M	$0.74 M	$8.58 M
Capital-Related	$0.00 M	$0.47 M	$5.61 M	$0.03 M	$0.09 M	$6.19 M
Rental	$2.24 M	$3.08 M	$2.89 M	$0.01 M	$0.31 M	$8.54 M
Relocation	$7.87 M	$3.69 M	$4.62 M	$0.12 M	$1.82 M	$18.11 M
Income Losses (subtotal)	***$10.10 M***	***$8.32 M***	***$19.83 M***	***$0.20 M***	***$2.97 M***	***$41.42 M***
Structural	$9.61 M	$7.55 M	$6.56 M	$0.27 M	$1.68 M	$25.68 M
Non-Structural	$32.25 M	$26.21 M	$16.40 M	$0.80 M	$4.79 M	$80.45 M
Content	$11.65 M	$6.07 M	$8.66 M	$0.45 M	$2.52 M	$29.34 M
Inventory	$0.00 M	$0.00 M	$0.28M	$0.09 M	$0.01 M	$0.37 M
Capital Stock Losses (subtotal)	***$53.51 M***	***$39.82 M***	***$31.91 M***	***$1.61 M***	***$9.00 M***	***$135.85 M***
Total Estimated Losses	**$63.62 M**	**$48.14 M**	**$51.73 M**	**$1.81 M**	**$11.96 M**	**$177.27 M**

Figure 6-51 Hazus Earthquake Building-Related Loss Estimates by Census Tract (PA 2)



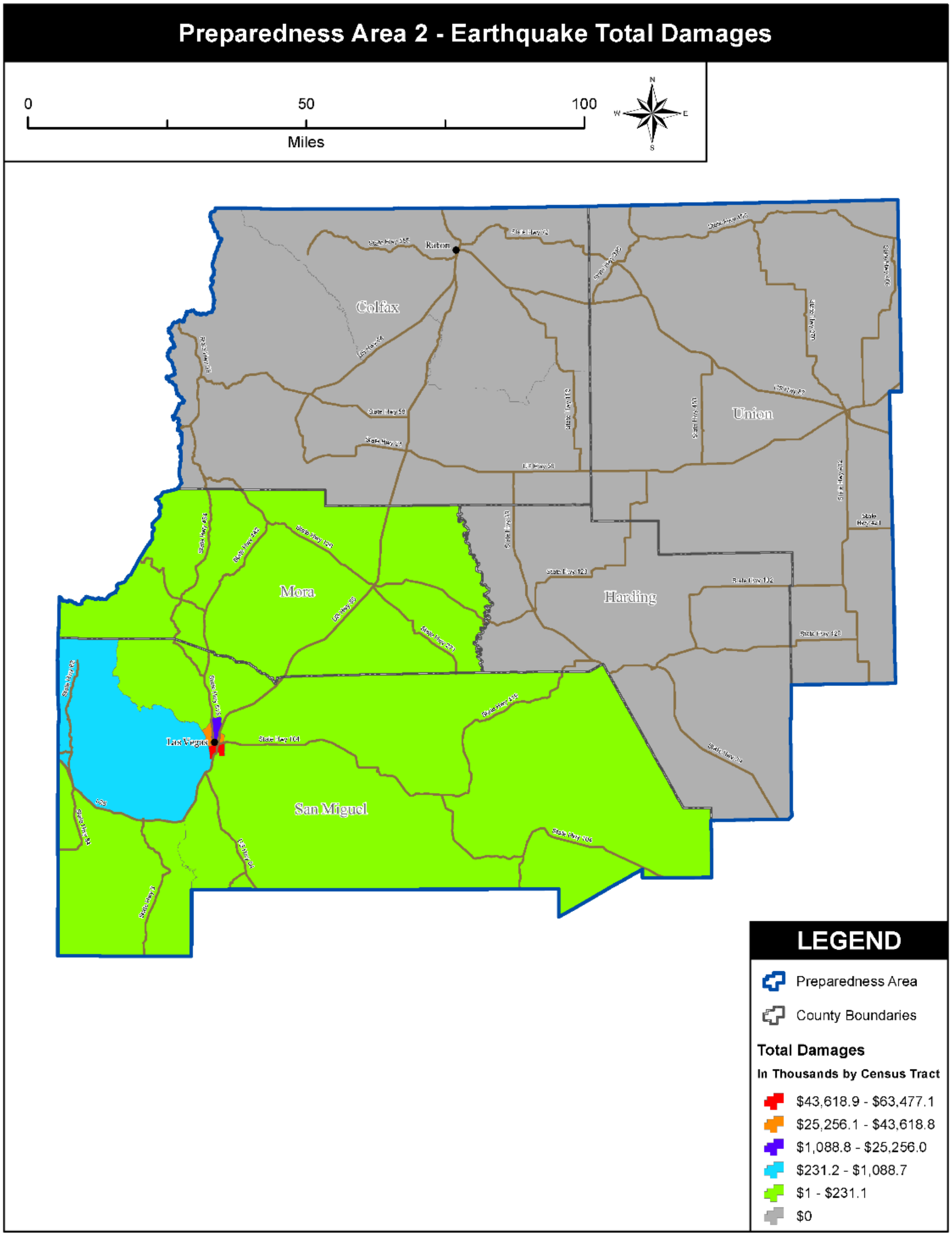
The following Table 6-34 presents additional modeled impacts from this same event. Note that all definitions are taken from the Hazus Global Summary Report (GSR).

Table 6-34 Hazus Earthquake Impacts and Loss Estimates (PA 2)

Impact	Summary of Modeled Impacts
Total Buildings Damaged	Slight: 2,044
	Moderate: 1,743
	Extensive: 829
	Complete: 174
Total Economic Losses (includes building and lifeline losses)	$182 million
Damage to Schools	0 with at least moderate damage
Damage to Medical Facilities	0 with at least moderate damage
Damage to Fire Stations	0 with at least moderate damage
Damage to Transportation Systems	0 highway bridges, at least moderate damage
	0 highway bridges, complete damage
	0 railroad bridges, moderate damage
	0 airport facilities, moderate damage
Households without Power/Water Service	Power loss, Day 1: 0
	Water loss, Day 1: 0
	Water loss, Day 3: 0
	Water loss, Day 7: 0
	Water loss, Day 30: 0
	Water loss, Day 90: 0
Displaced Households	175
Shelter Requirements	148 people out of 53,268 total population
Debris Generation	0.08 million tons

Figure 6-52 shows total damages resulting from the modeled earthquake in Preparedness Area 2 by census tract. Similar to building damages, the southwest portion of the Preparedness Area would experience the most in total damages due to the modeled earthquake.

Figure 6-52 Total Earthquake Damages by Census Tract (PA 2)



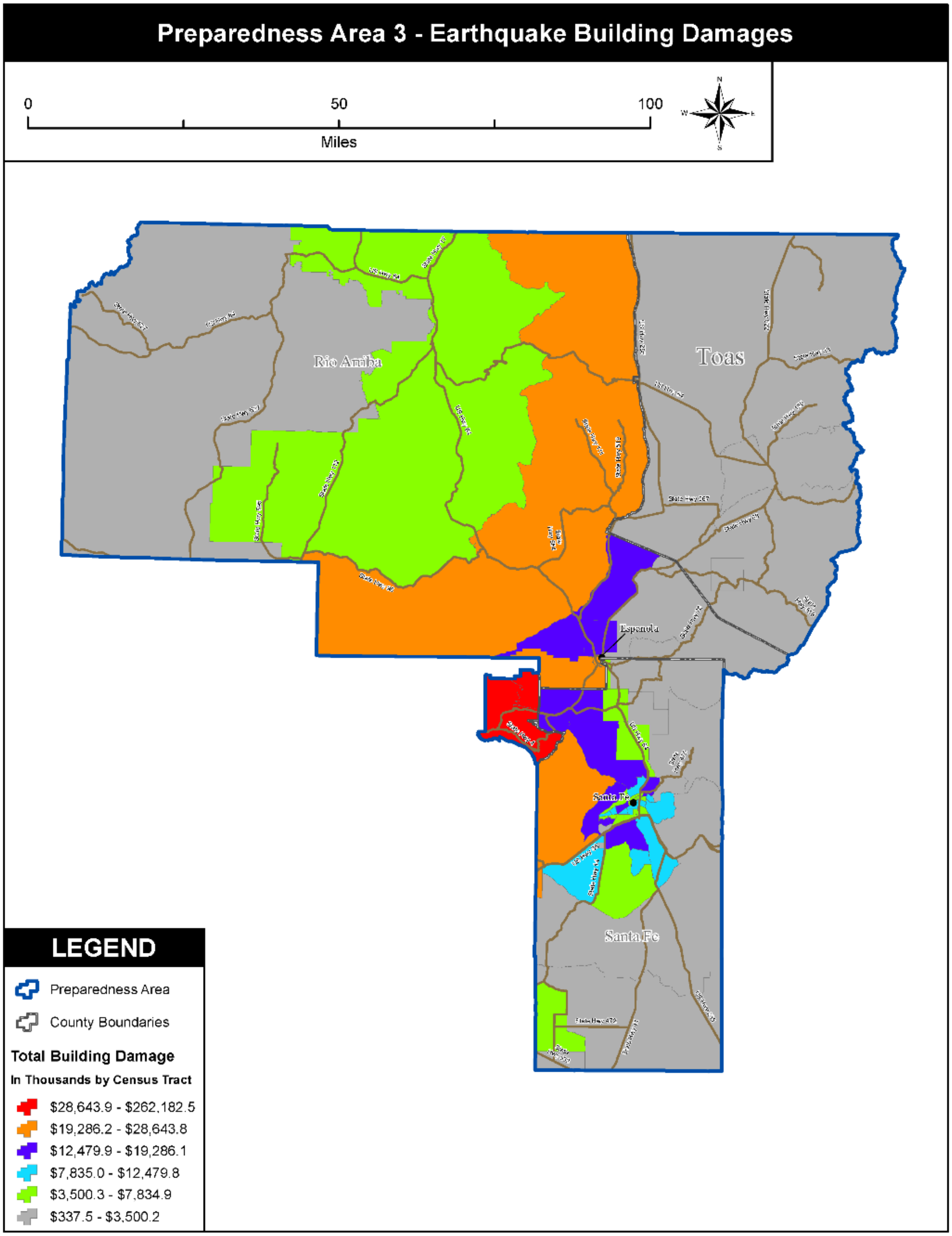
Preparedness Area 3

The following Table 6-35 presents the expected building-related economic loss estimates for a modeled probable maximum earthquake event in Preparedness Area 3. As shown in Figure 6-53, the central portion of the Preparedness Area would experience the most in building damages as a result of this modeled earthquake.

Table 6-35 Hazus Earthquake Building-Related Loss Estimates (PA 3)

Loss Estimates	Single Family	Other Residential	Commercial	Industrial	Others	Total
Wage	$0.00 M	$8.83 M	$62.49 M	$1.28 M	$6.45 M	$79.05 M
Capital-Related	$0.00 M	$3.77 M	$56.70 M	$0.77 M	$1.33 M	$62.56 M
Rental	$31.09 M	$18.58 M	$24.44 M	$0.50 M	$3.48 M	$78.08 M
Relocation	$106.33 M	$24.92 M	$38.27 M	$2.89 M	$23.40 M	$195.82 M
Income Losses (subtotal)	***$137.42 M***	***$56.10 M***	***$181.90 M***	***$5.44 M***	***$34.66 M***	***$415.51 M***
Structural	$205.13 M	$44.40 M	$59.77 M	$9.44 M	$20.26 M	$339.00 M
Non-Structural	$661.69 M	$161.66 M	$179.84 M	$29.37 M	$61.23 M	$1,093.78 M
Content	$178.18 M	$31.65 M	$83.54 M	$18.78 M	$28.89 M	$341.03 M
Inventory	$0.00 M	$0.00 M	$1.52 M	$2.99 M	$0.12 M	$4.63 M
Capital Stock Losses (subtotal)	***$1,045.00 M***	***$237.72 M***	***$324.67 M***	***$60.57 M***	***$110.50 M***	***$1,778.45 M***
Total Estimated Losses	**$1,182.42 M**	**$293.82 M**	**$506.57 M**	**$66.00 M**	**$145.15 M**	**$2,193.96 M**

Figure 6-53 Hazus Earthquake Building-Related Loss Estimates by Census Tract (PA 3)



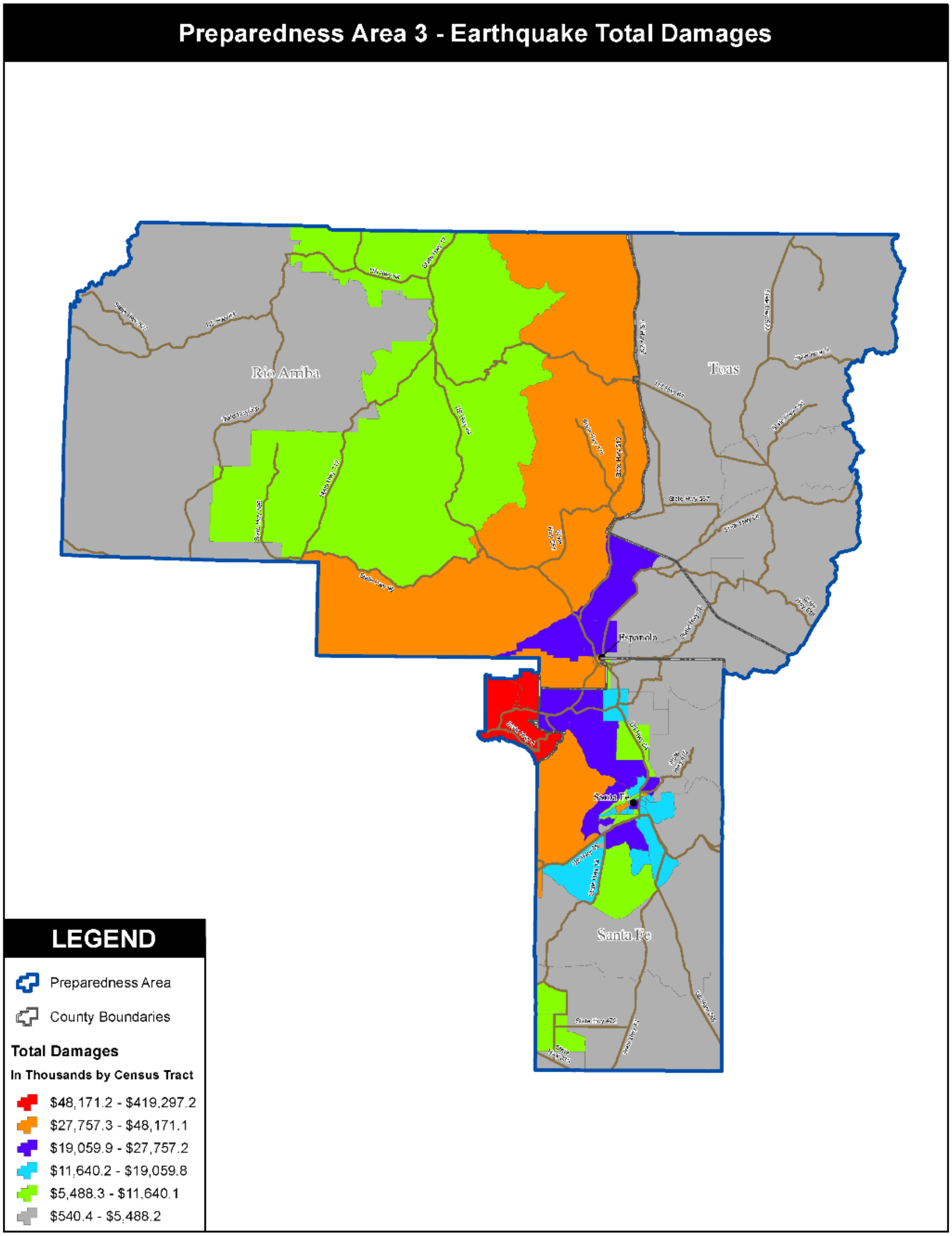
The following Table 6-36 presents additional modeled impacts from this same event. Note that all definitions are taken from the Hazus Global Summary Report (GSR).

Table 6-36 Hazus Earthquake Impacts and Loss Estimates (PA 3)

Impact	Summary of Modeled Impacts
Total Buildings Damaged	Slight: 17,296
	Moderate: 12,728
	Extensive: 5,239
	Complete: 2,224
Total Economic Losses (includes building and lifeline losses)	$2,236.33 million
Damage to Schools	15 with at least moderate damage
Damage to Medical Facilities	2 with at least moderate damage
Damage to Fire Stations	15 with at least moderate damage
Damage to Transportation Systems	5 highway bridges, at least moderate damage
	0 highway bridges, complete damage
	0 railroad bridges, moderate damage
	1 airport facilities, moderate damage
Households without Power/Water Service	Power loss, Day 1: 0
	Water loss, Day 1: 0
	Water loss, Day 3: 0
	Water loss, Day 7: 0
	Water loss, Day 30: 0
	Water loss, Day 90: 0
Displaced Households	2,032
Shelter Requirements	999 people out of 235,303 total population
Debris Generation	0.74 million tons

Figure 6-54 shows total damages resulting from an earthquake in Preparedness Area 3 by census tract. Similar to building damages, the central portion of the Preparedness Area would experience the most in total damages due to an earthquake.

Figure 6-54 Total Earthquake Damages by Census Tract (PA 3)



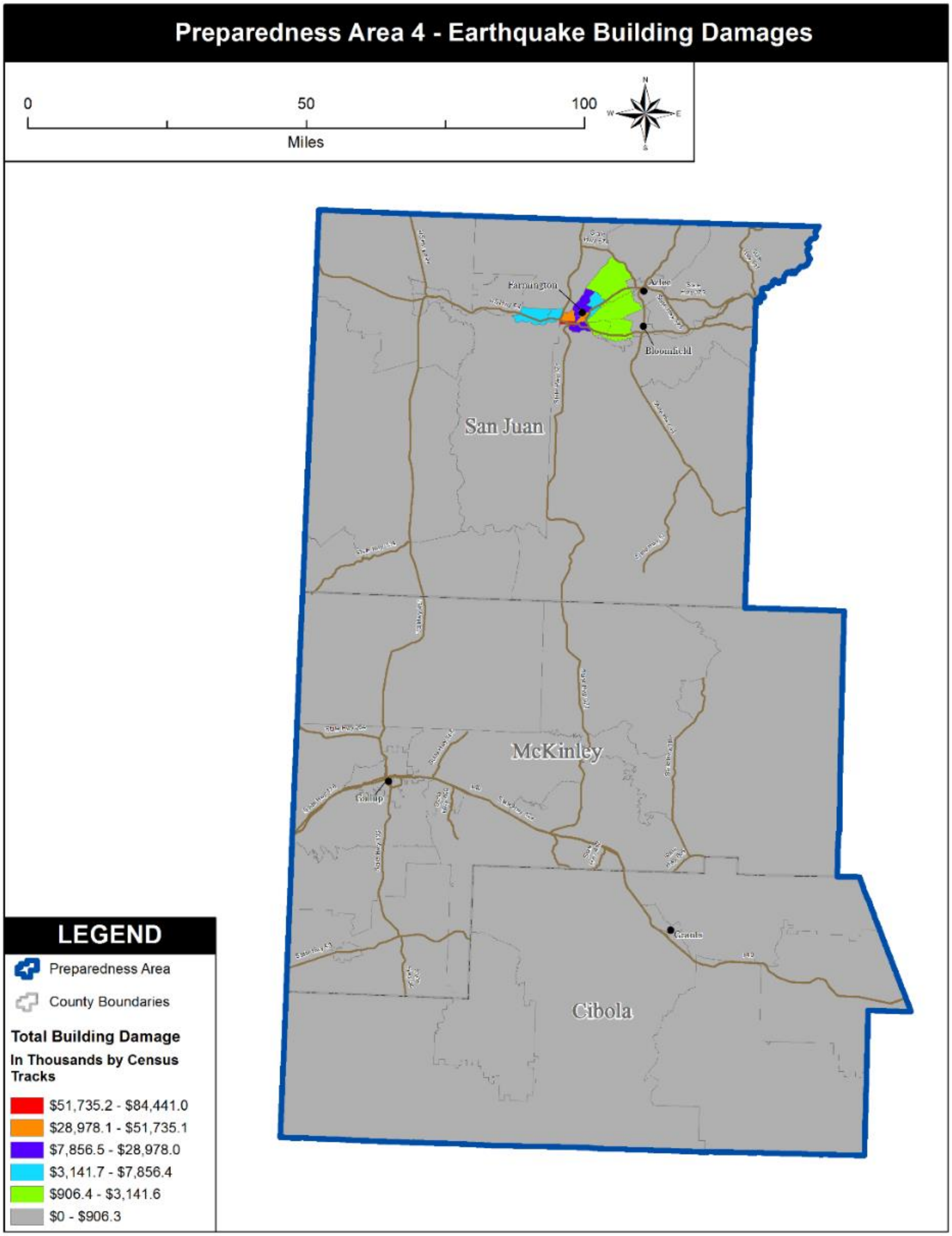
Preparedness Area 4

The following Table 6-37 presents the expected building-related economic loss estimates for a probable maximum earthquake event modeled in Preparedness Area 4. Figure 6-55 shows this information by census tract on a map. Only a small portion of the north-central region of the Preparedness Area would account for the building damages experienced from this modeled earthquake.

Table 6-37 Hazus Earthquake Building-Related Loss Estimates (PA 4)

Loss Estimates	Single Family	Other Residential	Commercial	Industrial	Others	Total
Wage	$0.00 M	$2.16 M	$24.08 M	$0.62 M	$1.42 M	$28.28 M
Capital-Related	$0.00 M	$0.92 M	$17.93 M	$0.69 M	$0.33 M	$19.87 M
Rental	$5.27 M	$4.66 M	$9.53 M	$0.37 M	$0.56 M	$20.38 M
Relocation	$18.57 M	$6.47 M	$17.36 M	$2.17 M	$5.40 M	$49.96 M
Income Losses (subtotal)	***$23.84 M***	***$14.20 M***	***$68.90 M***	***$3.85 M***	***$7.71 M***	***$118.50 M***
Structural	$29.40 M	$11.03 M	$24.14 M	$7.37 M	$5.07 M	$77.01 M
Non-Structural	$100.51 M	$38.70 M	$59.67 M	$20.34 M	$13.96 M	$233.18 M
Content	$36.98 M	$8.95 M	$33.25 M	$14.69 M	$7.49 M	$101.35 M
Inventory	$0.00 M	$0.00 M	$0.95 M	$1.73 M	$0.04 M	$2.72 M
Capital Stock Losses (subtotal)	***$166.90 M***	***$58.67 M***	***$118.01 M***	***$44.12 M***	***$26.56 M***	***$414.26 M***
Total Estimated Losses	**$190.73 M**	**$72.88 M**	**$186.91 M**	**$47.97 M**	**$34.27 M**	**$532.76 M**

Figure 6-55 Hazus Earthquake Building-Related Loss Estimates by Census Tract (PA 4)



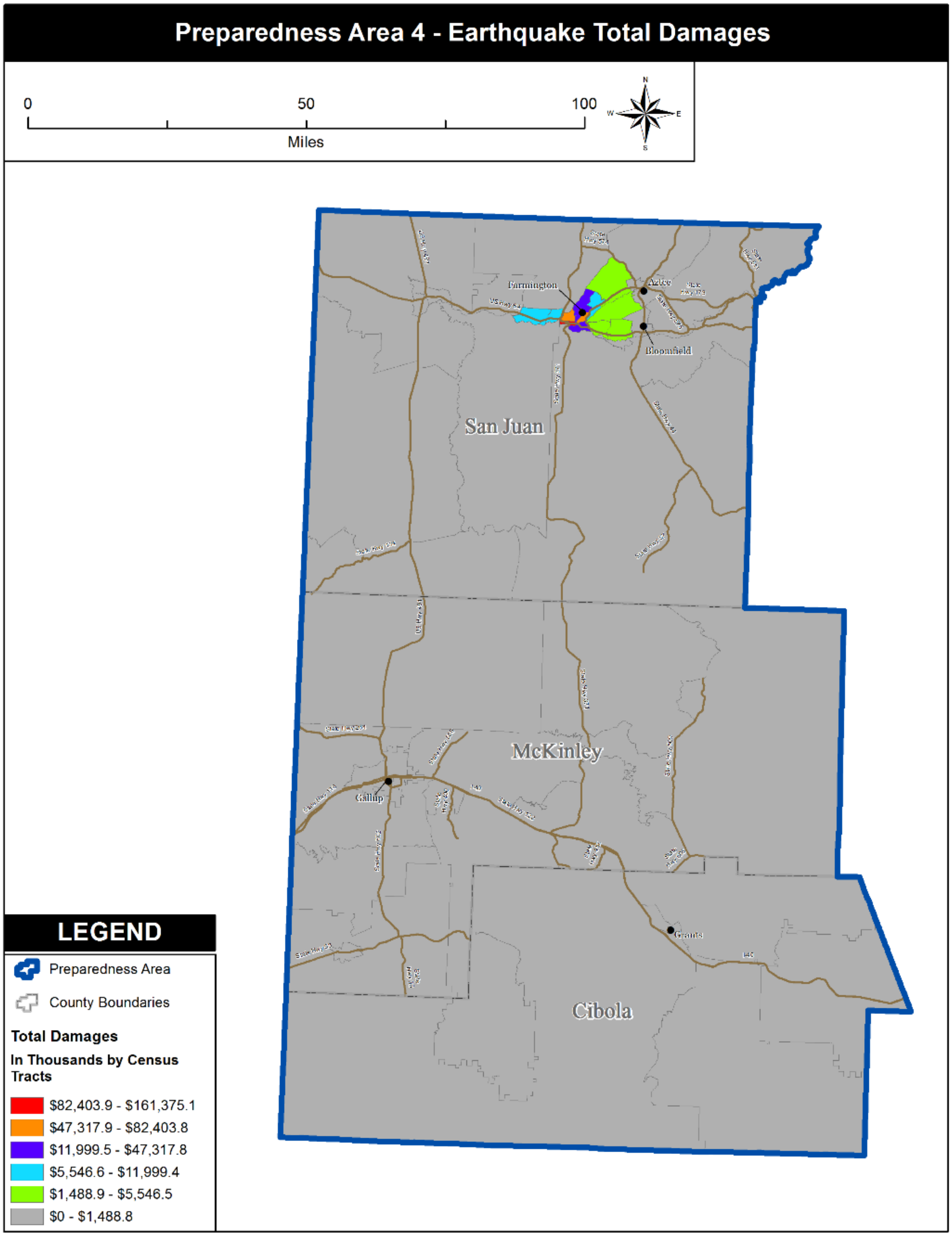
The following Table 6-38 presents additional modeled impacts from this same event. Note that all definitions are taken from the Hazus Global Summary Report (GSR).

Table 6-38 Hazus Earthquake Impacts and Loss Estimates (PA 4)

Impact	Summary of Modeled Impacts
Total Buildings Damaged	Slight: 6,087
	Moderate: 4,312
	Extensive: 1,384
	Complete: 221
Total Economic Losses (includes building and lifeline losses)	$537.50 million
Damage to Schools	0 with at least moderate damage
Damage to Medical Facilities	0 with at least moderate damage
Damage to Fire Stations	0 with at least moderate damage
Damage to Transportation Systems	0 highway bridges, at least moderate damage
	0 highway bridges, complete damage
	0 railroad bridges, moderate damage
	1 airport facility, moderate damage
Households without Power/Water Service	Power loss, Day 1: 0
	Water loss, Day 1: 0
	Water loss, Day 3: 0
	Water loss, Day 7: 0
	Water loss, Day 30: 0
	Water loss, Day 90: 0
Displaced Households	312
Shelter Requirements	211 people out of 228,749 total population
Debris Generation	0.19 million tons

Figure 6-56 shows total damages resulting from an earthquake in Preparedness Area 4 by census tract. Similar to building damages, a small area of the north-central region of the Preparedness Area would experience the most in total damages due to the modeled earthquake.

Figure 6-56 Total Earthquake Damages by Census Tract (PA 4)



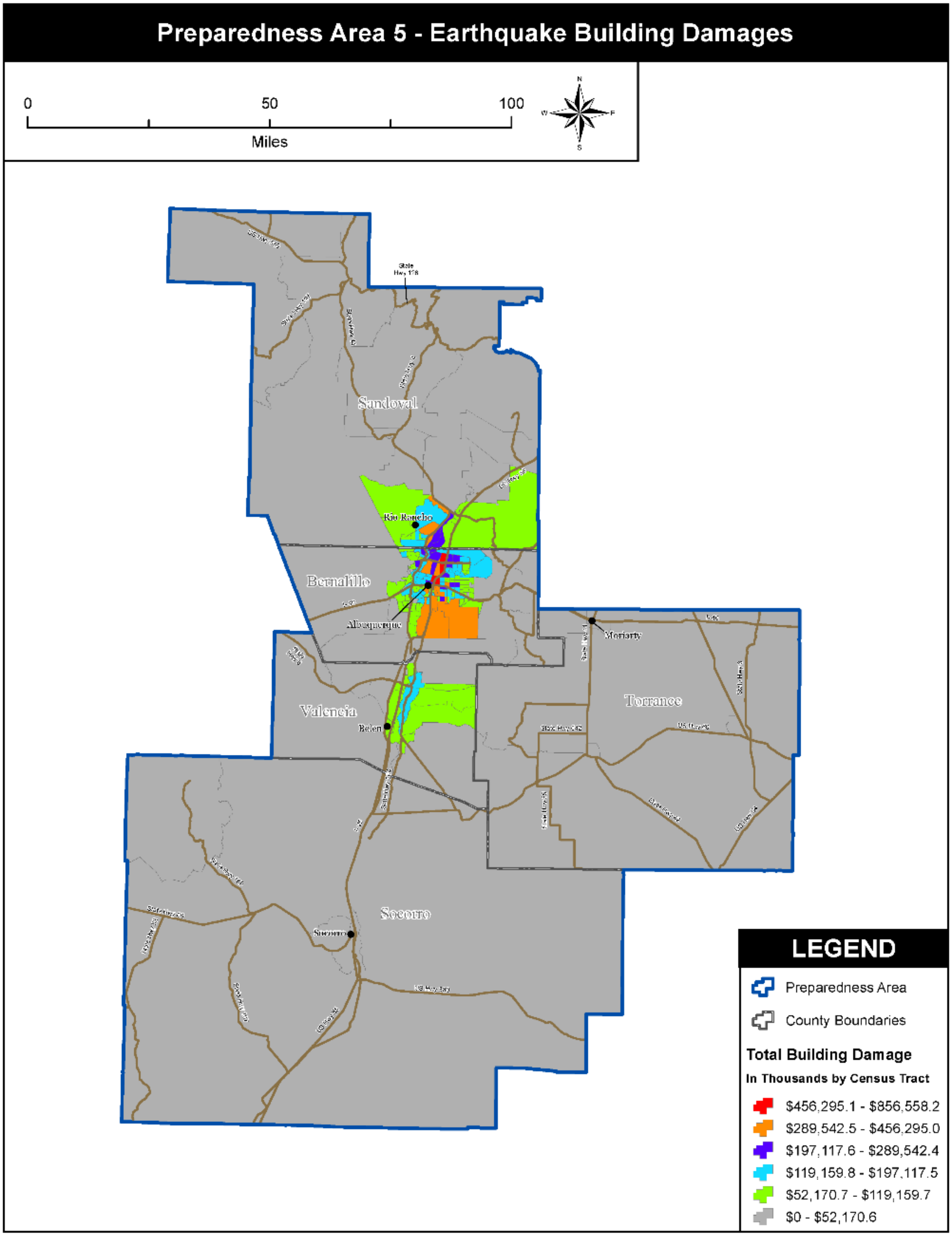
Preparedness Area 5

The following Table 6-39 presents the expected building-related economic loss estimates for a probable maximum earthquake event modeled in Preparedness Area 5. Figure 6-57 shows building damage information by census tract on a map. The north-central region of the Preparedness Area would experience the most in building damages due to the modeled earthquake.

Table 6-39 Hazus Earthquake Building-Related Loss Estimates (PA 5)

Loss Estimates	Single Family	Other Residential	Commercial	Industrial	Others	Total
Wage	$0.00 M	$113.66 M	$1,254.61 M	$36.86 M	$63.27 M	$1,468.41 M
Capital-Related	$0.00 M	$48.49 M	$1,174.82 M	$21.68 M	$16.16 M	$1,261.14 M
Rental	$572.70 M	$355.17 M	$510.16 M	$11.35 M	$37.34 M	$1,486.73 M
Relocation	$1,915.93 M	$283.97 M	$753.89 M	$54.19 M	$262.80 M	$3,270.77 M
Income Losses (subtotal)	***$2,488.63 M***	***$801.29 M***	***$3,693.48 M***	***$124.08 M***	***$379.57 M***	***$7,487.05 M***
Structural	$3,301.10 M	$710.98 M	$1,596.16 M	$240.25 M	$280.94 M	$6,129.43 M
Non-Structural	$10,644.01 M	$3,254.21 M	$5,403.24 M	$1,015.39 M	$1,006.26 M	$21,323.11 M
Content	$2,411.90 M	$678.87 M	$2,513.23 M	$640.29 M	$461.20 M	$6,705.49 M
Inventory	$0.00 M	$0.00 M	$64.59 M	$111.07 M	$3.11 M	$178.76 M
Capital Stock Losses (subtotal)	***$16,357.00 M***	***$4,644.06 M***	***$9,577.22 M***	***$2,007.00 M***	***$1,751.50 M***	***$34,336.78 M***
Total Estimated Losses	**$18,845.64 M**	**$5,445.35 M**	**$13,270.71 M**	**$2,131.07 M**	**$2,131.07 M**	**$41,823.83 M**

Figure 6-57 Hazus Earthquake Building-Related Loss Estimates by Census Tract (PA 5)



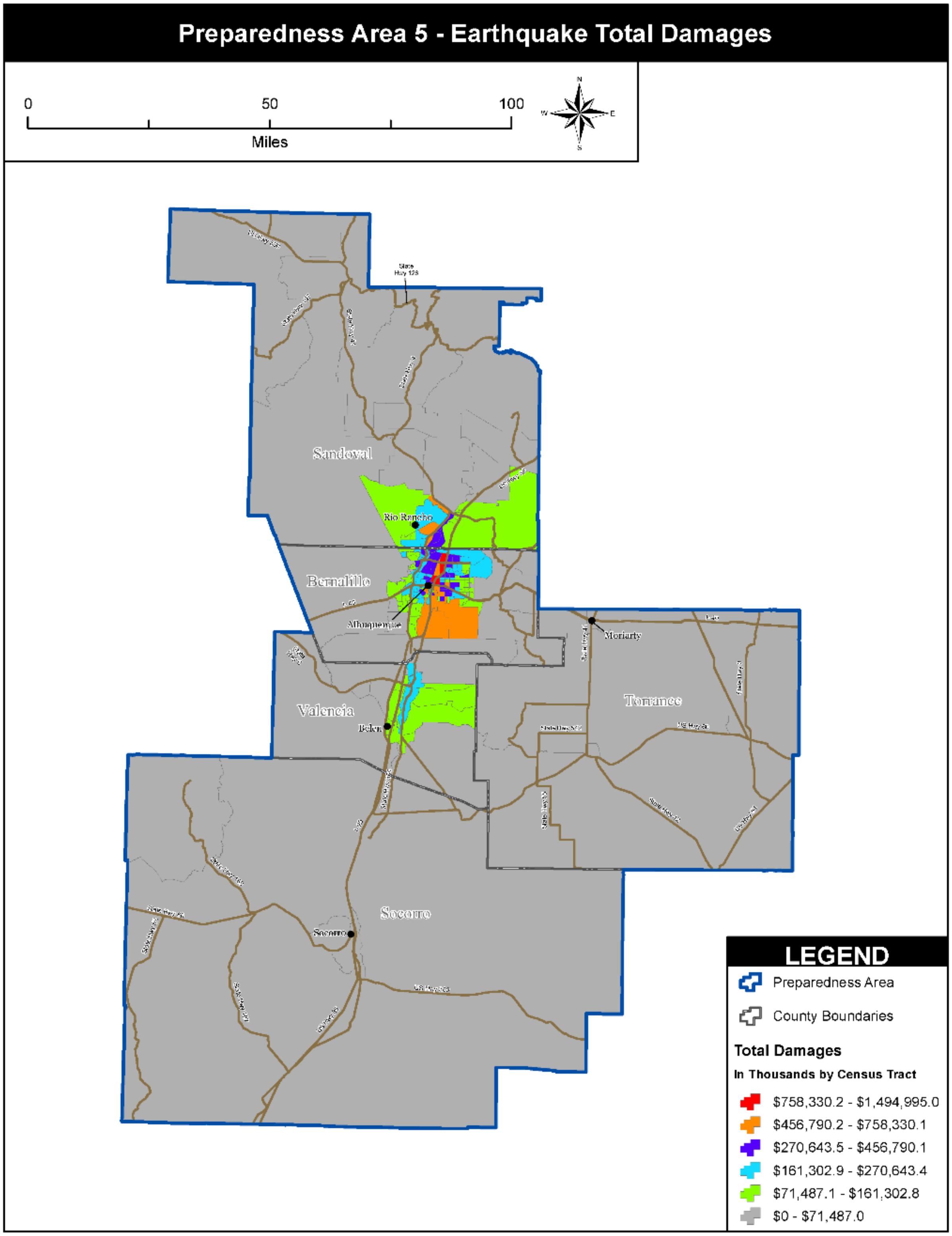
The following Table 6-40 presents additional modeled impacts from this same event. Note that all definitions are taken from the Hazus Global Summary Report (GSR).

Table 6-40 Hazus Earthquake Impacts and Loss Estimates (PA 5)

Impact	Summary of Modeled Impacts
Total Buildings Damaged	Slight: 70,823
	Moderate: 79,760
	Extensive: 52,368
	Complete: 68,581
Total Economic Losses (includes building and lifeline losses)	$41,977.57 million
Damage to Schools	122 with at least moderate damage
Damage to Medical Facilities	18 with at least moderate damage
Damage to Fire Stations	4 with at least moderate damage
Damage to Transportation Systems	143 highway bridges, at least moderate damage
	67 highway bridges, complete damage
	0 railroad bridges, moderate damage
	1 airport facilities, moderate damage
Households without Power/Water Service	Power loss, Day 1: 0
	Water loss, Day 1: 0
	Water loss, Day 3: 0
	Water loss, Day 7: 0
	Water loss, Day 30: 0
	Water loss, Day 90: 0
Displaced Households	67,228
Shelter Requirements	44,206 people out of 904,943 total population
Debris Generation	14.41 million tons

Figure 6-58 shows total damages resulting from the modeled earthquake in Preparedness Area 5. Similar to building damages, the north-central region of the area would experience the most in total damages.

Figure 6-58 Total Earthquake Damages by Census Tract (PA 5)



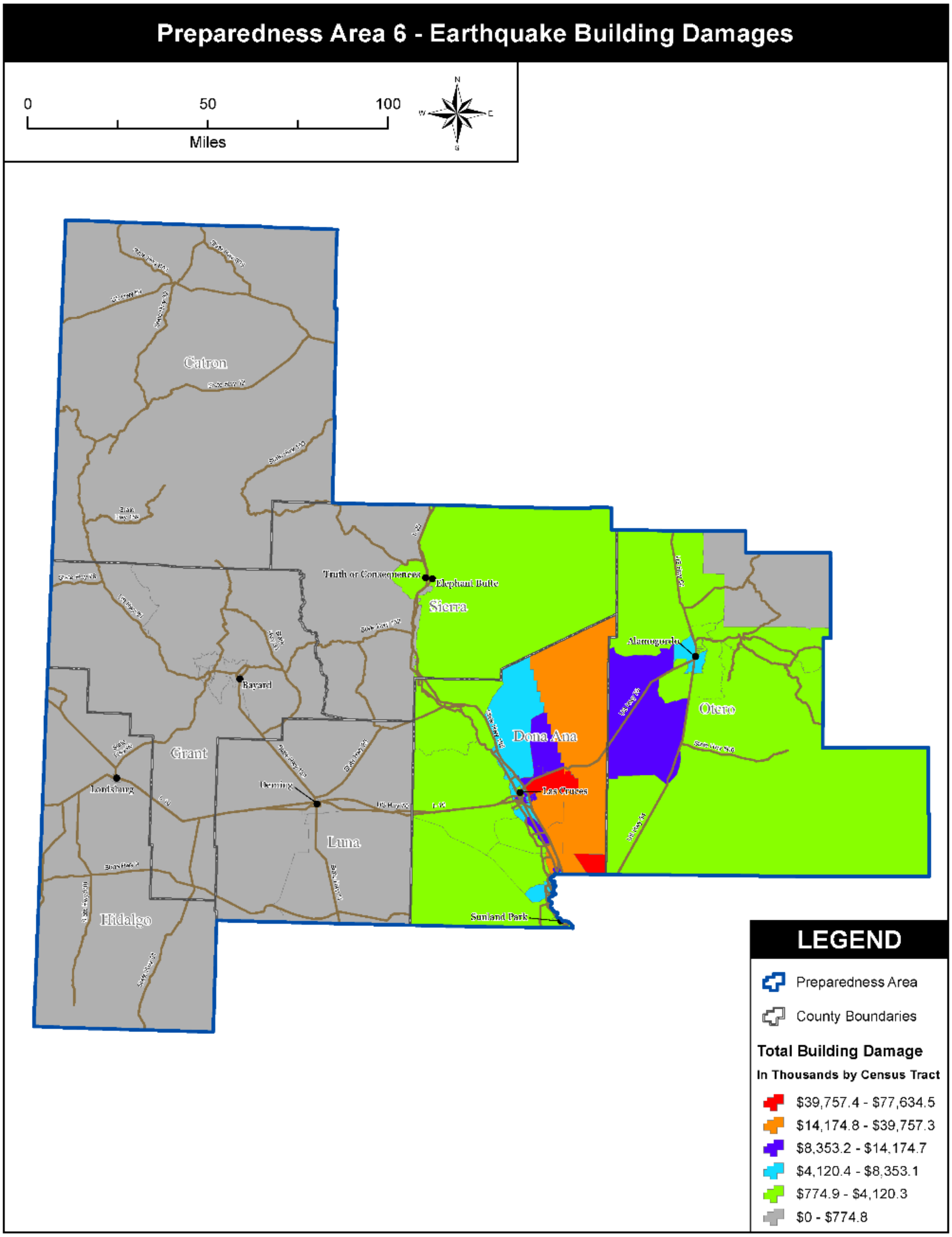
Preparedness Area 6

The following Table 6-41 presents the expected building-related economic loss estimates for a probable maximum earthquake event modeled in Preparedness Area 6. Figure 6-59 shows building damage information by census tract on a map. The eastern region of the Preparedness Area would experience the most in building damages due to the modeled earthquake.

Table 6-41 Hazus Earthquake Building-Related Loss Estimates (PA 6)

Loss Estimates	Single Family	Other Residential	Commercial	Industrial	Others	Total
Wage	$0.00 M	$2.83 M	$26.37 M	$0.74 M	$3.41 M	$33.35 M
Capital-Related	$0.00 M	$1.21 M	$22.78 M	$0.44 M	$0.56 M	$24.98 M
Rental	$10.76 M	$11.09 M	$11.62 M	$0.28 M	$2.03 M	$35.78 M
Relocation	$37.72 M	$26.42 M	$18.77 M	$1.70 M	$10.77 M	$95.39 M
Income Losses (subtotal)	***$48.48 M***	***$41.54 M***	***$79.54 M***	***$3.16 M***	***$16.78 M***	***$189.49 M***
Structural	$53.50 M	$45.91 M	$24.63 M	$4.24 M	$10.90 M	$139.18 M
Non-Structural	$164.90 M	$136.93 M	$54.30 M	$9.51 M	$25.68 M	$391.32 M
Content	$52.91 M	$25.87 M	$26.21 M	$5.91 M	$11.59 M	$122.50 M
Inventory	$0.00 M	$0.00 M	$0.72 M	$1.18 M	$0.16 M	$2.05 M
Capital Stock Losses (subtotal)	***$271.31 M***	***$208.71 M***	***$105.87 M***	***$20.83 M***	***$48.33 M***	***$655.04 M***
Total Estimated Losses	**$319.78 M**	**$250.24 M**	**$185.41 M**	**$23.99 M**	**$65.11 M**	**$844.53 M**

Figure 6-59 Hazus Earthquake Building-Related Loss Estimates by Census Tract (PA 6)



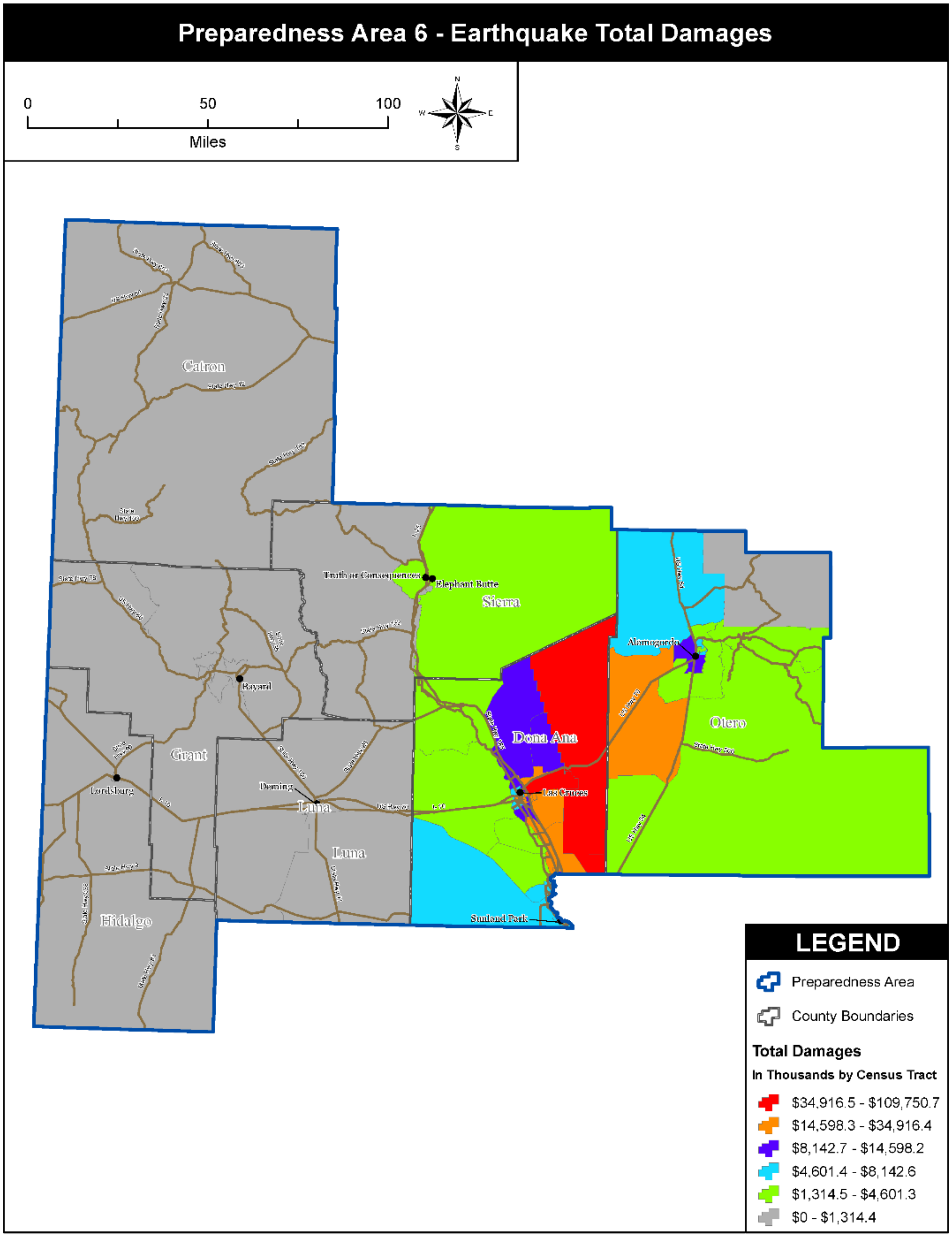
The following Table 6-42 presents additional modeled impacts from this same event. Note that all definitions are taken from the Hazus Global Summary Report (GSR).

Table 6-42 Hazus Earthquake Impacts and Loss Estimates (PA 6)

Impact	Summary of Modeled Impacts
Total Buildings Damaged	Slight: 16,607
	Moderate: 11,607
	Extensive: 4,182
	Complete: 1,364
Total Economic Losses (includes building and lifeline losses)	$852.50 million
Damage to Schools	9 with at least moderate damage
Damage to Medical Facilities	0 with at least moderate damage
Damage to Fire Stations	6 with at least moderate damage
Damage to Transportation Systems	2 highway bridges, at least moderate damage
	0 highway bridges, complete damage
	0 railroad bridges, moderate damage
	0 airport facilities, moderate damage
Households without Power/Water Service	Power loss, Day 1: 0
	Water loss, Day 1: 0
	Water loss, Day 3: 0
	Water loss, Day 7: 0
	Water loss, Day 30: 0
	Water loss, Day 90: 0
Displaced Households	870
Shelter Requirements	771 people out of 348,246 total population
Debris Generation	0.39 million tons

Figure 6-60 shows total damages resulting from the modeled earthquake in Preparedness Area 6. Similar to building damages, the eastern region of the area would experience the most in total damages.

Figure 6-60 Total Earthquake Damages, Preparedness Area 6



6.5.8 What Can Be Mitigated?

Damage from earthquakes can be mitigated for existing buildings by structural retrofits and by improved securing of vulnerable contents/furnishings/installations within structures. New buildings are typically built stronger based on the most recent seismic design specifications to minimize their vulnerability to earthquake damage. Structures erected before the adoption of modern building codes, such as un-reinforced masonry buildings, are typically far more vulnerable to earthquake damage. Present building codes also require construction of certain occupancies (schools, hospitals, public buildings) to high earthquake resistance standards, although seismic mitigating construction is not required for residential buildings. A prudent homeowner, business owner, or developer would be well advised to consider earthquake mitigation when designing subdivisions, apartment buildings, shopping centers, and individual residences in certain parts of the State. More detailed information on other structures in each Preparedness Area is required to identify those that are highly vulnerable.

The purchase of earthquake insurance in New Mexico has not generally been widespread. One mitigation action is to research the benefits of earthquake insurance to New Mexico communities.

6.5.9 Risk Summary

Table 6-43 identifies potential impacts from earthquakes.

Table 6-43 Potential Impacts from Earthquakes

Subject	Potential Impacts
Agriculture	In an earthquake, agriculture and food processing facilities may be damaged along with critical infrastructure that supports those operations. Damage to production agriculture is limited; possibly due to blocked roads.
Health and Safety of the Public	The public may be injured or killed by falling materials. Broken glass can cause injuries.
Health and Safety of Responders	Responders face the same impacts as the public.
Continuity of Operations	Those operations that are in or near the impact area may be shut down or even destroyed.
Delivery of Services	Service delays are anticipated to operations within or near the damaged areas.
Property, Facilities, Infrastructure	Earthquakes can cause widespread damages to buildings and infrastructure. Some buildings or bridges can be condemned. Water and gas lines as well as dams may rupture. Earthquake building codes have not been implemented consistently throughout the State, and this could be a serious problem.
Environment	Earthquake related phenomena, such as landslides or fires, may locally degrade the environment.
Economic Condition	A strong earthquake may cause severe damages within a community.
Public Confidence	Not impacted by the event itself, but may be damaged if the response to an event is poor.

6.6 Extreme Heat

Hazard	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
Extreme Heat	Medium	Medium	Low	High	Medium	Low	Medium

6.6.1 Hazard Characteristics

Extreme heat is defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for several weeks. In an average year, extreme heat kills 175 people in the U.S. Young children, the elderly, outdoor laborers, and sick people are the most likely to suffer the effects of extreme heat. The heat index measures the severity of hot weather by estimating the apparent temperature: how hot it feels (Figure 6-61). Skin resistance to heat and moisture transfer is directly related to skin temperature, therefore the ambient temperature can be quantified by examining the relation between relative humidity versus skin temperature. If the relative humidity is higher/lower than the base value, the apparent temperature is higher/lower than the ambient temperature.

Table 6-44 also outlines the heat disorders during extreme temperatures. In New Mexico at elevations below 5,000 feet, individual day-time temperatures often exceed 100°F during the summer months. However, during July, the warmest month, temperatures range from slightly above 90°F in the lower elevations, to 70°F in the higher elevations.

Table 6-44 Heat Index/Heat Disorders

Danger Category	Heat Disorders	Apparent Temperature (^{0}F)
I Caution	Fatigue possible with prolonged exposure and physical activity.	80-90
II Extreme Caution	Sunstroke, heat cramps and heat exhaustion possible with prolonged exposure and physical activity.	90-105
III Danger	Sunstroke, heat cramps and heat exhaustion likely; heatstroke possible with prolonged exposure and physical activity.	105-130
IV Extreme Danger	Heatstroke or sunstroke imminent.	>130

Extreme heat is a public health concern. During extended periods of very high temperatures or high temperatures with high humidity, individuals can suffer a variety of ailments, including heatstroke, heat exhaustion, heat syncope, and heat cramps.

Heatstroke is a life-threatening condition that requires immediate medical attention. It exists when the body's core temperature rises above 105° F as a result of environmental temperatures. Patients may be delirious, in a stupor or comatose. The death-to-care ratio in reported cases in the U.S. averages about 15%.

Heat exhaustion is much less severe than heatstroke. The body temperature may be normal or slightly elevated. A person suffering from heat exhaustion may complain of dizziness, weakness, or fatigue. The primary cause of heat exhaustion is fluid and electrolyte imbalance. The normalization of fluids will typically alleviate the situation.

Heat syncope is typically associated with exercise by people who are not acclimated to physical activity. The symptoms include a sudden loss of consciousness. Consciousness returns promptly when the person lies down. The cause is primarily associated with circulatory instability because of heat. The condition typically causes little or no harm to the individual.

Heat cramps are typically a problem for individuals who exercise outdoors but are unaccustomed to heat. Similar to heat exhaustion, it is thought to be a result of a mild imbalance of fluids and electrolytes.

The elderly, disabled, and debilitated are especially susceptible to heat stroke. Large and highly urbanized cities can create an island of heat that can raise the area's temperature by 3 to 5° F. Therefore, urban communities with substantial populations of elderly, disabled, and debilitated people could face a significant medical emergency during an extended period of excessive heat. The highest temperature recorded in New Mexico is 122°F on June 27, 1994 at the Waste Isolation Pilot Plant (WIPP) site in Eddy County (Preparedness Area 1).

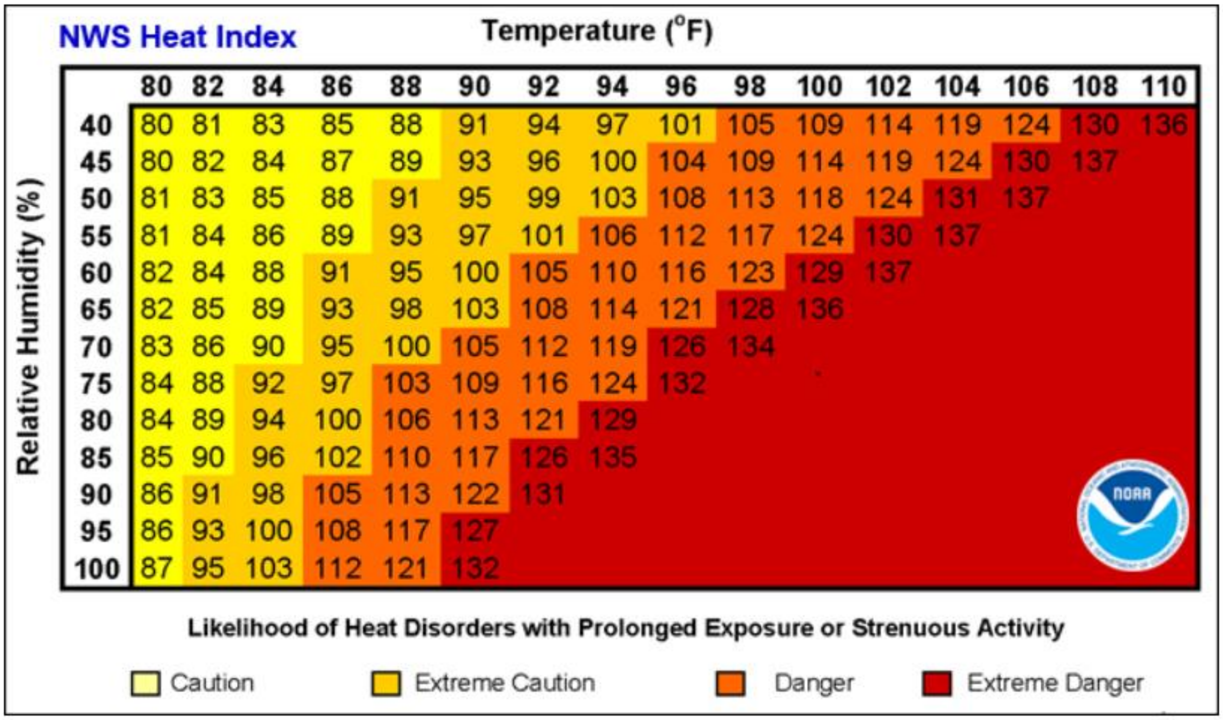
New Mexico is partially an arid desert State, and summer temperatures often exceed the 100-degree mark under normal conditions. Nighttime temperatures are typically cool due to low humidity, and even though daytime temperatures may be high, people experience relief at night. Heat waves in which daily high temperatures exceed 110° F for many days in a row are rare. Such a heat wave in the higher altitudes would probably have a more damaging effect because people would not be expecting such hot conditions. However, anywhere in the State that experienced the humidity/temperature combination could suffer ill effects from the event. A heat wave would also have a drying effect on vegetation, facilitating the ignition of wildfires. If a heat wave were coupled with a power failure, the effect on the population would be much more severe due to a lack of air conditioning. In general, it is safe to say that there is no area of the State that is immune from the hazard of heat wave.

A unique aspect to extreme heat in New Mexico is the fact that UVB radiation also increases with increasing altitude, or distance above the surface of the earth. For every 1,000 feet of altitude, the UV radiation increases by about four percent. This means that approximately 20% more UV radiation reaches the Earth's surface in Santa Fe than in a city that is at similar latitude but at sea level. This can exacerbate heat effects at high altitude.

In 1979, meteorologist R.G. Steadman developed a heat index (Figure 6-61) to illustrate the risks associated with extreme summer heat. NOAA's heat alert procedures are based mainly on Heat Index Values. The Heat Index, sometimes referred to as the "apparent temperature" is given in degrees Fahrenheit. The Heat Index is a measure of how hot it really feels when relative humidity is factored with the actual air temperature.

Periods of excessive heat usually result in high electrical consumption for air conditioning, which can cause power outages and brownouts. While PNM reports no widespread power failures due to overuse, the large numbers of new homes and conversion to air conditioning from evaporative coolers, could put a strain on the electrical grid.

Figure 6-61 Heat Index



NWS Heat Index — Temperature (°F); Relative Humidity (%)

RH (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Several deaths due to heat events have been recorded by the New Mexico Environmental Public Health Tracking, summarized in Table 6-45. According to the NWS, young children and infants, older adults, people with chronic medical conditions, and pregnant women are all particularly susceptible to extreme heat. Socially vulnerable communities and communities that have experienced historical oppression are likely to suffer disproportionate impacts from extreme heat events. This may be due to existing disparities in the prevalence of medical comorbidities, inadequate access to healthcare, and residing in areas with higher risk of extreme heat exposure. Outdoor workers are also at higher risk due to greater exposure to heat.

Table 6-45 Heat Related Deaths by Decedent's County of Residence, 2018-2022

PA	County of Residence	2017	2018	2019	2020	2021	Total
PA 1	Chaves County	0	0	0	1	1	2
	Curry County	0	0	0	1	0	1
	Eddy County	0	0	0	1	0	1
	Roosevelt County	1	0	0	0	0	1
	Lea County	0	0	1	0	0	1
PA 2	Colfax County	0	0	1	0	0	1
	San Juan County	1	1	0	1	2	5
PA 3	Rio Arriba County	0	1	0	0	0	1
	Santa Fe County	0	1	0	0	0	1
PA 4	McKinley County	0	2	0	1	4	7
	Sandoval County	0	1	3	0	0	4
PA 5	Bernalillo County	4	3	2	2	5	16

PA	County of Residence	2017	2018	2019	2020	2021	Total
	Torrance County	0	0	0	0	1	1
PA 6	Dona Ana County	0	0	1	3	2	6
	Luna County	0	1	0	1	0	2
	Otero County	0	1	0	1	0	2
	Sierra County	0	0	0	0	1	1

6.6.2 Previous Occurrences

The State of New Mexico experiences extreme heat events annually. Table 6-46 highlights past occurrences recorded by the Department of Homeland Security and Emergency Management.

Table 6-46 Significant Past Occurrences - Extreme Heat (June 1980 – December 2022)

Date	Location	Significant Event
December 2021	Roswell, NM (Preparedness Area 1)	Roswell reported its warmest December on record since records began in 1949, with an average temperature of 50.6°F, 9.7°F above the baseline average.
May 2022	Mora, San Miguel, and Taos Counties (Preparedness Areas 2 and 3)	Hermits Peak fire becomes the largest in New Mexico history, fueled by prolonged drought and unfavorable fire weather (hot, dry, and windy), conditions conducive for wildfire ignition and spread.
June 2021	State of New Mexico (All Preparedness Areas)	New Mexico experienced its warmest nighttime temperatures on record for June, with an average minimum temperature of 62.9°F.
Jan-Dec 2020	Roswell, NM (Preparedness Area 1	Roswell reported its warmest year on record since records began in 1949, with an annual average temperature of 64.6 °F, 3.8 °F above normal.
August 2020	State of New Mexico (All Preparedness Areas)	Warmest August on record, with average temperature of 76.2°F, 5.3°F above average.
September 2019	Tucumcari, NM (Preparedness Area 1)	Anomalously warm temperatures were observed at the Tucumcari Municipal Airport, which logged its warmest September on record with an average temperature of 78.1° F, a +8.2° F departure from normal.
August 2019	Carlsbad, NM (Preparedness Area 1)	Carlsbad reported its warmest August on record with an average temperature of 86.7° F, which was a +6.8° F departure from normal.
Jan-Dec 2017	State of New Mexico (All Preparedness Areas)	New Mexico had its warmest year on record, with an average +3.5°F anomaly for the year.
November 2017	Albuquerque, NM (Preparedness Area 5)	Albuquerque logged its warmest November in a 127-year record at 52.8° F, 7.9° F above normal.
March 2017	State of New Mexico (All Preparedness Areas)	Warmest March on record, with an average temperature of 51.4°F, 7.9°F above average.
March 2017	Albuquerque, NM Las Cruces, NM (Preparedness Areas 5 and 6)	Albuquerque and Las Cruces, both with over 120 years of record, observed their warmest March. Temperatures at Albuquerque were 6.7° F above normal and 6.6° F above normal in Las Cruces.
July 2016	State of New Mexico (All Preparedness Areas)	The New Mexico statewide average temperature was 76.8°F, 4.1°F above average, tying July 2003 as the warmest month of any month for the state.
June 10, 2013	Albuquerque, NM (Preparedness Area 5)	An infant left inside a hot car for over 2 hours during the afternoon was left in critical condition due to the heat. Temperatures around the city were in the upper 90's to low 100's Fahrenheit.

Date	Location	Significant Event
August 6, 2012	Albuquerque, NM (Preparedness Area 5)	A toddler died after being left inside a parked vehicle for over eight hours. Ambient air temperatures were in the lower to mid-90s Fahrenheit. An Albuquerque toddler died Monday afternoon after being left inside a car for at least 8 hours. The boy was found Monday afternoon inside the car and was pronounced dead later at the hospital. High temperature recorded at the Albuquerque International Sunport was 93°F.
July 14, 2010	Albuquerque, NM (Preparedness Area 5)	A 2-year-old died after being left in a hot car for almost four hours at Southwestern Indian Polytechnic Institute. By noon MST, the outside air temperature was 93°F which may have resulted in temperatures exceeding 135°F in the vehicle.
July 2003	State of New Mexico (All Preparedness Areas)	Hottest month ever recorded in New Mexico. There were 14 days of highs of 100°F or more, and no cooling at night. A new all- time high low temperature of 78°F is set. 21 days do not go below 70°F. Average temperature of 84.6°F for the entire month shatters 1980 record of 82.7°F.
May 24, 2000	State of New Mexico (All Preparedness Areas)	New daily high temperature records were set across the State as temperatures soared into the high 90s and 100s all across the east and south. Record highs in the mid and upper 80s were also set in the higher elevation communities of both the south central, central and northern mountains.
June 1998	State of New Mexico (All Preparedness Areas)	Conditions had been unusually warm and dry throughout the month, but the heat intensified beginning on the 20th with daily high temperatures climbing well above 100°F, except in mountain communities at elevations above 7500 feet. Readings in the southeast section of the State peaked at 108°F to 113°F as these locations exceeded 10 consecutive days with daily highs above 100 Fahrenheit. New records for duration of 100°F were set from Carlsbad north to Clovis and Tucumcari. The heat broke records that had lasted 60 to 70 years. By the end of the month a number of locations in the east had observed 16 to 20 days with a daily high over 100°F.
June 27, 1994	Albuquerque, NM (Bernalillo County) (Preparedness Area 5)	Albuquerque area hits 107°F, the highest temperature ever recorded in Albuquerque (the 104°F on June 26 tied the previous record).
Summer (June through August) 1980	Albuquerque, NM (Bernalillo County) (Preparedness Area 5)	Record heat with 25 days of 100 or more in the Albuquerque metro area (prior record was 12 days). July average daytime high is 99.1°F.

Table 6-47 outlines previously recorded extreme heat events within each Preparedness Area. Note the information in the table below only includes data presented by county, and does not include data presented by National Weather Service Forecast Zones.

Table 6-47 Preparedness Areas 1 - 6 Extreme Heat History (January 1980 – December 2022)

Preparedness Area 1
Counties: Chaves, Curry, De Baca, Eddy, Guadalupe, Lea, Lincoln, Quay, and Roosevelt

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Excessive Heat	2	-	0	0	$0	$0
Heat	7	-	1	1	$0	$0
Total	**9**	-	**1**	**1**	**$0**	**$0**

Preparedness Area 2
Counties: Colfax, Harding, Mora, San Miguel, and Union

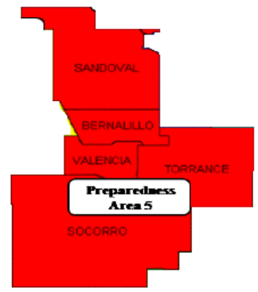
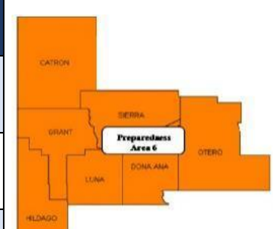
Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Excessive Heat	0	-	0	0	$0	$0
Heat	4	-	0	0	$0	$0
Total	**4**	**-**	**0**	**0**	**$0**	**$0**

Preparedness Area 3
Counties: Los Alamos, Rio Arriba, Santa Fe and Taos
Pueblos: Nambe, Ohkay Owingeh, Picuris, Pojoaque, San Ildefonso, Santa Clara, Tesuque, and Taos
Tribal Nations: Jicarilla Apache

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Extreme Heat	0	-	0	0	$0	$0
Heat	2	-	0	0	$0	$0
Total	**2**	**0**	**0**	**0**	**$0**	**$0**

Preparedness Area 4
Counties: Cibola, McKinley, and San Juan
Pueblos: Acoma, Laguna, Zuni
Tribal Nations: Navajo Nation

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Extreme Heat	0	-	0	0	$0	$0

Heat	5	-	1	0	$0	$0	
Total	**5**	**-**	**0**	**0**	**$0**	**$0**	
Preparedness Area 5 **Counties:** Bernalillo, Sandoval, Socorro, Torrance, and Valencia **Pueblos:** Cochiti, Isleta, Jemez, Sandia, Santa Ana, Santo Domingo, San Felipe, and Zia **Tribal Nations:** Navajo Nation							
Hazard Type	**# of Events**	**Mag**	**Deaths**	**Injuries**	**Property Damage**	**Crop Damage**	
Extreme Heat	0	-	0	0	$0	$0	
Heat	7	-	2	0	$0	$0	
Total	**7**	**-**	**2**	**1**	**$0**	**$0**	
Preparedness Area 6 **Counties:** Catron, Dona Ana, Grant, Hidalgo, Luna, Otero, and Sierra **Tribal Nation:** Mescalero Apache							
Hazard Type	**# of Events**	**Mag**	**Deaths**	**Injuries**	**Property Damage**	**Crop Damage**	
Extreme Heat	0	-	0	0	$0	$0	
Heat	1	-	0	0	$0	$0	
Total	**1**	**-**	**0**	**0**	**$0**	**$0**	

6.6.3 Past Frequency

Patterns, frequency, and degree of severity of extreme heat events are difficult to predict. Referencing the map in Figure 6-62, the State can experience average summer temperatures from 70 to well over 78 degrees with temperatures in the summer reaching up to 100 degrees plus. In temperatures exceeding 90°F, young children, the elderly, outdoor laborers, and sick people are the most likely to suffer from sunstroke, heat cramps, heat exhaustion, and possibly heatstroke.

Figure 6-63 displays the average monthly temperature for July from 1950 to 2022, and Figure 6-64 shows observed and modeled temperatures from 1900 to 2100, which both show a clear trend of increasing temperatures.

Figure 6-62 2012 Average Temperature and Preparedness Area Map of New Mexico

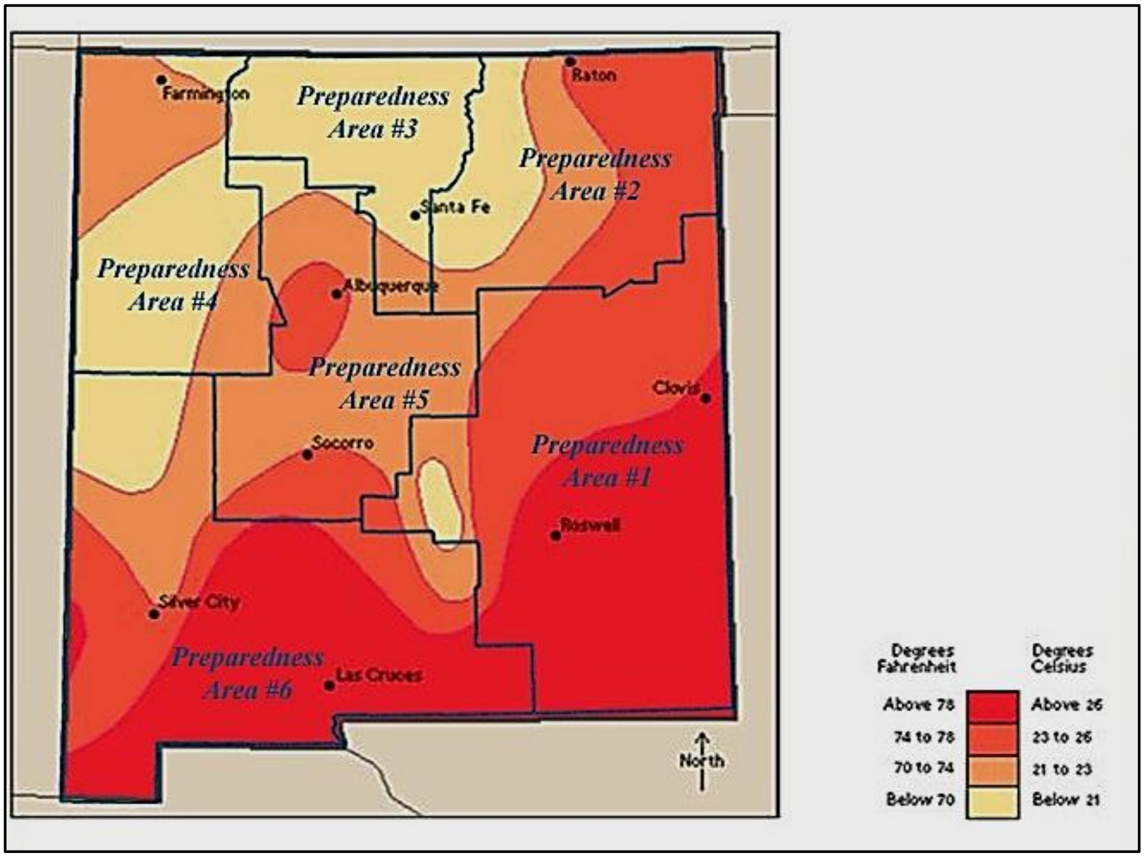


Figure 6-63 New Mexico Average 1-Month Temperature for July, 1950-2023

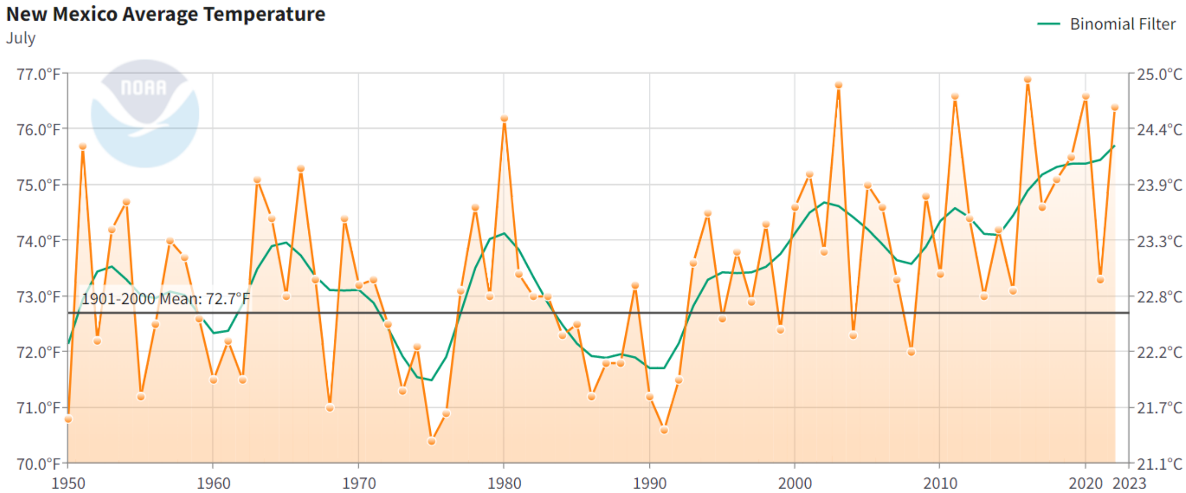
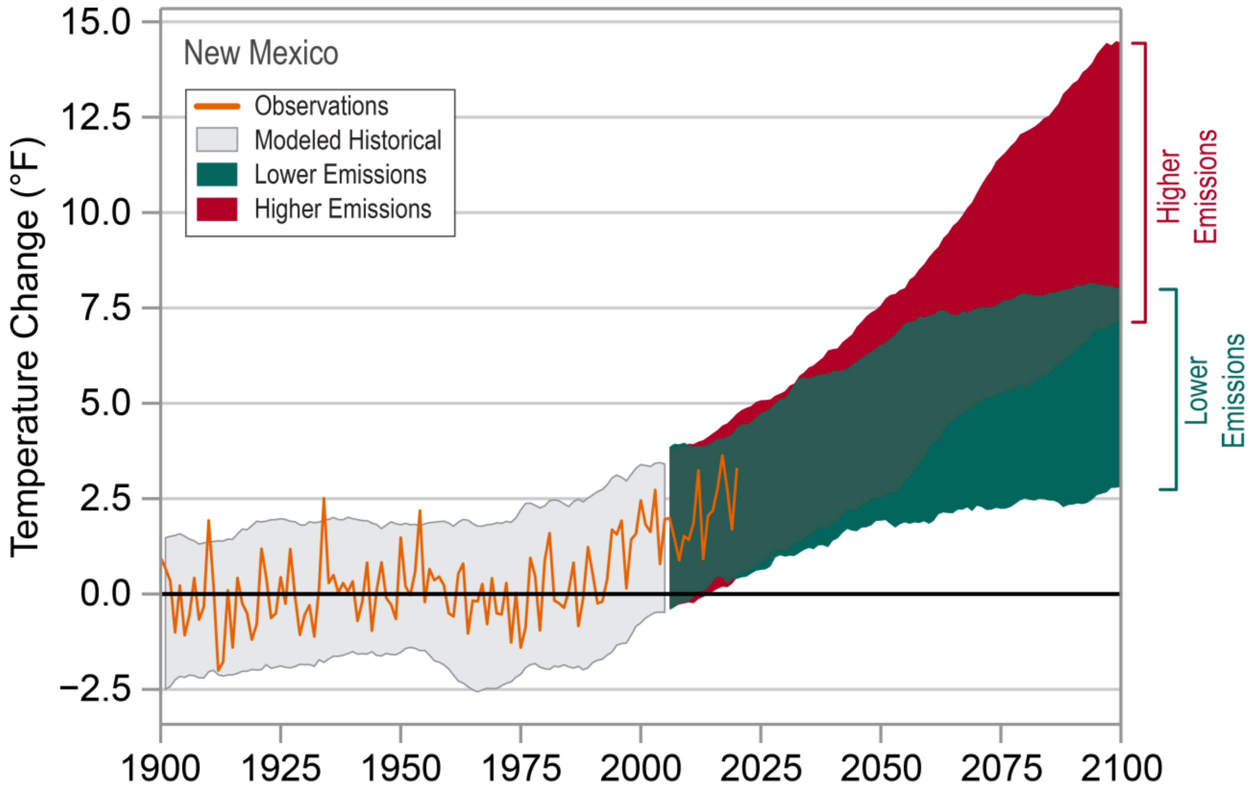


Figure 6-64 Observed and Projected Temperature in Near-Surface Air Temperature in New Mexico



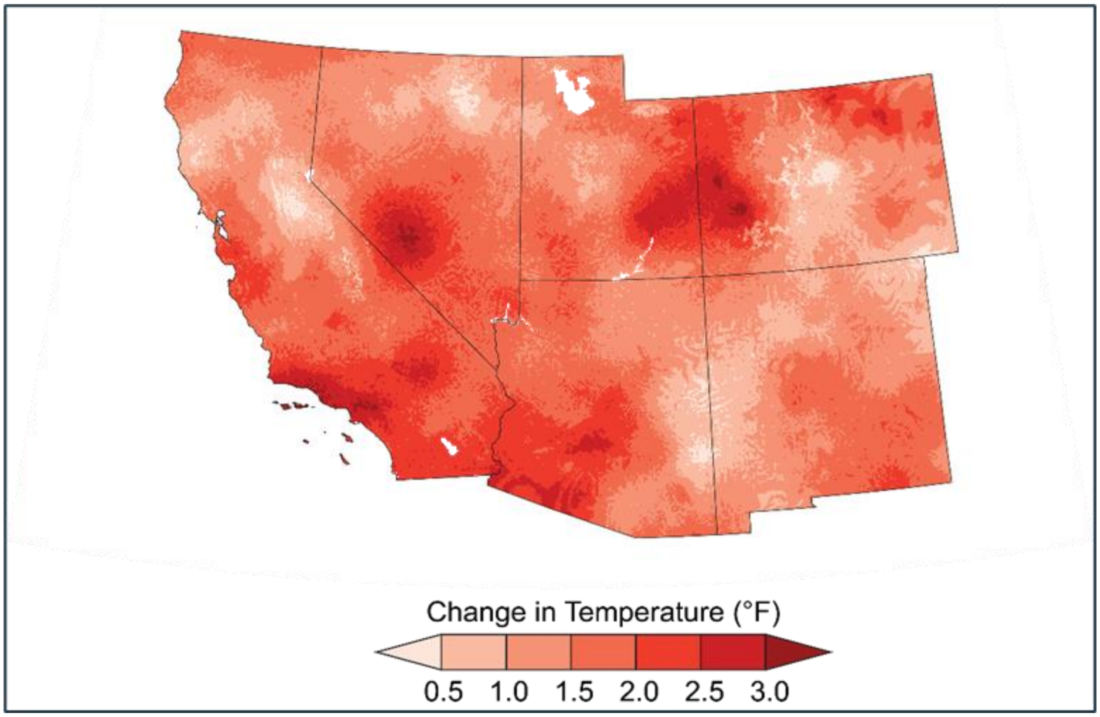
The National Oceanic and Atmospheric Administration reported above average monthly temperatures in New Mexico for 2017, which was the warmest year since records began in 1893. At each of their climate stations, the average annual temperature was above average. In Albuquerque, the 2017 average temperature was 60.1˚F, almost 3˚F above the mean; Roswell similarly saw an average temperature of 64˚F in 2017, 2.5˚F above their mean temperature.

6.6.4 Climate Change Impacts

Climate change is projected to increase the uncertainty of weather patterns and produce more extreme climate-induced events. Scientists have suggested that warming in the Artic has been linked to changes in the jet stream which may lead to increased polar vortex events. The polar vortex is well documented and is described as large areas of low pressure and cold air surrounding the North and South poles. Increased temperatures in the polar regions have weakened and destabilized the jet stream leading polar air to dip into lower latitudes, bringing it farther south than typical (UC Davis).

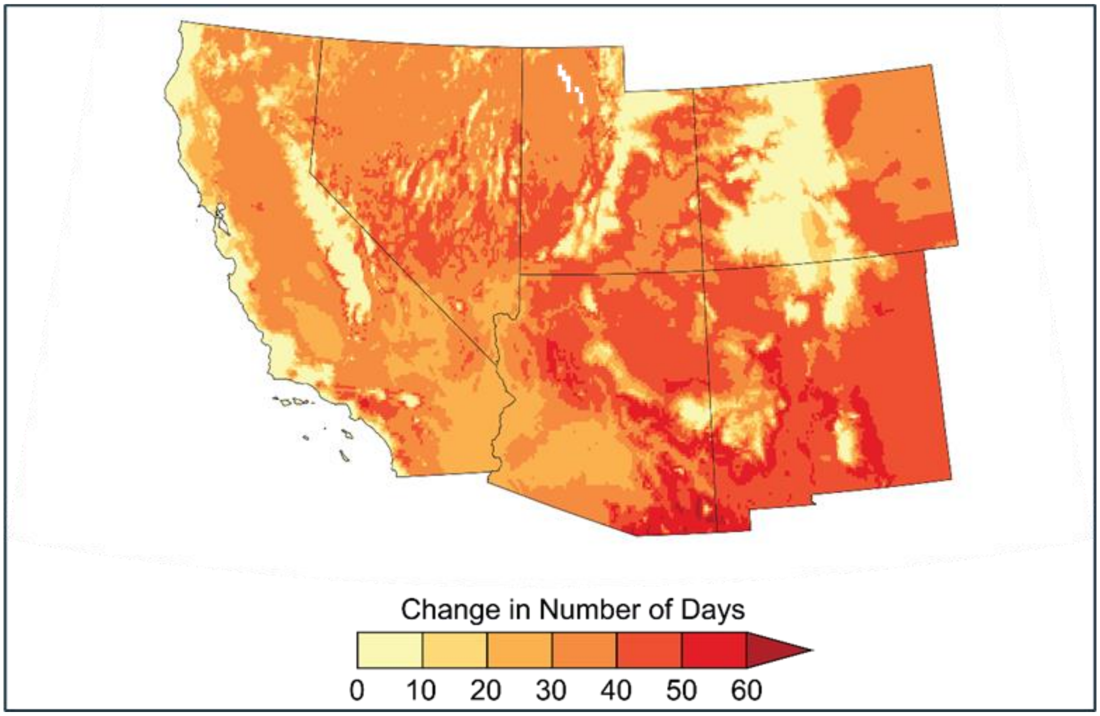
Research cited in the Fourth National Climate Assessment indicates that average temperatures have already increased across the Southwest and will likely continue to rise. Figure 6-65 shows the difference between the 1986-2016 average temperature and the 1901-1960 average temperature. This trend toward higher temperatures is expected to continue and would cause more frequent and severe droughts in the Southwest as well as drier future conditions and an increased risk of megadroughts (dry periods lasting 10 years or more). Additionally, current models project decreases in snowpack, less snow and more rain, shorter snowfall seasons, and earlier runoff, all of which may increase the probability of future water shortages (Gonzalez et al., 2018).

Figure 6-65: Change in Average Temperature Across the Southwest, 1901-1960 to 1986-2016



Source: Fourth National Climate Assessment

Figure 6-66: Projected Increases in Extreme Heat



*Source: Fourth National Climate Assessment *Based on higher emission scenario RCP8.5*

Extreme heat is also expected to increase in frequency. Figure 6-66 above shows projected increases in extreme heat as an increase in the number of days per year when the temperature exceeds 90°F by the period 2036-2065 compared to the period 1976-2005. Under the higher emissions scenario (RCP8.5), the number of days of extreme heat in much of New Mexico could increase by 30 to 50 days.

6.6.5 Probability of Future Occurrence

To determine the probability of each Preparedness Area experiencing future extreme heat occurrences, the probability or chance of occurrence was calculated based on historical data identified in Table 6-46 above. Table 6-48 identifies the probability of each Preparedness Area experiencing some type of extreme heat event annually.

Probability was determined by dividing the number of events observed by the number of years (42 years) and multiplying by 100. This gives the percent chance of the event happening in any given year. It should be noted that general inconsistencies in local event reporting to the NCEI would make this probability seem low as extreme heat events are an annual occurrence.

Table 6-48 Probability of Occurrence - Extreme Heat

Preparedness Area	Extreme Heat
PA 1	21%
PA 2	10%
PA 3	5%
PA 4	12%
PA 5	17%
PA 6	2%

6.6.6 Vulnerability Assessment

Due to its semi-arid to arid climate, high altitude, and low humidity, the entirety of the State of New Mexico is vulnerable to the effects of extreme heat. Increasing temperatures resulting from an excess of GHGs in the atmosphere have intensified this vulnerability. In the past 10 years, New Mexico has shattered previous records for warmest months, years, and nights. This has led to a host of secondary effects, including human mortality and the largest wildfire in the State's history.

State Assets

While extreme heat typically has minimal direct impact on buildings and critical facilities, some economic impact to state assets can be assumed. Due to the regional nature of extreme heat, all state assets are assumed to be at risk (see Table 6-7). For purposes of this analysis, the State assumed losses up to 10% of total asset value for assets at high risk of extreme heat, 5% for assets at medium risk, and 1% for assets at low risk; risk ratings were based on the ratings in Table 6-3 Hazard Risk Rankings by Preparedness Area. Table 6-49 shows estimated losses for state assets from extreme heat; these estimates are for planning purposes only and should not be used for insurance purposes.

Table 6-49 Potential Losses to State Assets From Extreme Heat

County	Total	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
PA 1						
Chaves	**5**	1	3	1	$48,197,000	**$2,409,850**
Curry	**1**	-	1	-	$933,000	**$46,650**
PA 2						
Colfax	**3**	1	2	-	$89,310,000	**$4,465,500**
San Miguel	**3**	1	1	1	$152,965,000	**$7,648,250**
PA 3						
Rio Arriba	**1**	-	1	-	$558,985	**$5,590**
Santa Fe	**16**	-	14	2	$602,912,704	**$6,029,127**
Taos	**1**	-	1	-	$501,000	**$5,010**
PA 4						
Cibola	**2**	-	1	1	$39,102,000	**$3,910,200**
McKinley	**1**	-	1	-	$2,807,000	**$280,700**
PA 5						
Bernalillo	**6**	3	2	1	$393,344,167	**$19,667,208**
Sandoval	**1**	-	1	-	$17,085,000	**$854,250**
Socorro	**1**	-	1	-	$3,026,251	**$151,313**
Valencia	**3**	1	2	-	$148,620,000	**$7,431,000**
PA 6						
Dona Ana	**2**	-	2	-	$76,250,000	**$762,500**
Grant	**1**	1	-	-	$0	**$0**
Luna	**1**	-	-	1	$9,553,000	**$95,530**
Sierra	**1**	1	-	-	$24,528,000	**$245,280**
Total	**49**	**9**	**33**	**7**	**$1,609,693,107**	**$1,103,310**

Preparedness Area 1

Preparedness Area 1 is especially vulnerable to extreme heat events. It has broken several extreme heat records in recent years. The NOAA weather station in Roswell recorded its warmest year on record in 2020. Roswell also recorded its warmest December to date in 2021, with temperatures 9.7°F over the 20-year average. This points to a trend of increasing exposure to extreme heat in the Area that is likely to continue.

Preparedness Area 2

Preparedness Area 2 has moderate vulnerability to extreme heat events. According to NCEI data, there is a 10% chance of an extreme heat event occurring during any given year. Between 2017 and 2016, there were 6 heat related fatalities in the Area.

Preparedness Area 3

Preparedness Area 3 is located on the northern border of the State, where average temperatures skew cooler. This is reflected in its relatively small number of recorded NCEI extreme heat events, with a 5% chance of an extreme heat event being recorded during any given year. Preparedness Area 3 recorded two heat-related fatalities between 2017 and 2021.

Preparedness Area 4

Preparedness Area 4 is located on the northwestern corner of the State, where average temperatures skew cooler. However, there were 11 recorded extreme heat-related fatalities in the Area in the five years between 2017 and 2021, showing that the Area is still vulnerable to the impacts of extreme heat.

Preparedness Area 5

Preparedness Area 5 is especially vulnerable to extreme heat events, likely due in part to its large population. It had the highest number of heat-related deaths between 2017 and 2021, with 17 recorded fatalities. The Preparedness Area with the next highest heat-related mortality count was nearly 30% lower (Preparedness Area 6, with 12 fatalities).

Preparedness Area 6

Preparedness Area 6 is vulnerable to extreme heat events. While it has the lowest probability of extreme heat events based on NCEI data, it also has the second highest recorded number of heat-related fatalities. The high number of fatalities may be in part due to the large size of the Area, as well as its location in the southwestern corner of the state where temperatures skew higher.

6.6.7 Data Limitations

The SHMT could not quantify vulnerability of individual structures to damage from extreme heat hazards. The NCEI is limited in the amount of extreme heat incidents have occurred in New Mexico.

6.6.8 What Can Be Mitigated?

One important part of mitigating extreme heat hazards is forecasting and warning so that people can prepare. Communities can prepare for disruptions of utilities and transportation due to extreme heat by advising people to stay home or to use caution if they must go out, and by recommending that people stock up on food, water, batteries, and other supplies. The National Weather Service, combined with local television stations, have an effective strategy for notifying residents about impending extreme heat events.

Other mitigation activities include reducing urban heat islands through tree planting and green infrastructure, establishing cooling centers, developing lists of at-risk populations, and public education.

6.6.9 Risk Summary

New Mexico experiences some form of extreme heat activity annually, based on seasonal meteorological patterns and local topographical conditions. All Preparedness Areas are susceptible to extreme heat conditions, although local topography, such as elevation and land contours, plays a significant part in how this extreme heat affects a particular area. The effects of extreme temperatures generally affect at risk sectors of the population: the elderly, the young, the sick/infirmed, those living below the poverty level, and outdoor laborers. Table 6-50 outlines impacts from extreme heat events for each Preparedness Area to consider when planning for these types of events.

Table 6-50 Extreme Heat Impacts

Subject	Impacts
Agriculture	Extreme heat can affect crops, livestock and those working in and around agriculture production areas. The heat can also affect agriculture transportation from the aspect that some commodities are perishable and movement of those products must occur more expeditiously in extreme heat.
Health and Safety of The Public	Injuries and death have resulted from extreme heat events. Individuals caught outdoors can suffer dehydration and death from high temperatures; Increased wildfire risk
Health And Safety of Responders	Responders face the same impacts as the public.
Continuity of Operations	Airport closures and local/regional power failures
Delivery of Services	Airport closures and local/regional power failures
Property, Facilities, Infrastructure	No impacts anticipated
Environment	Increased drought conditions (see Drought section for a list of associated environmental impacts)
Economic Condition	Increased utility costs due to the extreme temperatures are anticipated; Loss of tourism; Decreased agricultural yields
Public Confidence	No impacts anticipated

6.7 Expansive Soils

Hazard	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
Expansive Soil	Medium	Low	Low	Low	NR	NR	Low

6.7.1 Hazard Characteristics

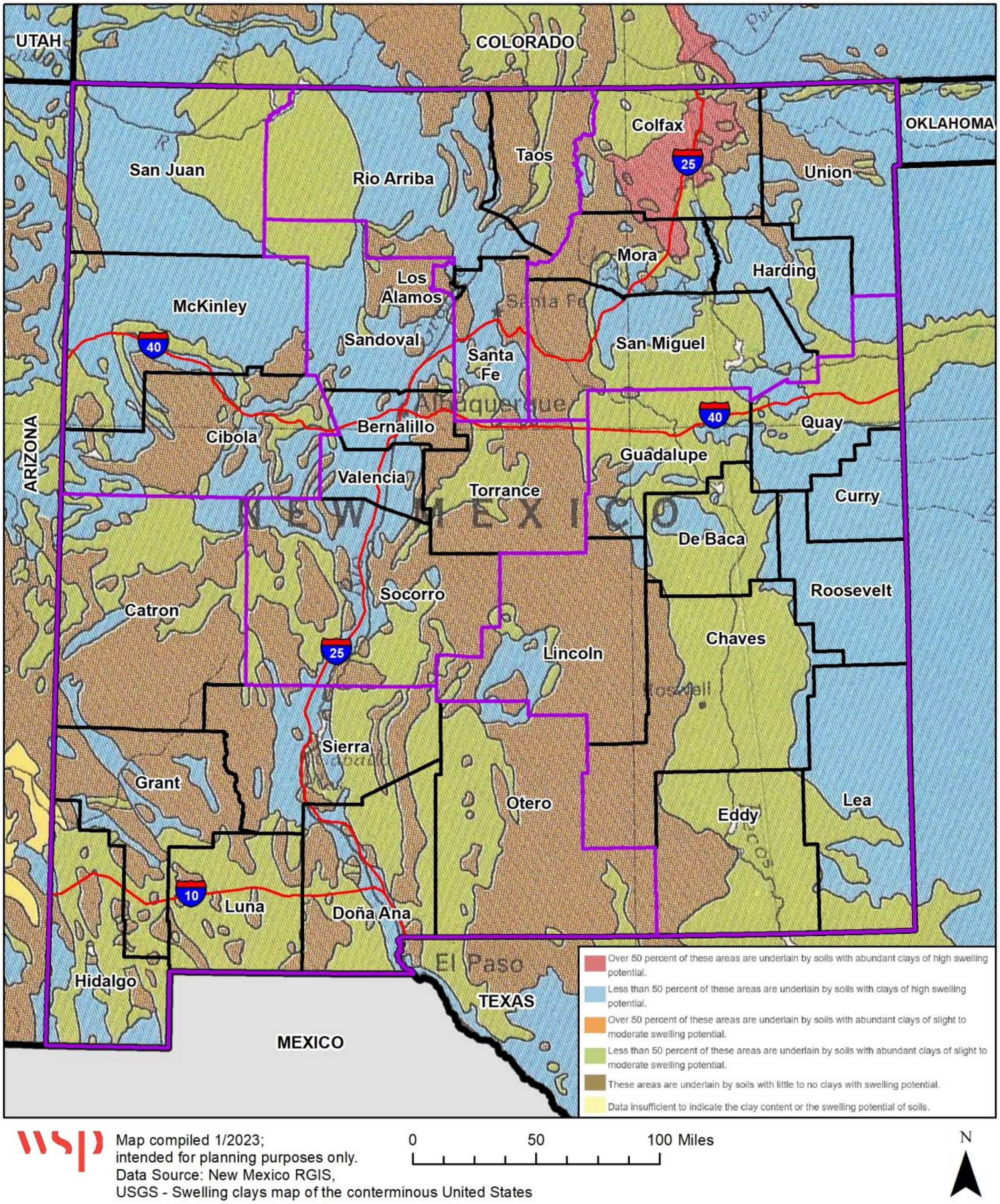
Expansive soils, also locally called adobe or clay, are fine-grained soils generally found in areas that historically were a floodplain or lake areas. Expansive soils swell when wet and shrink when dry. They contain abundant expandable clay that generally accumulates in low-energy areas. Expansive soil is subject to swelling and shrinkage, varying in proportion to the amount of moisture present in the soil. As water is absorbed into the soil (by rainfall or watering), expansion takes place. If dried out, the soil contracts, often leaving small fissures or cracks. Excessive drying and wetting of the soil can progressively deteriorate "slab on grade" foundations over the years and can rupture pipes, leading to further problems.

Expansive soil is found in all States, although the highest concentrations are found in Texas, Colorado, Virginia, North Dakota, Oklahoma, and Montana. One of the most expansive soils, known locally as adobe, is found in New Mexico, Texas, and Colorado. The expansion and contraction of soil beneath a structure tends to exert tremendous pressure and stress, causing severe structural damage. In some cases, entire sidewalks and streets have been lifted, resulting in severe cracking and distortion.

According to the New Mexico Bureau of Geology and Mineral Resources, the landscape of New Mexico has six distinct physiographic providences. The northwest corner of the State is within the Colorado Plateau. South of this area is the Mogollon-Datil Volcanic Field, with the southwestern corner of the State being within the Basin and Range province. The far north central portion of the State is within the Southern Rocky Mountains. The central part of the State is within the Rio Grande Rift, and the eastern third of the State is classified as the Great Plains.

Figure 6-67 shows the areas of expansive soils in New Mexico. The red areas in the northeast portion of the State (in Mora and Colfax Counties) indicate that these locations contain abundant clay with high swelling potential. These are the areas that are most likely to experience impacts from expansive soils in the State of New Mexico. The blue areas indicate the second most severe category of expansive soils, and are determined to be locations that have less than 50% clay with high swelling potential. The green areas are less likely to see impacts from expansive soils, and are determined to be areas with more than 50% clay with slight to moderate swelling potential. The brown areas have little or no swelling clay, so these areas are unlikely to see impacts from expansive soils.

Figure 6-67 New Mexico Expansive Soils and Preparedness Areas



6.7.2 Previous Occurrences

In conducting research for this hazard there were no previous occurrences identified at this time. While damages due to expansive soils are occurring in New Mexico, the fact that the onset takes a very long time, damages are cumulative rather than instantaneous. In the SHMT's opinion, damage is fairly frequent but under-reported.

6.7.3 Past Frequency

Good data on past expansive soils incidents does not currently exist in the State, making past frequency difficult to determine. Based on anecdotal evidence and SHMT experience, frequency is estimated to be occasional.

6.7.4 Climate Change Impacts

The best available data does not indicate significant impacts on the frequency or severity of expansive soils due to climate change.

Many soils and rocks have the potential to swell or expand based on a combination of its mineralogy and water content. The actual swelling of expansive soils will be caused by a change in the environment (e.g. water content, stress, chemistry, or temperature) in which the material exists. Since the 1950s, snow precipitation and duration of snowpack have both decreased while rising temperatures have increased the rate of water evaporating into the air and earlier runoff, creating drier soil conditions in western states (EPA 2016). More extremes in climate conditions (e.g. wet-dry conditions), could potentially exacerbate the swelling of expansive soil issues in the future.

6.7.5 Probability of Future Occurrence

The probability of future expansive soils events is estimated to be **occasional**. As noted in Section 6.7.3 above, due to a lack of data this estimate is based primarily on anecdotal experience.

6.7.6 Vulnerability Assessment

Expansive Soils can result in serious structural damage to roads, buildings, irrigation channels, utilities and pipelines. Due to the low frequency of this hazard, the SHMT will not profile Expansive Soils any further. If future conditions or events warrant, upcoming editions of the plan will further elaborate on this hazard.

State Assets

A geospatial analysis of state owned assets potentially at risk of expansive soils was not conducted. Historically, losses to state facilities due to expansive soils has been minimal.

Preparedness Area 1

In Preparedness Area 1, the greatest potential for expansive soils lies within the counties located on the eastern portion of the area. The counties with the greatest potential for swelling soils include Curry, Roosevelt, and Lea. Counties located in the western portion of the area are generally underlain with soils that have little to no swelling potential. These counties include Eddy, Chaves, and Lincoln.

Preparedness Area 2

Preparedness Area 2 has the greatest vulnerability to expansive soils in the state. A large portion of Colfax County, and the northern part of Mora County, are composed of the soil type with highest swelling potential. These are the only two counties in the state with swelling potential of this magnitude.

Preparedness Area 3

In Preparedness Area 3, vulnerability to expansive soils differs across the area. Toas County has little to no potential for swelling soils, while Rio Arriba County and Santa Fe County contain a variety of soil types, some of which are prone to swelling and others that are not.

Preparedness Area 4

Preparedness Area 4 is primarily in an area where less than 50% of soils have high swelling potential. The County of Cibola is the least vulnerable to expansive soils in this area, composed primarily of soils with little to no swelling potential.

Preparedness Area 5

Many of the counties in Preparedness Area 5 contain a mix of soils, some of which have high swelling potential and some which have little to no swelling potential. Sandoval County and Valencia County have the greatest area of soils with high swelling potential. Torrance County is mainly composed of soils with no swelling potential.

Preparedness Area 6

Preparedness Area 6 also contains diverse soil types, most of which are of little to no swell potential. Hidalgo, Sierra, and Luna Counties have greatest swelling potential in the State, and Otero County has least potential for impacts from expansive soils.

6.7.7 Data Limitations

In the absence of good data, it is difficult to analyze this hazard in detail. According to the Subject Matter Experts, there are no hazardous soils mapping or damage occurrence data being collected.

6.7.8 What Can Be Mitigated?

With regards to current day construction, mitigation of expansive soils is relatively simple in New Mexico. For small structures, the expansive clay can be excavated and removed. Then, compacted sandy soil is put beneath the foundations before construction starts. For larger structures with deeper foundations in thick expansive soils or rock, more extensive procedures are required.

It is possible that human activities in the area of expansive, hydrocompactive, and corrosive soils could be more closely regulated. Land management agencies, construction and inspection agencies, along with local government permit review could be more proactive in requiring testing of soils before construction.

6.7.9 Risk Summary

Table 6-51 provides impacts for consideration when reviewing expansive soil issues.

Table 6-51 Impacts from Expansive Soil

Subject	Potential Impacts
Agriculture	In agriculture production, expansive soils would typically be in pastures that support livestock range grazing. No significant impact would be anticipated.
Health and Safety of the Public	None anticipated.
Health and Safety of Responders	None anticipated.
Continuity of Operations	None anticipated.
Delivery of Services	None anticipated.
Property, Facilities, Infrastructure	The slow nature of this type of event causes the impacts to be almost imperceptible, however, costly damages to the built environment may occur - primarily highways and roads.
Environment	Pipeline ruptures could have significant impact.
Economic Condition	High infrastructure and building repair costs.
Public Confidence	Very little impact anticipated.

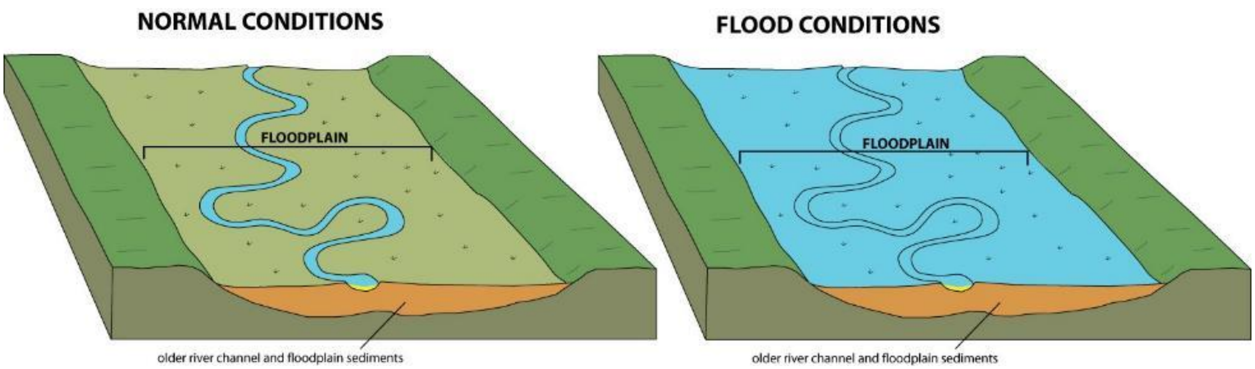
6.8 Flood/Flash Floods

Hazard	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
Flood	High	Low	High	High	High	High	High

6.8.1 Hazard Characteristics – Floods/Flash Flooding

Nationwide, hundreds of floods occur each year, making flooding one of the most common hazards in all 50 States and U.S. territories. Most injuries and deaths from flooding happen when people are swept away by flood currents, and most property damage results from inundation by sediment-filled water. The majority of flood events in the United States involve inundation of floodplains. Figure 6-68 shows inundation of floodplains during a large-scale weather system with prolonged rainfall from storms or snowmelt.

Figure 6-68 Flood Definition



For the purposes of this report, this type of flooding is referred to as *riverine flooding* and is characterized by a gradual and predictable rise in a river or stream due to persistent precipitation. After the stream or river overflows its banks, the surrounding area often remains under water for an extended period of time.

Riverine floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence. Flood studies use historical records to determine the probability of occurrence for different extents of flooding. The probability of occurrence, shown in Table 6-52, is expressed as the percentage chance that a flood of a specific extent will occur in any given year. Flash floods are usually the result of excessive precipitation, rapid snowmelt, increased impervious surface, or burn scar run-off and can occur suddenly. Although the State of New Mexico experiences riverine flooding, *flash flooding* is a more common and a more damaging type of flooding.

Table 6-52 Flood Probability Terms

Flood Recurrence Intervals	Chance of exceedance in any given year
10-year	10%
50-year	2%
100-year	1%
500-year	0.2%

Flash floods are aptly named: they occur suddenly after a brief but intense downpour; they move quickly and end abruptly. Although the duration of these events is usually brief, the damages can be quite severe. People are often surprised at how quickly a normally dry arroyo can become a raging torrent. Flash floods are the primary weather-related killer with around 140 deaths recorded in the United States each year. Flash floods are common and frequent in New Mexico, and as a result, New Mexico has the 10th highest flash flood fatality rate in the nation. Flash floods cannot be predicted; however, some conditions are known to make certain areas more vulnerable to flash floods. For example, the presence of hydrophobic soils following high-severity wildfire increases flood hazard in and downstream of the affected watershed. Alluvial fans and alluvial fan flood hazards exist in the State. Alluvial fan flood hazard characteristics include heavy sediment/debris loads and high velocity flows.

Flash flooding is the second greatest weather hazard in New Mexico. New Mexico ranks 10th in the Nation in flash flood deaths per capita, using statistics based on storm data from 2006 - 2012. The flash flooding problem stems from a number of factors. During the summer (June through August period), thunderstorm frequency in certain parts of New Mexico is among the highest in the Nation. Excessive moisture during the summer can lead to large volume runoffs enhanced by the terrain. Table 6-53 lists the major contributing factors of riverine flooding vs. flash flooding.

Table 6-53 Flooding vs. Flash Floods – Contributing Factors

Riverine Floods	Flash Floods
Low lying, relatively undisturbed topography	Hilly/mountainous areas
High season water tables	High velocity flows
Poor drainage	Short warning times
Excess paved surfaces	Steep slopes
Constrictions – filling	Narrow stream valleys
Obstructions – bridges	Parking lots and other impervious surfaces
Soil characteristics	Improper drainage

According to FEMA, “an alluvial fan is a sedimentary deposit located at a topographic break such as the base of a mountain front, escarpment, or valley side, that is composed of stream flow and/or debris flow/sediments and has the shape of a fan, either fully or partially extended.” “Over 15-25% of the arid west is covered by alluvial fans,” reports FEMA. New Mexico has more alluvial plains than alluvial fans due to the natural apex, according to Paul Dugie, NM Floodplain Managers Association. Though the intense rainstorms which produce fan floods occur randomly, they nevertheless can develop very rapidly at any time and can recur with frequency. The California Alluvial Fan Task Force States, “When alluvial fan flooding occurs, it is flashy and unpredictable and variable in magnitude. This type of flooding does not necessarily occur as the result of large amounts of rain. Often, it is triggered by intense rainfall over short periods of time. The natural flooding process that drives alluvial fan sedimentation tends to produce thick deposits of sand and gravel, particularly near the apex of the fan, with relatively minor proportions of fine-grained particles.” According to Dr. David Love, New Mexico Bureau of Geology and Mining Resources, in the State of New Mexico, there have been no confirmed studies specific to alluvial fan flooding risk.

According to multiple studies, alluvial fan flood risk can cause high velocity flow (as high as 15-30 feet per second) producing significant hydrodynamic forces, erosion/scour to depths of several feet, deposition of sediment and debris (to depths of several feet), deposition of sediment and debris (depths of 15 – 20 feet have been observed), debris flows/impact forces, mudflows, inundation, producing hydrostatic/buoyant forces (pressure against buildings caused by standing water), flash flooding with little, if any, warning times.

Alluvial fans are often an overlooked as hazards and there is a tendency to underestimate both the potential and severity of alluvial fan flood events. The infrequent rainfall, gently sloping terrain, and often long-time spans between successive floods contribute to a sense of complacency regarding the existence of possible flood hazards.

6.8.2 Floodplain Mapping and Current Status of DFIRMs Maps

Through FEMA's flood hazard mapping program, Risk Mapping, Assessment and Planning (Risk MAP), FEMA identifies flood hazards, assesses flood risks and partners with states and communities to provide accurate flood hazard and risk data to guide them to mitigation actions. Flood hazard mapping is an important part of the National Flood Insurance Program (NFIP), as it is the basis of the NFIP regulations and flood insurance requirements. FEMA maintains and updates data through Flood Insurance Rate Maps (FIRMs) and risk assessments. FIRMs include statistical information such as data for river flow, storm tides, hydrologic/hydraulic analyses and rainfall and topographic surveys. During FEMA's Map Modernization program, Digital Flood Insurance Rate Maps (DFIRMs) for 23 of New Mexico's 33 counties were developed. Ten counties were not digitized and six; Catron, De Baca, Guadalupe, Harding, Hidalgo, and Union Counties, have had no floodplain mapping conducted. Mora and Torrance counties' FIRM effective dates are 1977 and 1978, respectively, and were converted by letter from HUD Flood Hazard Boundary Maps. Sierra County's effective FIRM date was 1986 and Quay County's is 2003. Though county wide mapping is not available for Catron, De Baca, Guadalupe, Hidalgo, and Union Counties, some extent of these counties has some form of floodplain delineation. No mapping for Harding County has ever been conducted.

Flood hazard areas depicted on the Flood Insurance Rate Map are identified as a Special Flood Hazard Area (SFHA). SFHA are defined as the area that will be inundated by the flood event having a 1% chance of being equaled or exceeded in any given year. The 1% annual chance flood is also referred to as the base flood or 100-year flood. SFHAs are labeled as Zone A, Zone AO, Zone AH, Zones A1-A30, Zone AE, Zone A99, Zone AR, Zone AR/AE, Zone AR/AO, Zone AR/A1-A30, Zone AR/A, Zone V, Zone VE, and Zones V1-V30. Moderate flood hazard areas, labeled Zone B or Zone X (shaded) are also shown on the FIRM, and are the areas between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood. The areas of minimal flood hazard, which are the areas outside the SFHA and higher than the elevation of the 0.2-percent-annual-chance flood, are labeled Zone C or Zone X (unshaded). Zone D Areas with possible but undetermined flood hazards, no flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk. Approximately 34% of mapped areas in New Mexico are designated as Zone D, including nine counties and 18 Tribal Reservations. This Zone D designation adversely impacts residents and local communities economically, communities are unable to determine the actual risk to their residents and businesses and economic opportunities have been lost due to this zone designation. The large area of New Mexico designated as Zone D significantly impacts local communities and a strategy to lessen the impacts of unknown flood risk needs to be developed.

Figure 6-69 shows the status of FEMA regulatory maps as of February 2023. There has been significant additional mapping done in recent years. While non-regulatory, these maps are still useful for planning purposes. Figure 6-70 add those newer non-regulatory mapped areas to the FEMA mapped areas.

A Statewide floodplain map based on existing FEMA floodplain mapping, Figure 6-69, delineates Special Flood Hazard Areas (SFHA), or land areas that are identified by FEMA maps as subject to inundation by a flood. On this map, the SFHAs are shaded with different colors and divided into distinct flood hazard zones depicted on the map legend. Floodplain maps are useful tools for identifying the location of flood-prone areas. This information contributes to the development of strategies that may mitigate the potential impacts from a flooding event. The major population centers have zoning and regulatory authority that is adequate to control development and offer some regulatory protections to the population, limiting or restricting development in high hazard areas. In more remote locations, communities may be eager to encourage development and less prepared to educate the public about the risks from natural hazards ahead of an event. Resources in remote locations for assisting communities after a hazard event are also limited. Remote locations present challenges to providing adequate floodplain mapping to programs such as FEMA's Risk Mapping, Assessment, and Planning (Risk MAP), which can lead to inadequate information on existing maps or a lack of flood maps.

Almost all of New Mexico's recent disaster declarations have been flood related, and all of the flood declarations since 2008 have been for public assistance (infrastructure) and Hazard Mitigation Grant Program (HMGP) only. This means that vital infrastructure such as roads and bridges are being affected by flooding. While approximate flood mapping allows for flood insurance rates to be determined, it does not provide information about whether bridges and roads may be overtopped or the true depth of flooding. Therefore, the heights that structures and infrastructure need to be elevated to are unknown.

Outdated maps pose similar problems in some jurisdictions. Flood events can alter the floodplain over time or, in some cases, during a single event. The City of Corrales saw up to three feet of silt and sand deposited in areas and extreme erosion in other during the July 2013 floods. The silt and erosion caused significant changes in elevations in some areas, decreasing or eliminating the usefulness of effective FIRM maps for the area. There are several potential mitigation techniques that can be applied here. The first would be to update FIRMs which would allow communication of updated risk. Another would be to account for debris in drainage infrastructure since it is a known problem. One other option would be to apply bank stability and erosion protection in the areas where the silt and debris originates.

Figure 6-69 New Mexico Regulatory Floodplain Maps

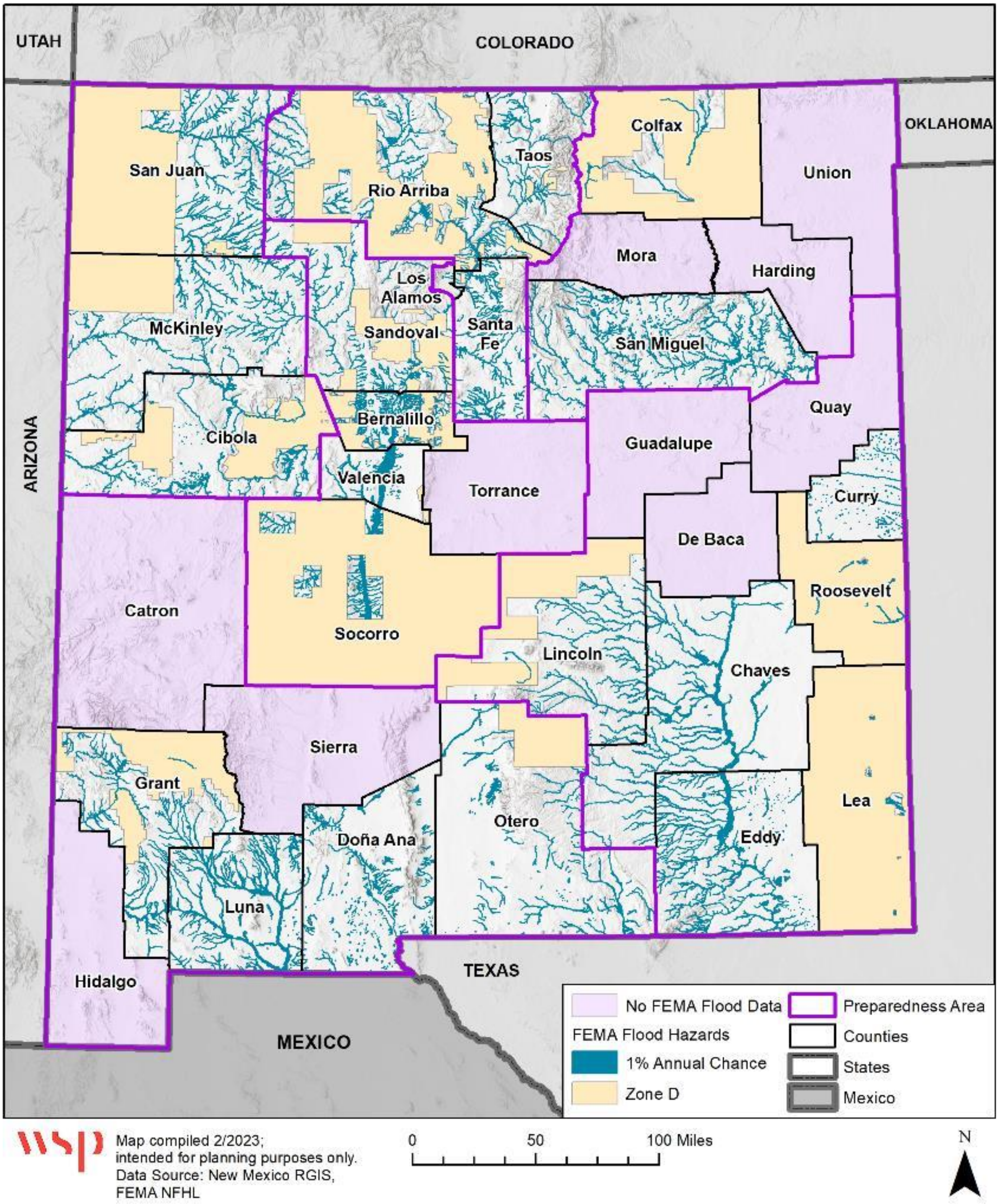
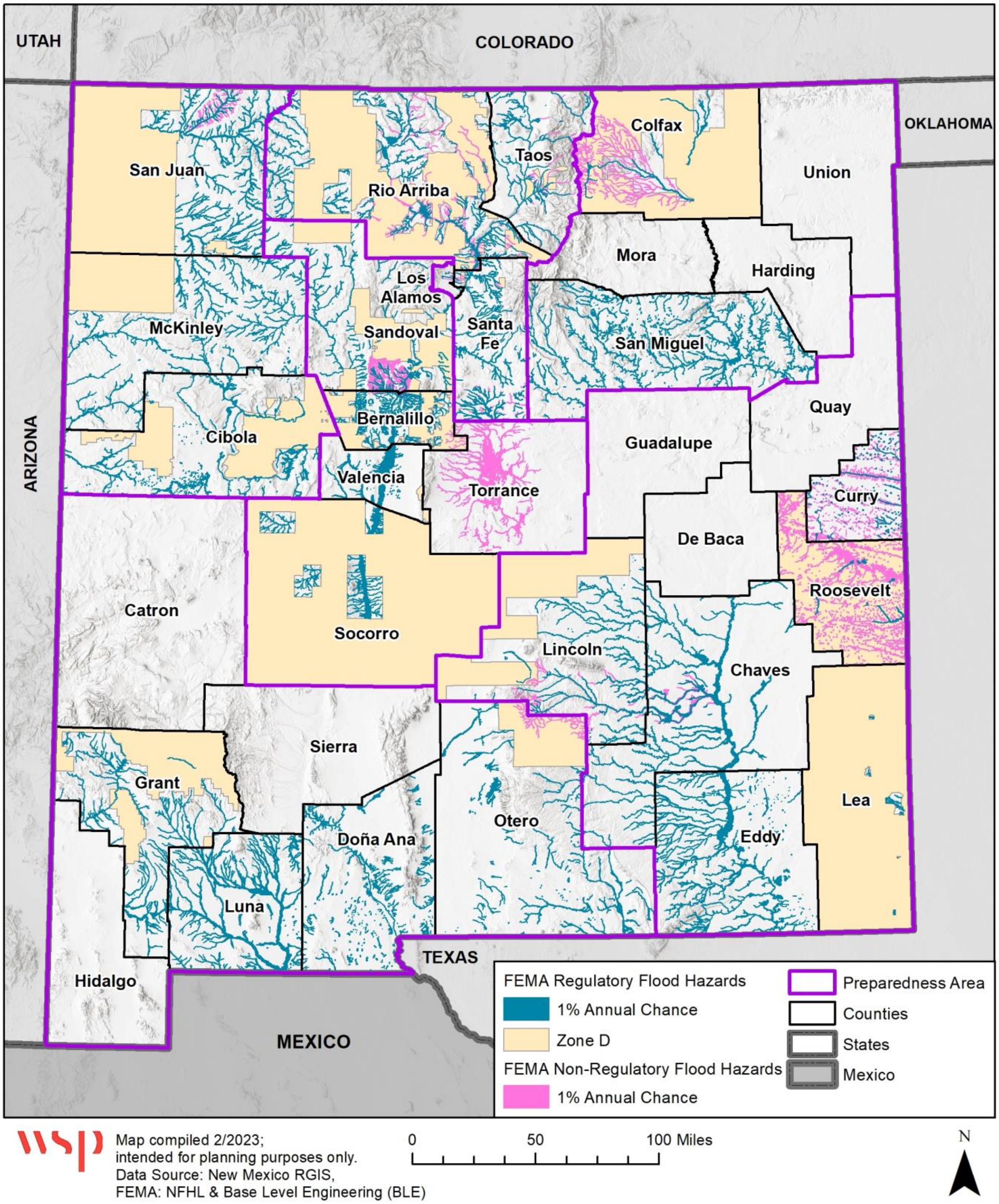


Figure 6-70 New Mexico Regulatory and Non-regulatory Flood Hazards



The New Mexico CTP, the Earth Data Analysis Center, annually updates the New Mexico Risk Map Five Year Business Plan which outlines projects that the CTP will undertake to help New Mexico communities reduce flood risk. These projects are developed in conjunction with the New Mexico State Floodplain Coordinator and FEMA Region VI and are guided by the New Mexico Hazard Mitigation Plan. The projects are prioritized according to Risk Map guidelines in its Multi-Year Plan. The strategies and products address the need for better flood hazard identification and mapping. These strategies include utilizing a watershed study approach with allows for a better understanding of flooding and includes elevation data improvement in the form of Lidar acquisition. Along with the acquisition of accurate elevation data FEMA has instituted a new approach to FIRM in the unmodernized and underserved areas that are currently lacking flood risk information. The Base Level Engineering (BLE) approach creates data that may be used to assess stream inventory, prioritize watersheds or stream segments for further study, provides a sounding board and initiates a discussion with communities that revolves around risk information, risk identification and indication of flood risk abatement and mitigation strategies that may reduce current or future flood risk. BLE datasets are produced to meet the current technical mapping standards outlined in FIMA Policy 204-078-1 Standards for Flood Risk Analysis and Mapping. This allows FEMA Region VI to move efficiently from Discovery to the update of the FIRMs, preparing Zone A maps for communities that are currently underserved by the National Flood Insurance Program. The BLE approach also produces a range of flood risk datasets to include Floodplains (10%, 1% and 0.2% annual chance events), Water Surface Elevation Grids (1% and 0.2% annual chance events), Flood Depth Grids (1% and 0.2% annual chance events), and Hazus Flood Risk Assessment. This wealth of information is intended to elevate the delivery of Zone A FIRMs. BLE datasets can be used in support of local floodplain management activities, hazard mitigation planning efforts, grant applications and disaster response. The BLE information is released through an interactive data portal after review with State and Local officials. This portal allows users to produce a site-specific report for any location within the 1% annual chance floodplain and it produces a site-specific report that can be used for local discussions about individual risk. The site is available for use at: https://apps.femadata.com/estbfe

The Rio Hondo Watershed in southeastern New Mexico was the first HUC-8 watershed to undergo a BLE study, additional watersheds are scheduled for study in the upcoming years.

Acequias

Acequias and ditches have played an important role in the settlement of New Mexico and today remain an integral part of community life. The words “acequia” and “ditch” can defined in both a physical and political context. As a physical structure, an acequia or ditch is typically man-made earthen channel that conveys water to individual tracts of land. As a political organization, a community ditch or acequia is a public entity that functions to allocate and distribute irrigation water to the landowners who are its members.

The physical characteristics of an acequia or ditch typically include a diversion dam and headgate, a main ditch channel commonly called the *acequia madre*, lateral ditches leading from the main channel to irrigate individual leading from the main channel to irrigate individual parcels of land, and wasteway channel that returns surplus water from the acequia or ditch system back to the stream. Occasionally, the works include a storage reservoir or transbasin ditch. The diversion structures can be built or readily available materials, such as timber, bush, and rocks, or consist of concrete and masonry. The channels are usually unlined, open and operate by gravity flow.

The community acequia or ditch association is composed of owners of the lands irrigated by a ditch. Landowners are assessed dues by the acequia association for the operation and maintenance of, and improvements to the ditch systems. Three commissioners and a mayordomo, elected by association members, manage the allocation and distribution of irrigation water, and all members participate in acequia maintenance.

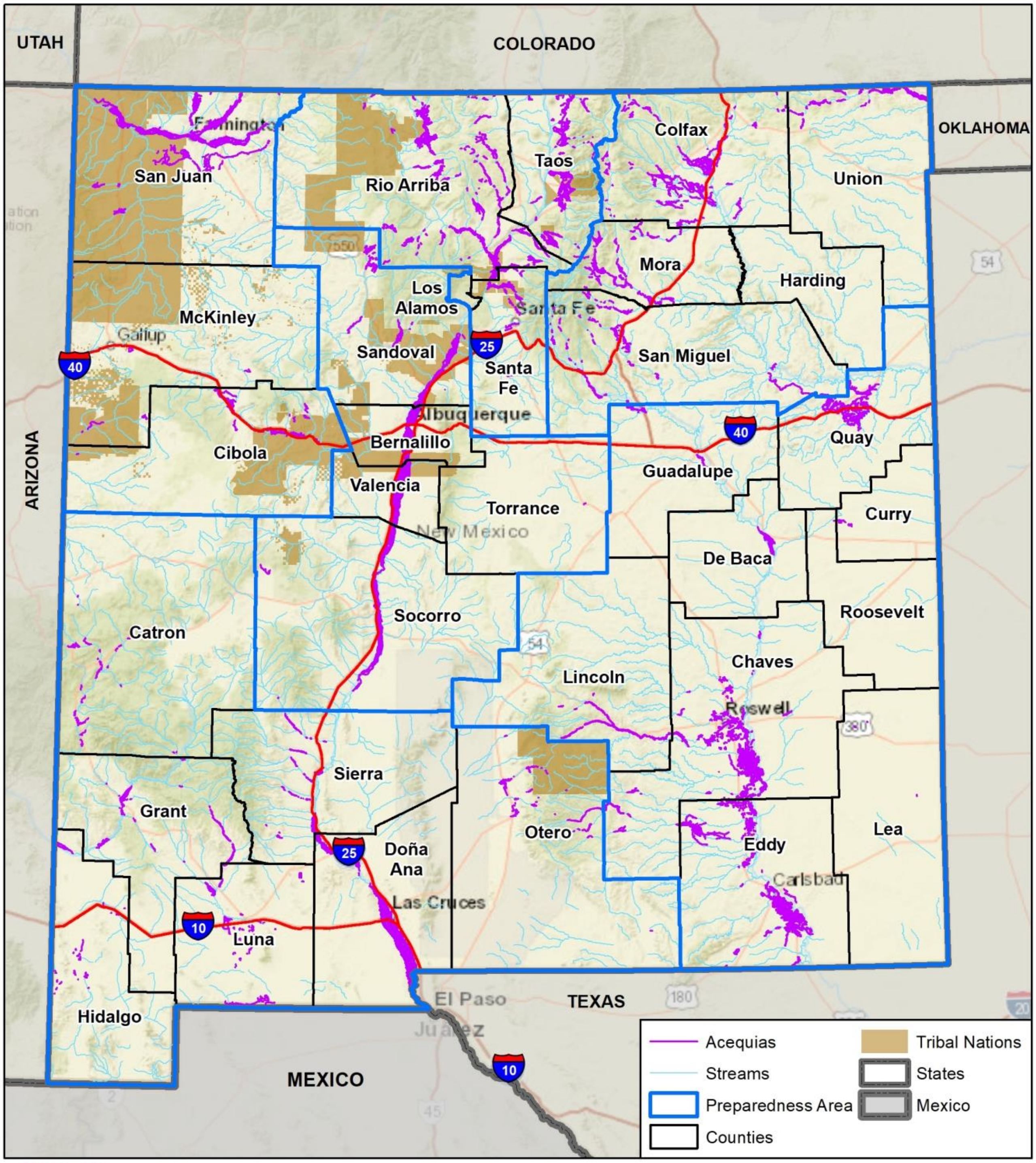
It is estimated that New Mexico has approximately 9,000 acequia miles. Preparedness Area 1 has the most miles of acequias, with 2,487. The farms served by acequias range in size from less than one acre to more than 500 acres; the majority are less than 20 acres.

Acequias are vulnerable to flooding, which can damage the acequia itself as well as cause property damage surrounding the acequia. Flood waters can damage culverts and diversion dams, and fill acequias with silt, requiring extensive restoration efforts. All acequias and acequia associations were mapped for each Preparedness Area and are displayed in each Preparedness Area vulnerability section below. Table 6-54 shows a Statewide summary of acequia data, and Figure 6-71 shows acequia information on a Statewide map.

Table 6-54 Statewide Acequia Summary by Preparedness Area

	Total	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6
Acequia Miles	9,126	2,487	1,038	1,958	1,006	1,413	1,224
DR Claims	353	44	95	81	16	30	85
Flood Risk Miles	4,721	930	455	1,056	508	1,098	674
# of Acequia Associations	32	2	4	15	2	5	4

Figure 6-71 New Mexico Acequias



Map compiled 2/2023;
intended for planning purposes only.
Data Source: New Mexico RGIS

0 50 100 Miles

N

6.8.3 National Flood Insurance Program

In 1968, Congress created the National Flood Insurance Program (NFIP) in response to the rising cost of taxpayer funded disaster relief for flood victims and the increasing amount of damage caused by floods.

The National Flood Insurance Program aims to reduce the impact of flooding on private and public structures. It does so by providing affordable insurance to property owners and by encouraging communities to adopt and enforce floodplain management regulations. These efforts help mitigate the effects of flooding on new and improved structures. Overall, the program reduces the socio-economic impact of disasters by promoting the purchase and retention of general risk insurance, but also of flood insurance, specifically.

The NFIP is self-supporting for the average historical loss year, which means that operating expenses and flood insurance claims are not paid for by the taxpayer, but through premiums collected for flood insurance policies. To obtain secured financing to buy, build, or improve structures in Special Flood Hazard Areas (SFHAs), flood insurance must be purchased. Lending institutions that are Federally regulated or Federally insured must determine if the structure is located in a SFHA and must provide written notice requiring flood insurance. Flood insurance is available to any property owner located in a community participating in the NFIP. All areas are susceptible to flooding, although to varying degrees.

Nearly 22,000 communities across the United States and its territories participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. In exchange, the NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities. Flood insurance is designed to provide an alternative to disaster assistance to reduce the escalating costs of repairing damage to buildings and their contents caused by floods.

The Federal Insurance and Mitigation Administration (FIMA) manages the NFIP and implements a variety of programs authorized by Congress to reduce losses that may result from natural disasters. In addition to providing flood insurance and reducing flood damages through floodplain management regulations, the NFIP identifies and maps the Nation's floodplains. Mapping flood hazards creates broad-based awareness of the flood hazards and provides the data needed for floodplain management programs and to actuarially rate new construction for flood insurance.

In 2014, FEMA established the Technical Mapping Advisory Council (TMAC), as mandated by the Biggert-Waters Flood Insurance Reform Act of 2012 (BW-12), to review the National Flood Mapping Program (Program), recommend improvements to the Program, and assess projected future conditions as they relate to flooding. Since 2014, the TMAC has issued annual recommendations that have the potential to impact the NFIP program. These new recommendations highlight the importance of accurate flood hazard maps to provide relevant information for determining flood risk-rated insurance premiums (FRIPs) and communicating the cost of those premiums over time to residents in areas subject to inundation and water damage. The TMAC recommendations have the potential to significantly change flood insurance and risk mapping in New Mexico.

Future flood studies in New Mexico in areas which have levees will be subject to FEMA’s updated Levee Analysis and Mapping Procedures. If the levees are found to be non-accredited according to the requirements set forth in 44 CFR 65.10 then FEMA will contact community officials and collect local input prior to determining the procedure(s) that will be used to identify the areas of potential flood hazard on the landward side of non-accredited levee systems.

The most widely adopted design and regulatory standard for floods in the United States is the 1% annual chance exceedance (ACE) flood and this is the standard formally adopted by FEMA. The 1% annual flood, also known as the base flood elevation, has a 1% chance of occurring in any particular year. It is also often referred to as the “100-year flood” since its probability of occurrence suggests it should only reoccur once every 100 years (although this is not the case in practice). Experiencing a 100-year flood does not mean a similar flood cannot happen for the next 99 years; rather it reflects the probability that over a long period of time, a flood of that magnitude should only occur in 1% of all years.

The State of New Mexico reported the following NFIP participation statistics as of March 13, 2023, based on information provided by FEMA Region VI. The statistics are summarized for each Preparedness Area in Table 6-55 below.

- Number of NFIP Policies was 8,301
    - A decrease of 4,502 from the 12,803 reported in the 2018 Plan
- Amount of Insured Assets Covered was $1,901,286,700
    - A decrease of $87,130,550 from the $2,772,592,200 reported in the 2018 Plan
- Amount of Total Premiums is $5,805,461
    - A decrease of $4,731,369 from the $10,536,830 reported in the previous plan
- Claims made since 1978 were 1,448
    - An increase of 131 from the 1,317 reported in the previous Plan
- Total Value of Claims Paid since 1978 was $16,879,889
    - An increase of $1,933,572 from the $14,946,317 reported in the previous Plan

Table 6-55 NFIP Participation Statistics as of March 13, 2023

Preparedness Area	County	Number Of Policies	Total Coverage	Insured SFHA Properties	Total Premium	Total Claims Since 1978	Total Paid Since 1978
1	Chaves	200	$42,583,900	126	$152,826	46	$255,247
	Curry	189	$43,373,600	165	$102,549	51	$498,296
	Eddy	250	$52,687,300	193	$251,479	51	$332,647
	Lea	782	$153,563,500	744	$429,577	206	$924,792
	Lincoln	174	$41,453,000	58	$131,253	95	$2,288,765
	Quay	3	$770,000	1	$1,852	10	$12,314
	Roosevelt	279	$45,462,100	271	$199,124	28	$317,444
	Sub-Total	**1,877**	**$379,893,400**	**1,558**	**$1,268,660**	**487**	**$4,629,505**
2	Colfax	14	$3,530,000	7	$10,151	7	$14,219
	Mora	3	$700,000	-	$2,686	0	$0
	San Miguel	75	$17,589,800	45	$84,061	21	$96,688
	Sub-Total	**92**	**$21,819,800**	**52**	**$96,898**	**28**	**$110,907**
3	Los Alamos	19	$6,475,000	-	$8,465	11	$31,798
	Rio Arriba	134	$32,708,400	85	$113,263	39	$354,264

Preparedness Area	County	Number Of Policies	Total Coverage	Insured SFHA Properties	Total Premium	Total Claims Since 1978	Total Paid Since 1978
	Santa Fe	381	$114,233,900	88	$254,001	48	$937,388
	Taos	72	$20,660,400	33	$58,427	26	$52,123
	Sub-Total	**606**	**$174,077,700**	**206**	**$434,156**	**124**	**$1,375,573**
4	Cibola	45	$6,813,500	38	$35,750	26	$445,471
	McKinley	50	$11,478,500	32	$28,660	16	$19,132
	San Juan	141	$43,294,600	66	$127,332	47	$506,764
	Sub-Total	**236**	**$61,586,600**	**136**	**$191,742**	**89**	**$971,367**
5	Bernalillo	1,156	$312,330,700	621	$642,672	178	$1,451,189
	Sandoval	454	$103,728,400	257	$357,600	36	$271,453
	Socorro	145	$33,641,600	93	$154,983	20	$280,331
	Torrance	62	$8,179,700	58	$49,621	1	$4,797
	Valencia	1,700	$354,293,400	1,360	$1,280,305	118	$917,417
	Sub-Total	**3,517**	**$812,173,800**	**2,389**	**$2,485,181**	**353**	**$2,925,187**
6	Catron	2	$90,000	-	$1,313	5	$168,085
	Dona Ana	898	$226,639,300	494	$641,133	200	$4,706,679
	Grant	44	$12,478,200	19	$44,684	12	$116,507
	Hidalgo	3	$280,000	1	$1,418	3	$27,828
	Luna	23	$4,664,000	13	$14,176	4	$151,028
	Otero	977	$202,256,200	590	$602,818	128	$1,539,366
	Sierra	26	$5,327,700	13	$23,282	15	$157,857
	Sub-total	**1,973**	**$451,735,400**	**1,130**	**$1,328,824**	**367**	**$6,867,350**
GRAND TOTAL		**8,301**	**$1,901,286,700**	**5,471**	**$5,805,461**	**1,448**	**$16,879,889**

Currently there are 104 communities participating in the NFIP: 29 counties, 35 cities, 26 villages, 13 towns and one Tribal jurisdiction. There are 11 jurisdictions not participating in the NFIP.

In the State of New Mexico, as in the whole United States, the number of NFIP policies has been decreasing. Between December 2017 and March 2023, the number of NFIP policies has dropped by 4,502 which is a 35.2% drop in the number of policies over a period of six years.

Community Rating System (CRS)

The Community Rating System (CRS) is a voluntary program for NFIP participating communities implemented in 1990 as a program to recognize and encourage community floodplain management activities that exceed minimum NFIP standards. The goals of the CRS are to (1) reduce flood damages to insurable property, (2) strengthen and support the insurance aspects of the NFIP, and (3) encourage a comprehensive approach to floodplain management. The CRS has been developed to provide incentives in the form of premium discounts for communities to go beyond the minimum floodplain management requirements to develop extra measures to provide protection from flooding. A study of the 450 communities nationwide that participate in the CRS program found that these activities, freeboard requirements, open space protection, and flood protection, significantly reduce flood damage. The State NFIP Coordinator can assist local communities with aspects of the CRS program that provide the greatest benefit by training and supporting local floodplain administrators and assisting local communities in developing ordinances and regulations to guide drainage infrastructure projects and development to provide New Mexico Communities with increased flood protection and resilience.

Participation in the CRS program is voluntary and participating communities have their flood insurance premium rates adjusted to reflect the reduced flood risk resulting from community activities that meet the three goals of the CRS. Table 6-56 shows the participating CRS communities in New Mexico. There are 11 New Mexico communities that participate in the CRS. There are two communities (Albuquerque and Las Cruces) that has a Class 7 rating; this rating allows for a 15% insurance premium discount for structures located in the SFHA and 5% discount for structures outside the SFHA. There are five communities that have a Class 8 rating; this rating allows for a 10% insurance premium discount for structures located in the SFHA and 5% discount for structures outside the SFHA. There are three communities that have a Class 9 rating; this rating allows for a 5% insurance premium discount for structures located in the SFHA and 5% discount for structures outside the SFHA. It is also one community that has a class 10 rating. This allows for a 10% discount within the SFHA and a 0% discount on structures located outside the SFHA. CRS communities with New Mexico are located in Table 6-56 below.

Table 6-56 New Mexico CRS Communities as of March 13, 2023

Community Number	Community Name	NFIP Entry Date	Current Effective Date	Current Class	% Discount for SFHA	% Discount for Non-SFHA	Status
350045	Alamogordo	10/01/91	10/01/91	9	5	5	C
350002	Albuquerque	10/01/93	11/04/16	7	15	5	C
350001	Bernalillo County	10/01/93	05/01/13	8	10	5	C
350010	Clovis	10/01/91	05/16/13	8	10	5	C
350012	Dona Ana County	10/01/03	10/01/20	10	10	0	C
350067	Farmington	10/01/91	05/01/17	8	10	5	C
350029	Hobbs	10/01/92	05/01/08	8	10	5	C
355332	Las Cruces	10/01/91	07/06/16	7	15	5	C
350054	Portales	10/01/95	10/01/95	9	5	5	C
350006	Roswell	10/01/92	10/01/92	9	5	5	C
350064	San Juan County	05/01/08	10/01/12	8	10	5	C

Repetitive Loss Properties

The NFIP defines a Repetitive Loss (RL) property as one that has incurred flood-related damage on two occasions during a 10-year period, each resulting in at least a $1000 claim payment.

As of July 1, 2023, 58 repetitive loss properties are identified in the State. This represents a 61% increase from the 36 RL properties listed in the 2018 SHMP. Those 58 properties have experienced 130 losses totaling $2,289,233 in damages. The RL properties are summarized by preparedness area in Table 6-57 and listed by community in Table 6-58.

Table 6-57 Summary of Repetitive Loss Properties by Preparedness Area

PA	RL Properties	Total Losses	Total Paid
1	24	57	$709,495
2	1	2	$50,004
3	2	4	$62,027
4	6	12	$331,956
5	7	15	$285,115
6	18	40	$850,636
Total	**58**	**130**	**$2,289,233**

Table 6-58 Repetitive Loss Properties

County	Community	NFIP Insured	Zip Code	Total Losses	Total Paid
Bernalillo County	Albuquerque, City of	No	87112	2	$5,585.38
Bernalillo County	Albuquerque, City of	No	87105-1728	2	$42,604.50
Bernalillo County	Bernalillo County	No	87105-5943	3	$24,676.20
Chaves County	Chaves County	Yes	88232-9701	2	$31,671.09
Chaves County	Roswell, City of	No	88201-2047	3	$11,523.13
Chaves County	Roswell, City of	No	88201-6246	2	$9,890.56
Cibola County	Grants, City of	No	87020-2740	2	$44,538.28
Curry County	Clovis, City of	Yes	88101-8375	2	$175,614.10
Dona Ana County	Dona Ana County	Yes	88005-8606	3	$47,690.80
Dona Ana County	Dona Ana County	Yes	88081-7394	2	$83,238.63
Dona Ana County	Dona Ana County	No	88007-4830	2	$26,109.24
Dona Ana County	Dona Ana County	Yes	88007-6305	2	$41,113.78
Dona Ana County	Las Cruces, City of	No	88005-2910	5	$29,796.10
Eddy County	Carlsbad, City of	Yes	88220-3332	2	$35,781.76
Eddy County	Carlsbad, City of	Yes	88220-3332	2	$38,218.28
Eddy County	Carlsbad, City of	No	88220-4256	2	$12,971.87
Eddy County	Carlsbad, City of	Yes	88220-3080	2	$9,266.86
Lea County	Hobbs, City of	No	88240-4733	2	$14,224.26
Lea County	Hobbs, City of	No	88240-4745	2	$40,549.20
Lea County	Hobbs, City of	No	88240	2	$9,023.07
Lea County	Hobbs, City of	No	88240-4748	3	$13,064.88
Lea County	Hobbs, City of	No	88240-4747	2	$13,587.29
Lea County	Hobbs, City of	No	88240-4749	4	$25,323.38
Lea County	Hobbs, City of	Yes	88240-4542	4	$21,957.15
Lea County	Hobbs, City of	No	88240-4748	2	$6,222.27
Lea County	Hobbs, City of	No	88240-4749	2	$14,074.41
Lea County	Hobbs, City of	Yes	88242-9671	2	$30,843.88
Lea County	Hobbs, City of	Yes	88240-1044	2	$9,000.48

County	Community	NFIP Insured	Zip Code	Total Losses	Total Paid
Lincoln County	Ruidoso, Village of	No	88345-7509	2	$22,154.83
Luna County	Deming, City of	No	88030-8776	2	$88,420.82
McKinley County	Gallup, City of	No	87301	2	$12,090.08
Otero County	Alamogordo, City of	No	88310-6104	2	$11,781.50
Otero County	Alamogordo, City of	No	88310-4105	2	$53,570.41
Otero County	Alamogordo, City of	No	88310-4107	2	$48,035.09
Otero County	Alamogordo, City of	No	88310-4179	2	$15,417.25
Otero County	Alamogordo, City of	No	88310-4138	2	$23,448.64
Otero County	Alamogordo, City of	No	88310-4107	2	$57,991.20
Otero County	Alamogordo, City of	No	88310-4138	2	$45,965.89
Otero County	Alamogordo, City of	No	88310-4107	2	$76,273.94
Otero County	Alamogordo, City of	No	88310-4107	2	$59,057.57
Otero County	Alamogordo, City of	No	88310-3400	2	$39,303.73
Otero County	Alamogordo, City of	No	88310-3400	2	$73,307.18
Otero County	Alamogordo, City of	No	88310-3400	2	$30,114.34
Roosevelt County	Portales, City of	No	88130-6102	2	$6,658.21
Roosevelt County	Portales, City of	Sdf	88130-7334	5	$110,480.84
Roosevelt County	Portales, City of	Yes	88130-6923	2	$9,927.44
Roosevelt County	Portales, City of	Yes	88130-5301	2	$37,465.74
San Juan County	Aztec, City of	Sdf	87410-4514	2	$97,969.07
San Juan County	Aztec, City of	No	87410-2044	2	$105,534.85
San Juan County	Aztec, City of	No	87410-2098	2	$65,449.13
San Juan County	San Juan County	Yes	87412-9703	2	$6,374.92
San Miguel County	San Miguel County*	No	87701-9747	2	$50,003.52
Santa Fe County	Santa Fe County	No	87532	2	$56,444.28
Socorro County	Socorro County*	Yes	87801-5097	2	$35,209.46
Taos County	Taos County	No	87556-661	2	$5,583.15
Valencia County	Belen, City of	Yes	87002-3508	2	$20,000.00
Valencia County	Valencia County	Yes	87002-9300	2	$95,924.34
Valencia County	Valencia County	Yes	87002-9300	2	$61,115.13
			TOTAL	**130**	**$2,289,233.38**

The NFIP defines a Severe Repetitive Loss (SRL) property as one covered by a contract for flood insurance under the National Flood Insurance Program (NFIP) that has incurred flood-related damage — for which 4 or more separate claims payments have been made under flood insurance coverage under this title, with the amount of each such claim exceeding $5,000, and with the cumulative amount of such claims payments exceeding $20,000; or for which at least 2 separate claims payments have been made under such coverage, with the cumulative amount of such claims exceeding the value of the insured structure. In addition, the structure must be residential and two of the losses must have occurred within 10 years of each other.

As of July 1, 2023, two severe repetitive loss structures are identified in New Mexico, both located in Preparedness Area 1. These two properties have nine losses between them totaling $321,516 in damages.

Table 6-59 Severe Repetitive Loss Properties (as of 12/31/17)

Community Name	County Name	Zip Code	Losses per Structure	Total Claim Amount Paid Out
Curry County	Clovis, City of	88101-7829	5	$234,322
Lea County	Hobbs, City of	88240-1002	4	$87,194
		TOTAL	**9**	**$321,516**

6.8.4 Previous Occurrences

As described in Section 6.4.2, most of New Mexico has experienced below-average rainfall for the last several years. Nevertheless, New Mexico has experienced numerous flood/flash flooding events in each Preparedness Area. The current online NCDC database is limited in past events and contains data starting from May 1996 to December 2017, as entered by NOAA's National Weather Service (NWS). Referencing this online database, NCDC reports a total of 1,292 flood/flash flood events with 32 deaths, 15 injuries, over $115 million in property damage, and over $5 million in crop damage.

The years 2013 and 2014 saw very heavy flooding throughout the State of New Mexico. The flooding during this time resulted in over $20 million in property damage and six Presidential Disaster Declarations. This figure represents Federal dollars obligated to date and is expected to increase as repair work continues. Overall, the State has had eight flood disaster declarations since 2010 and 12 since 2004. For comparison's sake, from 1973 to 2003, a 30-year period, there were 11 flood declarations. There is a potential that this level of damage could continue as a result of extreme weather, climate change, floods after fires, and increased development.

From September 9th-18th, 2013, New Mexico experienced a major precipitation event that resulted in extensive flooding in some drainages, and record and near-record flows in many streams. The interaction between monsoonal circulation from the south that tracked in moisture sourced from tropical storms over Mexico, and a trough over Arizona and Nevada that helped steer this moisture into New Mexico and Colorado and, eventually, Texas, resulting in widespread flooding and approximately $18.5 million in damages. Portions of the State experienced 1,000-year rainfall events.

The US Army Corps of Engineers completed a post flood report after the September 2013 floods (DR 4151 and DR 4152). The report summarizes the meteorological and hydrological characteristics of the flood event, and its impacts to infrastructure and communities in each major basin throughout the State. The analysis includes performance of flood control structures and in each major basin within the USACE, Albuquerque District and includes a preliminary overview of damages caused by these events as well as losses avoided. Table 6-60 shows losses avoided by flood control measures in each basin.

Table 6-60 Losses Avoided by Flood Control Measures by Basin for the September 2013 Floods

Basin	Project	Flood Control Benefits
Rio Grande	Cochiti	$113,088,400
	Jemez Canyon	$37,696,200
	Galisteo	$45,326,800
	Total	$196,111,400
Pecos	Brantley	$1,948,900
	Santa Rosa	$4,060,800
	Sumner	$8,244,700
	Two Rivers	$185,554,000
	Total	$199,808,400
Upper Canadian River	None	None
Upper Arkansas River	None	None
Upper San Juan River	None	None
Lower Colorado River Tributary Headwaters	None	None
Total		**$395,919,800**

Declared Disasters from Flood/Flash Flooding

FEMA reports 28 Federally Declared Disasters for flooding between 1955 and 2023. 2018 has seen the most recent federally declared flooding event in New Mexico due to flooding. This event occurred within the Pueblo of Acoma Indian Reservation.

Table 6-61 summarizes the declaration title, year of the event, incident type and county or reservation that each flooding event that has been federally declared has occurred. The timespan between 2013 and 2016 has seen some of the busiest flood event periods within New Mexico. With DR-4152 and DR-4197 effecting many counties within the state.

Table 6-61 Federally Declared Flooding Disasters, 1955-2023

Declaration	Year	Incident	Title	County
DR-4352-NM	2018	Flood	Severe Storms And Flooding	Pueblo of Acoma
DR-4199-NM	2015	Severe Storm	Severe Storms And Flooding	Colfax, Eddy, Lea, Lincoln, Otero, San Miguel, Santa Fe, Sierra
DR-4197-NM	2015	Severe Storm	Severe Storms And Flooding	Guadalupe, Lincoln, Pueblo of Santa Clara, Otero, Rio Arriba, Sandoval, San Miguel
DR-4152-NM	2014	Flood	Severe Storms, Flooding, And Mudslides	Catron, Chaves, Cibola, Colfax, Eddy, De Baca, Dona Ana, Guadalupe, Harding, Isleta Pueblo Reservation, Los Alamos, Lincoln, McKinley, Mora, Navajo Nation Reservation (Also AZ and UT), Otero, Rio Arriba, Sandia Pueblo Reservation, Sandoval, Santa Fe, San Juan, San Miguel, Sierra, Socorro, Taos, Torrance
DR-4151-NM	2014	Severe Storm	Severe Storms And Flooding	Santa Clara Pueblo Reservation
DR-4148-NM	2013	Severe Storm	Severe Storms And Flooding	Bernalillo, Luna, Sandoval, Santo Domingo Pueblo Indian Reservation

Declaration	Year	Incident	Title	County
DR-4079-NM	2012	Flood	Flooding	Los Alamos, Lincoln, Mescalero Tribe, Sandoval, Santa Clara Pueblo (Indian Reservation)
DR-4047-NM	2012	Flood	Flooding	Cibola, Cochiti Pueblo Indian Reservation, Pueblo of Acoma, Los Alamos, Sandoval, Santa Clara Pueblo Reservation
DR-1936-NM	2010	Flood	Severe Storms And Flooding	Cibola, Mora, McKinley, Navajo Nation Reservation, Pueblo of Acoma, San Juan, Socorro
DR-1783-NM	2008	Severe Storm	Severe Storms And Flooding	Lincoln, Otero
DR-1659-NM	2006	Severe Storm	Severe Storms And Flooding	Cibola, Dona Ana, Grant, Guadalupe, Harding, Hidalgo, Lincoln, Luna, McKinley, Navajo Nation Reservation, Otero, Mora, Rio Arriba, Sandoval, San Miguel, Sierra, Socorro, Taos, Torrance, Valencia
DR-1514-NM	2004	Severe Storm	Severe Storms And Flooding	Bernalillo, Eddy, Mora, San Miguel
DR-1301-NM	1999	Severe Storm	Severe Ice Storms, Flooding And Heavy Rains	Dona Ana, Luna, Mescalero Tribe, Mora, Rio Arriba, Sandoval, San Juan, Sierra
DR-992-NM	1993	Flood	Severe Storms & Flooding	Catron, Grant, Hidalgo, McKinley
DR-945-NM	1992	Flood	Thunderstorms, Hail & Flooding	Lea
DR-731-NM	1985	Flood	Severe Storms & Flooding	Catron, Grant, Hidalgo, Lincoln, Torrance
DR-722-NM	1984	Flood	Severe Storms & Flooding	Eddy, Lincoln, Otero
DR-692-NM	1984	Flood	Severe Storms And Flooding	Catron, Grant, Hidalgo
DR-589-NM	1979	Flood	Severe Storms, Snowmelt & Flooding	Mora, Lincoln, Rio Arriba, Santa Fe, San Miguel, Taos
DR-571-NM	1979	Flood	Flooding	Catron, Grant, Hidalgo, Lincoln, Sierra
DR-380-NM	1973	Flood	Severe Storms, Snow Melt & Flooding	Colfax, Harding, McKinley, Mora, Rio Arriba, Sandoval, Santa Fe, San Miguel, Taos, Union, Valencia
DR-361-NM	1973	Flood	Heavy Rains & Flooding	Catron, Grant, Hidalgo
DR-353-NM	1972	Flood	Heavy Rains & Flooding	Dona Ana, McKinley, Sierra
DR-202-NM	1965	Flood	Severe Storms & Flooding	Colfax, Lincoln, Mora, San Miguel
DR-27-NM	1955	Flood	Flood	Statewide

FEMA.GOV

Another source of flood damage information is from the NCEI. Table 6-62 gives a tally of flood damage as reported by NCEI broken out by Preparedness Area. According to NCEI, Statewide property damage from flood damage was over $115 million and crop damage was over $5 million from May 1996 through

December 2022. Table 6-62 outlines significant past events that have occurred in New Mexico Preparedness Areas.

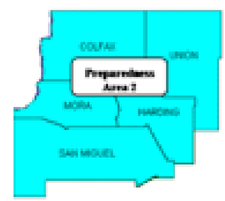
Table 6-62 Preparedness Areas 1 - 6 Flood/Flash Flood History, 2018 - 2022

Preparedness Area 1
Counties: Chaves, Curry, De Baca, Eddy, Guadalupe, Lea, Lincoln, Quay, and Roosevelt

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Flood	15	0	0	0	$27,256,500	$0
Flash Flooding	73	0	2	0	$10,977,200	$0
Total	**88**	**0**	**2**	**0**	**$6,994,000**	**$0**

Preparedness Area 2
Counties: Colfax, Harding, Mora, Union, and San Miguel

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Flood	0	0	0	0	$0	$0
Flash Flooding	68	0	1	1	$6,970,000	$0
Total	**68**	**0**	**1**	**6**	**$6,970,000**	**$0**

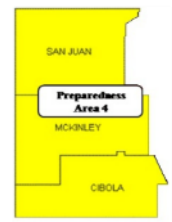


Preparedness Area 3
Counties: Los Alamos, Rio Arriba, Santa Fe and Taos
Pueblos: Nambe, Ohkay Owingeh, Picuris, Pojoaque, San Ildefonso, Santa Clara, Tesuque, and Taos
Tribal Nations: Jicarilla Apache

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Flood	0	0	0	0	$0	$0
Flash Flooding	29	0	1	0	$2,273,000	$0
Total	**29**	**0**	**1**	**0**	**$2,273,000**	**$0**

Preparedness Area 4
Counties: Cibola, McKinley, and San Juan
Pueblos: Acoma, Laguna, Zuni
Tribal Nations: Navajo Nation

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Flood	0	0	0	0	$0	$0
Flash Flooding	27	0	0	0	$$1,015,000	$0
Total	**27**	**0**	**0**	**0**	**$1,015,000**	**$0**

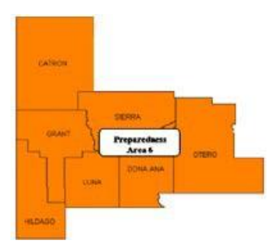


Preparedness Area 5
Counties: Bernalillo, Sandoval, Socorro, Torrance, and Valencia
Pueblos: Cochiti, Isleta, Jemez, Sandia, Santa Ana, Santo Domingo, San Felipe, and Zia

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Flood	0	0	0	0	$0	$0
Flash Flooding	48	0	4	0	$4,550,000	$0
Total	**48**	**0**	**4**	**0**	**$4,550,000**	**$0**

Preparedness Area 6
Counties: Catron, Dona Ana, Grant, Hidalgo, Luna, Otero, and Sierra
Tribal Nation: Mescalero Apache

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Flood	4	0	0	0	$0	$0
Flash Flooding	44	0	0	1	$4,007,000	$0
Total	**48**	**0**	**0**	**1**	**$4,007,000**	**$0**

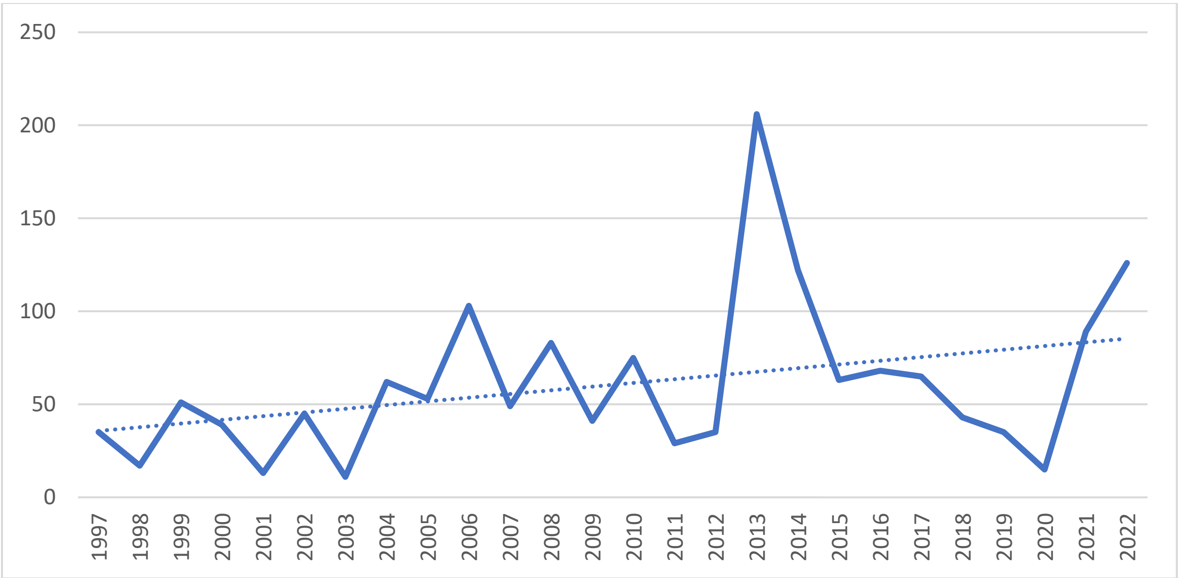


Source: NCEI

6.8.5 Past Frequency

New Mexico experiences flooding somewhere in the State every year. NCEI records 1573 flood events from 1997 through 2022, an average of 60 per year. There have been 25 Federal Disaster Declarations for flooding in New Mexico since 1950, an average of roughly one every 3 years. Figure 6-72 shows the number of flash flood events per year, showing a clear trend upward over the past 26 years.

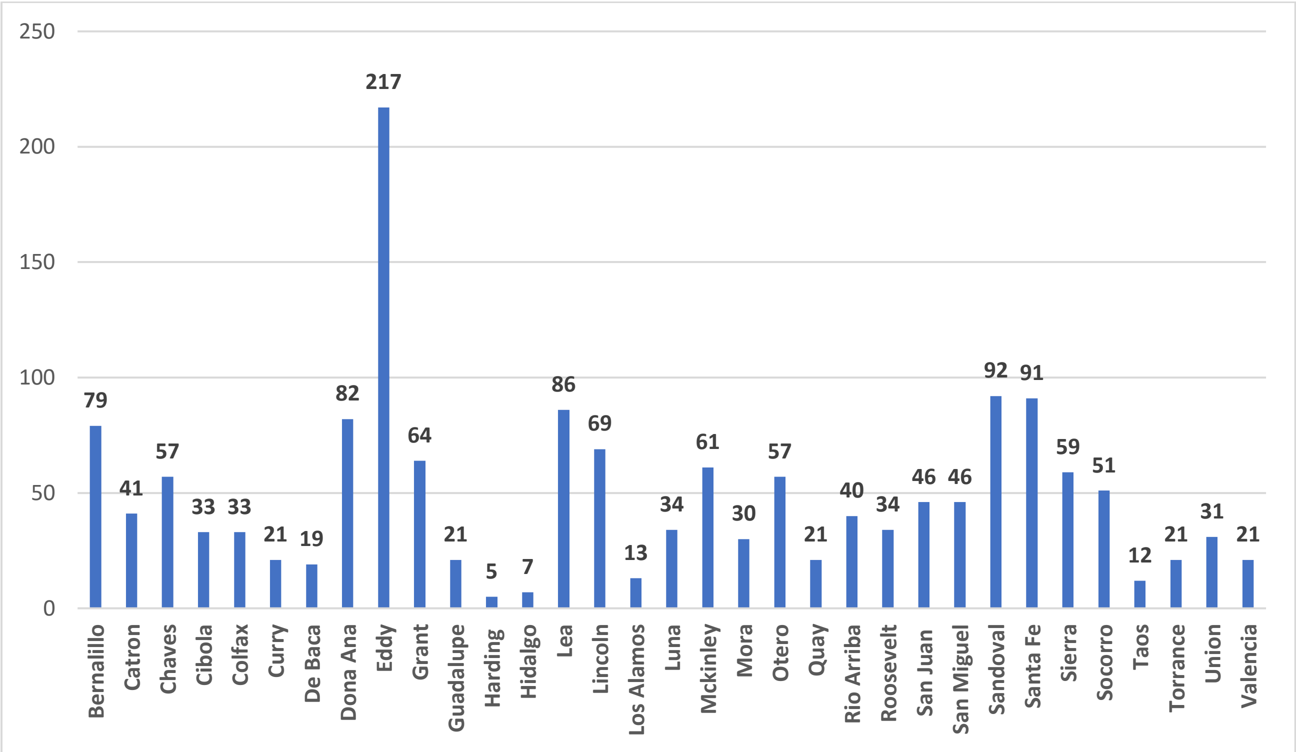
Figure 6-72 Flood/Flash Flood Events by Year, 1997-2022



Source: NCEI

Figure 6-73 breaks out the number of floods and flash floods per county.

Figure 6-73 Flood/Flash Flood Events by County, 1997-2022

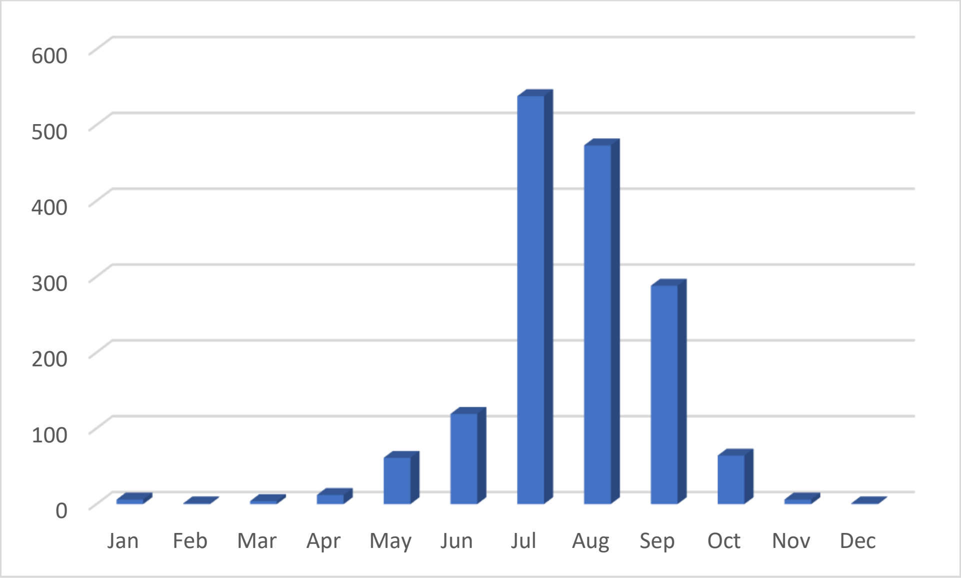


Source: NCEI

New Mexico and other areas across the Southwest U.S. are affected by the North American Monsoon System every summer, and the "Monsoon Season" is designated as the period lasting from June 15th through September 30th. With the onset of the Monsoon, New Mexico is typically impacted by a variety of weather hazards that can often put the population at risk for serious injury or death. Thunderstorm frequency increases during this period, while exceptionally hot days are common as well. These pages were prepared to help promote awareness of the life-threatening weather hazards that affect New Mexico during the Summer Monsoon.

Most of the flash floods in New Mexico are associated with the summer monsoon season. Approximately 60% of all flash floods in the State occur in July and August. The monsoon season generally dissipates in the northern part of the State (Preparedness Area 4) in early September. In mid to late summer, the pacific winds bring humid subtropical air into the State. Solar heating triggers afternoon thunderstorms that can be devastating.

Figure 6-74 Flood/Flash Flood Events by Month, 1997-2022



Source: NCEI

Spring floods vary between winter type events where the rain falls over the remaining winter snowpack in or near the mountains to events in the eastern plains, which are often associated with cold fronts, abundant moisture from the Gulf of Mexico, and upslope conditions. Although all the eastern plains are subject to this type of event, the greatest frequencies have been in the far southeast, in Eddy and Lea Counties (Preparedness Area 1).

Late summer floods can occur due to hurricane remnants and tropical storms that move over the State from both the Gulf of Mexico and the Pacific Ocean. By the time these remnants reach New Mexico, however, usually the only feature remaining is an abundance of moisture. Hurricane-force winds have long since dissipated. Flash floods frequently occur on alluvial fans with devastating results. The combination of rapidly rising floodwater, high velocities and heavy sediment/debris loads contributed to the damage in Alamogordo and Hatch (Preparedness Area 6) in 2006 (Figure 6-75).

Figure 6-75 Flooding in Preparedness Area 6 (Alamogordo and Hatch, NM) 2006

Photos provided by NMDHSEM.

Figure 6-76 Flooding in Preparedness Areas 4, 5, and 6 (DR-4197) 2013

6.8.6 Climate Change Impacts

Climate projections across the United States have shown that while total annual precipitation will likely decrease in the Southwest region, the heaviest annual rainfall events will become more intense. Extreme precipitation, one of the controlling factors in flood statistics, is observed to have generally increased and is projected to continue to do so across the United States in a warming atmosphere. As a result, damaging flood events have the potential to increase with climate change. (Climate Science Special Report, Fourth National Climate Assessment 2017, https://science2017.globalchange.gov/chapter/8/) Also, with wildfires already being a problem in New Mexico, increasing periods of drought and lack of precipitation are expected to exacerbate conditions for fires to occur, and in turn worsen the potential for runoff and flooding associated with burned areas.

Warming is likely to directly affect flooding in many mountain settings, as catchment areas receive increasingly more precipitation as rain rather than snow, or more rain falling on existing snowpack. In some such settings, river flooding may increase as a result – even where precipitation and overall river flows decline.

According to the 2014 National Climate Assessment, southwestern river basins will experience gradual runoff declines during this century but flooding in the region is generally expected to increase. There are no specific projections or trends that have been noted to indicate that more substantial or more frequent flooding events can be expected to occur.

Global warming may also lead to more ice-jam flooding along mountain streams, when heavy rainfall or upstream melting raises stream flows to the point of breaking up the ice cover, which can pile up on bridge piers or other channel obstructions and cause flooding behind the jam.

Once the ice jam breaks up, downstream areas are vulnerable to flash floods. Global warming could create conditions ripe for ice-jam floods. The increasing possibility of mid-winter thaws and heavy rainfall events could increase the risk of sudden ice break up. Flooding can be further exacerbated if the ground is still frozen and unable to soak up rainwater.

Other influences on flood generation that should be considered in projections of future flood risks are land cover, flow and water supply management, soil moisture and channel conditions. In addition to discouraging development in flood-prone areas and protecting natural systems such as wetlands, local government planners and engineers should design infrastructure with the capacity to accommodate heavy rains and manage stormwater runoff during extreme events.

6.8.7 Probability of Future Occurrence

As noted above, from 1997 through 2022 New Mexico has an average of 60 per year and one Disaster Declaration for flooding roughly every 3 years. However Figure 6-72 shows the frequency of flooding events has been increasing over the last several decades. If current trends continue, in 5-10 years New Mexico may be experiencing and average of 80-100 floods per year.

To determine the probability of New Mexico experiencing flood/flash flood event, the probability or chance of occurrence was calculated based on historical data identified in the NCEI database from a period of 1997 through 2022. Applying this formula at the Preparedness Areas level gives the following probabilities.

Table 6-63 Probability of Occurrence - Flood/Flash Flood

Preparedness Area	Riverine Flood	Flash Flooding
PA 1	100%	100%
PA 2	38%	100%
PA 3	33%	100%
PA 4	19%	100%
PA 5	57%	100%
PA 6	100%	100%

6.8.8 Vulnerability Assessment

From 1997 through 2022, NCEI reports 38 deaths and 16 injuries from flooding, along with $140 million in property damage and $5.8 million in uninsured crop damage. This equates to an average annualized loss of 1.5 deaths, 0.6 injuries, $5.4 million property damage, and $4224,000 in uninsured crop damage.

Flash flooding occurs when too much rain falls in too small an area in too short a time. These flash floods generally travel down arroyos (normally dry streambed) and can involve a rapid rise in water level, high velocity, and large amounts of debris, which can lead to significant damage that includes the uprooting of trees, undermining of buildings and bridges, and scouring new channels. The intensity of flash flooding is a function of the intensity and duration of rainfall, steepness of the watershed, stream gradients, watershed vegetation, natural and artificial flood storage areas, and configuration of the streambed and floodplain. Dam failure and ice jams may also lead to flash flooding. Urban areas are increasingly subject to flash flooding due to the removal of vegetation, replacement of ground cover with impermeable surfaces, and construction of drainage systems. Local drainage floods may occur outside of recognized drainage channels or delineated floodplains due to a combination of locally heavy precipitation, a lack of infiltration, inadequate facilities for drainage and storm water conveyance, and increased surface runoff.

Winter flash flood events usually result from unseasonably high-level rain on top of a snowpack. Excessive runoff allows the combined release of the water in the snowpack along with the rain. These can be flash flood events lasting less than a day, or they can evolve into longer-term flooding events lasting from one day to a couple of weeks. Winter flooding occurs between November and February and usually affects the southwest portion of the State.

Each Preparedness Area has several conditions that may contribute to flash floods and exacerbate the associated impacts:

Steep Slopes: Moderate to steep sloping terrain that can contribute to flash flooding, since runoff reaches the receiving arroyos and rivers more rapidly over steeper terrain.

Obstructions: During floods, obstructions can block flood flow and trap debris, damming floodwaters and potentially causing increased flooding uphill from the obstructions.

Soils: Soils throughout much of the State are derived from underlying parent materials rich in carbonate as well as mixed clays. As a result, soils are typically fine grained, and have low infiltration rates and high runoff potential. Vegetative cover is either mixed shrubs or mixed grasses. Sparse vegetative cover combines with high runoff soil potential to result in significant flooding hazards in ephemeral washes and adjacent areas. Wildfires result in extreme soil damage. Soil damage usually occurs where burn intensities are severe to moderate. The loss of the organic components in the soil greatly decreases the ability of rain to infiltrate. Large floods can occur in these burned areas from average monsoonal rainstorms.

Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related probability of occurrence. Flood studies use historical records to determine the probability of occurrence for different extents of flooding. The probability of occurrence is expressed as the percentage chance that a flood of a specific magnitude will occur in any given year.

Below are six preparedness area scale floodplain maps based on existing flood insurance rate maps. Figure 6-77 – Figure 6-82 delineate Special Flood Hazard Areas (SFHA), or land areas that are identified by FEMA maps as subject to inundation by a flood. Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk. These zones are depicted on a community's Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map. On this map, the SFHAs are shaded with different colors and divided into distinct flood hazard zones depicted on the map legend. Each zone reflects the severity or type of flooding in the area. The following flood zone maps have been included to allow for a finer level of analysis by depicting flood risks by Preparedness Area.

State Assets

A geospatial analysis of state assets overlaid on the best available floodplain data found no state owned buildings or facilities located in a FEMA floodplain or non-regulated floodplains. While state assets could still be exposed to flooding outside the floodplain, this risk is difficult to quantify. Nonetheless, the fact that no state assets are located in floodplains speaks well of the state's regulations and policies about limiting development in areas at increase risk of flooding.

Property Exposure from LHMPs

A total of 67% of the LHMPs reported data on flood exposure. A summary of the analysis identifies approximately 35,000 structures/parcels exposed statewide, with an overall reported value of almost $5.8 billion. Most notable in exposure is PA 1 which has approximately 33%, or over 11,000, of the total statewide exposed structures/parcels reported and 28% of the total exposure as reported in six LHMPs. PA 6 accounts for approximately 22% of the total exposed structures/parcels in the 1% annual chance floodplain and 33% of the total structure value reported in the six LHMPs.

Table 6-64 Exposure to 1% Annual Chance Floodplain by Preparedness Area

PAs and Jurisdictions	Total Dollar Value Exposure	Total Exposed Structures/Parcels
PA 1	**$1,660,074,000**	**11,625**
Quay County	$10,658,000	146
Guadalupe County	$14,880,000	118
Curry County	$45,710,000	503
De Baca County	$124,124,000	-
Lincoln County	$534,527,000	4,586
Eddy County	$930,175,000	6,272
PA 2	**$1,380,000**	**-**
Union County	$1,380,000	-
PA 3	**$468,309,000**	**1,676**
Santa Clara Pueblo	-	25
Los Alamos	$2,377,000	-
Taos County	$119,604,000	743
Santa Fe County	$162,506,000	749
City of Santa Fe	$183,822,000	159
PA 4	**$659,203,000**	**5,883**
McKinley County	-	892
San Juan County	$34,030,000	-
Zuni Pueblo	$90,646,000	405
Laguna Pueblo	$534,527,000	4,586

PAs and Jurisdictions	Total Dollar Value Exposure	Total Exposed Structures/Parcels
PA 5	**$1,126,757,000**	**8,467**
Zia Pueblo	$13,000	1
Socorro County	$8,695,000	-
Santa Ana Pueblo	$13,655,000	193
Torrance County	$123,084,000	1,169
Sandoval County	$148,675,000	3,123
Bernalillo County / Albuquerque	$832,635,000	3,981
PA 6	**$1,923,747,000**	**7,688**
Mescalero Apache	-	325
Luna County	$9,300,000	21
Hidalgo County	$24,687,000	345
Sierra County	$78,170,000	451
Otero County	$422,073,000	-
Dona Ana County	$1,389,517,000	6,546
Grand Total	**$5,839,470,000**	**35,339**

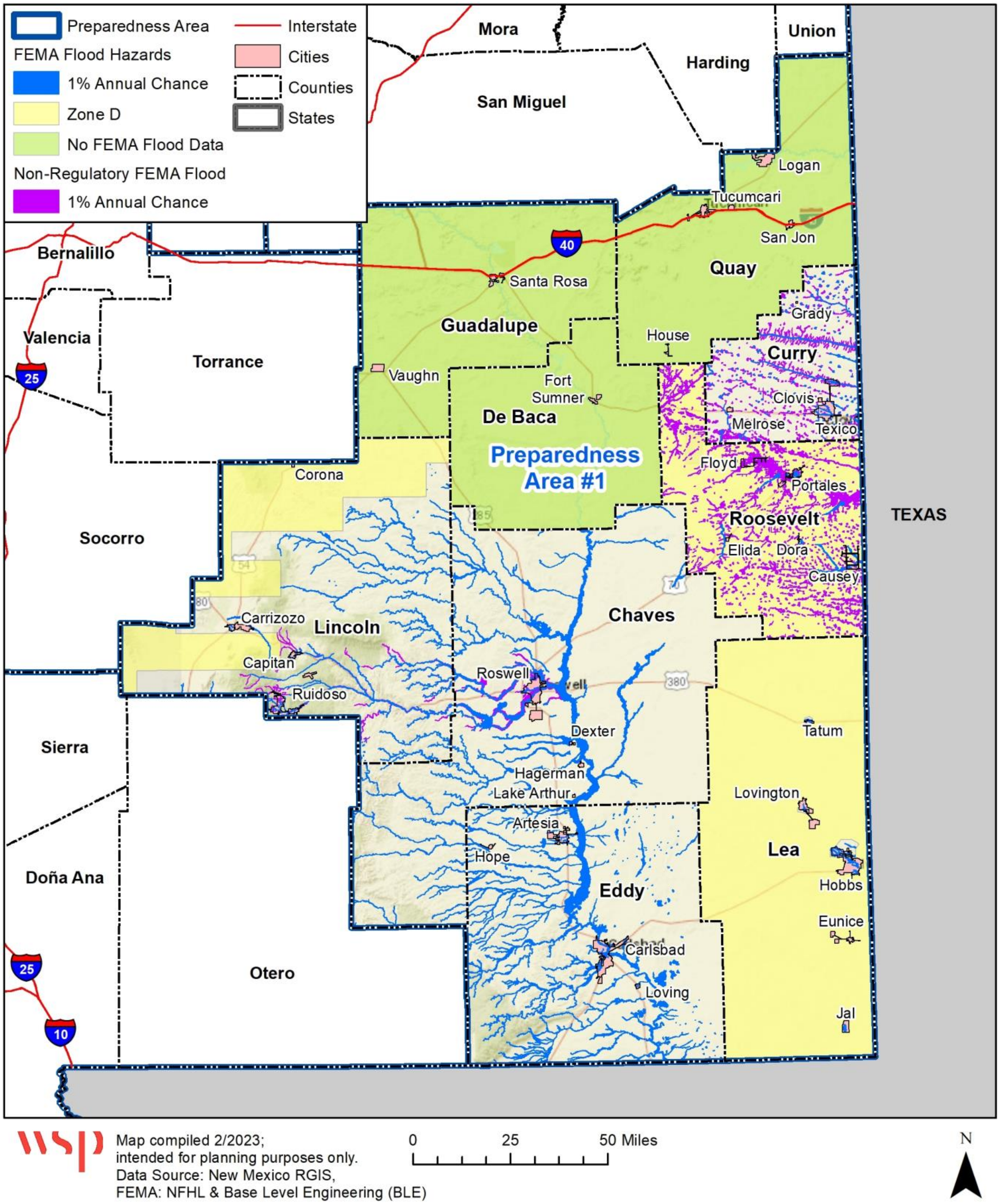
Levee inundation exposure was reported by a single LHMP in PA 5. Data shows that almost 33,000 structures/parcels, worth $4.2 billion, are exposed to levee inundation in Bernalillo County.

Table 6-65 Exposure to Levee Inundation Areas by Preparedness Area

PAs and Jurisdictions	Total Dollar Value Exposure	Total Exposed Structures/Parcels
PA 5	**$4,166,419,232**	**32,658**
Bernalillo County	$4,166,419,232	32,658
Grand Total	**$4,166,419,232**	**32,658**

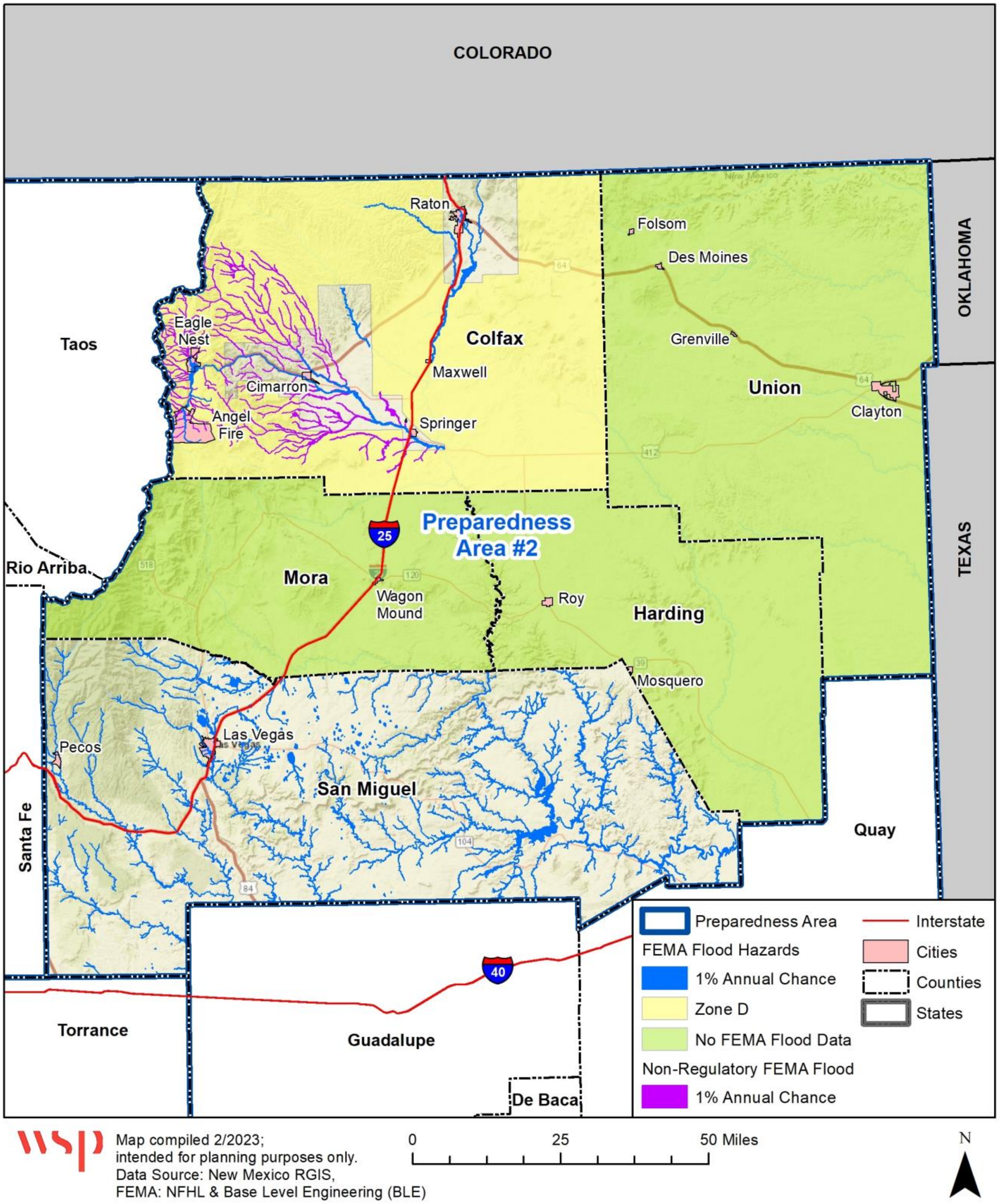
Preparedness Area 1

Figure 6-77 Preparedness Area 1 Floodplain Map



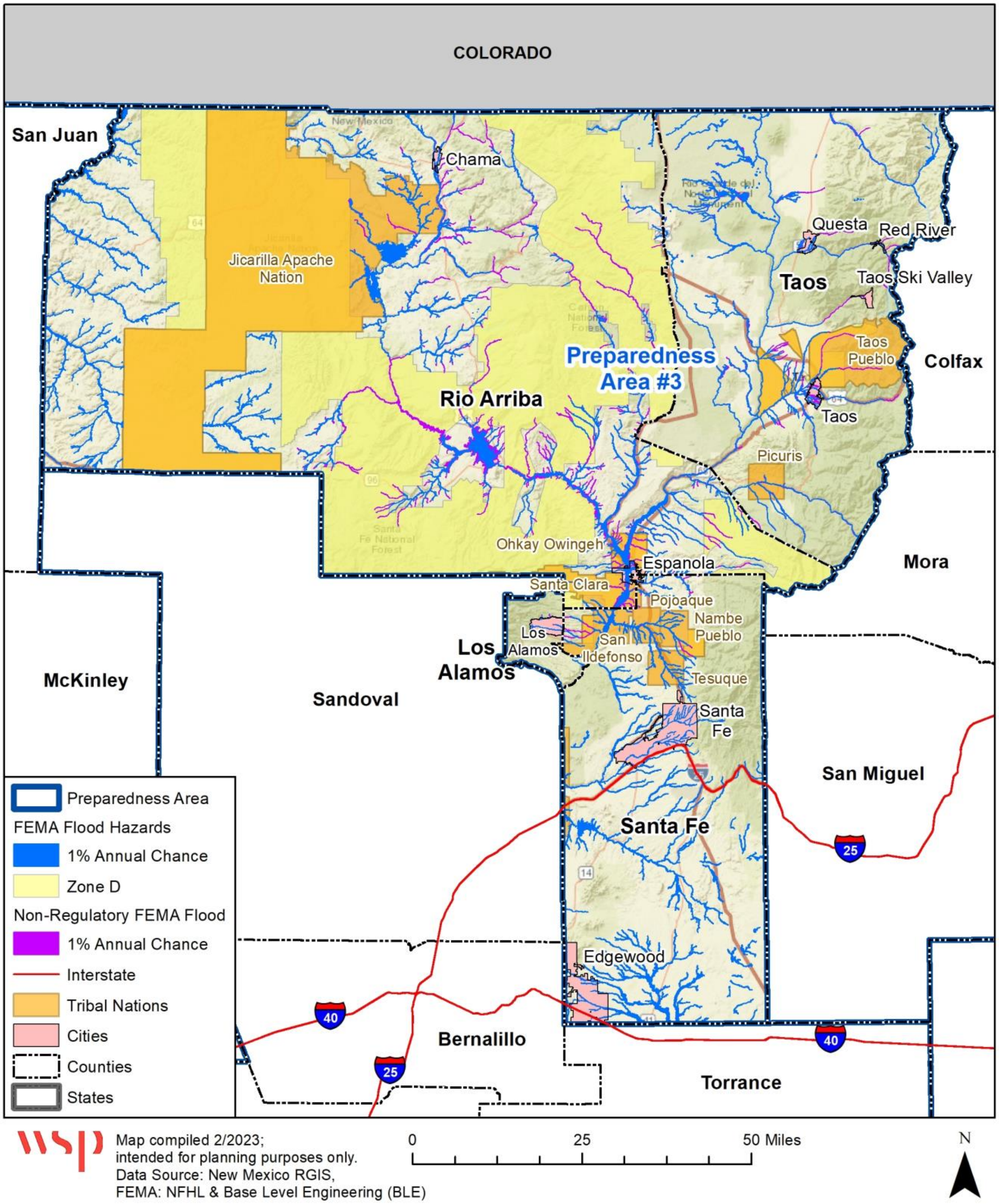
Preparedness Area 2

Figure 6-78 Preparedness Area 2 Floodplain Map



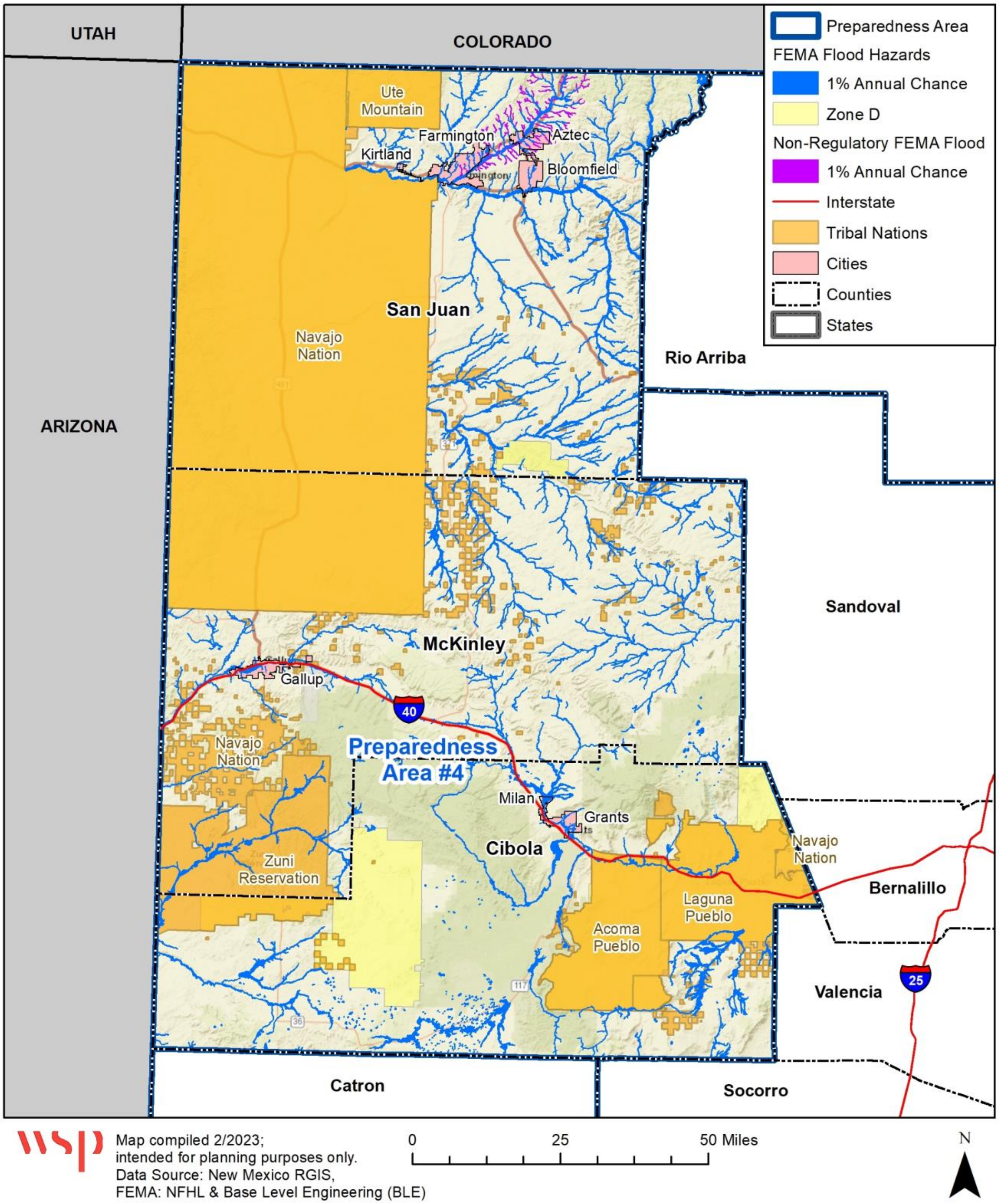
Preparedness Area 3

Figure 6-79 Preparedness Area 3 Floodplain Map



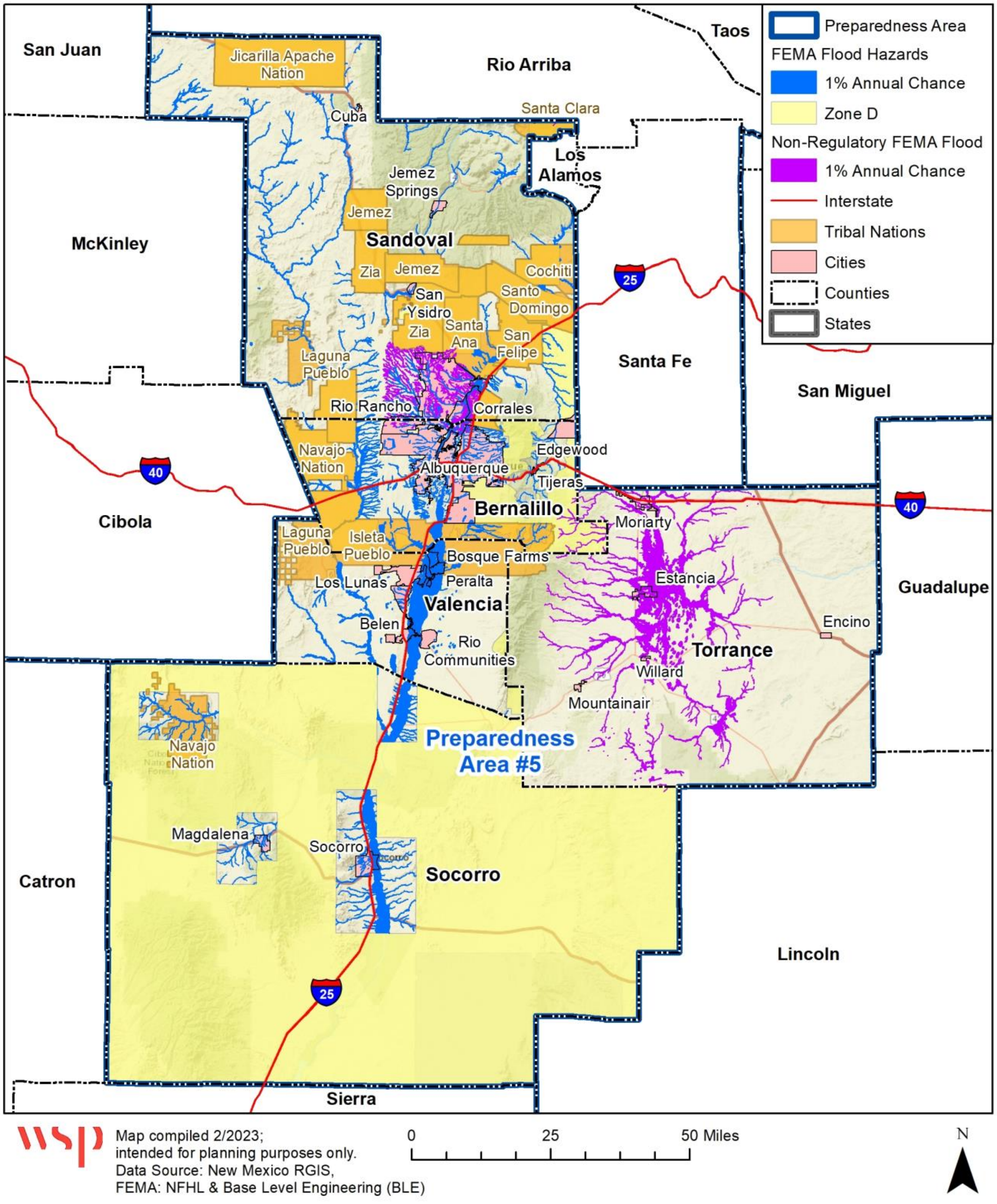
Preparedness Area 4

Figure 6-80 Preparedness Area 4 Floodplain Map



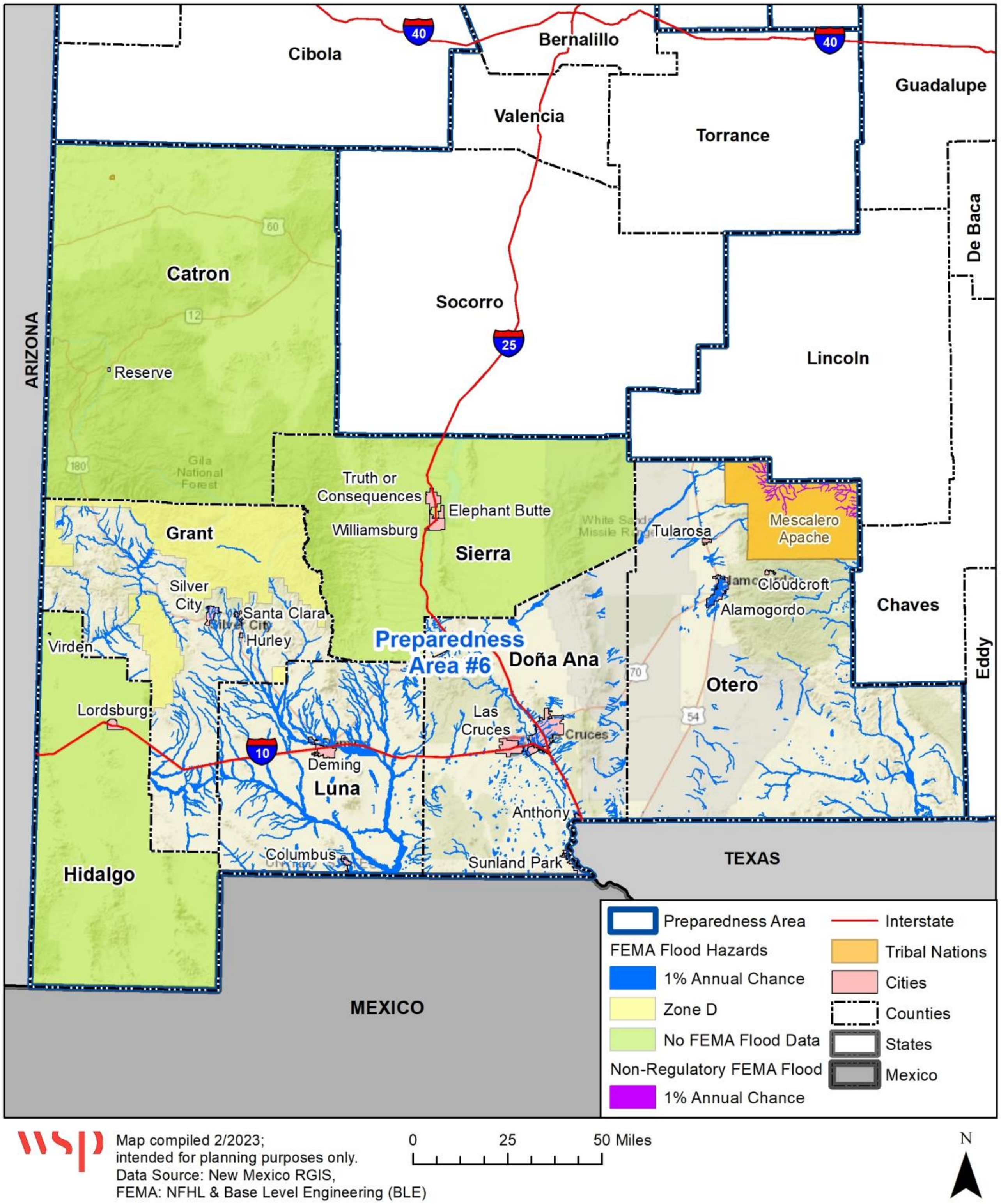
Preparedness Area 5

Figure 6-81 Preparedness Area 5 Floodplain Map



Preparedness Area 6

Figure 6-82 Preparedness Area 6 Floodplain Map



6.8.9 Flooding and Debris Flow Post-fire

Freshly burned landscapes are at risk of damage from post-wildfire erosion hazards such as those caused by flash flooding and debris flows. Burn scar areas have a tremendous impact on flood and debris flow following short duration high intensity rainfall. These high volume low frequency floods result from typical monsoon summer rains and occur in and downstream of the burn scar areas. Dramatic changes in runoff, erosion, and deposition have been documented in watersheds affected by wildfire. These post-fire changes have led to loss of life, damage to property, and significant impacts on infrastructure.

Extreme soil damage occurs within watersheds that experience a wildfire. Soil damage usually occurs where burn intensities are severe to moderate. The loss of the organic components in the soil greatly decreases the ability of rain to infiltrate. Within these burned areas, large floods result from average monsoonal rainstorms. In combination with the damaged soil, the destruction of vegetation by wildfires and in particular the forest canopy has created high potential for floods. In general, coniferous trees intercept more rainfall than deciduous trees in full leaf. New Mexico forests are predominantly coniferous and the risk for flooding is increased when these forest types and others are drastically reduced and destroyed by wildfires.

Increased long term risk of flooding will continue for years after a watershed has experienced a burn. Ongoing concerns are the increased potential for flooding and debris flow plus large amounts of sediment being transported from the burn scar areas. Additionally, debris flows could create temporary dams or sediment plugs along drainage courses that could fill and breach, sending flood waves downstream creating life safety issues. Life safety concerns are higher in those communities located downstream of burned watersheds.

A recent example of the destructive power and repetitive nature of flood damage in burn scar areas is the Santa Clara Pueblo, which has received four flood disaster declarations since the highly destructive Las Conchas Fire in 2011 (also a disaster declaration). The USACE Albuquerque District studied the altered hydrology post-fire in Santa Clara Pueblo after the Las Conchas Fire. The hydrologic discharge increased from 25% to 400% for the 100-year flood (1% annual chance exceedance flood) after the fire. These changes are for the two to three months after the fire when the soils were extremely hydrophobic. While the vegetation will eventually grow back and the ash soil will wash away, an increase in hydrologic discharge will continue for several years until pre-fire conditions have returned. The post-fire watershed effects in the Pueblo were also ripe for massive landslides and debris flow. Retention basins designed to catch upstream flows could quickly fill with sediment and overtop and even breach. Another issue related to flood risk after fire is that with mountainsides denuded of protective vegetation, rainfall events cause severe erosion resulting in debris flows and damage to water control facilities that quickly become full of sediment. The drought/wildfire/flood cycle in the western United States from 2000 to the present has wreaked heavy damage in many parts of New Mexico. Developed areas downstream from forested areas with steep terrain are especially vulnerable.

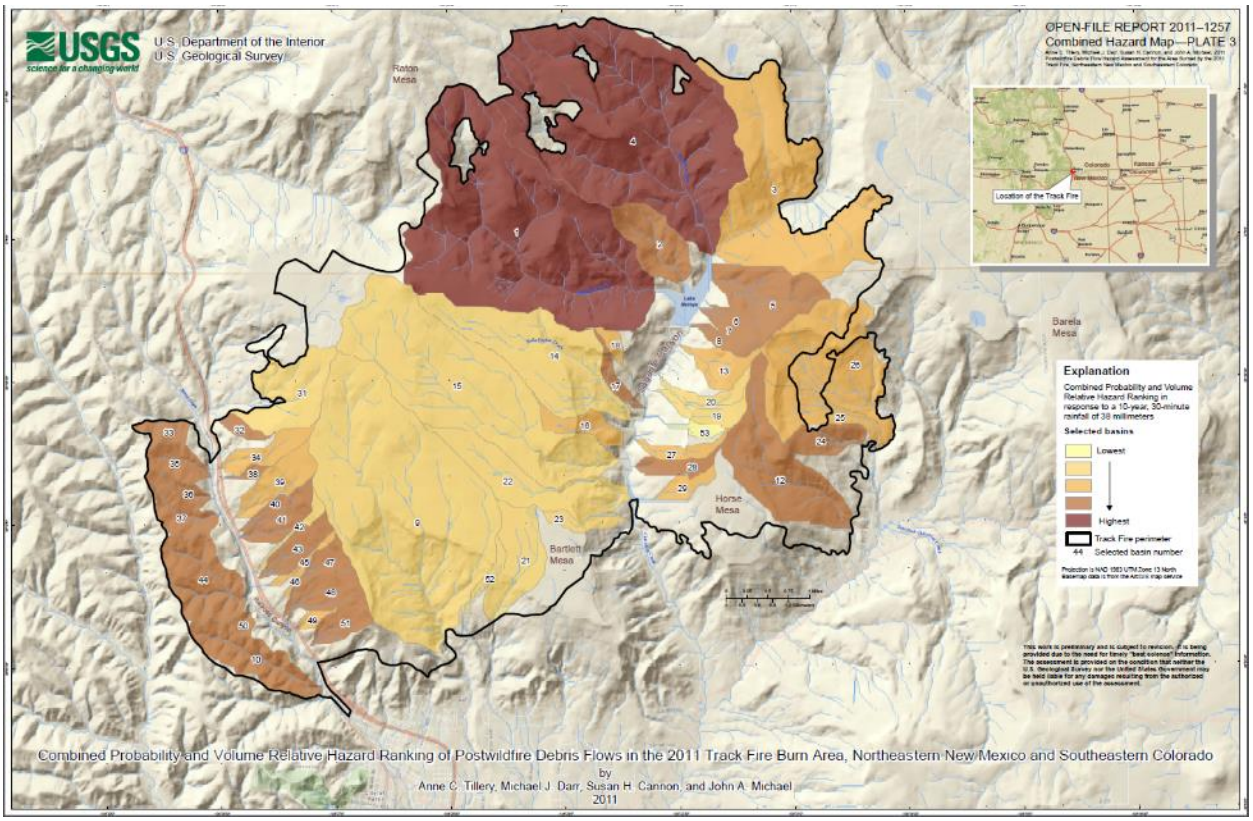
Debris flows are destructive, fast-moving slurries of water and sediment that can originate from rainfall on recently burned, rugged areas and can have an enormous destructive power. The location, extent, and severity of wildfire and the subsequent rainfall intensity and duration cannot be known in advance; however, it is possible to determine likely locations and sizes of post-wildfire debris flows using available geospatial data and mathematical models. Debris flow hazards can also be assessed for areas that have not burned but are at high risk of wildfire.

The USGS has developed a model to estimate post-wildfire debris-flow probability and volume for watersheds originating in basins of concern, or areas most at risk for loss of life and property. The models incorporate measures of burn severity, topography, soils, and storm rainfall to estimate the probability and volume of post-wildfire debris flows following the fire. Combined Relative Debris-Flow Hazard Rankings are produced by summing the estimated probability and volume rankings to illustrate those areas with the highest potential occurrence of debris flows of the largest volumes resulting from modeled storm events. These post wildfire debris-flow hazard models have been applied after four fires in New Mexico since the model was developed: the 2011 Track and Las Conchas Fires and the 2012 Little Bear and Whitewater-Baldy Fires. The full USGS reports include results for several modeled storm events, as well as three maps that show the probability of a flood, volume estimates, and a combined hazard map.

Track Fire

Combined relative debris-flow hazard rankings for a 30-minute duration, 10-year recurrence storm producing 38 millimeters of rain, indicated the highest post-wildfire debris flow susceptibilities are associated with Segerstrom Creek and Swachheim Creek. These rankings reflect extremely hazardous conditions within and immediately downstream from these basins, where debris flows may impact Lake Maloya and pose significant hazards to life and property. The second highest possible combined relative debris-flow hazard rankings were estimated for most of the tributary basins to Railroad Canyon, which empties into the northwest shore of Lake Maloya, which empty into the east shore of Lake Maloya, in Sugarite Canyon, on the southeast edge of the fire. Figure 6-83 shows the combined debris-flow hazard from the Track Fire.

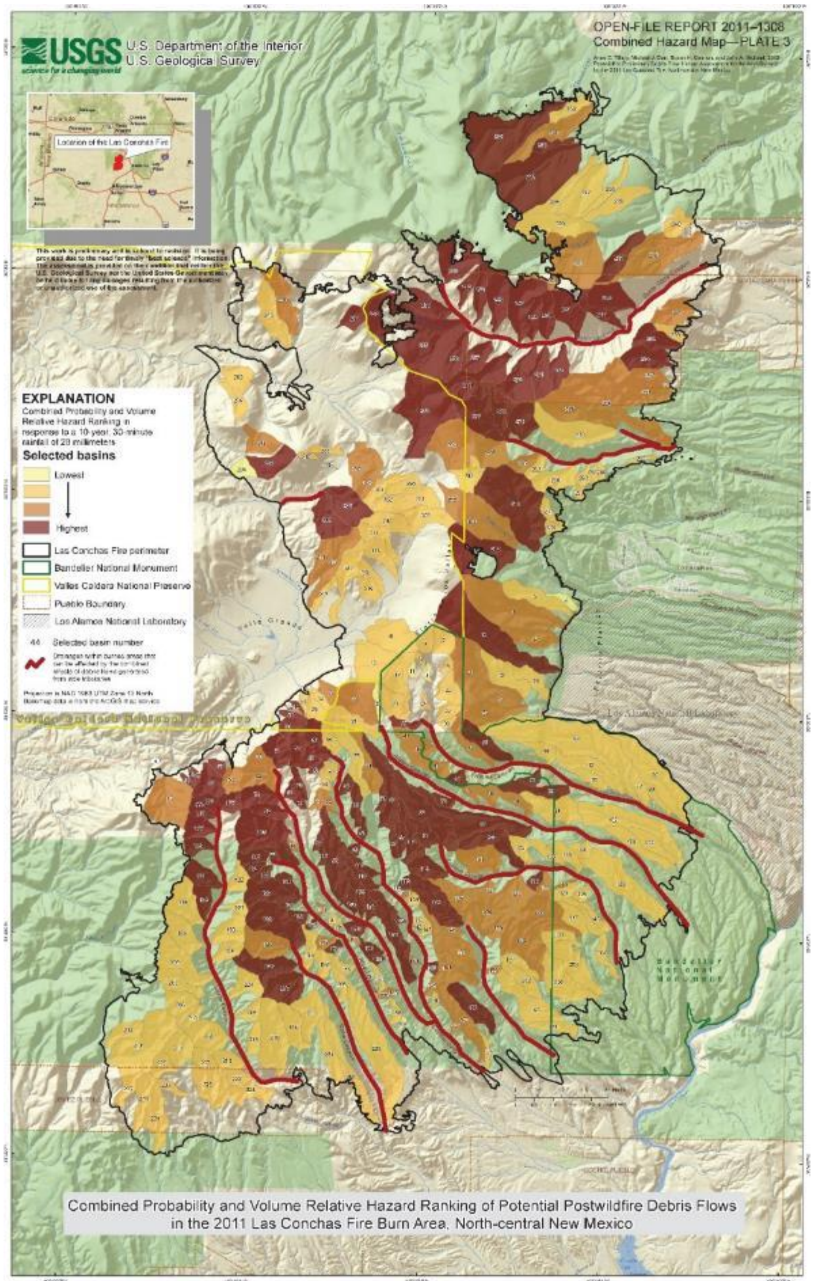
Figure 6-83 Combined Debris-Flow Hazard from the Track Fire



Las Conchas

The models showed that for a 30-minute-duration, 10-year-recurrence rainstorm of 28.0 millimeters, the highest combined hazard rankings in the northern section of the burned area are predicted for basins tributary to Santa Clara Canyon, the Rio del Oso, and Vallecitos Creek. The watersheds of Peralta, Colle, Bland, Cochiti, Capulin, Alamo, and Frijoles Canyons in the southern section of the burned area also showed high Combined Relative Debris-Flow Hazard Ranking, as well as basins in Water Canyon, Guaje Canyon, and Los Alamos Canyon. Figure 6-84 shows the combined debris-flow hazard from the Las Conchas fire.

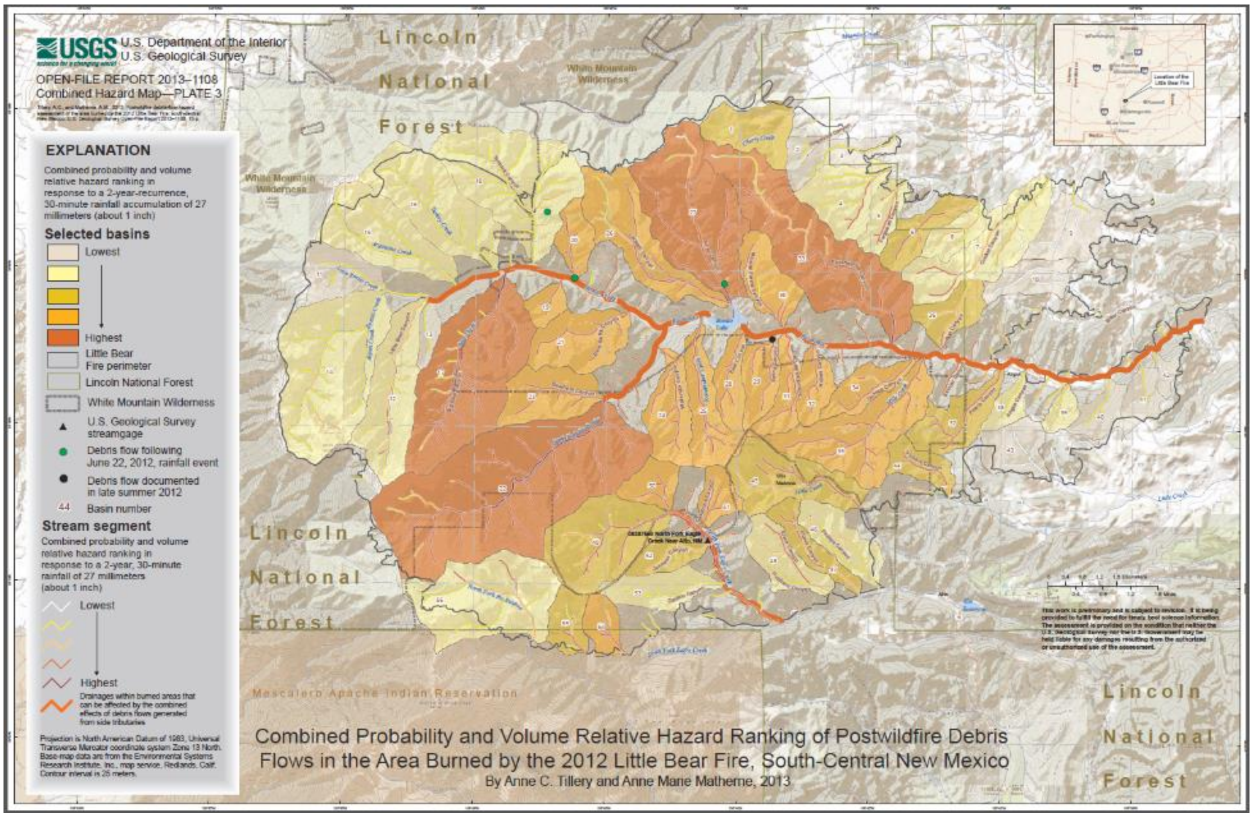
Figure 6-84 Combined Debris-Flow Hazard from the Las Conchas Fire



Little Bear

For a 2-year-recurrence, 30-minute-duration rainfall of 27 millimeters (a 50% chance of occurrence in any given year), the highest combined hazard ranking is predicted for four drainage basins, Bear Creek, South Fork Rio Bonito, Anan Canyon, and Philadelphia Canyon. For a 10-year-recurrence rainfall, those same four drainage basins plus Mills Canyon were modeled with the highest combined hazard ranking. For the 25-year-recurrence rainfall, an additional 10 drainage basins were modeled with the two highest combined hazard rankings. Stream segment analysis indicated a relative hazard ranking at the two highest categories over most of the central Rio Bonito drainage basin. North Fork Eagle Creek from Telegraph Canyon to below Carlton Canyon is the only stream segment in the southern burn area modeled with the highest relative hazard ranking. Figure 6-85 shows the combined debris-flow hazard from the Little Bear fire for a 2-year recurrence, 30-minute rainfall accumulation of 27 millimeters.

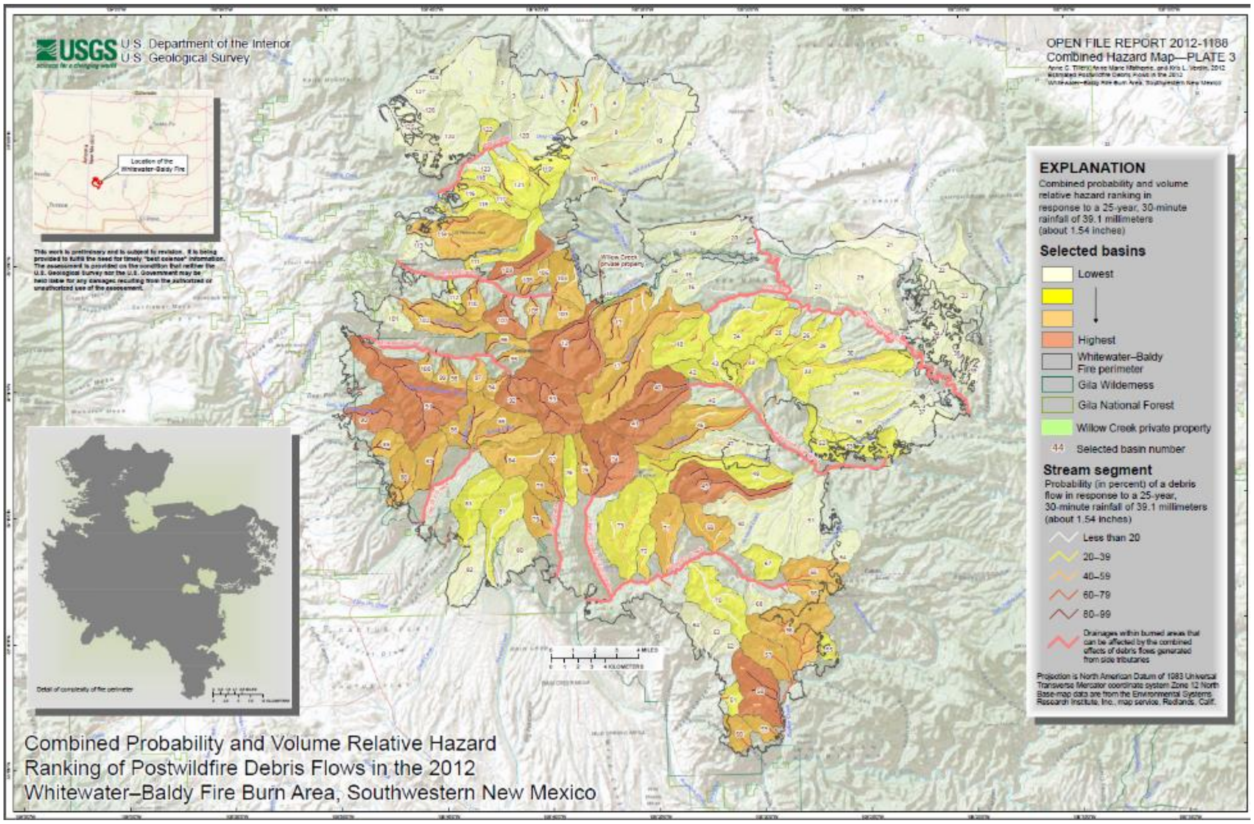
Figure 6-85 Combined Debris-Flow Hazard from the Little Bear Fire



Whitewater-Baldy

For a 25-year-recurrence, 30-minute-duration rainfall, basins with the highest combined probability and volume relative hazard ranking include tributaries to Whitewater Creek, Mineral Creek, Willow Creek, West Fork Gila River, West Fork Mogollon Creek, and Turkey Creek. Debris flows from Whitewater, Mineral, and Willow Creeks could affect the communities of Glenwood, Alma, and Willow Creek. Figure 6-86 shows the combined debris-flow hazard for a 25-year, 30-minute rainfall of 39 millimeters from the Whitewater-Baldy fire.

Figure 6-86 Combined Debris-Flow Hazard from the Whitewater-Baldy Fire

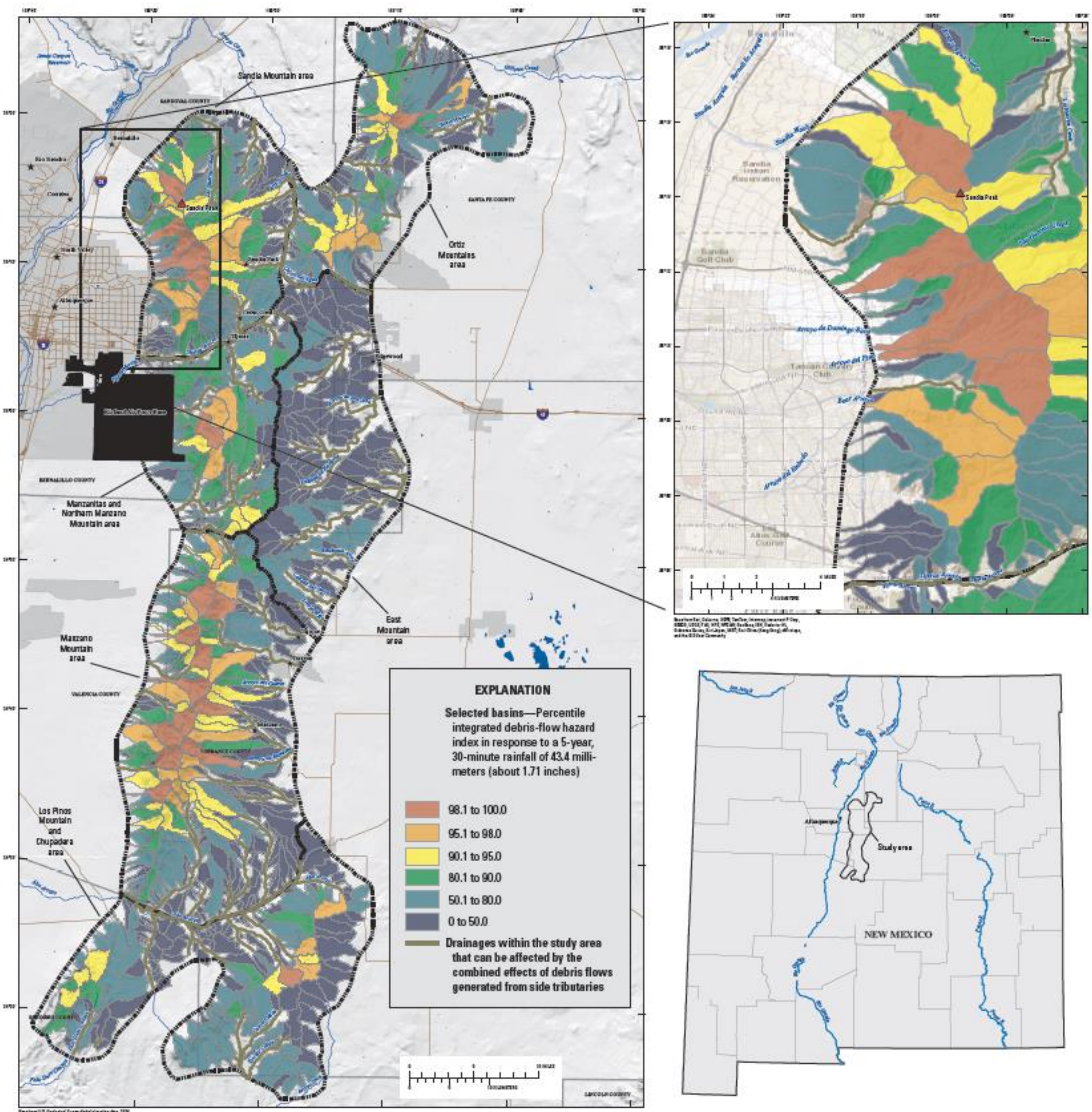


Additionally, in 2013, the USGS developed a new method for estimating post-fire erosion hazards before a wildfire actually burns with a study in the Sandia and Manzano Mountains, and an additional pre-wildfire evaluation for the Jemez Mountains in 2016. For these studies, an Integrated Relative Debris-Flow Hazard Index was modeled, based on a combination of debris-flow probability, estimated volume of debris flow, and average burn probability for each basin. For example, the most hazardous subbasins will have the highest probabilities of experiencing a fire in some part of the subbasin, the highest probabilities of debris-flow occurrence, and the largest estimated volumes of debris-flow material.

Sandia and Manzano Mountains – Pre-wildfire Evaluation

Most of the subbasins with the highest integrated debris-flow hazard index rankings are in the steepest parts of the Sandias and Manzanos and contain substantial areas of high simulated burn severity and therefore high basin-average, annual burn probability indices. Nineteen subbasins are contained in the upper 2% of integrated debris-flow hazard indices rankings. These subbasins include five subbasins on the west-facing slopes of the Sandias, four of which have downstream reaches that lead into the outskirts of the City of Albuquerque. Of the remaining 14 subbasins in the upper 2% of integrated debris-flow hazard indices rankings, 12 are located along the highest and steepest slopes of the Manzano Mountains, largely on the western slope; however, one of these subbasins is approximately five miles upstream from the community of Tajique and another is several miles upstream from the community of Manzano, both on the eastern slopes of the Manzanos. Figure 6-87 shows the potential integrated debris-flow hazard that could result from a 5-year, 30-minute rainfall of 43 millimeters post wildfire in the Sandia and Manzano Mountains.

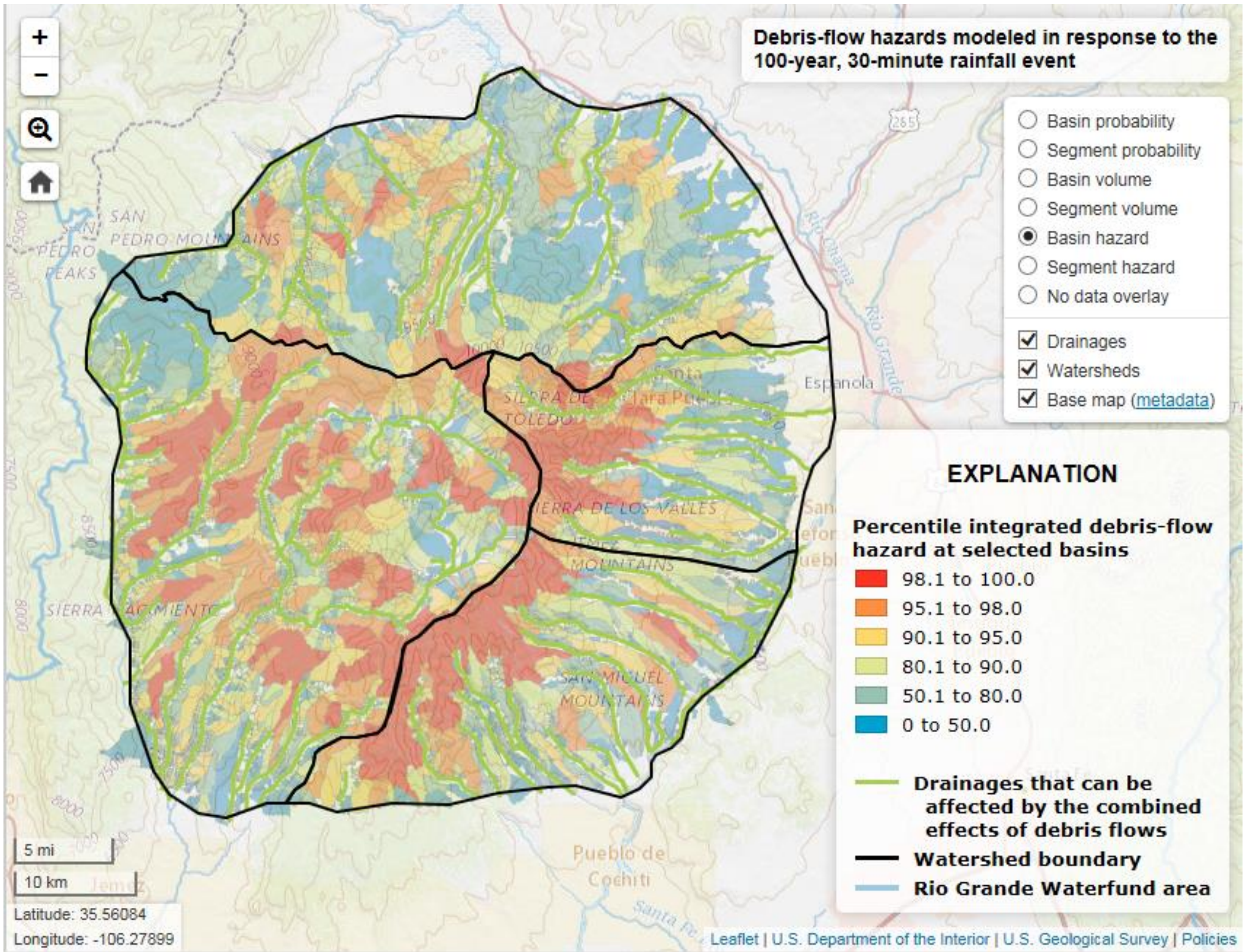
Figure 6-87 Potential Integrated Debris-Flow Hazard from a Wildfire in the Sandia and Manzano Mountains



Jemez Mountains Pre-wildfire Evaluation

For a 100-year recurrence interval, 30-minute duration rainfall event (referred to as the 100-year design storm), the subbasins with integrated hazard index values in the top 2% typically are large, upland tributaries to canyons and channels primarily in the Upper Rio Grande and Rio Grande-Santa Fe watershed areas. Other subbasins with integrated hazard-index values in the top 2% are scattered throughout the Jemez River watershed area, including some subbasins in the interior of the caldera. Only a few subbasins in the top integrated hazard index group are in the Rio Chama watershed area. Figure 6-88 shows the potential integrated debris-flow hazard that could result from a 100-year, 30-minute rainfall post wildfire in the Jemez Mountains.

Figure 6-88 Potential Integrated Debris-Flow Hazard from a Wildfire in the Jemez Mountains



The main driver of post-fire watershed response is rainfall intensity. Short rain events can lead to significant flooding in wildfire damaged landscapes. To help communities decrease response time to potential flooding in burn scar areas, the USGS can install real-time rain gages in wildfire burn scars areas. Figure 6-89 is an example of a real-time precipitation gage at Cochiti Mesa installed by a cooperative project of the USGS, US Forest Service and DHSEM. During the banner wildfire years of 2011 and 2012 in New Mexico, the USGS, in cooperation with the U.S. Forest Service, the U.S. Army Corps of Engineers, the Natural Resources Conservation Service, the NM Department of Homeland Security, and the U.S. National Park Service, installed real-time rain gages in the Las Conchas (6 gages), Whitewater Baldy (4 gages), and Little Bear (6 gages) burn scar areas. Figure 6-89 shows an example of a real-time rain gage installed by the USGS in the Los Conchas burn scar area on Cochiti Mesa. The data from the rain gages installed high in the watershed can be accessed online at any time by citizens and managers and provide reliable information for use in reducing losses to life associated with post wildfire flooding.

Figure 6-89 USGS real time precipitation gage at Cochiti Mesa (Las Conchas Fire)

Table 6-66 shows pre-burn and post-burn peak flows using a 25-year, 1-hour design storm for the area impacted by the Little Bear Fire (mostly in Lincoln County). A 25-year, 1-hour storm event would be a storm with 4% chance of occurrence in any given year and lasts one hour in duration. The average change is a 158% increase in runoff. The highest increase was found in the Upper Big Bear Canyon with a 459% increase (from 573 to 3,202 cubic feet per second (CFS)).

Table 6-66 Little Bear Fire Data

Watershed subHuc6	Acres	Peak CFS		
		Pre-Burn	Post-Burn	Increase
Eagle Lk_1	1086	851	1534	80%
Eagle Lk_2	586	565	960	70.0%
Kraut Creek	1027	1099	2871	161.0%
Little Creek	966	582	1744	200.0%
Philadelphia side drain	172	263	769	192.0%
SkiArea532drain	203	145	739	410.0%
Upper Big Bear Cyn	1050	573	3202	459.0%
FS_upper Eagle Creek Hm	2033	1794	4099	128.0%

Watershed subHuc6	Acres	Peak CFS		
		Pre-Burn	Post-Burn	Increase
Ski Area Outlet	1036	806	1515	88.0%
Upper Big Bear Cyn treated	1050	3202	2158	-32.6%
532midSkiDrain	117	36	93	160.0%
532NskiDrain	203	179	236	31.8%
Apache Bowl	278	60	123	105.0%
Moonshine Gulch	230	433	780	80.1%
Upper Reservoir Trib.	51	14	20	42.9%
Average % change				**158%**

Case Study: Post-Wildfire Debris Flow Mitigation in the Rio Nambe Watershed

In June of 2011, the Pacheco fire burned 10,250 acres in the Rio Nambe watershed, which drains to the Nambe Falls Dam and Reservoir on the Pueblo of Nambe tribal lands. The fire created 5,771 acres of hydrophobic soil which caused post-fire debris flows and floods in the Rio Nambe watershed. These debris flows and sedimentation caused box culvert bridge damages, floodplain aggradation, destruction of access road and picnic structures, recreational fisheries losses, and a reduction in the reservoir capacity by greater than 40 acre-feet.

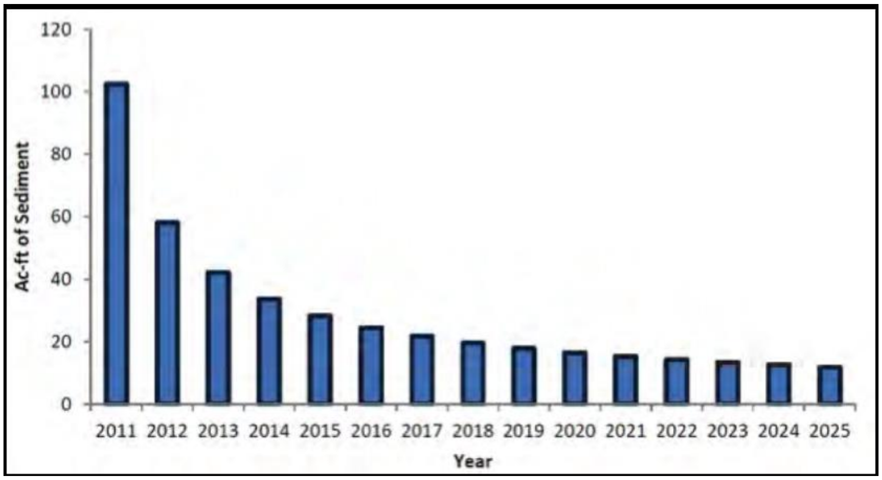
This prompted the Rio Nambe Watershed Hazard and Risk Assessment, a USACE Technical Assistance Report for flood/debris and sediment mitigation using PL 84-99 Category 250 "advance measures" authority for emergency flood assistance. This included a risk assessment for Nambe Falls Dam and Reservoir and downstream communities, hydrologic modeling for pre- and post-fire peak flows, sediment yield model, recommendations for mitigation measures/conceptual designs, and a benefit/cost analysis. Table 6-67 shows the results of the pre- and post-fire peak flows for the watershed. According to the USACE and USBOR, "The hydrologic model results show that the magnitude of the floods discharged from a precipitation event are five to 30 times larger under post-fire conditions in the Rio Nambe watershed."

Table 6-67 Pre/Post Wildfire Peak Discharge Estimates

Recurrence Interval	Pre-fire Peak Discharge Estimate	Post-fire Peak Discharge Estimate
2 yr. / 50%	131 cfs	1,155 cfs
10 yr. / 10%	237 cfs	7,315 cfs
25 yr. / 4%	1,239 cfs	10,905 cfs
100 yr. / 1%	3,509 cfs	16,683 cfs

Figure 6-90 shows the post fire Rio Nambe watershed sediment yield through 2025. The pre-fire average annual sediment yield was 3.8 acre-feet/year.

Figure 6-90 Post Wildfire Rio Nambe Watershed Sediment Yield through 2025



Source: USACE-USBOR, 2014

Based on the study, the feasibility of a debris flow barrier was conducted, and a cost-estimate derived for grant funding. The debris flow barrier designed was a multi-level debris flow barrier system of three flexible ring-net barriers (Figure 6-91). Along with other ongoing efforts, such as early flood warning system implementation, trails and recreation area rehabilitation, fisheries re-stocking, water quality sampling, and long term, post-project monitoring, the risk of the Rio Nambe watershed to post-fire flooding and debris flows was reduced.

Figure 6-91 Debris Flow Barrier System

Source: Kane, 2016

6.8.10 Data Limitations

In order to address the data deficiency, a team of subject matter experts (NM FPMA, local research scientists in geomorphology or geology) would study the probability, extent, vulnerability and impact of post-fire flooding and alluvial fan flood hazards.

6.8.11 What Can Be Mitigated?

For counties with extremely limited resources, mitigation actions have to be very specific and cost effective. As a result, mitigation actions should focus on property protection, localized corrective measures for drainage and erosion in developed areas, and ensuring that future development is sited out of the floodplain as identified by the study. One priority is to protect critical infrastructure such as utilities, access routes and water supply wellheads.

In order to address the data deficiency, a team of subject matter experts (NM FPMA, local research scientists in geomorphology or geology) would study the probability, extent, vulnerability and impact of post-fire flooding and alluvial fan flood hazards.

Other mitigation actions can include adoption of building codes, floodplain management and regulations, stormwater system upgrades, elevation or floodproofing structures, removing structures from flood hazard areas, constructing flood control measures, encouraging flood insurance, and public education.

6.8.12 Risk Summary

Impacts from Floods/Flash Flooding to New Mexico are identified in Table 6-68.

Table 6-68 Potential Impacts from Flood/Flash Flood Events

Subject	Potential Impacts
Agriculture	Flooding and flash flooding events can be devastating to the agriculture industry. Crops, livestock, and agriculture infrastructure can be destroyed. Long term a water supply for irrigation and livestock water can be eliminated by the flood waters, changing existing water channels. The potential also exists that an approved irrigation water supply in compliance with the Food Safety and Modernization Act can be contaminated from floodwaters causing the crops to not be certified for market or consumption.
Health and Safety of the Public	Flooding in the State has been known to sweep people away and cause drowning.
Health and Safety of Responders	Same impact as the public.
Continuity of Operations	While the flooding in New Mexico is generally short lives the long-term impacts such as in the Village of Hatch can shut down an entire community for weeks.
Delivery of Services	Delivery of services may be impossible for weeks.
Property, Facilities, Infrastructure	Facilities in the flooded areas will sustain damages, up to and including total loss. Utilities such as water and sewage may be completely unusable.
Environment	Long term severe impacts are possible due to the severe contamination often found in flood waters. Fortunately for us, flash flooding passes quickly and doesn't linger. However, the strong forces of the water can cause massive amounts of erosion and can divert natural waterways.
Economic Condition	As we saw in 2006, communities can have severe economic losses in the form of damages, and business shutdowns.
Public Confidence	If a community is impacted by flooding, the public may very well be angry for allowing development to occur in hazardous areas, or for allowing adverse impacts downstream form development.

6.9 High Wind

Hazard	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
High Wind	**High**	**High**	**Medium**	**High**	**Medium**	**High**	**Medium**

6.9.1 Hazard Characteristics

Wind is defined as the motion of air relative to the earth's surface, and the hazard of high wind is commonly associated with severe thunderstorm winds (exceeding 58 mph) as well as tornadoes, hurricanes, tropical storms, and nor'easters. High winds can also occur in the absence of other definable hazard conditions, events often referred to as simply "windstorms." High wind events might occur over large, widespread areas or in a very limited, localized area. They can occur suddenly without warning, at any time of the day or night.

Typically, high winds occur when large air masses of varying temperatures meet. Rapidly rising warm moist air serves as the "engine" for severe thunderstorms, tornadoes, and other windstorm events. These storms can occur singularly, in lines or in clusters. They can move through an area very quickly or linger for several hours. While scales exist to measure the effects of wind, they can be conflicting or leave gaps in the information. For the purposes of this plan, we use the Beaufort Wind Scale (Table 6-69) because it is specifically adapted to wind effects on land.

Table 6-69 Beaufort Wind Scale

Beaufort Number	Wind Speed mph	Description	Land Conditions
0	0	Calm	Calm. Smoke rises vertically.
1	1-3	Light air	Wind motion visible in smoke.
2	4-7	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	8-12	Gentle breeze	Leaves and smaller twigs in constant motion.
4	13-18	Moderate breeze	Dust and loose paper rise. Small branches begin to move.
5	19-24	Fresh breeze	Smaller trees sway.
6	25-31	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes
7	32-38	Near gale	Whole trees in motion. Effort needed to walk against the wind.
8	39-46	Gale	Twigs broken from trees. Cars veer on road.
9	47-54	Strong gale	Light structure damage.
10	55-63	Storm	Trees uprooted. Considerable structural damage.
11	64-73	Violent storm	Widespread structural damage.
12	73-95	Hurricane	Considerable and widespread damage to structures.

All areas of the State can experience all 12 Beaufort categories. As used in this section, windstorms are both high velocity straight-line winds and violent wind gusts not associated with thunderstorms. Dust storms are strong windstorms that fill the air with thick dust, sometimes reducing visibility to resemble a dense fog. Other wind events include wet or dry microbursts that may produce damaging convective winds and dust devils even on a clear and otherwise calm day.

High wind events are experienced in every region of the United States. Figure 6-92 illustrates various wind zones throughout the country based on design wind speeds established by the American Society of Civil Engineers. It divides the country into four wind zones, geographically representing the frequency and magnitude of potential high wind events including severe thunderstorms, tornadoes, and hurricanes. The figure shows that New Mexico is located Zone I, II and III wind speeds for shelters of up to 160 mph. Table 6-70 shows how New Mexico Preparedness Areas relate to the wind speed map.

Figure 6-92 Wind Zones in the United States

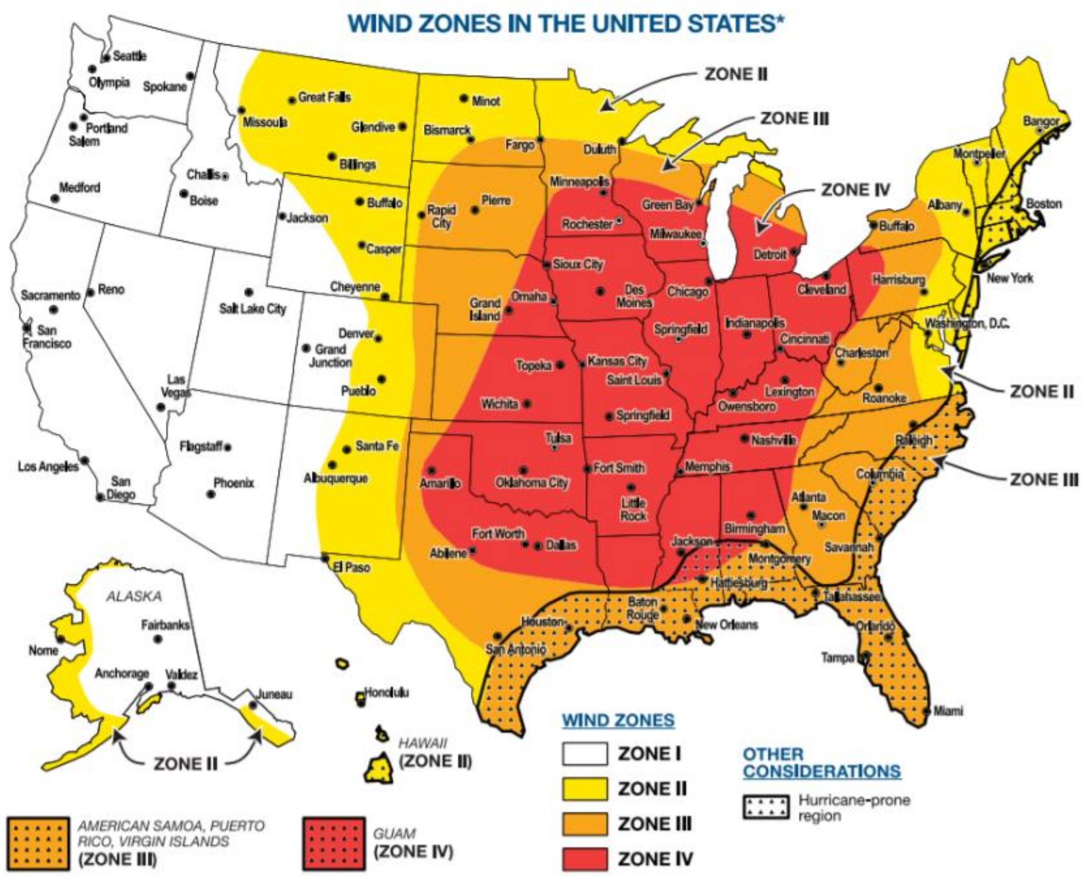
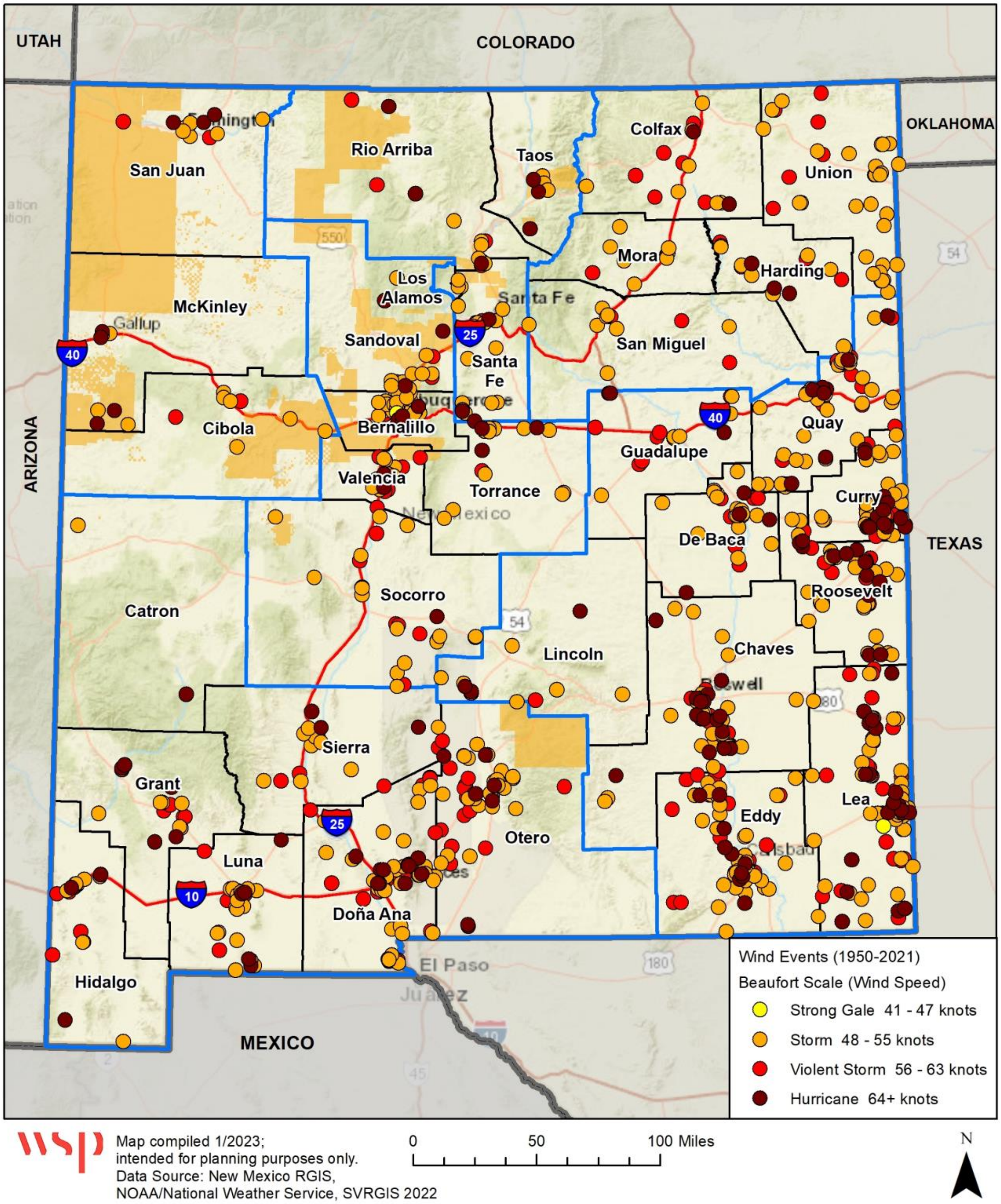


Table 6-70 Wind Speed Experienced by New Mexico Preparedness Areas

Preparedness Area	Wind Speed Zone
PA 1	Zone II (Winds up to 160 mph)
PA 2	Zone I and II (Winds from 130 up to 160 mph)
PA 3	Zone I and II (Winds from 130 up to 160 mph)
PA 4	Zone I (winds up to 130 mph)
PA 5	Zone I and II (Winds from 130 up to 160 mph)
PA 6	Zone I and II (Winds from 130 up to 160 mph)

The entire State of New Mexico is subject to high wind conditions, but areas most vulnerable where the population is concentrated and buildings are of older design. Figure 6-93 shows average wind speeds in New Mexico as provided by the U.S. Department of Energy's (Energy Department's) Wind Program and the National Renewable Energy Laboratory. This resource map shows estimates of wind power density at 50 m above the ground. This map indicates that New Mexico has wind resources consistent with community-scale production. The largest contiguous area of good-to-excellent resource is in central New Mexico between Albuquerque (Preparedness Area 1) and Clovis (Preparedness Area 1). Other notable areas of good-to-excellent resource are located near the Guadalupe Mountains in southern New Mexico, near Tucumcari (Preparedness Area 1), and in the northeastern part of the State (Preparedness Area 2 and 3) near the Colorado and Oklahoma borders.

Figure 6-93 New Mexico High Wind Events by Magnitude, 1950-2021



6.9.2 Previous Occurrences

The current online NCDC database contains data from January 1996 to December 2022, as entered by NOAA's National Weather Service (NWS). Referencing this online database, NCEI reports a total 3,027 high wind events with 27 injuries, 12 deaths, $31,715,800 in property damage, and $3,500 in crop damage between 1996 and December 2022.

Table 6-71 describes significant events that have occurred in New Mexico.

Table 6-71 Significant Past Occurrence - High Wind

Date	Location	Significant Event
July 2021	Lordsburg, NM (Preparedness Area 6)	Two accidents were reported near mile marker 35 on Interstate 10 westbound caused by dust storm. Numerous vehicles were involved, including a semi. Interstate was closed for 4 to 5 hours following accident.
May 2019	Dairy, NM (Preparedness Area 6)	A seven-vehicle accident occurred near exit 51 on Interstate 25 caused by low visibility due to blowing dust.
December 2021	Taos County, NM (Preparedness Area 3)	The weather station at Taos Ski Valley measured about twelve hours of wind speeds in excess of 58 mph with a peak wind gust of 103 mph. These high winds resulted in significant tree damage across Taos Ski Valley with numerous trees downed and splintered. Taos County declared a State of Emergency due to the widespread wind damage. This event resulted in a total of $2.5M property damage.
March 2019	Chaves County Plains, NM & Quay County, NM (Preparedness Area 1)	A record breaking late winter storm system moved through New Mexico on March 12-14, 2019. Various sources across Quay County reported peak wind gusts between 58 mph and 71 mph, including the Tucumcari airport. A cargo train with 26 cars was blown off a bridge and fell nearly 50 feet to the bottom of the Canadian River near Logan. NM-469 was closed while the wreckage was cleared from the river bottom. Moreover, significant blowing dust resulted in near zero visibility along NM-2. Carports and other light weight structures were damaged across the Roswell area. This event resulted in a total of $6M property damage.
June 2017	Lordsburg, NM (Hidalgo County) (Preparedness Area 6)	Six people died in a 25-vehicle pileup caused by a sudden dust storm along Interstate 10 near Lordsburg. High winds and limited visibility caused 18 commercial trucks and seven passenger vehicles to crash. The highway was closed for one day, and drivers were forced to take a long detour on a two-lane highway. Removing the damaged vehicles was a slow process due to the lack of tow trucks in the area.
February 2017	Lordsburg, NM (Hidalgo County) (Preparedness Area 6)	Two women were killed when their car got sandwiched between two semitrailers in a dust storm along Interstate 10 near Lordsburg.
May 2014	Lordsburg, NM (Hidalgo County) (Preparedness Area 6)	Seven people died when a driver suddenly hit the brakes as blowing dust shrouded visibility along Interstate 10 near Lordsburg.
December 2009	Magdalena, NM (Socorro County) (Preparedness Area 5)	As reported by the Mountain Mail, after a weekend of wintry weather, high winds were a cause of concern for many county residents, especially those traveling on Highway 60, which had to be shut down near Magdalena for over an hour. The closure was the result of diesel fuel leaking from the tank of a wrecked semi-tractor trailer. According to the Magdalena Marshal, two semis were blown off the road; one at mile marker 126, and the other at mile marker 119. The semi at 119 leaked 240 gallons of diesel fuel causing the highway had to be closed until the hazmat

Date	Location	Significant Event
		operation had been completed. The truck driver from Boise, Idaho, said he was on his way to Tucson when he experienced the estimated 100 mph gusts on Highway 60. Higher winds were recorded at other stations in the county. Magdalena Ridge Observatory sustained wind speeds at the 10,600 foot facility averaged about 100 mph over a seven hour period with gusts up to 128 mph.
April 2003	Silver City, NM (Grants County) Deming, NM Columbus, NM (Luna County) (Preparedness Area 6)	Strong winds blew dust from northern Mexico and caused a 10- car accident on US-180 near Deming in the southern part of the State. In Milan, two people were killed and five more injured when the blowing dust reduced visibility and caused a multiple car accident. State Police shut down several roads around Deming, including Interstate 10, U.S. 180 to Silver City, NM 11 from Deming to Columbus, NM 549 near Deming, NM 26 between Deming and Hatch, and NM 212 near Fort Sumner. High winds also blew a roof off a school and destroyed a church under construction. Over $200 thousand in damages were reported.
April 6, 2001	Artesia, NM Carlsbad, NM (Eddy County) (Preparedness Area 1)	A strong upper level storm system moving across the area produced strong gradient winds across southeast New Mexico during the afternoon of April 6. Wind gusts in excess of 70 mph at times resulted in a six-vehicle accident on Highway Two north of the city of Artesia and a four-vehicle accident on Highway 285 north of the city of Artesia minutes later. The wind snapped large tree branches and electric power lines. The wind was responsible for disrupting cable television transmitters and for blowing a parking canopy support through the windshield of a pickup truck. In Carlsbad, winds as high as 67 mph blew down a 60-foot Arizona Cypress tree and caused major roof damage to a greenhouse. Total damage was estimated to be in excess of $600 thousand.
May 24, 1999	Socorro Count Valencia County (Preparedness Area 5)	Over $1.2 million in damages were caused by a severe storm which began near Alamo in northwest Socorro County swept northeast across central Valencia County with high winds and large hail. Heavy wind damage from sustained winds estimated near 80 mph overturned and destroyed about 15 mobile homes and caused damage to about 150 other homes with many small outbuildings and sheds blown down in the area from Los Chavez to Tome Hill between Los Lunas and Belen. Large hail also knocked out numerous windows and broke windshields. Only two relatively minor injuries were reported in the hardest hit area. Residents had 40-60 minutes advanced warning and school officials successfully evacuated numerous portable classroom buildings without incident or injury to students before high winds struck.
May 1, 1999	Chaves County (Preparedness Area 1)	High winds were blamed in a fatal travel trailer-church bus accident in southwest Chaves County that claimed seven lives. State Police concluded that winds of 50-55 mph swept a truck pulling a travel trailer into the opposing lane and slicing into an on-coming bus filled with teenagers returning from a church retreat. One adult and six teenage girls died at the scene with other serious injuries reported.
April 9, 1999	White Sands, NM (Preparedness Area 6)	A major dust storm event occurred in the White Sands area when large clouds of milky white dust were observed overtopping the nearby Sacramento Mountains and blowing to the northeast. The

Date	Location	Significant Event
		dust storm started quickly and lasted for more than eight hours, with visibilities reduced to as low as 1.5 miles and winds gusting to at least 38 knots (44 mph). NOAA wind data from White Sands National Monument indicated winds at approximately 10,000 feet above ground level in excess of 50 knots. Reduced visibility continued long after the active production of blowing dust ended.
March – April 1993	Albuquerque, NM (Preparedness Area 5)	Windstorms/Dust storms. Numerous days with high winds and blowing dust. Albuquerque Airport recorded a peak gust of 80 MPH in March, Sandia Peak a gust of 106 MPH.
December 1977	Albuquerque, NM (Bernalillo County) (Preparedness Area 5)	The central Rio Grande valley is occasionally subject to mountain wave-induced winds, which can become exceptionally strong. One such wave-induced windstorm occurred when surface winds with gusts between 50 and 70 mph were reported at the airport in Albuquerque. Wind reports from around the Albuquerque metro area included a peak wind of 71 mph at the airport, 97 mph at the base of the Sandia Tramway and gusts between 80 and 90 mph at Coronado Airport.
March 1977	Roswell and Clovis, NM (Preparedness Area 1)	Dust from White Sands was visible on the Geostationary Operational Environmental Satellite (GOES) imagery. It formed a plume more than 400 kilometers long, and blew eastward through Roswell, across eastern New Mexico to Clovis and then into the Texas Panhandle, where it eventually dissipated.

Table 6-72 provides a cumulative overview of significant high wind events that have occurred in all Preparedness Areas. Column "Mag" is "Maximum Magnitude." Note the information in the table below only includes data presented by county, and does not include data presented by National Weather Service Forecast Zones.

Table 6-72 Preparedness Areas 1 - 6 High Wind History (January 1996 - December 2017)

Preparedness Area 1 **Counties:** Chaves, Curry, De Baca, Eddy, Guadalupe, Lea, Lincoln, Quay, and Roosevelt							
Hazard Type	**# of Events**	**Mag**	**Deaths**	**Injuries**	**Property Damage**	**Crop Damage**	
High Wind	922	35-86 kts	1	12	$9,830,050	$0	
Strong Wind	5	39-49 kts	0	0	$25,200	$0	
Dust Storm	11	-	0	0	$15,000	$0	
Total	**938**	**35-86 kts**	**1**	**12**	**$9,870,250**	**$0**	
Preparedness Area 2 **Counties:** Colfax, Harding, Mora, Union, and San Miguel							
Hazard Type	**# of Events**	**Mag**	**Deaths**	**Injuries**	**Property Damage**	**Crop Damage**	

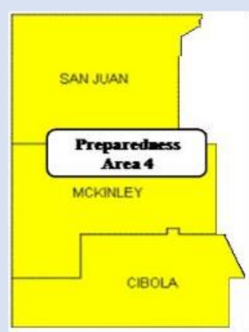
High Wind	450	35-73 kts	0	0	$2,017,500	$0
Strong Winds	4	33-47 kts	1	0	$141,000	$0
Dust Storm	1	-	0	0	$0	$0
Total	**337**	**33-72 kts**	**1**	**0**	**$1,323,500**	**$0**

Preparedness Area 3
Counties: Los Alamos, Rio Arriba, Santa Fe and Taos
Pueblos: Nambe, Ohkay Owingeh, Picuris, Pojoaque, San Ildefonso, Santa Clara, Tesuque, and Taos
Tribal Nations: Jicarilla Apache

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
High Wind	309	35-82 kts	0	0	$274,000	$500
Strong Wind	7	35-48 kts	0	0	$35,100	$0
Dust Storm	0	-	0	0	$0	$0
Total	316	**35-82 kts**	**0**	**0**	**$309,100**	**$500**

Preparedness Area 4
Counties: Cibola, McKinley, and San Juan
Pueblos: Acoma, Laguna, Zuni
Tribal Nations: Navajo Nation

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
High Wind	66	35-65 kts	0	0	$479,000	$0
Strong Wind	1	45 kts	0	0	$2,500	$0
Dust Storm	0	0	0	0	$0	$0
Total	67	**35-65 kts**	**0**	**0**	**$481,500**	**$0**



Preparedness Area 5
Counties: Bernalillo, Sandoval, Socorro, Torrance, and Valencia
Pueblos: Cochiti, Isleta, Jemez, Sandia, Santa Ana, Santo Domingo, San Felipe, and Zia

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage

High Wind	485	35-96 kts	0	0	$6,006,200	$2,500
Strong Wind	19	35-48 kts	3	3	$133,600	$0
Dust Storm	2	0	0	0	$0	$0
Total	506	**35-96 kts**	**3**	**3**	**$6,139,800**	**$2500**

Preparedness Area 6
Counties: Catron, Dona Ana, Grant, Hidalgo, Luna, Otero, and Sierra
Tribal Nation: Mescalero Apache

Hazard Type	# of Event	Mag	Deaths	Injuries	Property Damage	Crop Damage
High Wind	183	35-96 kts	0	0	$565,000	$0
Strong Wind	1	0	0	0	$75,000	$0
Dust Storm	4	-	0	0	$0	$0
Total	**188**	**35-96 kts**	**0**	**0**	**$640,000**	**$0**

6.9.3 Past Frequency

The State of New Mexico experiences high wind events annually, based on seasonal meteorological patterns and local topographical conditions. The north/southeast section of the State is susceptible to high wind events. One type of wind event is the gap wind or canyon wind. This occurs as the wind rushes over mountain passes, “gaps,” in the ridgeline of a mountain chain. Wind speeds are generally strongest at narrow canyon openings. Another type of wind event is referred to as the spillover wind, which occurs when cold air to the east of the mountains has a sufficient depth (approximately 10,000 feet above sea level) to overtop the Sandia and Manzano Mountain ranges and spill over to the west, typically down slope toward the Albuquerque metropolitan area (Preparedness Area 5).

Wind speeds over the State are usually moderate, although relatively strong winds often accompany occasional frontal activity during late winter and spring months and sometimes occur just in advance of thunderstorms. Frontal winds may exceed 30 mph for several hours and reach peak speeds of more than 50 mph. Spring is the windy season in New Mexico. Blowing dust and serious soil erosion of unprotected fields may be a problem during dry spells. Winds are generally stronger in the eastern plains than in other parts of the State. 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.

Every Preparedness Area experiences some type of wind event as illustrated in Table 6-73. A study conducted by the National Weather Service – Albuquerque dated May 2010 conducted a study titled, "A Climatology of High Wind Warning Events for Northern and Central New Mexico: 1976-2005." The study conducted an assessment of climatological wind data across northern and central New Mexico in an effort that would benefit forecasters by providing supplemental knowledge of the synoptic regimes and frequency of high wind events.

The climatological record of high wind events was built for eight observational sites across New Mexico utilizing a 30-year period of record from 1976 to 2005. Locations included Albuquerque – Preparedness Area 1, Clayton – Preparedness Area 2, Farmington – Preparedness Area 4, Gallup – Preparedness Area 4, Los Vegas – Preparedness Area 2, Roswell – Preparedness Area 1, Santa Fe – Preparedness Area 3 and Tucumcari – Preparedness Area 1. NWS staff conducted hourly, monthly, seasonal, and yearly intervals and interim surface observations from these eight sites to determine the frequency of high wind events. The observations provided the NWS with information that with continued future work will hopefully include the construction of a database that will allow improved methods for inter-site comparisons of events on an individual and collective basis.

As the past occurrences show, each Preparedness Area in New Mexico experience high wind events every year based on the climate, topography of the land and due to the annual spring and monsoon season weather patterns. Preparedness Area 1 shows the highest probability of experiencing a high wind event.

6.9.4 Climate Change Impacts

Ongoing research compiled in the recent climate assessment has resulted in different conclusions on the effect of climate change on wind regimes. The August 2021 IPCC report argues that in most places, wind speeds will be drastically reduced because of climate change, whereas in 2019, Scientific American reported that winds across the world were speeding up. Unusual wind patterns combined with other climate change issues, such as hotter water temperatures, can also cause problems. At this time, these changing factors are not well understood and are still being incorporated into state and regional research and risk analysis (Garrison 2022).

6.9.5 Probability of Future Occurrence

High winds are difficult to predict precisely in pattern, frequency, and degree of severity. The windiest time of the year is during the spring months of April and May, with March and June often times not far behind.

To determine the probability of New Mexico experiencing future high wind occurrences, the probability or chance of occurrence was calculated based on historical data identified in the NCEI database from a period of January 1996 – December 2022 (324 months/27 years) and from local emergency management officials. Probability was determined by dividing the number of events observed by the number of years (27 years) and multiplying by 100. This gives the percent chance of the event happening in any given year. Table 6-73 provides the probability of occurrence in each Preparedness Area.

Table 6-73 Probability of Occurrence - High Winds

Preparedness Area	High Wind	Strong Wind	Dust Storm
PA 1	100%	19%	41%
PA 2	100%	15%	7%
PA 3	100%	26%	0%
PA 4	100%	4%	0%
PA 5	100%	70%	7%
PA 6	100%	4%	26%

6.9.6 Vulnerability Assessment

Strong winds can damage buildings and uproot trees, but can also produce areas of blowing dust that can reduce visibilities making road travel hazardous. The NWS Albuquerque issues high wind warnings when winds are expected to have sustained speeds of 40 mph or greater and/or instantaneous gusts of 58 mph or higher. A study was recently completed to determine the frequency of high wind events across New Mexico, and to evaluate the synoptic regime associated with these events. This study showed that high wind events are also most common in the Spring.

High wind events often have a westerly component. During the Spring months two factors work in tandem to create strong winds. By March or April, the polar jet stream has started migrating northward but can still often influence the southwest U.S., such that wind speeds increase dramatically with height. Meanwhile, the sun angle is getting higher in the sky and creating greater heating near the surface of the earth. The heated surface air rises to a greater depth of the atmosphere during these spring months, often to a height between 7,500 and 10,000 feet above the surface. The rising air mixes with stronger winds aloft, resulting in stronger and turbulent winds mixing down to the surface. Strong surface pressure gradients can enhance surface winds. High wind events across New Mexico can also occur with strong surface fronts, especially those that race through the eastern plains.

Thunderstorm activity in New Mexico is consistent due to seasonal meteorological patterns and local topographical conditions. The entire State is susceptible to a full range of weather conditions, including thunderstorms, lightning, and hail. All areas of State are susceptible to thunderstorm conditions, although local topography, such as elevation and land contours, plays a significant part in how weather affects a particular area. Extreme variations in damages due to thunderstorm events across the Preparedness Areas can be attributed to differences in the concentration of population and infrastructure.

State Assets

Because high wind events can occur anywhere in the state, all state assets are assumed to be at risk (see Table 6-7). For purposes of this analysis, the State assumed losses up to 25% of total asset value for assets at high risk of drought, 15% for assets at medium risk, and 5% for assets at low risk; risk ratings were based on the ratings in Table 6-3 Hazard Risk Rankings by Preparedness Area. Table 6-74 shows estimated losses for state assets from drought; these estimates are for planning purposes only and should not be used for insurance purposes.

Table 6-74 Potential Losses to State Assets From High Wind

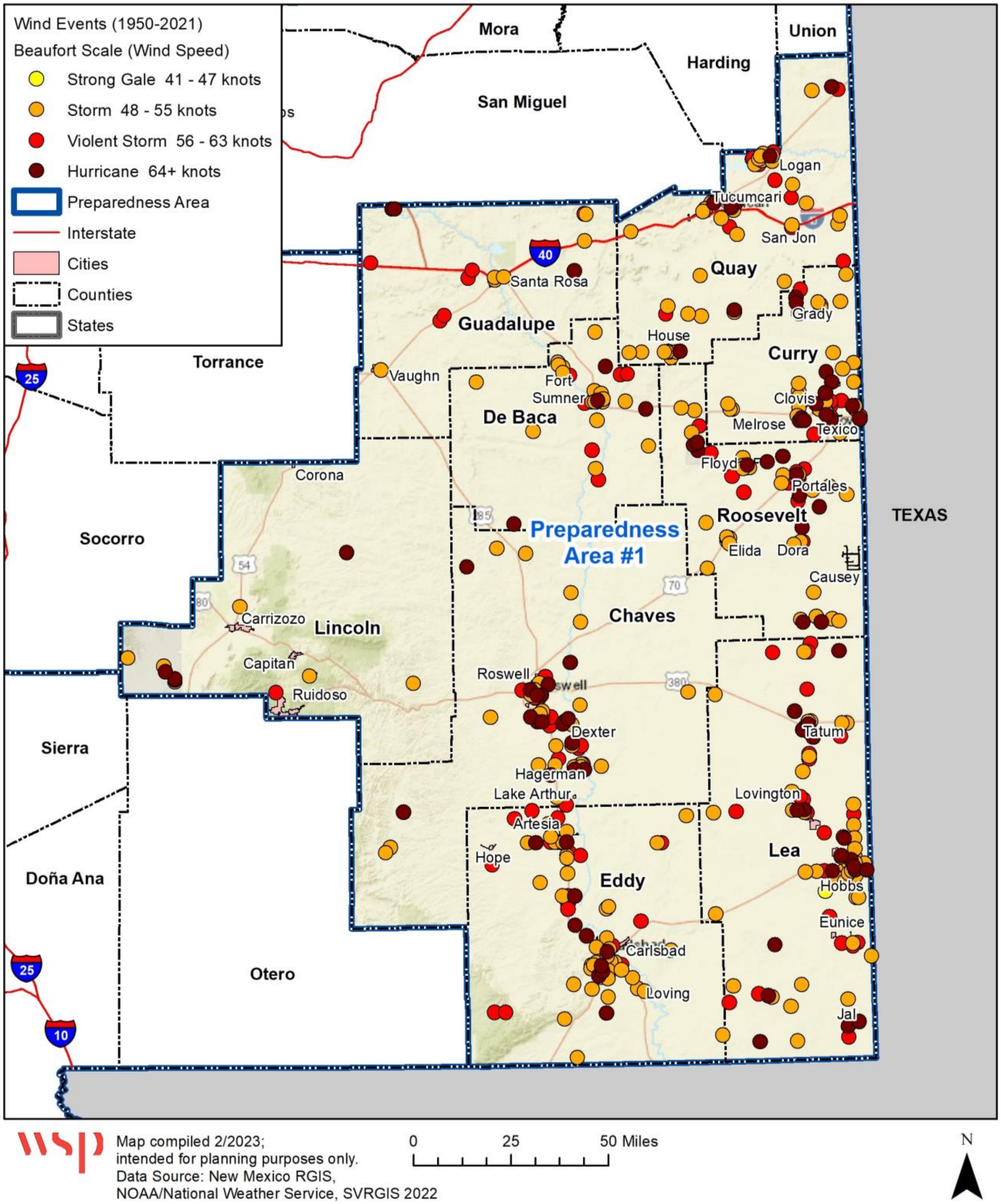
County	Total Assets	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
PA 1						
Chaves	**5**	1	3	1	$48,197,000	**$12,049,250**
Curry	**1**	-	1	-	$933,000	**$233,250**
PA 2						
Colfax	**3**	1	2	-	$89,310,000	**$22,327,500**
San Miguel	**3**	1	1	1	$152,965,000	**$38,241,250**
PA 3						
Rio Arriba	**1**	-	1	-	$558,985	**$83,848**
Santa Fe	**16**	-	14	2	$602,912,704	**$90,436,906**
Taos	**1**	-	1	-	$501,000	**$75,150**
PA 4						
Cibola	**2**	-	1	1	$39,102,000	**$9,775,500**
McKinley	**1**	-	1	-	$2,807,000	**$701,750**
PA 5						
Bernalillo	**6**	3	2	1	$393,344,167	**$59,001,625**
Sandoval	**1**	-	1	-	$17,085,000	**$2,562,750**
Socorro	**1**	-	1	-	$3,026,251	**$453,938**
Valencia	**3**	1	2	-	$148,620,000	**$22,293,000**
PA 6						
Dona Ana	**2**	-	2	-	$76,250,000	**$19,062,500**
Grant	**1**	1	-	-	$0	**$0**
Luna	**1**	-	-	1	$9,553,000	**$2,388,250**
Sierra	**1**	1	-	-	$24,528,000	**$6,132,000**
Total	**49**	**9**	**33**	**7**	**$1,609,693,107**	**$27,582,750**

Preparedness Area 1

The NCEI database has recorded 1 fatality, 12 injuries, and almost $9.9 million in property damages in Preparedness Area 1. In total, 938 high wind, strong wind and dust storm related events were recorded in this area from 1955-2022. Preparedness Area 1 has the greatest frequency of events in the state. The counties in this area are located along the eastern portion of the state, where the most frequent high wind events tend to occur. Additionally, this planning area had significant documented property damages due to the moderate population size and one significant event, which resulted in $6 million of property damage, accounted for over 60 percent of the total damages in the area (see Table 6-97).

Figure 6-94 below shows the wind events by magnitude from the year 1950 to 2021 in Preparedness Area 1.

Figure 6-94 New Mexico Preparedness Area 1 – Wind Events by Magnitude (1950 – 2021)

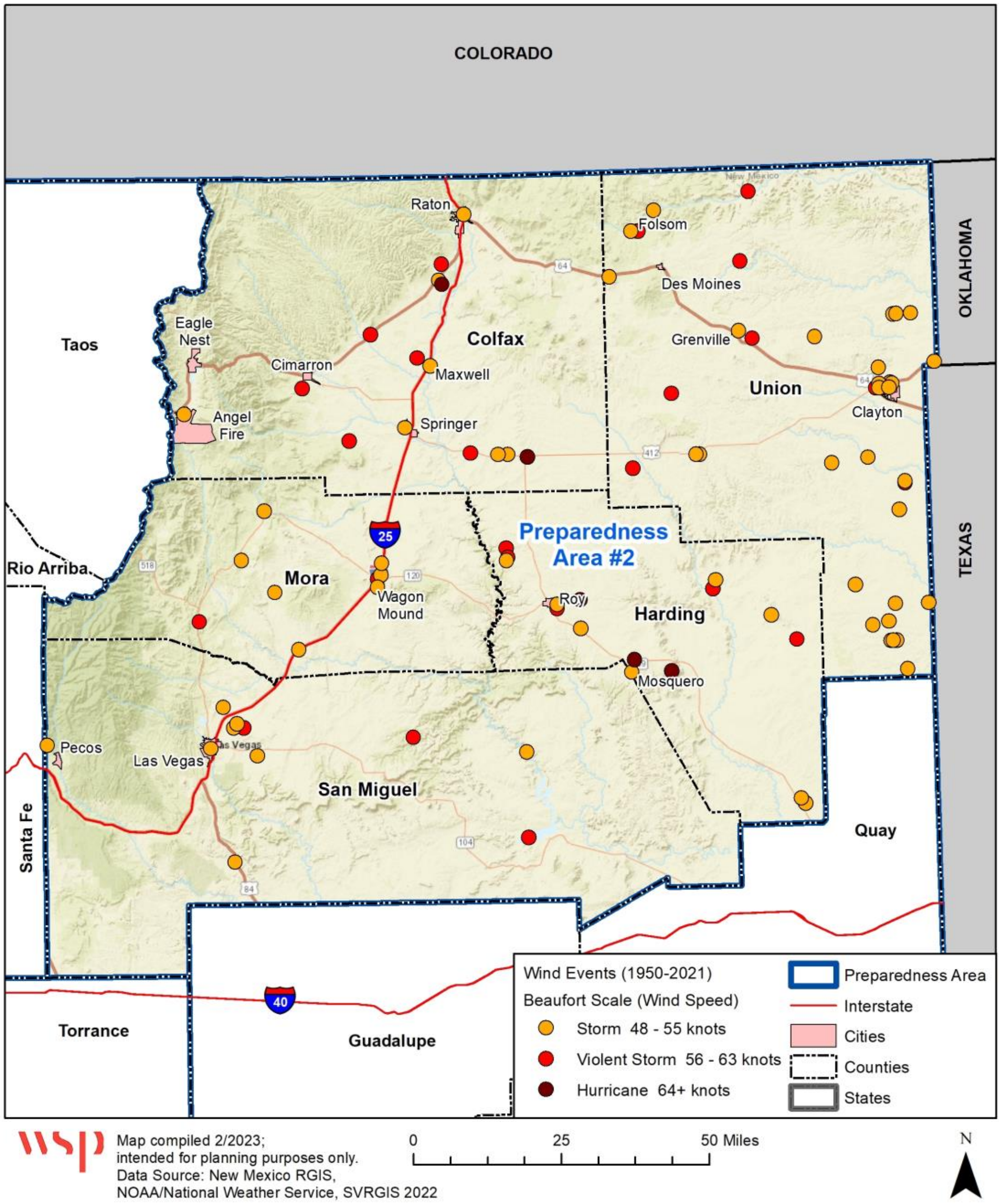


Preparedness Area 2

The NCEI database has recorded 1 fatality, 0 injuries, and over $1.3 million in property damages in Preparedness Area 2. In total, 337 high wind, strong wind and dust storm related events were recorded in this area from 1955-2022. Like Preparedness Area 1, the counites in Preparedness Area 2 are in the eastern portion of New Mexico and therefore experience a greater frequency of thunderstorm events than the rest of the state. Documented damages are much smaller here than in Preparedness Area 1 and 5 because counties in this area have smaller populations and less infrastructure to be damaged.

Figure 6-95 below shows wind events by magnitude from the year 1950 to 2021 in Preparedness Area 2.

Figure 6-95 New Mexico Preparedness Area 2 – Wind Events by Magnitude (1950 – 2021)

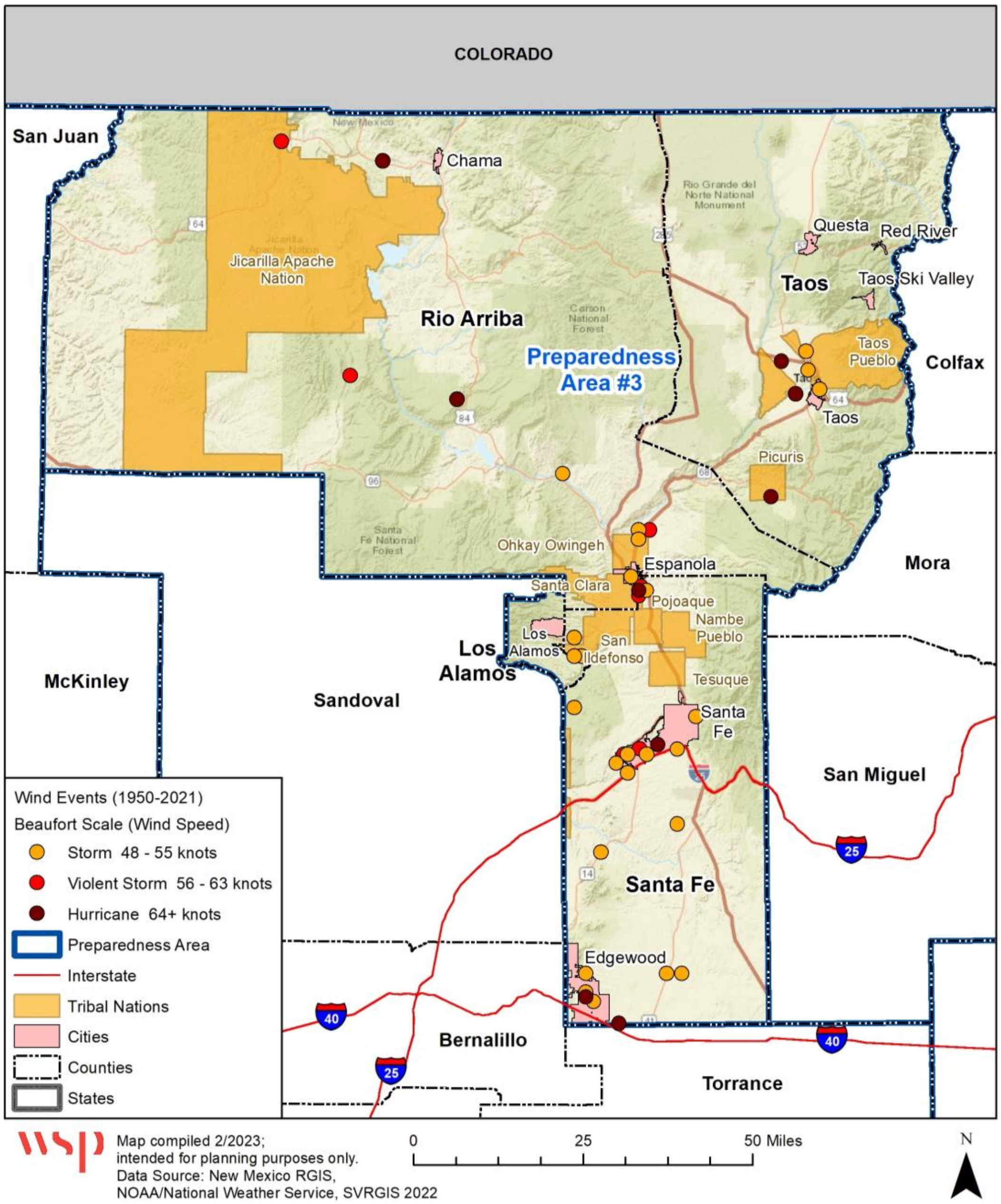


Preparedness Area 3

The NCEI database has recorded over $309,000 in property damages and $500 in crop damages in Preparedness Area 3. In total, 316 high wind, strong wind and dust storm related events were recorded in this area from 1955-2022. Preparedness Area 3 has the lowest amount of property damages due to high wind events in the State. This area is located in the northern portion of the state, damaging where events are less frequent. Most of the damages recorded in this area occurred in Santa Fe County due to its dense concentration of population and infrastructure.

Figure 6-96 below shows wind events by magnitude from the year 1950 to 2021 in Preparedness Area 3.

Figure 6-96 New Mexico Preparedness Area 3 – Wind Events by Magnitude (1950 – 2021)

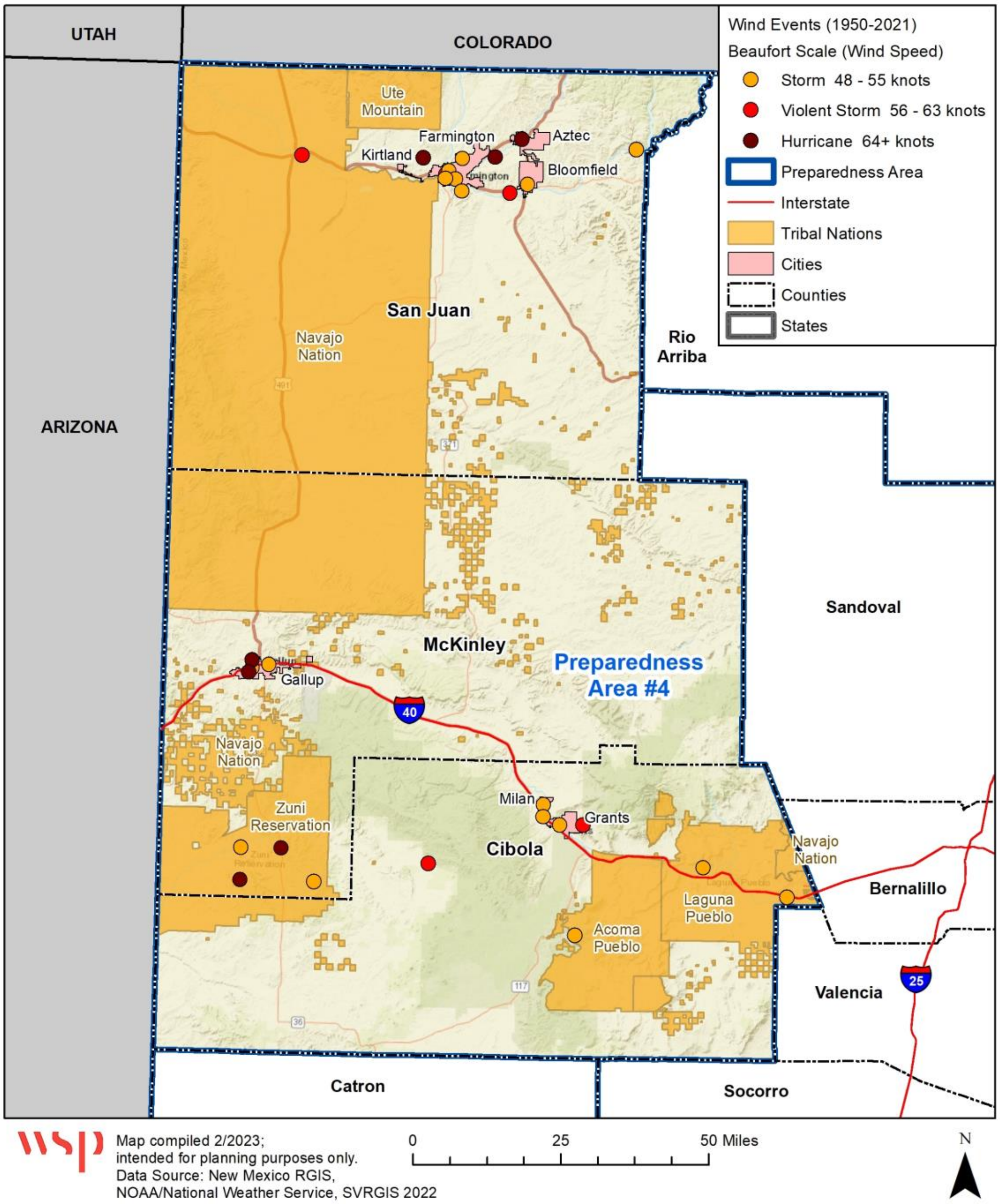


Preparedness Area 4

The NCEI database has recorded over $481,000 in property damages in Preparedness Area 4. In total, 67 high wind, strong wind and dust storm related events were recorded in this area from 1955-2022. Preparedness Area 4 has relatively low amount of property damages due to high wind events in the State and the least amount of total documented events. This is mainly due to the location of the area in the northwest portion of the state where events are less frequent.

Figure 6-97 below shows wind events by magnitude from the year 1950 to 2021 in Preparedness Area 4.

Figure 6-97 New Mexico Preparedness Area 4 – Wind Events by Magnitude (1950 – 2021)

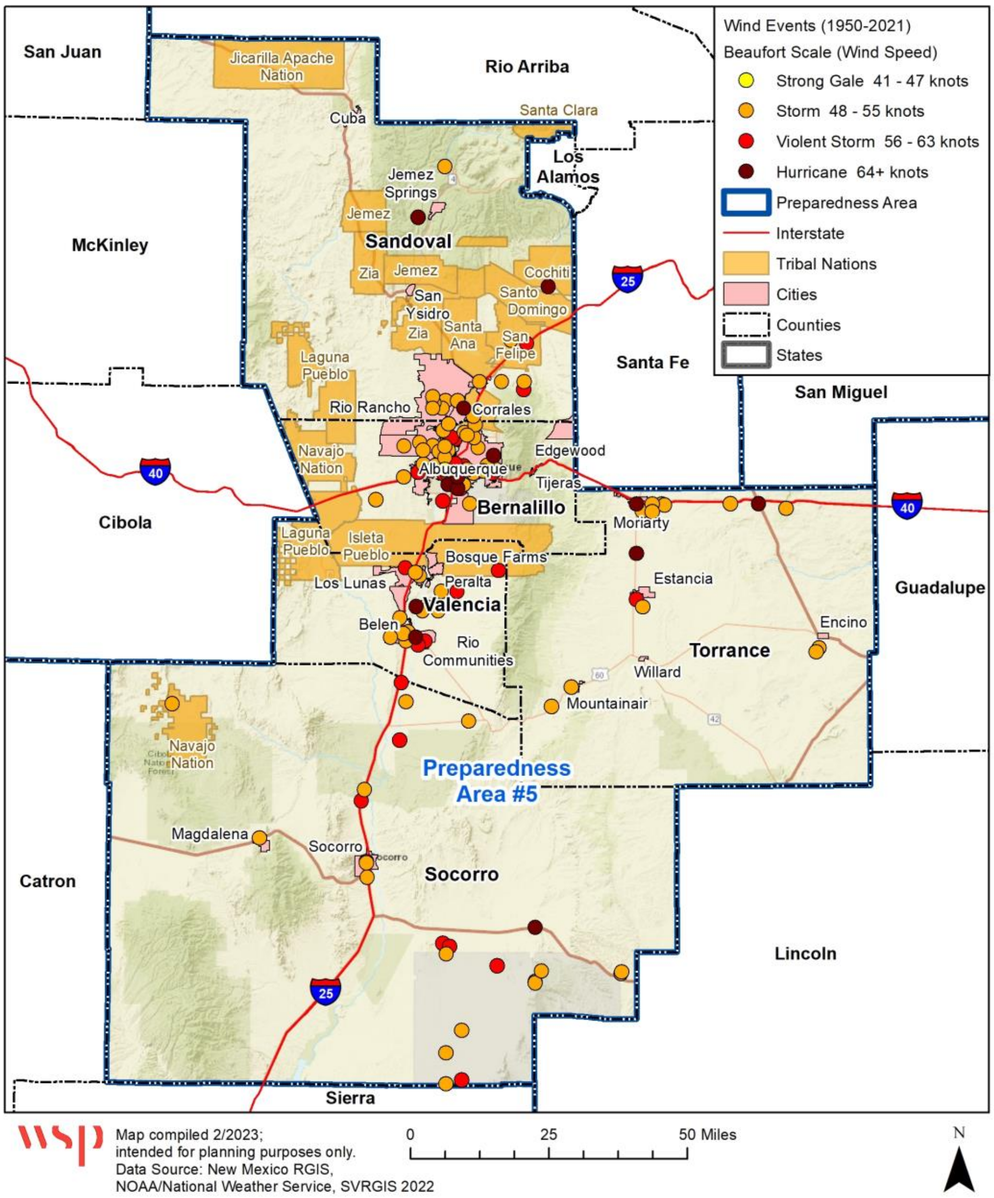


Preparedness Area 5

The NCEI database has recorded 3 fatalities, 3 injuries, almost $6.14 million in property damages, and $2,500 in crop damages in Preparedness Area 5. In total, 506 high wind, strong wind and dust storm related events were recorded in this area from 1955-2022. Preparedness Area 5 has the largest population in the state, concentrated in Bernalillo County. Due to this dense concentration of infrastructure and people, the damages reported in this Preparedness Area are the second most significant in the State, despite the lower number of event occurrences. This also makes the people living in this area more vulnerable to injury and death from these events, as indicated by the high number of injuries during past events.

Figure 6-98 below shows wind events by magnitude from the year 1950 to 2021 in Preparedness Area 5.

Figure 6-99 New Mexico Preparedness Area 5 – Wind Events by Magnitude (1950 – 2021)

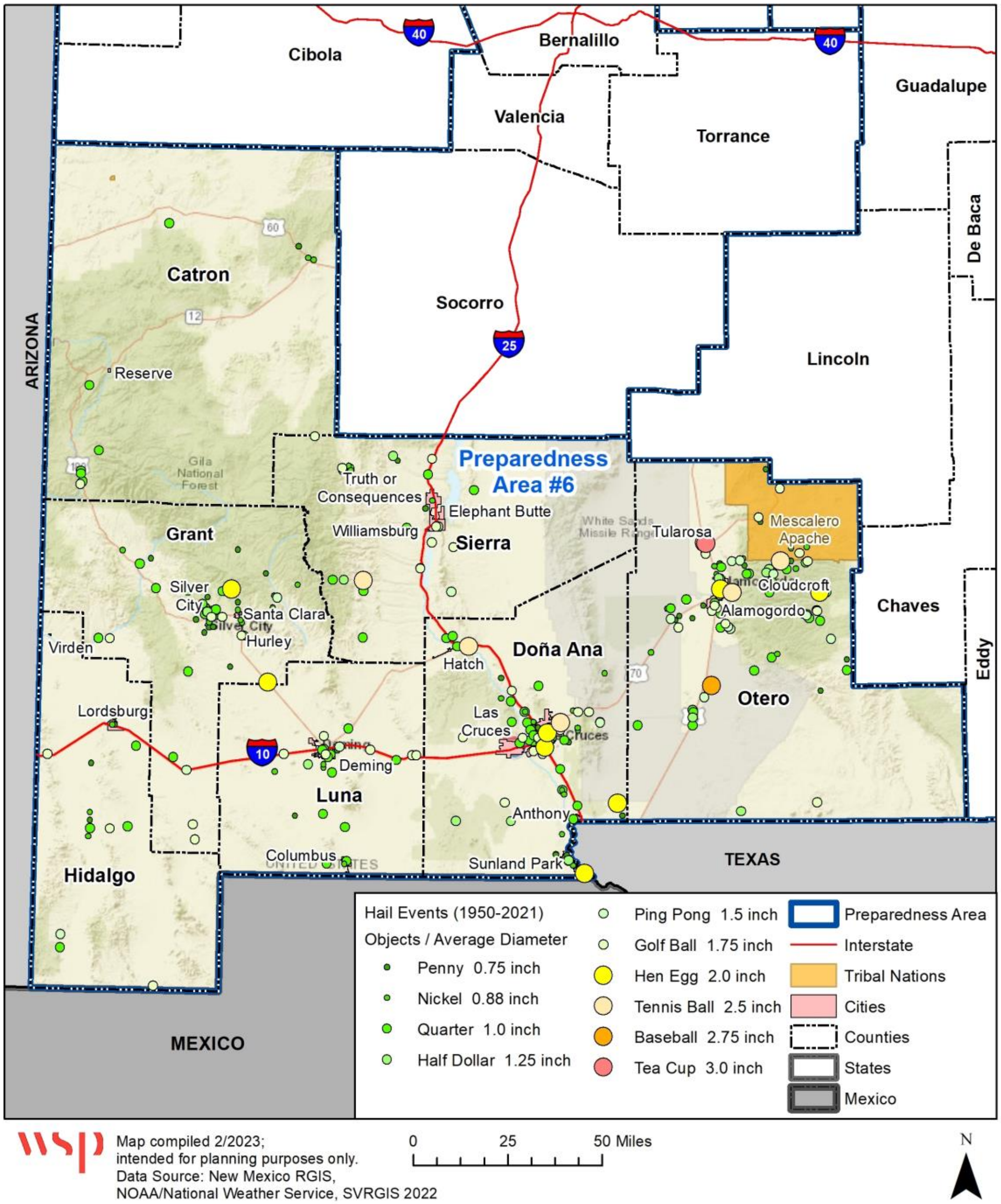


Preparedness Area 6

The NCEI database has recorded over $640,000 in property damages in Preparedness Area 6. In total, 188 high wind, strong wind and dust storm related events were recorded in this area from 1955-2022. Preparedness Area 4 has relatively low amount of property damages due to high wind events in the State and the least amount of total documented events. This is mainly due to the location of the area in the southwest portion of the state where events are less frequent.

Figure 6-100 below shows wind events by magnitude from the year 1950 to 2021 in Preparedness Area 5.

Figure 6-101 New Mexico Preparedness Area 6 – Wind Events by Magnitude (1950 – 2021)



6.9.7 Data Limitations

Manufactured homes that are not adequately anchored are the most vulnerable structures for damage from high wind events. The information necessary to determine the location and condition of manufactured homes and aged or dilapidated structures was not available during the development of this mitigation plan. Consequently, the SHMT could not quantify vulnerability of individual structures to damage from high winds. In addition, accurate methods to quantify potential future damages are not readily available. The amount of business lost due to high wind events has not been calculated due to the difficulty of attaining this information. The SHMT could also not specify which critical facilities were vulnerable to high wind events. Subsequent versions of this Plan Update will need to incorporate and respond to these data deficiencies.

6.9.8 What Can Be Mitigated?

One important part of mitigating high wind hazards is forecasting and warning so that people can prepare. Communities can prepare for disruptions of utilities and transportation due to high wind events by advising people to stay home or to use caution if they must go out, and by recommending that people stock up on food, water, batteries, and other supplies. The National Weather Service, combined with local television stations, have an effective strategy for notifying residents about impending wind events. Consistently enforcing building codes provides the greatest benefit for new construction to mitigate damages due to wind events. For existing structures and critical facilities, follow-up inspections and retrofits provide effective mitigation.

Other mitigation activities can include adoption and enforcement of building codes, retrofit of existing structures, construction of safe rooms and shelters, hardening power lines and other utilities, and public education of the risk.

6.9.9 Risk Summary

No areas of New Mexico are immune from damaging high winds. High wind is a fact of life for State residents, especially in the spring. Extremely high velocity wind over a prolonged period is rare. Such occurrences can result in downed power lines, roof damage, trees being blown down, and difficulty in controlling high profile vehicles on the highways. Microburst wind damage is more common, since it is often associated with powerful downdrafts originating from thunderstorms. These winds are of relatively short duration. Certain areas of the State are subject to hazardous dust storms when high winds blow over terrain that is relatively devoid of vegetation. The southwestern part of the State between Deming and the Arizona border is especially susceptible to this hazard, and highway closure is sometimes required. Localized dust storms can arise unexpectedly when high winds pick up dust and debris from construction sites.

These large-scale dust storms occasionally occur in the White Sands region of New Mexico and in the region between Deming (Luna County – Preparedness Area 6) westward to the Arizona border. Major dust events can transport mineral aerosols (dust) for long distances, obscuring vision for motorists and causing breathing problems for people with respiratory difficulties.

The state airs public service announcements and posted signs that span 100 miles warning drivers about sudden winds. The following actions are recommended when driving during a windstorm:

- Dust storms usually last a few minutes, and up to an hour at most. Stay where you are until the dust storm passes.
- Avoid driving into or through a dust storm. If you encounter a dust storm:
    - Immediately check traffic around your vehicle (front, back and to the side) and begin slowing down.
    - Do not wait until poor visibility makes it difficult to safely pull off the roadway -- do it as soon as possible. Completely exit the highway if you can.
    - Do not stop in a travel lane or in the emergency lane. Look for a safe place to pull completely off the paved portion of the roadway.
    - PULL OFF! LIGHTS OFF! FOOT OFF!
- If you encounter a dust storm while driving, pull off the road immediately.
    - Turn off your headlights and taillights, put your vehicle in "PARK," and take your foot off the brake (so your brake lights are not illuminated.) Other motorists may tend to follow taillights in an attempt to get through the dust storm, and may strike your vehicle from behind.
    - Stay in the vehicle with your seatbelts buckled and wait for the storm to pass.
- Drivers of high-profile vehicles should be especially aware of changing weather conditions and travel at reduced speeds.

Table 6-75 identifies impacts related to high wind events.

Table 6-75 Impacts from High Wind Events

Subject	Impacts
Agriculture	Row crops, those standing above ground level, are most susceptible to high wind damage. Agriculture infrastructure such as grain silos and windmills can be damaged or destroyed.
Health and Safety of the Public	The public can face severe injuries and even death because of high wind events.
Health And Safety of Responders	Responders face the same risks as the public.
Continuity of Operations	Little to no impacts anticipated, except for facilities that may be damaged or during an event.
Delivery of Services	Little to no impacts anticipated, except for facilities that may be damaged or during an event.
Property, Facilities, Infrastructure	High wind can cause anywhere from minor damage to total destruction of facilities and infrastructure depending on the size of the event. Extensive damages are anticipated.
Environment	Wind can cause widespread extensive damage to the environment in the form of damaged or downed trees and crops, and debris or contamination dispersal.
Economic Condition	A small community can be heavily damaged and by wind. The economic base (businesses) and individuals can lose everything, and recovery may require substantial investment.
Public Confidence	Not impacted by the event itself, but may be damaged if the response to an event is poor.

6.10 Landslide

Hazard	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
Landslide	NR	Low	Medium	Low	Medium	Low	Low

6.10.1 Hazard Characteristics

Landslides are the downward and outward movement of rock or soil on slopes. Although generally associated with mountainous regions, sometimes they can occur in low-relief areas. Human activity can potentially promote landslide activity. These activities include steep slopes created during excavations or road cuts, unstable mine waste dumps or tailings piles, or saturation of slopes (e.g., due to irrigation or irrigation ditches). The USGS has produced an informative, short publication regarding landslide types and processes that serves as a valuable reference, from which much of the summary material presented below was derived.

Landslides include a wide range of ground movement, such as rock falls, rock topple, deep failure of slopes, and shallow failure of slopes (the latter of which may become debris flows if saturated). Although gravity is an essential driving force, landslides are often prompted by the occurrence of other phenomena such as seismic activity or heavy rainfall. Other contributing factors include the following:

- Over-steepened slopes created by erosion associated with rivers, glaciers, or waves.
- Over-steepened slopes caused by construction activity, such as excavations or road cuts.
- Rock and soil slopes weakened through saturation by snowmelt or heavy rains.
- Earthquakes waves creating forces contributing to slope failure.
- Volcanic eruptions producing loose ash deposits, heavy rain, and debris flows.
- Excess weight from accumulation of rain or snow, stockpiling of rock or ore or waste piles, or from manmade structures stressing weak slopes.
- Floods or long duration precipitation events creating saturated, unstable soils that are more susceptible to failure.
- Addition of water from irrigation ditches crossing steep slopes and saturating the substrate.
- Moist clay on slopes that deform, slide, and flow easily.

During heavy or sustained precipitation (including snow melt), slope material can become saturated with water and, if it fails, a debris or mudflow may develop. In this saturated state, the water weakens the soil and rock by reducing cohesion and friction between particles. Cohesion, which is the tendency of soil particles to "stick" to each other, and friction affect the strength of the material in the slope and contribute to a slope's ability to resist down-slope movement. Moist clays on slopes are plastic, deforming and sliding under slight loads; clays also prevent water from percolating downward and may promote local saturation of soils. Saturation increases the weight of the slope materials and, like the addition of material on the upper portion of a slope, increases the gravitational force on the slope. Undercutting of a slope reduces the slope's resistance to the force of gravity by removing buttressing mass at the base of the slope. Alternating cycles of freeze and thaw can result in a slow, virtually imperceptible fracturing of rock, thereby weakening it and increasing susceptibility for slope failure or rockfall. Slopewash associated with intense precipitation may wash small stones off of steep cliffs, causing rockfall events. Intense precipitation also may promote shallow failure of weakly consolidated material, resulting in a debris flow. The resulting slurry of rock and mud causes flooding along its path and can pick up trees, houses, and cars;

this slurry can also block or weaken bridges and damage roads. Additionally, removal of vegetation can leave a slope much more susceptible to superficial landslides because of the loss of the stabilizing root systems.

Geologists attempt to identify active landslides and areas subject to slope instability so that they may be avoided or mitigated. Together, geologists and civil engineers develop and implement measures to improve the stability of slopes, repair existing landslides, and prevent damage from future landslides. Slope stability can be improved by removing material from the top of the slope, adding material or retaining structures to the base of the slope, and reducing the degree of saturation by improving drainage within the slope.

Figure 6-102 Google Earth Image Showing an Active Landslide in New Mexico

Figure 6-102 shows a Google Earth image showing an active landslide in New Mexico, located in the Rio Grande Gorge 3.7 miles southwest of the town of Pilar. The road in the foreground is NM State Highway 68, which connects the cities of Española and Taos. Note how the landslide has caused deflection of both the river (to the lower left of the image) and the road crossing the lower part of the landslide. Progressive movement of the landslide has caused narrowing of the river and creation of rapids. This landslide is probably best classified as an earthflow (see Figure 6-103 below).

Figure 6-103 Photographs of "Baby Huey" Boulder

This boulder, estimated at 2.7x105 kg (300 ton), slid and bounced down the steep slope flanking the southeast side of NM State Highway 68, at a location 2.9 mi southwest of Pilar. The source of the boulder is shown by the white arrow in the left photograph. This was the most impressive of the numerous rockfalls that occurred on July 25 of 1991. As it bounced down the slope, it created a 45x15x15 ft crater on Highway 68. The boulder's momentum allowed it to travel across the river, where it came to rest on the lower slope (right photos). It was estimated that this boulder was traveling at approximately 21 m/sec and had a total kinetic energy of about 8.5x107 N-m. These rockfalls, in addition to debris flows, trapped 20 cars and closed Highway 68 for 19 hours. Photos courtesy of Paul Bauer (NM Bureau of Geology and Mineral Resources).

Landslide Types

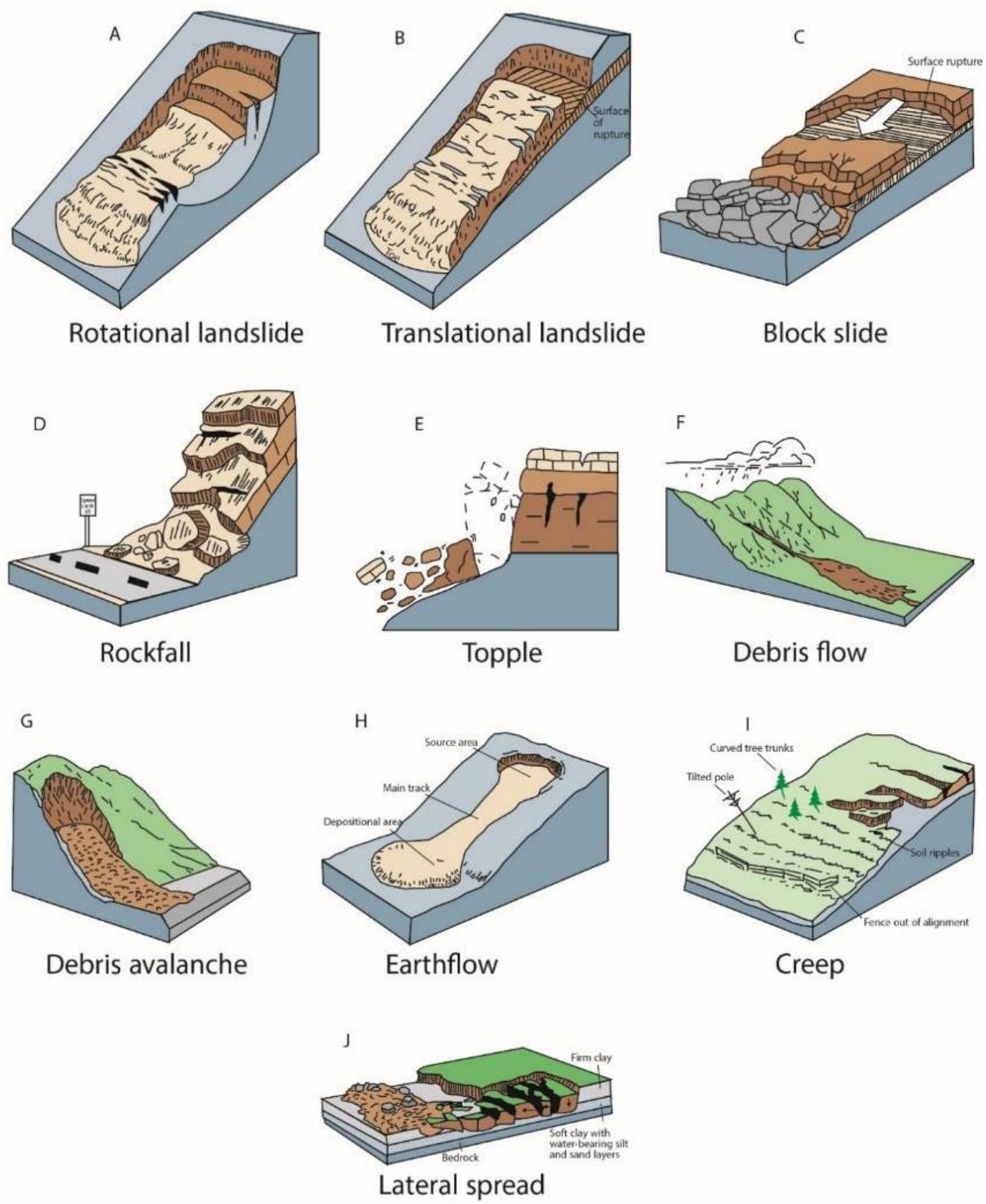
Landslides are commonly categorized according to the material involved and the type of movement. The material involves either bedrock or unconsolidated material. The type of movement can be classified as follows: slides, falls+topples, flows, lateral spreads, or combinations of these processes. The figures below summarize the types of landslides, followed by text briefly summarizing landslide types (in the order as presented by the figure). Table 6-76 summarizes the different types of landslides. It is from the USGS Fact Sheet on landslides, and is as an abbreviated version of Varnes' classification of slope movements.

Table 6-76 Summary of Landslide Types

TYPE OF MOVEMENT		TYPE OF MATERIAL		
		BEDROCK	ENGINEERING SOILS	
			Predominantly coarse	Predominantly fine
FALLS		Rock fall	Debris fall	Earth fall
TOPPLES		Rock topple	Debris topple	Earth topple
SLIDES	ROTATIONAL	Rock slide	Debris slide	Earth slide
	TRANSLATIONAL			
LATERAL SPREADS		Rock spread	Debris spread	Earth spread
FLOWS		Rock flow (deep creep)	Debris flow (soil creep)	Earth flow
COMPLEX		Combination of two or more principal types of movement		

Figure 6-104 shows schematic figures to illustrate the main types of landslides. Figure courtesy of the U.S. Geological Survey.

Figure 6-104 Main Types of Landslides



Rotational landslides – a landslide (A in Figure 6-104 above) consisting of a mass of material moving down slope as a unit along a concave-up, curved plane of failure. Slide movement is approximately rotational about an axis that is parallel to the ground surface and orientated transverse across the landslide. The sliding mass of soil and rock leave an abrupt drop-off at the top of the landslide, known as a main scarp or head scarp. Over much of its length, the moving mass of material is back-tilted towards this head scarp. Repeated movements can often result in terracing, or series of scarps, as secondary failures occur within the landslide mass.

Translational landslides – a landslide (B in Figure 6-104 above) where the mass moves (translates) along an approximately planar surface with little rotation or back-tilting. A translational slide involving bedrock is also referred to as a rockslide, which generally moves along a plane of weakness, such as a bedding plane or joint. If the bedrock mass breaks apart as it moves, then the slide can be termed a block slide (C in figure above). In general, translational slides occur on steep mountain faces, but have been known to occur on slopes as low as 15 degrees.

Rockfall and rock topple – these types of landslides involve freefall of hard blocks (rock or boulders) from a steep slope or cliff (D and E in Figure 6-104 above), eventually coming to rest at a shallower slope. Rockfall involves abrupt downward detachment along a surface (D in Figure 6-104 above). Rock topple, on the other hand, is when the rock body has forward rotation (out from the slope) about a semi-horizontal axis below the center of gravity of the displaced mass (E in Figure 6-104 above). During its transport, the moving block may remain intact or shatter into smaller pieces (depending on the degree of acceleration and the strength of the falling rock). The blocks typically accumulate at the base of the cliff in the form of talus (loose rock). Separation from a cliff occurs along discontinuities such as joints, fractures, or bedding planes. Potential driving forces for rockfalls + rock topples include freeze/thaw weathering or segregation ice growth, expansion of clays in cracks, solar heating of rocks that can form cracks, earthquakes, and precipitation. Rockfalls + rock topples are influenced by bedrock type -- especially its hardness, orientation of bedding planes (if any), or fracture density.

Debris flow – a mixture of rock fragments, soil, vegetation, water and, in some cases, entrained air that flows downhill as a fluid (F in Figure 6-104 above). Debris flows include <50% fines (clat+silt+sand) and are commonly caused by intense surface-water flow associated with heavy precipitation or rapid snowmelt. This runoff erodes weakly consolidated material accumulated in gullies or from steep slopes (the latter facilitated by wildfire denudation of vegetation). Shallow landslides on steep slopes that involve saturated, weakly consolidated material can also evolve into debris flows.

Debris avalanche – a debris flow that is emplaced very rapidly due to slope failure (G in Figure 6-104 above), commonly from collapse of an unstable, steep slope (such as a steep flank of a volcano).

Earthflow and mudflow – These landslide types generally involve fine-grained material that behaves in a liquefied manner. The flow is elongate, commonly having an "hourglass" shape, and leaves a bowl or depression near its head (H in Figure 6-104 above). A mudflow is an earthflow that is sufficiently wet to flow rapidly and contains at least 50% sand-, silt-, or clay-sized particles.

Creep – steady, downward movement of material along a slope involving rates that are imperceptibly slow. This phenomenon is evidenced by curved tree trunks, bent fences or retaining walls, or tilted poles (I in Figure 6-104 above). It is common in New Mexico on slopes underlain by shale.

Lateral spread – slides involving lateral extension of material, either weakly consolidated or solid, that occurs in or over liquefied, fine-grained material (J in Figure 6-104 above). Failure is often triggered by rapid ground motions, such as that experienced during an earthquake.

Landslides can be classified by using the Alexander Scale (Table 6-77). The Alexander Scale provides descriptions of landslide damage and the different levels and type of damage.

Table 6-77 Alexander Scale for Landslide Damage

Level	Damage	Description
0	None	Building is intact.
1	Negligible	Hairline cracks in walls or structural members; no distortion of structure or detachment of external architectural details
2	Light	Buildings continue to be habitable; repair not urgent. Settlement of foundations, distortion of structure, and inclination of walls are not sufficient to compromise overall stability.
3	Moderate	Walls out of perpendicular by one or two degrees, or there has been substantial cracking in structural members, or the foundations have settled during differential subsidence of at least 15 cm; building requires evacuation and rapid attention to ensure its continued life.
4	Serious	Walls out of perpendicular by several degrees; open cracks in walls; fracture of structural members; fragmentation of masonry; differential settlement of at least 25 cm compromising foundations; floors may be inclined by one or two degrees or ruined by heave. Internal partition walls will need to be replaced; door and window frames are too distorted to use; occupants must be evacuated and major repairs carried out.
5	Very Serious	Walls out of plumb by five or six degrees; structure grossly distorted; differential settlement has seriously cracked floors and walls or caused major rotation or slewing of the building [wooden buildings are detached completely from their foundations]. Partition walls and brick infill will have at least partly collapsed; roofs may have partially collapsed; outhouses, porches, and patios may have been damaged more seriously than the principal structure itself. Occupants will need to be re-housed on a long-term basis, and rehabilitation of the building will probably not be feasible.
6	Partial Collapse	Requires immediate evacuation of the occupants and cordoning of the site to prevent accidents with falling masonry.
7	Total Collapse	Requires clearance of the site.

Landslides occur in every State and U.S. territory. The Appalachian Mountains, the Rocky Mountains, the Pacific Coastal Ranges, and some parts of Alaska and Hawaii experience severe landslide problems. Any area composed of very weak or fractured materials resting on a steep slope may experience landslides. Although frequently associated with areas of high rainfall, landslides are a potential hazard in arid or semi-arid States like New Mexico. Landslides in New Mexico range from large, slow-moving, deep-seated masses, which can destroy structures by gradual movement, to shallow, fast-moving debris flows that threaten life and property. Of the various landslide phenomena, debris flows and rockfalls pose the greatest hazards to New Mexico. Although they still have potential to be a modern-day threat (given the right slope conditions and driving forces), most deep-seated landslides observed on the landscape probably happened in cooler or wetter climates prior to 10,000 years ago.

The New Mexico Bureau of Geology has provided GIS data utilized to produce Statewide susceptibility maps for landslides and rockfalls. Susceptibility is used to describe the natural propensity of the landscape to produce a given hazard (in this case, landslides and rockfall). In other words, these maps depict the likelihood that a landslide or rockfall event will occur in a specified area based on local terrain conditions, given adequate driving forces or destabilizing phenomena. Landslide susceptibility is mapped in Figure 6-105.

Two series of maps depict rockfall susceptibility. The first series show kernel-function contouring of previously mapped rockfall density. Because these mapped rockfalls were interpreted using aerial photography, which likely can only pick out boulders ≥ 3 m in diameter, this rockfall density map is best-suited for hazards posed by large-block rockfalls. Figure 6-106 and Figure 6-107 shows the susceptibility of rockfalls by county statewide. Indicating that rockfalls are most likely to occur in Northern, Western and the Southern portions of the state. Landslide susceptibility data are derived from logistic regression modeling of topographic, climatic, and geologic parameters. A set of six logistic regression models relating topographic, climatic, and geologic variables to deep-seated landslide susceptibility were created (Cikoski and Koning 2017). The final models were merged across gradational boundaries, then classified into four susceptibility classes as shown in the maps below, based on the distribution of model probabilities occurring in known landslide areas. Note that most rockfalls correspond to mesa flanks or steep mountains slopes.

Landslides and Rockfalls have resulted in deaths over the past 30 years and are a constant reason for the NMDOT having to close down some highways. On July 11, 2008, three homeless people died in Gallup when a rock fell on them while asleep. One of the most challenging rockfall areas in the state is the Rio Grande Gorge along NM 68 between Taos and Española, where rockfall events occurred on September 12, 1988 and July 25, 1991. In 1988, a boulder hit a bus, killing five and injuring 14. In 1991, several rockfalls and debris flows blocked 20 cars and closed the highway for 19 hours. A 300-ton boulder recoiled off the highway, creating a hole 45 feet long and 15 feet deep before coming to a stop on the other side of the river. Repair costs for this one event was about $75,000. On average, the yearly cost of rockfall response in the state is valuated at tens of thousands of dollars.

Figure 6-105 New Mexico Landslide Susceptibility Classes

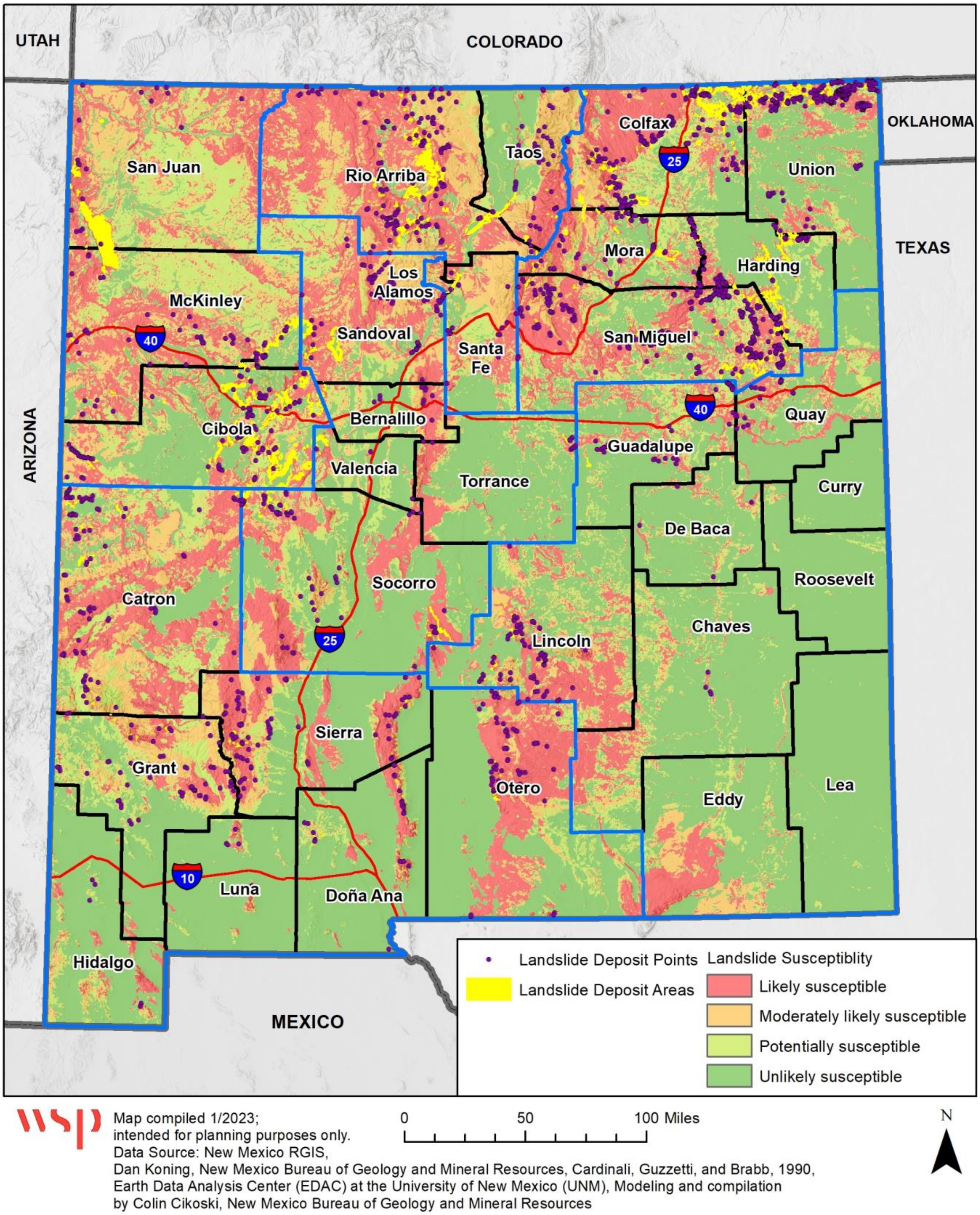


Figure 6-106 New Mexico Rockfall Susceptibility Classes

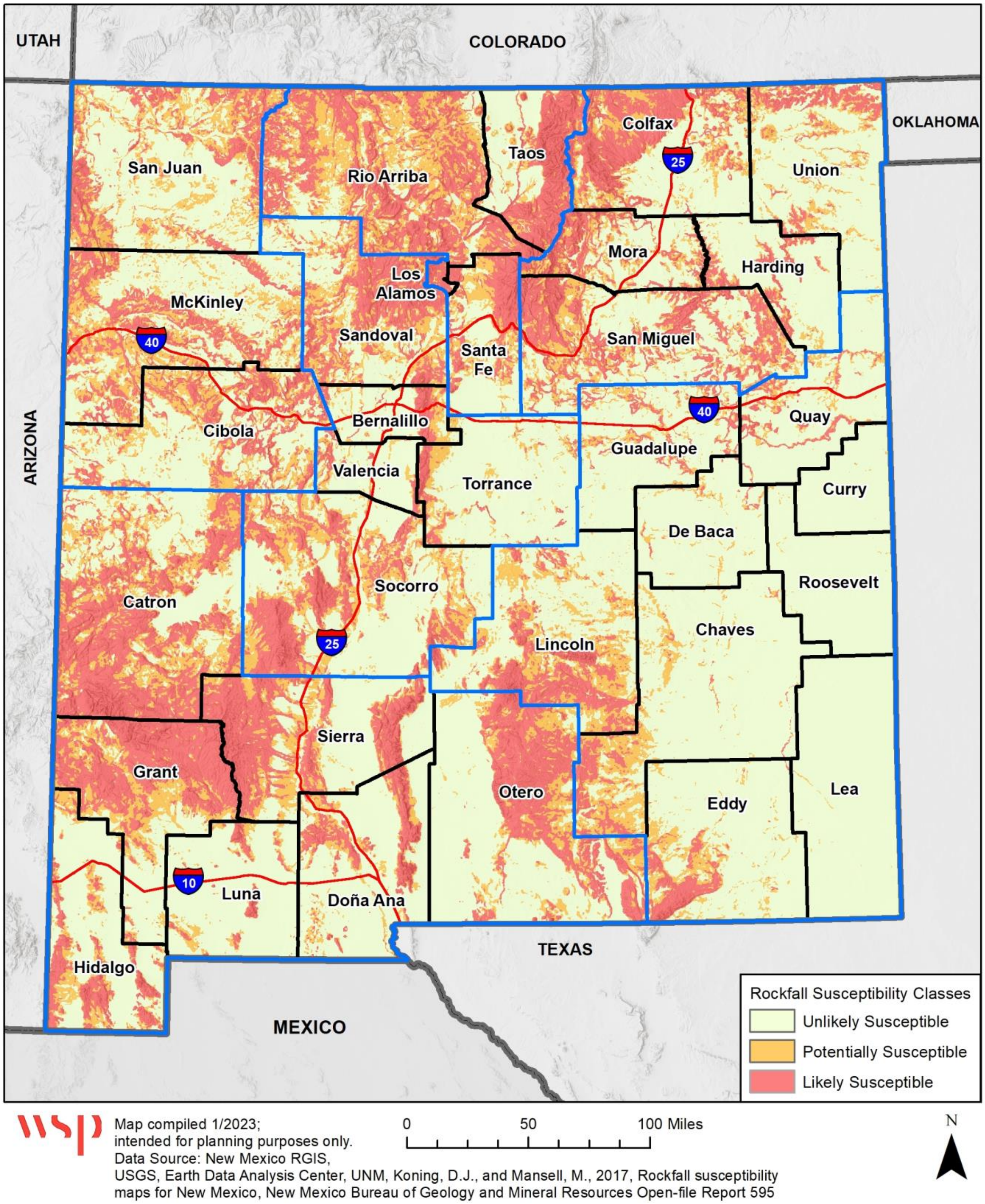
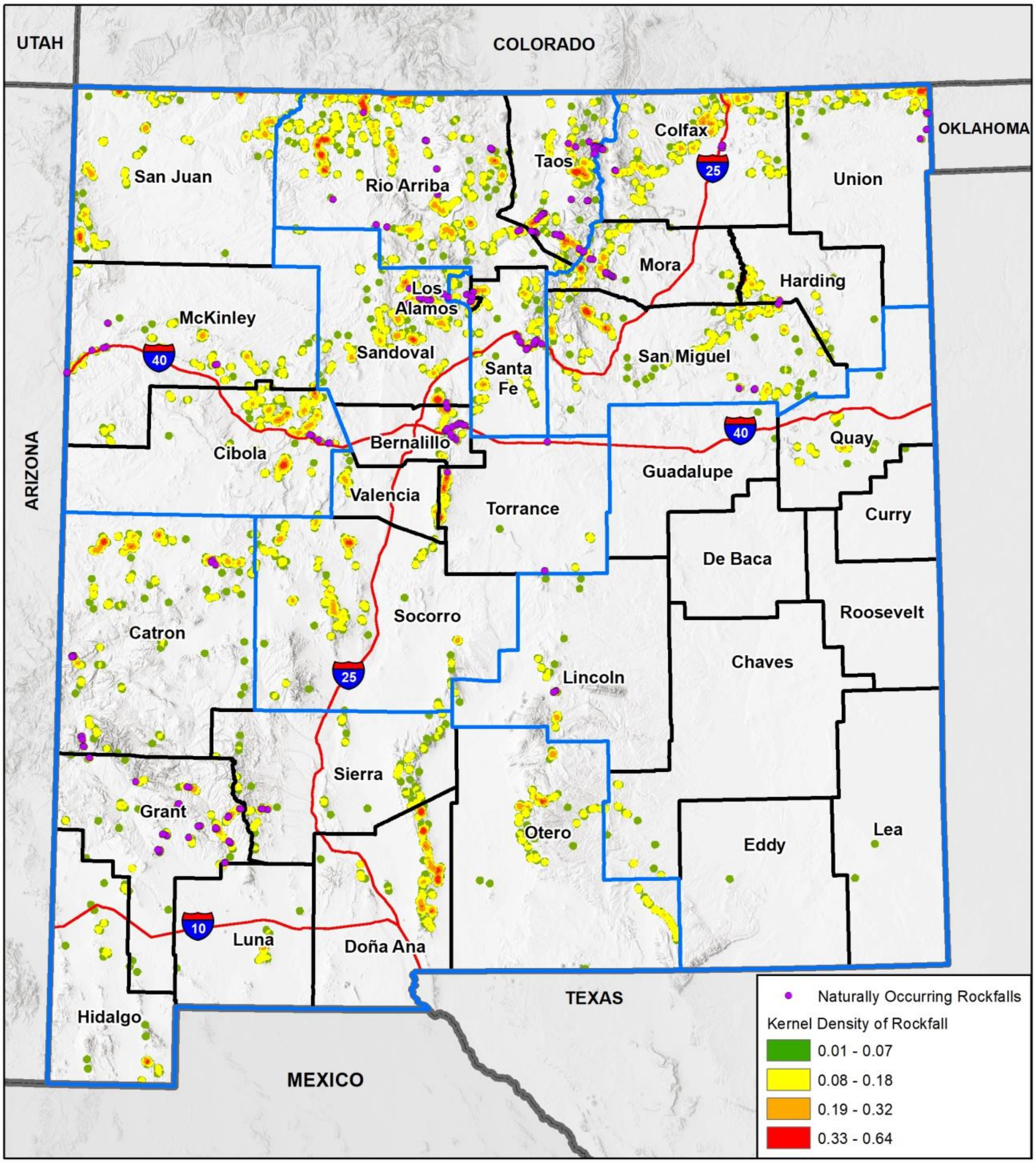


Figure 6-107 New Mexico Rockfall Kernal Density



Map compiled 1/2023;
intended for planning purposes only.
Data Source: New Mexico RGIS,
USGS, Earth Data Analysis Center, UNM, Koning, D.J., and Mansell, M., 2017, Rockfall susceptibility maps for New Mexico, New Mexico Bureau of Geology and Mineral Resources Open-file Report 595

6.10.2 Previous Occurrences

In referencing the NCDC, no previous occurrences are listed in the database. There is little information capturing previous landslide events in New Mexico, specifically at the Preparedness Area level. Table 6-78 briefly explains significant events that have occurred, based on information provided by local jurisdictions and DHSEM. There is no information on significant landslides more recently than 2015.

Table 6-78 Significant Past Occurrence - Landslide

Date	Location	Significant Event
July 8, 2015	Highway 38, west of Red River (Taos County) (PA 3)	A mudslide covered State Highway 38 after heavy rain and hail ripped through the area. The New Mexico Department of Transportation closed the road for cleanup crews to clear the mud and boulders.
September 9, 2013	Chaves, Guadalupe, and Eddy County (PA 1) Colfax, San Miguel, and Mora County (PA 2) Los Alamos and Santa Fe County (PA 3) Cibola County, McKinley County (PA 4) Sandoval, Socorro, and Torrance County (PA 5) Catron and Sierra County (PA 6)	A Major Disaster Declaration was issued on October 29, 2013 for DR-4152, New Mexico Severe Storms, Flooding, and Mudslides. The Severe Storms, Flooding, and Mudslides took place September 9 through September 13, 2013, damaging public facilities and roads in 14 New Mexico counties.
January 15, 2013	Guadalupe Mesa (Sandoval County) (PA 5)	Thousands of tons of rock (12,000-13,000 cubic yards) fell down the east face of Guadalupe Mesa leaving boulders displaced and a dust slope. A 30-foot thick and 150 foot high slab of rock broke loose. Some residents were awakened by the avalanche and there was a blanket of dust covering everything. No damage was reported in the article. Source: Jemez Thunder, Volume 19, No. 418, February 1, 2013
July 23, 2010	Magdalena Mountains (Socorro County) (PA 5)	Heavy rain triggered a mudslide in the Magdalena Mountains blocking a road and isolating researchers at a key New Mexico science facility. The landslide isolated the Langmuir Laboratory for Atmospheric Research located high on 10,700-foot South Baldy Peak. Five New Mexico Institute of Mining and Technology scientists and two technicians were working at the facility whose primary mission is to study thunderstorms. It wasn't long after the storm started that dirt and large boulders tumbled down the mountain sprawling over the only access road. Five members of the lab crew abandoned their vehicles and were picked up by a four-wheel-drive vehicle that took them to safety. The other two walked down part of the mountain to a four-wheel-drive vehicle that also took them to safety. No one was hurt in the landslide.

Date	Location	Significant Event
April 10, 2007	San Juan County (PA 4)	The Farmers Mutual Ditch suffered a complete obstruction of the main canal due to a landslide for a length of approximately 300 yards in San Juan County. In this area, the canal runs along the north side of the San Juan River and below a cliff face. The Navajo Nation owns the land on the south side of the river, and their property line is defined as the middle of the river. (BLM owns the land on the north side.) Both up- or down- stream is a wetland and is the home of at least two Threatened or Endangered Species. This water system is quite large and services several communities with irrigation and drinking water. The complexity and severity of the event lead to a State Disaster Declaration The total cost of this landslide event is $263,408.
July 15, 2008	Gallup, NM (PA 4)	A rockslide crushed three people in a homeless camp outside of Gallup, NM. One female and two male bodies were recovered after they were found trapped under a roughly 12-foot-wide boulder. Heavy rain had hampered recovery efforts. Gallup police Lt. Rick White says the rockslide might have happened during a rainstorm.
September 1998	Taos, NM (Taos County) (PA 3)	A falling boulder (270,000 kg) struck a bus, killed five people, and injured 14, along HWY 68. The boulder left a 5x5x14 meter crater in the highway. The highway was closed for 19 hours and clean-up costs were approximately $75,000.
September 1991	De Baca County (PA 1)	In De Baca County, a rockslide occurred that damaged a ranch road and buckled buried PVC pipes.
June 1977	Taos, NM (Taos County) (PA 3)	A landslide event caused $50,000 in property damage.

Declared Disasters from Landslide

There has been one State and one Federally declared disaster for Landslide between 2012 and 2017 (Table 6-79). According to FEMA, DR-4152 was declared on October 29, 2013 for the New Mexico Severe Storms, Flooding, and Mudslides that occurred between September 09, 2013 and September 22, 2013. The Public Assistance Dollars Approved and Obligated was $41,435,522.02 which was split between Emergency Work (Categories A-B) of $13,096,232.75, and Permanent Work (Categories C-G) of $27,002,216.27. The Executive Order in support of DR 4152 is Executive Order 016-034. Executive Order 07-021 is for a State 2007 landslide disaster in the amount of $291,137.

Table 6-79 New Mexico Landslide Disaster Declarations (2003 – 2022)

Event Type	Disaster Declaration	Dollar Loss
Mudslide	DR-4152	$41,435,522.02
Landslide	016-034	$225,000.00
Landslide	07-021	$291,137.00
Total		**$41,951,659.02**

Figure 6-108 shows two photos from the State landslide disaster at Farmers Mutual Ditch in San Juan County on April 10, 2007.

Figure 6-108 Landslide Occurrence at Farmers Mutual Ditch in Preparedness Area 4

Additionally, news reports show that a mudslide covered State Highway 38 on July 8, 2015 west of Red River. Figure 6-109 shows the mudslide covering Highway 38.

Figure 6-109 Mudslide Occurrence on Highway 38 in Preparedness Area 3

Another source of landslide damage information is from the NCDC. Below is a tally of landslide damage as reported by NCDC broken out by Preparedness Area. According to NCDC from 1997 through December 2017, Statewide property damage from landslide damage was $388,408 and no crop damage was reported. Table 6-80 provides a cumulative overview of all landslide events that have occurred in all Preparedness Areas.

Table 6-80 Preparedness Areas 1 - 6 Landslide History (1997 – 2022)

Preparedness Area 1
Counties: Chaves, Curry, De Baca, Eddy, Guadalupe, Lea, Lincoln Quay, and Roosevelt

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Landslide	1	0	0	0	$0	$0
Total	**1**	**0**	**0**	**0**	**$0**	**$0**

Preparedness Area 2
Counties: Colfax, Harding, Mora, Union, and San Miguel

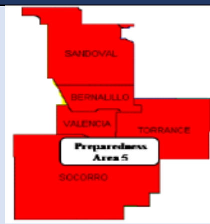
Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Landslide	0	0	0	0	$0	$0
Total	**0**	**0**	**0**	**0**	**$0**	**$0**

Preparedness Area 3
Counties: Los Alamos, Rio Arriba, Santa Fe and Taos
Pueblos: Nambe, Ohkay Owingeh, Picuris, Pojoaque, San Ildefonso, Santa Clara, Tesuque, and Taos
Tribal Nations: Jicarilla Apache

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Landslide	2	0	0	0	$125,000	$0
Total	**2**	**0**	**0**	**0**	**$125,000**	**$0**

Preparedness Area 4
Counties: Cibola, McKinley, and San Juan
Pueblos: Acoma, Laguna, Zuni
Tribal Nations: Navajo Nation

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Landslide	3	0	3	0	$263,408	$0

Total	**3**	**0**	**3**	**0**	**$263,408**	**$0**	
Preparedness Area 5 **Counties:** Bernalillo, Sandoval, Socorro, Torrance, and Valencia **Pueblos:** Cochiti, Isleta, Jemez, Sandia, Santa Ana, Santo Domingo, San Felipe, and Zia							
Hazard Type	**# of Events**	**Mag**	**Deaths**	**Injuries**	**Property Damage**	**Crop Damage**	
Landslide	1	0	0	0	$0	$0	
Total	**1**	**0**	**0**	**0**	**$0**	**$0**	
Preparedness Area 6 **Counties:** Catron, Dona Ana, Grant, Hidalgo, Luna, Otero, and Sierra **Tribal Nation:** Mescalero Apache							
Hazard Type	**# of Events**	**Mag**	**Deaths**	**Injuries**	**Property Damage**	**Crop Damage**	
Landslide	0	0	0	0	$0	$0	
Total	**0**	**0**	**0**	**0**	**$0**	**$0**	

6.10.3 Past Frequency

The frequency of landslides in New Mexico is low based on previous occurrences. An issue for consideration is unreported landslide events that may occur in unpopulated areas.

6.10.4 Climate Change Impacts

Climate projections across the United States have shown that while total annual precipitation will likely decrease in the Southwest region, the heaviest annual rainfall events will become more intense. More frequent high-magnitude precipitation events would cause more frequent debris flows and landslides across the State. Also, the severity of debris flows would correlate to the intensity of these precipitation events. Sustained periods of higher-than-normal moisture could possibly result in more rockfall and deep-seated landslide events according to the 2018 state plan.

Although uncertainty exists in the evaluation of the impacts of climate change on landslides and the stability of natural and engineered slopes, an increase in the frequency and intensity of severe rainfall events -- a primary trigger of rapid-moving landslides that can cause fatalities -- will result in more people and property exposed to landslide risk.

According to a 2012 special report by the IPCC, "There is high confidence that changes in heat waves, glacial retreat, and/or permafrost degradation will affect slope instabilities in high mountains, and medium confidence that temperature-related changes will influence bedrock stability. There is also high confidence that changes in heavy precipitation will affect landslides in some regions."

6.10.5 Probability of Future Occurrence

Landslides can result in serious structural damage to roads, buildings, irrigation channels, utilities, and pipelines. To determine the probability of each Preparedness Area experiencing future landslide occurrences, the probability or chance of occurrence was calculated based on historical data provided by local authorities. Probability was determined by dividing the number of events observed by the number of years and multiplying by 100. This gives the percent chance of the event happening in any given year. Table 6-81 provides the probability of each Preparedness Area experiencing a landslide event.

Table 6-81 Probability of Annual Occurrence of Landslide

Preparedness Area	Landslide
PA 1	3%
PA 2	0%
PA 3	7%
PA 4	7%
PA 5	3%
PA 6	0%

One concern that is under review is landslides following a wildfire. In June 2011, the Track Fire burned 113 square kilometers in Colfax County, northeastern New Mexico, and Las Animas County, southeastern Colorado, including the upper watersheds of Chicorica and Raton Creeks. The burned landscape is now at risk of damage from post wildfire erosion that may be accompanied by debris flows and flash floods.

A report by the USGS presents a preliminary hazard assessment of the debris-flow potential from basins burned by the Track Fire. A pair of empirical hazard-assessment models developed using data from recently burned basins throughout the intermountain western United States were used to estimate the probability of debris-flow occurrence and volume of debris flows at the outlets of selected drainage basins within the burned area. The models incorporate measures of burn severity, topography, soils, and storm rainfall to estimate the probability and volume of post-fire debris flows following the fire.

In response to a design storm of 38 millimeters of rain in 30 minutes (10-year recurrence-interval), the probability of debris flow estimated for basins burned by the Track fire ranged between two and 97%, with probabilities greater than 80% identified for the majority of the tributary basins to Raton Creek in Railroad Canyon; six basins that flow into Lake Maloya, including the Segerstrom Creek and Swachheim Creek basins; two tributary basins to Sugarite Canyon, and an unnamed basin on the eastern flank of the burned area. Estimated debris-flow volumes ranged from 30 cubic meters to greater than 100,000 cubic meters. The largest volumes (greater than 100,000 cubic meters) were estimated for Segerstrom Creek and Swachheim Creek basins, which drain into Lake Maloya. The Combined Relative

Debris-Flow Hazard Ranking identifies the Segerstrom Creek and Swachheim Creek basins as having the highest probability of producing the largest debris flows.

This finding indicates the greatest post-fire debris-flow impacts may be expected to Lake Maloya. In addition, Interstate Highway 25, Raton Creek and the rail line in Railroad Canyon, County road A-27, and State Highway 526 in Sugarite Canyon may also be affected where they cross drainages downstream from recently burned basins. Although this assessment indicates that a rather large debris flow (approximately 42,000 cubic meters) may be generated from the basin above the City of Raton (basin nine) in response to the design storm, the probability of such an event is relatively low (approximately 10 percent). Additional assessment is necessary to determine if the estimated volume of material is sufficient to travel into the City of Raton. In addition, even small debris flows may affect structures at or downstream from basin outlets and increase the threat of flooding downstream by damaging or blocking flood mitigation structures. The maps presented here may be used to prioritize areas where erosion mitigation or other protective measures may be necessary within a two-to-three-year window of vulnerability following the Track Fire. More information regarding USGS debris-flow studies is discussed in Section 6.8.9 on Flooding and Debris Flow Post-fire.

6.10.6 Vulnerability Assessment

Property Exposure from LHMPs

Land subsidence areas were assessed in four LHMPS across three Preparedness Areas with a total of approximately 34,000 structures/parcels with $7.6 billion of exposure. Over 85% of these structures/parcels, 29,000, and 89% of the value are located in PA 5, totaling $6.9 billion. Of the remaining structures/parcels identified, 11% or 3,700, were reported in PA 1 and have a value of $558 million. No exposure data was reported in PAs 2, 3, 6

Table 6-82 Exposure to Land Subsidence Susceptible Areas by Preparedness Area

PAs and Jurisdictions	Total Dollar Value Exposure	Total Exposed Structures/Parcels
One	**$558,105,000**	**3,763**
Eddy County	$558,105,000	3,763
Four	**$244,166,000**	**1,173**
McKinley County	$84,282,000	453
Zuni Pueblo	$159,884,000	720
Five	**$6,860,425,000**	**29,081**
Bernalillo County / Albuquerque	$6,860,425,000	29,081
Grand Total	**$7,662,696,000**	**34,017**

State Assets

A geospatial analysis of state owned assets potentially at risk of landslide and rockfall was conducted based on the susceptibility categories in Figure 6-105 and Figure 6-106. For purposes of this analysis, the State assumed losses up to 25% of total asset value for assets at likely susceptibility to landslide, 15% for assets at moderate susceptibility, 5% for assets at potential susceptibility, and 1% for assets at unlikely susceptibility. For rockfall, there were no assets identified at likely or moderate; the same values were used for potential and unlikely susceptibility. Table 6-83 and Table 6-84 shows estimated losses for state assets from landslide and rockfall respectively; these estimates are for planning purposes only and should not be used for insurance purposes.

Table 6-83 Potential Losses to State Assets From Landslide

	County	Total Assets	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
Likely Landslide Susceptibility	Colfax	1	1	-	-	$55,356,000	**$13,839,000**
	Total	**1**	**1**	**-**	**-**	**55,356,000**	**13,839,000**
Moderate Landslide Susceptibility	Grant	1	1	-	-	$0	**$0**
	McKinley	1	-	1	-	$2,807,000	**$421,050**
	San Miguel	2	1	1	-	$146,962,000	**$22,044,300**
	Total	**4**	**2**	**2**	**0**	**$149,769,000**	**$22,465,350**
Potential Landslide Susceptibility	Bernalillo	1	-	1	-	$4,644,000	**$232,200**
	Colfax	2	-	2	-	$33,954,000	**$1,697,700**
	San Miguel	1	-	1	-	$6,003,000	**$300,150**
	Sandoval	1	-	1	-	$17,085,000	**$854,250**
	Santa Fe	10	-	9	1	$352,877,704	**$17,643,885**
	Taos	1	-	1	-	$501,000	**$25,050**
	Total	**16**	**0**	**15**	**1**	**$415,064,704**	**$20,753,235**
Unlikely Landslide Susceptibility	Bernalillo	5	3	1	1	$388,700,167	**$3,887,002**
	Chaves	5	1	3	1	$48,197,000	**$481,970**
	Cibola	2	-	1	1	$39,102,000	**$391,020**
	Curry	1	-	1	-	$933,000	**$9,330**
	Dona Ana	2	-	2	-	$76,250,000	**$762,500**
	Luna	1	-	-	1	$9,553,000	**$95,530**
	Rio Arriba	1	-	1	-	$558,985	**$5,590**
	Santa Fe	6	-	5	1	$250,035,000	**$2,500,350**
	Sierra	1	1	-	-	$24,528,000	**$245,280**
	Socorro	1	-	1	-	$3,026,251	**$30,263**
	Valencia	3	1	2	-	$148,620,000	**$1,486,200**
	Total	**28**	**6**	**17**	**5**	**$989,503,403**	**$9,895,034**

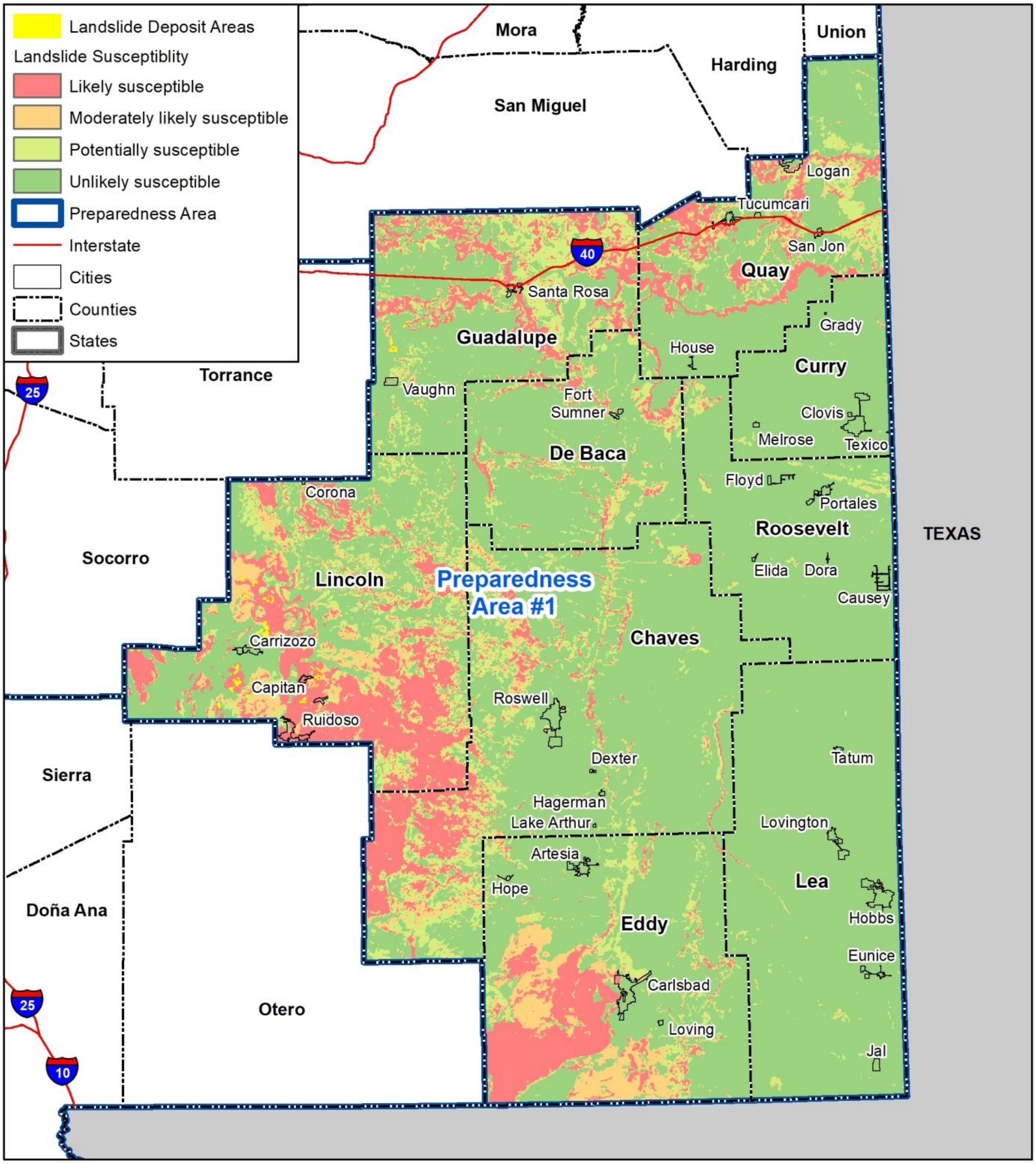
Table 6-84 Potential Losses to State Assets From Rockfall

	County	Health and Medical	Safety and Security	Transpor-tation	Total Assets	Total Value	Estimated Losses
Potential Rockfall	Grant	1	-	-	**1**	$0	**$0**
	San Miguel	1	-	1	**2**	$146,962,000	**$7,348,100**
	Sierra	1	-	-	**1**	$24,528,000	**$1,226,400**
	Total	**3**	**0**	**1**	**4**	$171,490,000	**$8,574,500**
Unlikely Rockfall	Bernalillo	3	2	1	**6**	$393,344,167	**$3,933,442**
	Chaves	1	3	1	**5**	$48,197,000	**$481,970**
	Cibola	-	1	1	**2**	$39,102,000	**$391,020**
	Colfax	1	2	-	**3**	$89,310,000	**$893,100**
	Curry	-	1	-	**1**	$933,000	**$9,330**
	Dona Ana	-	2	-	**2**	$76,250,000	**$762,500**
	Luna	-	-	1	**1**	$9,553,000	**$95,530**
	McKinley	-	1	-	**1**	$2,807,000	**$28,070**
	Rio Arriba	-	1	-	**1**	$558,985	**$5,590**
	San Miguel	-	1	-	**1**	$6,003,000	**$60,030**
	Sandoval	-	1	-	**1**	$17,085,000	**$170,850**
	Santa Fe	-	14	2	**16**	$602,912,704	**$6,029,127**
	Socorro	-	1	-	**1**	$3,026,251	**$30,263**
	Taos	-	1	-	**1**	$501,000	**$5,010**
	Valencia	1	2	-	**3**	$148,620,000	**$1,486,200**
	Total	**6**	**33**	**6**	**45**	**$1,438,203,107**	**$14,382,031**

Preparedness Area 1

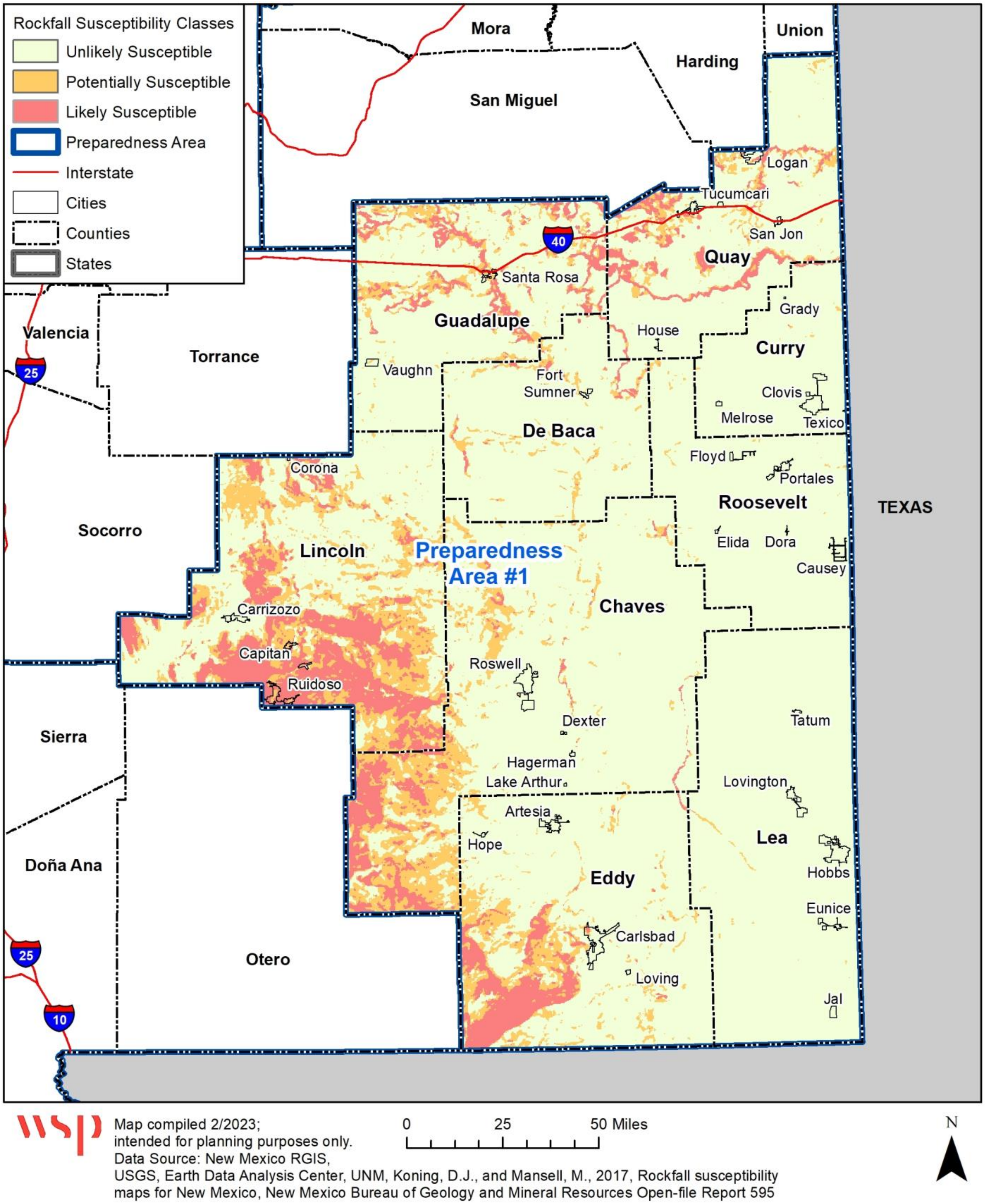
Within Preparedness Area 1 there are local areas mapped as likely susceptibility for deep-seated landslides and rockfall. Susceptibility is commonly associated with mesa flanks in Preparedness Area 1, However, steep slopes associated with mountains are correlated with likely susceptibility in Preparedness Area 1 in the Guadalupe and Capitan Mountains. Lea, Roosevelt, and Curry counties possess unlikely susceptibilities for landslide and rockfall hazard. The remaining counties in Preparedness Area 1 (Chaves, De Baca, Eddy, Guadalupe, Lincoln, Quay) have sizeable areas with relatively high potential (i.e., likely susceptibility) for deep-seated landslides or rockfall. This is visualized in Figure 6-110 and Figure 6-111 below.

Figure 6-110 New Mexico Preparedness Area 1 Landslide Susceptibility Classes



Map compiled 2/2023;
intended for planning purposes only.
Data Source: New Mexico RGIS,
Dan Koning, New Mexico Bureau of Geology and Mineral Resources, Cardinali, Guzzetti, and Brabb, 1990,
Earth Data Analysis Center (EDAC) at the University of New Mexico (UNM), Modeling and compilation
by Colin Cikoski, New Mexico Bureau of Geology and Mineral Resources

Figure 6-111 New Mexico Preparedness Area 1 Rockfall Susceptibility Classes



Preparedness Area 2

Within Preparedness Area 2, there are local areas mapped as likely susceptibility for deep-seated landslides and rockfall. Susceptibility is commonly associated with mesa flanks in Preparedness Area 2. However, steep slopes associated with mountains are correlated with likely susceptibility in Preparedness Area 2 in the eastern Sangre de Cristo Mountains. Somewhat higher susceptibilities could be expected locally in Union County. The remaining counties in Preparedness Area 2 (Colfax, Harding, Mora, San Miguel) have sizeable areas with relatively high potential (i.e., likely susceptibility) for deep-seated landslides or rockfall as shown in Figure 6-112 and Figure 6-113.

Figure 6-112 New Mexico Preparedness Area 2 Landslide Susceptibility Classes

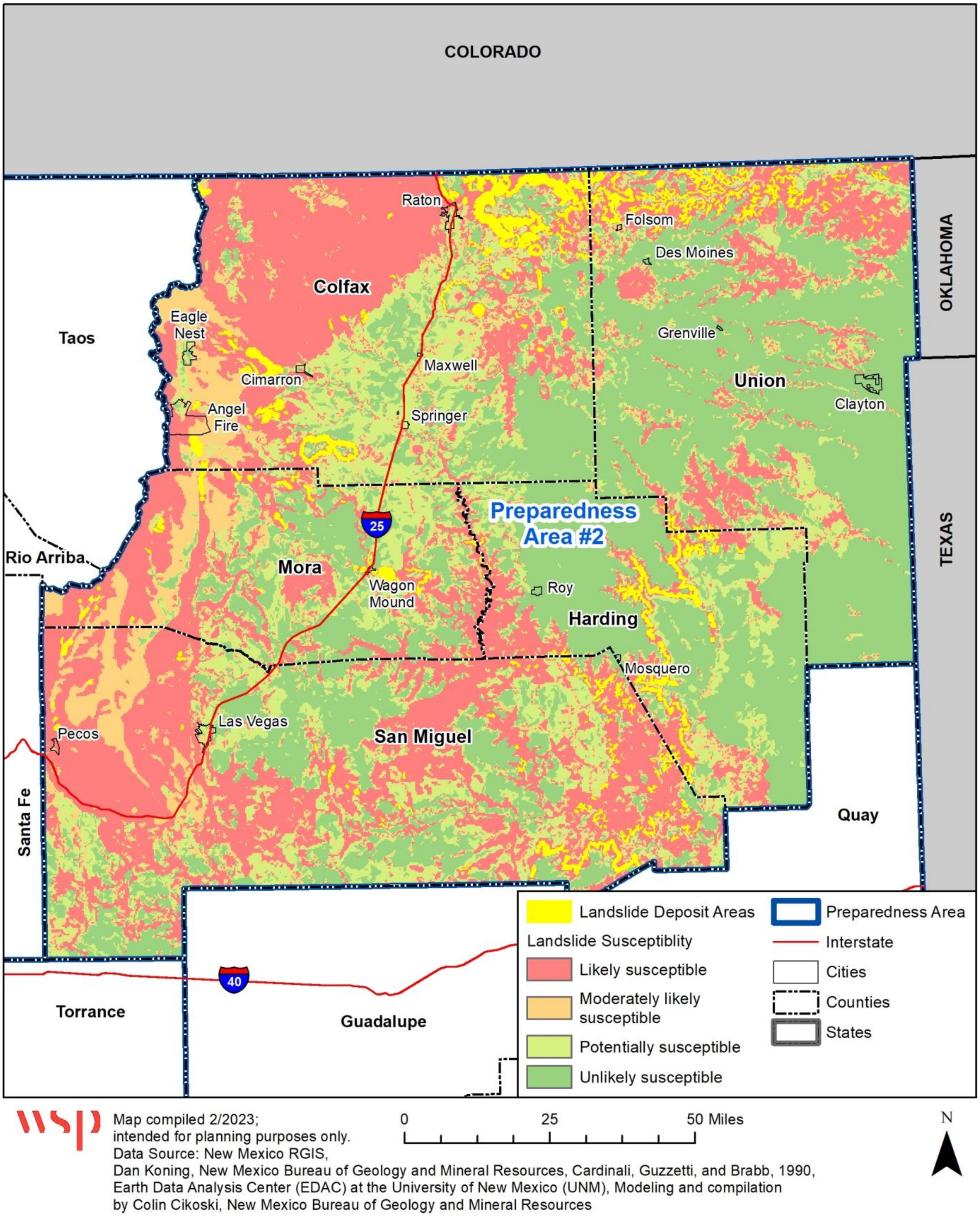
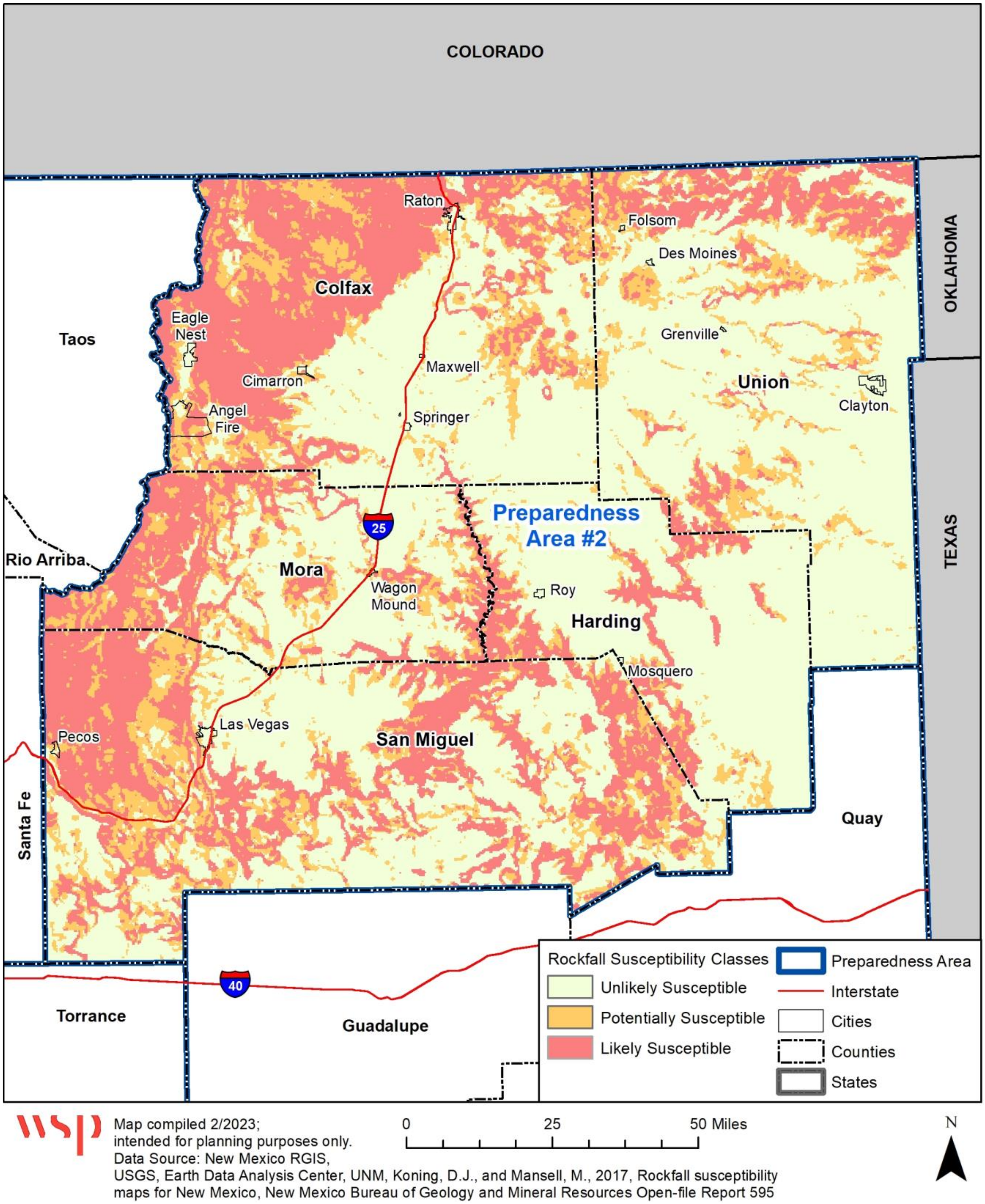


Figure 6-113 New Mexico Preparedness Area 2 Rockfall Susceptibility Classes



Preparedness Area 3

Within Preparedness Area 3 there are local areas mapped as likely susceptibility for deep-seated landslides and rockfall. Susceptibility is commonly associated with mesa flanks in Preparedness Area 3. However, steep slopes associated with mountains are correlated with likely susceptibility in Preparedness Area 3 in the Sangre de Cristo, Tusas, and northern Jemez Mountains. All counties in Preparedness Area 3 have sizeable areas with relatively high potential (i.e., likely susceptibility) for deep-seated landslides or rockfall. This is referenced in Figure 6-114 and Figure 6-115 below.

Figure 6-114 New Mexico Preparedness Area 3 Landslide Susceptibility Classes

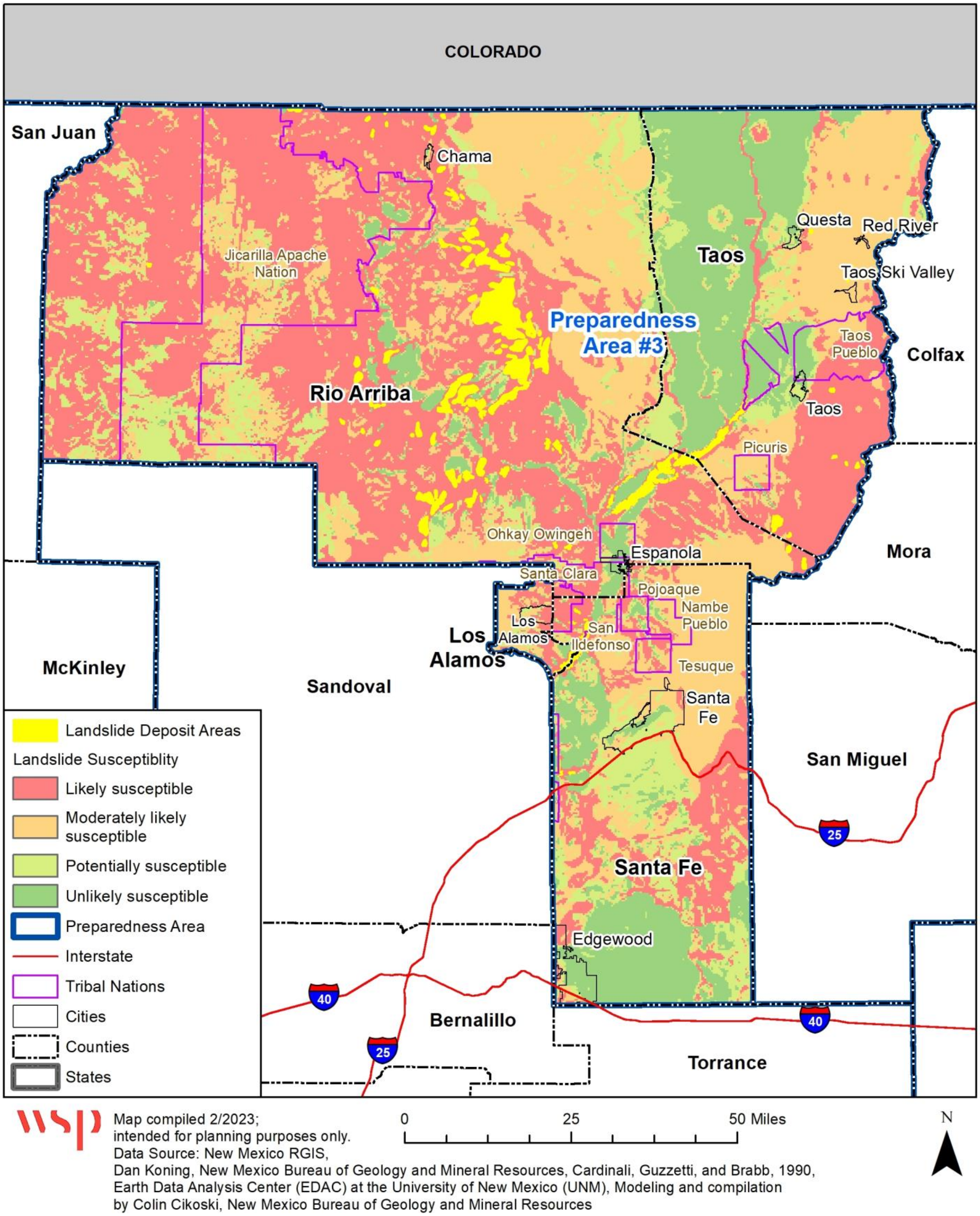
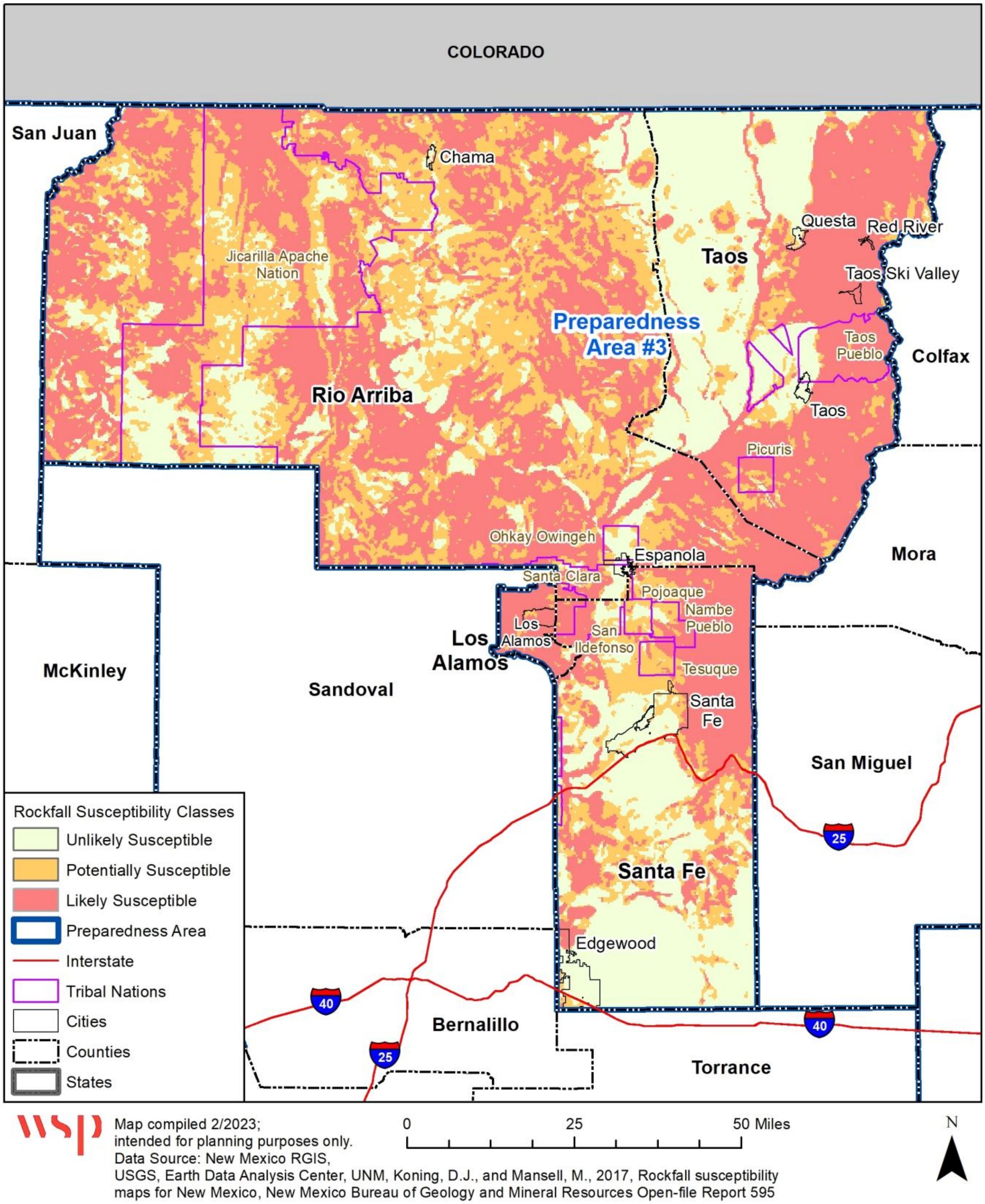


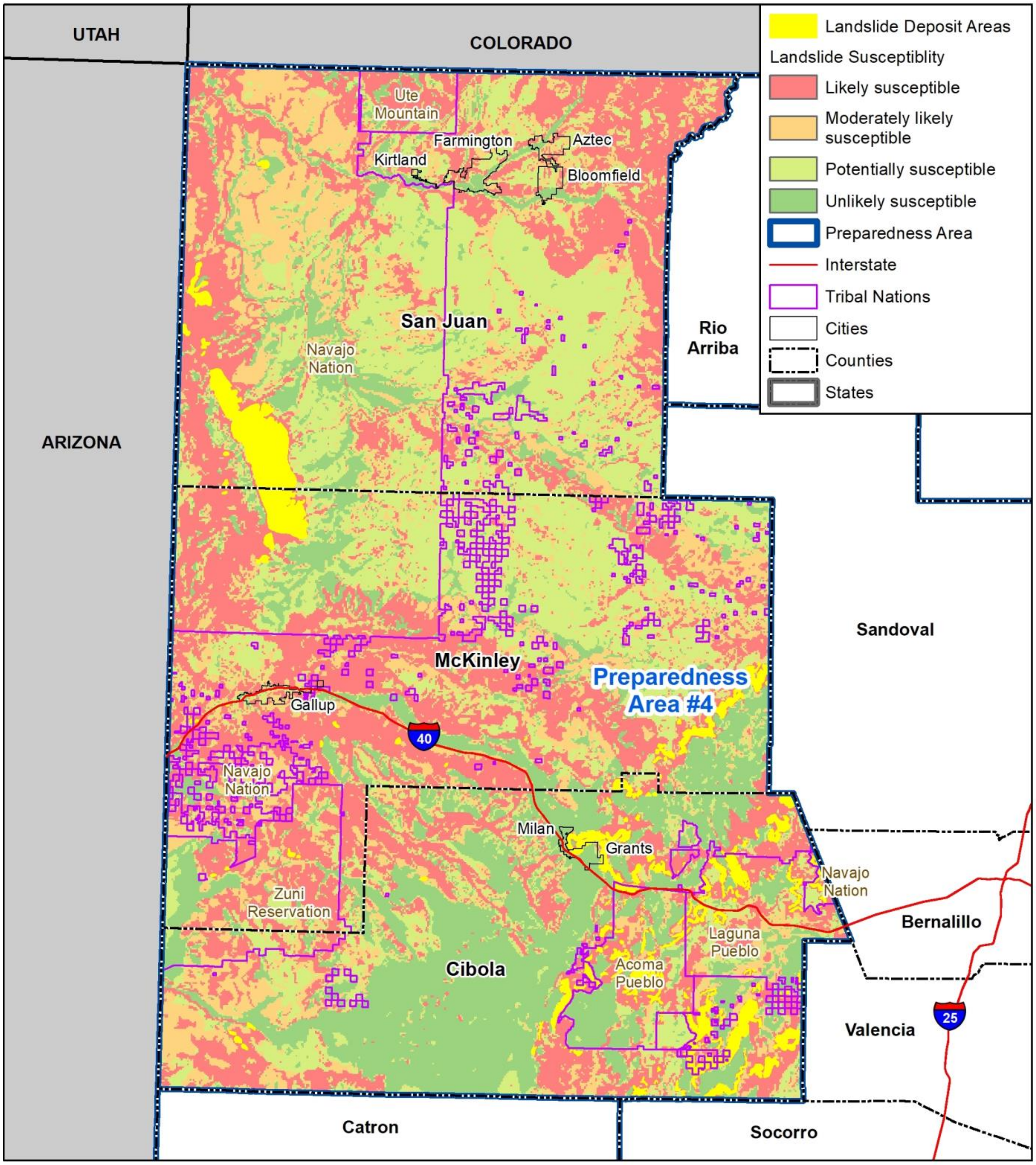
Figure 6-115 New Mexico Preparedness Area 3 Rockfall Susceptibility Classes



Preparedness Area 4

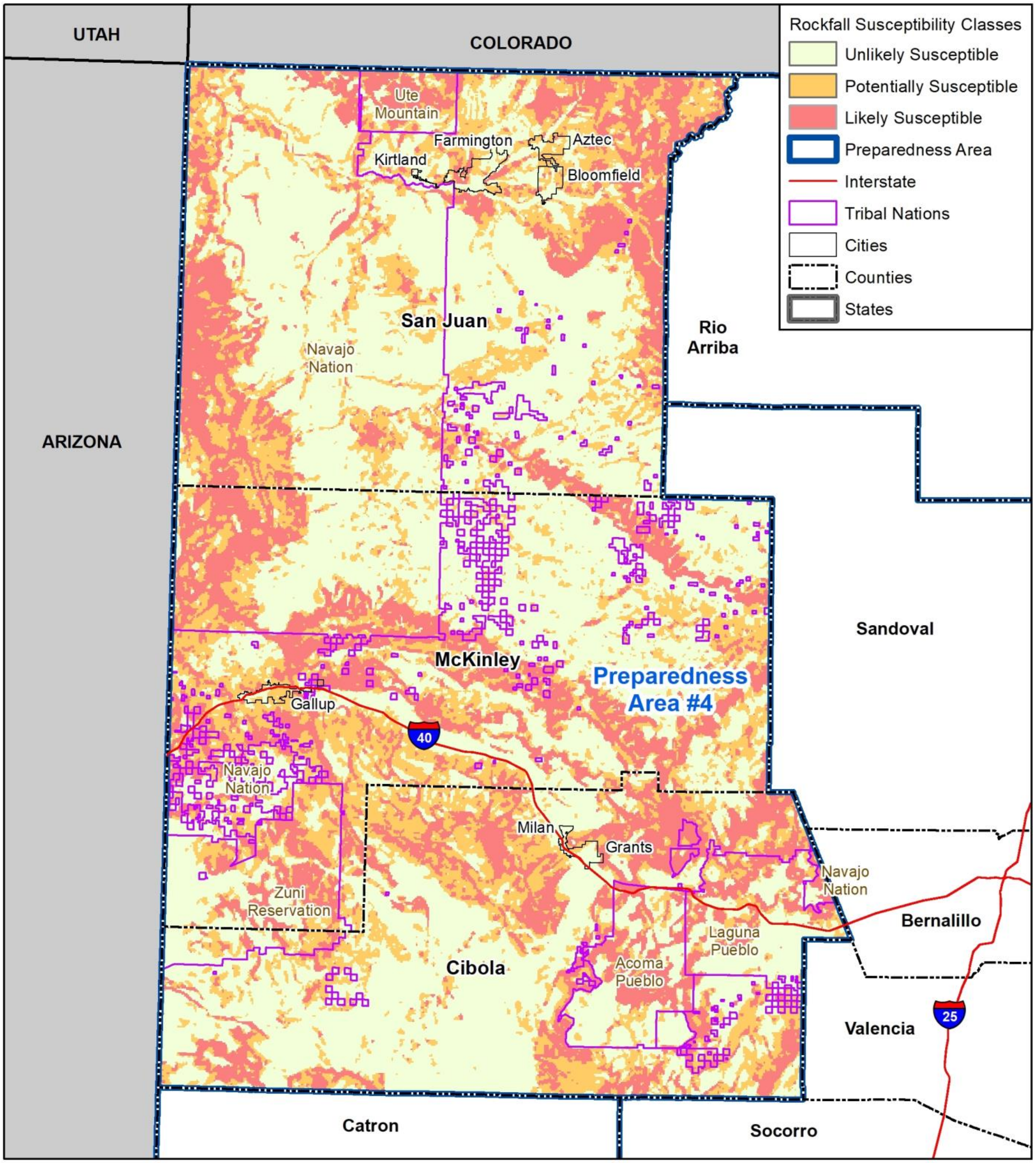
Within Preparedness Area 4, there are local areas mapped as likely susceptibility for deep-seated landslides and rockfall. Susceptibility is commonly associated with mesa flanks in Preparedness Area 4. However, steep slopes associated with mountains are correlated with likely susceptibility in Preparedness Area 4 in the Chuska Mountains. All counties in Preparedness Area 4 have sizeable areas with relatively high potential (i.e., likely susceptibility) for deep-seated landslides or rockfall. Shown in Figure 6-116 and Figure 6-117.

Figure 6-116 New Mexico Preparedness Area 4 Landslide Susceptibility Classes



Map compiled 2/2023;
intended for planning purposes only.
Data Source: New Mexico RGIS,
Dan Koning, New Mexico Bureau of Geology and Mineral Resources, Cardinali, Guzzetti, and Brabb, 1990,
Earth Data Analysis Center (EDAC) at the University of New Mexico (UNM), Modeling and compilation
by Colin Cikoski, New Mexico Bureau of Geology and Mineral Resources

Figure 6-117 New Mexico Preparedness Area 4 Rockfall Susceptibility Classes



Map compiled 2/2023;
intended for planning purposes only.
Data Source: New Mexico RGIS,
USGS, Earth Data Analysis Center, UNM, Koning, D.J., and Mansell, M., 2017, Rockfall susceptibility maps for New Mexico, New Mexico Bureau of Geology and Mineral Resources Open-file Report 595

Preparedness Area 5

Within Preparedness Area 5, there are local areas mapped as likely susceptibility for deep-seated landslides and rockfall. Areas of likely susceptibility in Preparedness Area 5 include both mountains and mesa flanks. In Preparedness Area 5, mountainous areas exhibiting large areas of likely susceptibility include the San Mateo, Oscura, Manzano, and Sandia Mountains. The southern flank of the Jemez Mountains also is mapped as having relatively higher susceptibility, as well as mesas along the Jemez and Rio Puerco Rivers. In contrast to the rest of the State, somewhat higher susceptibilities could be expected locally in Torrance County. Bernalillo, Sandoval, Socorro, and Valencia Counties have sizeable areas with relatively high potential (i.e., likely susceptibility) for deep-seated landslides or rockfall. This is shown in Figure 6-118 and Figure 6-119.

Figure 6-118 New Mexico Preparedness Area 5 Landslide Susceptibility Classes

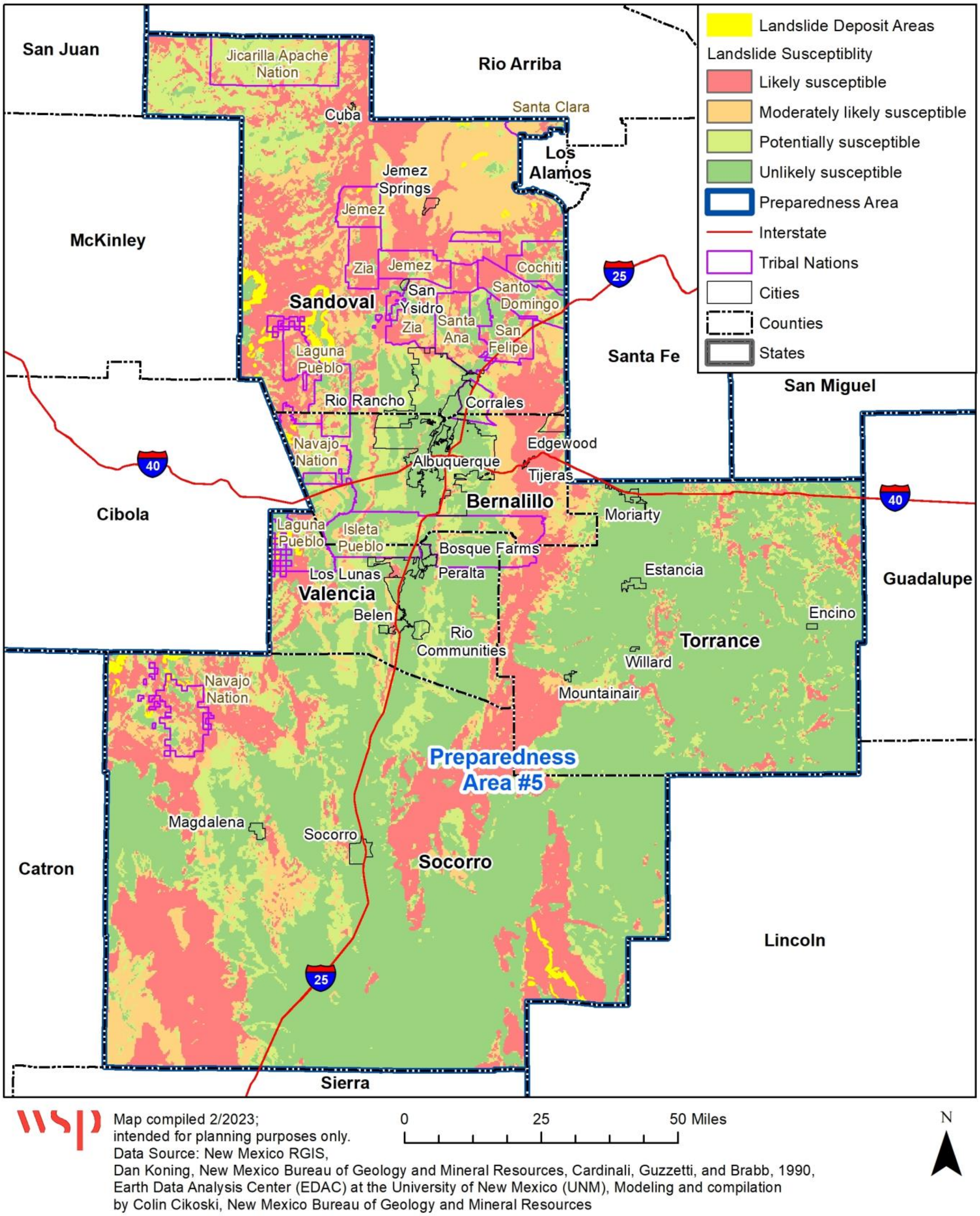
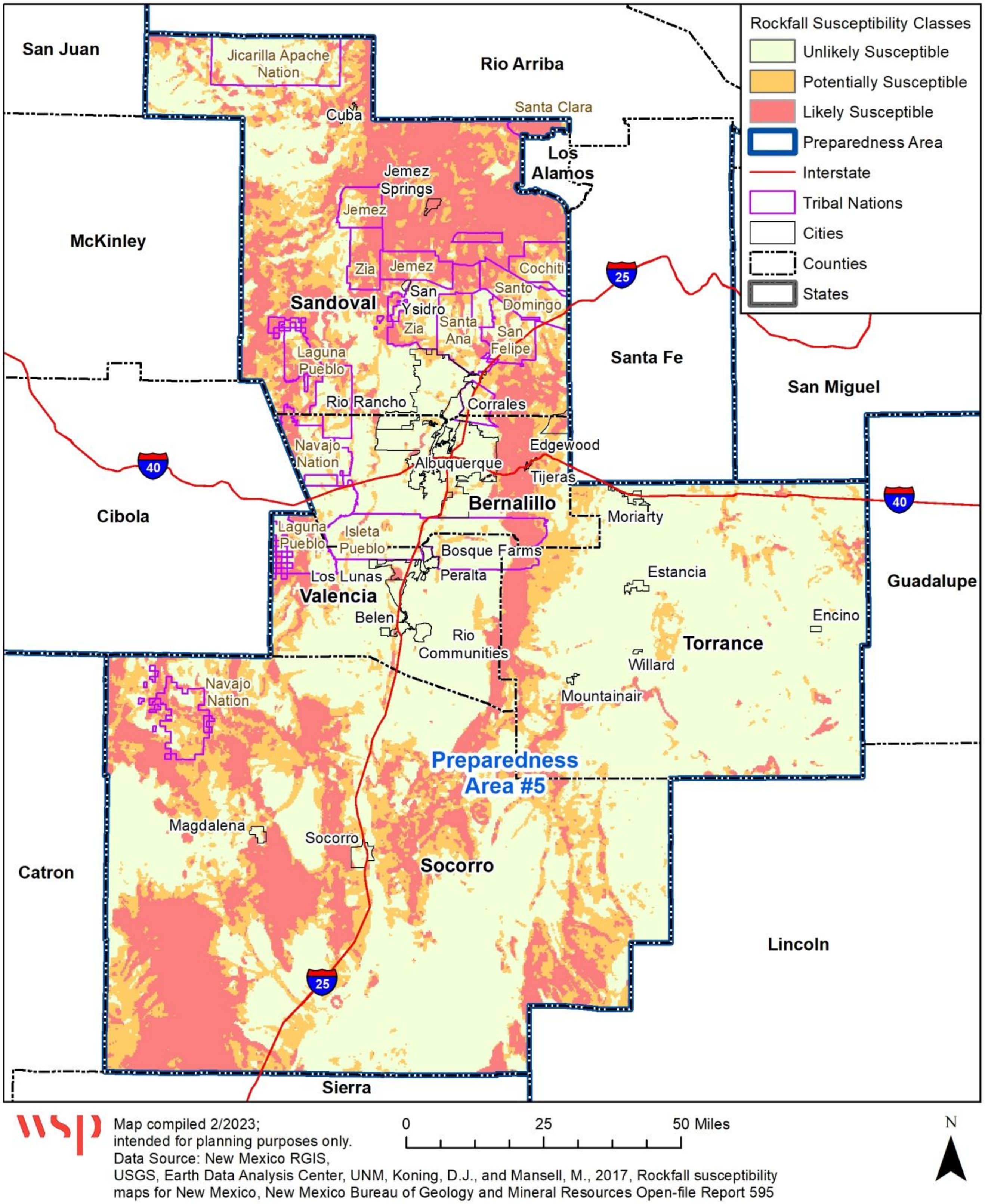


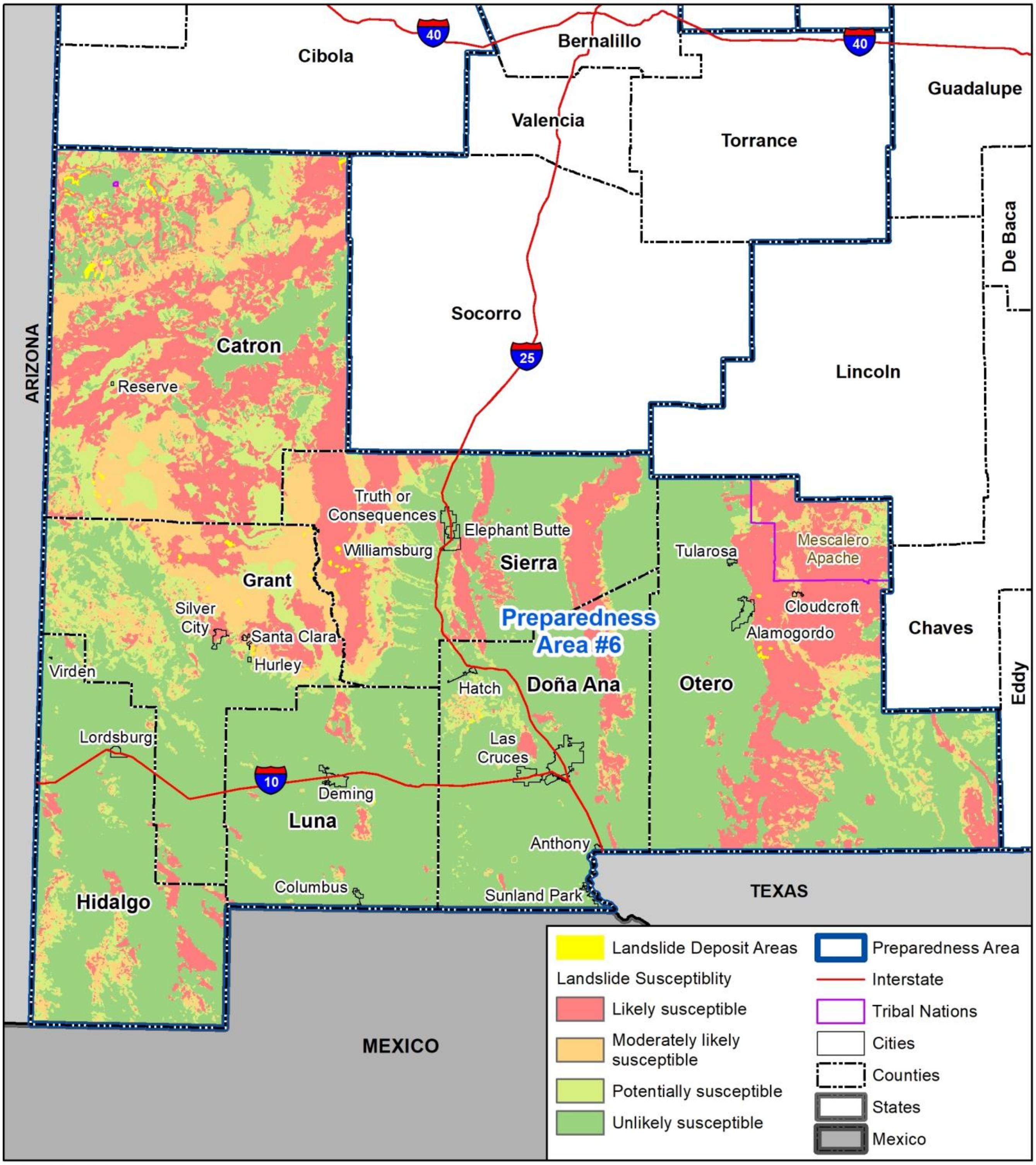
Figure 6-119 New Mexico Preparedness Area 5 Rockfall Susceptibility Classes



Preparedness Area 6

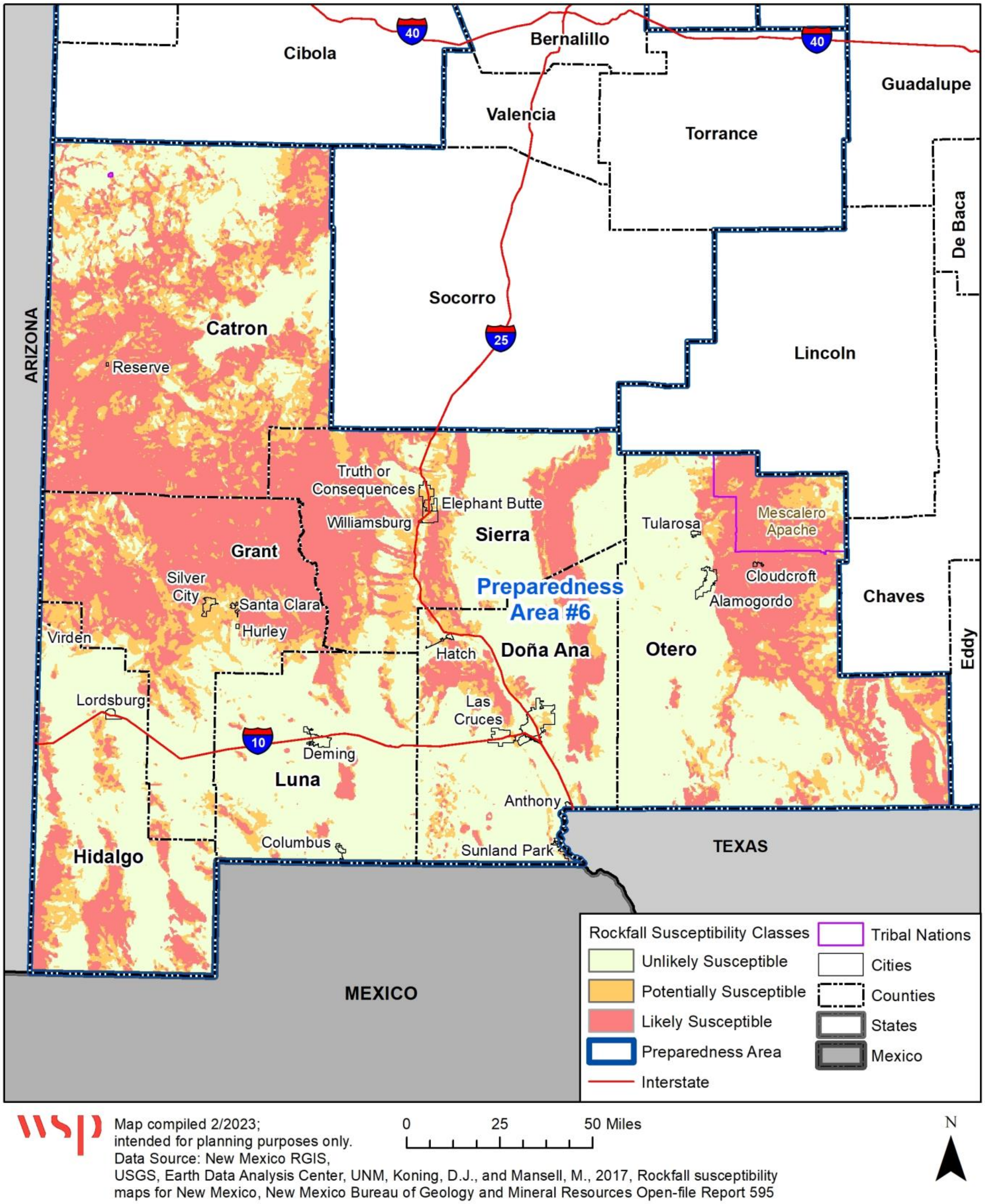
Within Preparedness Area 6, there are local areas mapped as likely susceptibility for deep-seated landslides and rockfall. Preparedness Area 6 generally lacks mesas. More likely susceptible areas consist of steep, mountainous areas that include most of the Sacramento, San Andres, Black Range, and Animas Mountains. The Mogollon Mountains have a slightly higher predicted susceptibility for rock fall than for deep-seated landslides. Somewhat higher susceptibilities could be expected locally in Luna County and Dona Ana County. Catron, Grant, Hidalgo, Otero, and Sierra counties have sizeable areas with relatively high potential (i.e., likely susceptibility) for deep-seated landslides or rockfall. This is shown in Figure 6-120 and Figure 6-121 below.

Figure 6-120 New Mexico Preparedness Area 6 Landslide Susceptibility Classes



Map compiled 2/2023; intended for planning purposes only.
Data Source: New Mexico RGIS,
Dan Koning, New Mexico Bureau of Geology and Mineral Resources, Cardinali, Guzzetti, and Brabb, 1990,
Earth Data Analysis Center (EDAC) at the University of New Mexico (UNM), Modeling and compilation by Colin Cikoski, New Mexico Bureau of Geology and Mineral Resources

Figure 6-121 New Mexico Preparedness Area 6 Rockfall Susceptibility Classes



6.10.7 Data Limitations

USGS produced a statewide landslide map approximately 20 years ago based on interpretation of aerial photography (USGS Open-file Report 90-293). These are now available in GIS format, but the spatial accuracy of these maps is variable (100-1200 m).

Also, the mapping the debris flow run-out zones would be helpful in understanding the potential impact of landslides. Mapping of run-out zones will be listed as a potential project under the mitigation action section of this Plan Update.

6.10.8 What Can Be Mitigated?

Mitigation activities can include better identification and analysis of landslide hazard areas, managing development in at risk areas, erosion control measures, debris fences, slope stabilization, hardening of structures and infrastructure or removing them from at risk areas, and public education.

6.10.9 Risk Summary

New susceptibility mapping indicates relatively higher landslide risk for Preparedness Areas 2, 3, 4, and 5. Recent landslides have occurred in New Mexico, specifically in Preparedness Areas 1, 3 and 4. Based on previous occurrence, Taos County (Preparedness Area 3) would be considered as having the highest risk to deep-seated landslide and rockfall occurrence. Debris flows could be expected across the entire state. Table 6-85 identifies potential impacts from a landslide.

Table 6-85 Potential Landslide Impacts

Subject	Potential Impacts
Agriculture	The greatest threat to agriculture would be the possible isolation of agriculture production by a landslide leaving it inaccessible. Typically, a landslide would not be expected in a field being farmed. Additionally, livestock would have some notice of the landslide through their senses and move.
Health and Safety of the Public	Anyone within the path of a land or rockslide at the time of occurrence, could be injured or killed
Health and Safety of Responders	Same as the public
Continuity of Operations	Any operation in the area of a slide may be unable to continue operations for unspecified time periods, the time being dependent on the extent of the landslide or debris flow.
Delivery of Services	Supply chains could be negatively affected if highways and roads are impacted. Otherwise minor impacts are anticipated.
Property, Facilities, Infrastructure	Buildings and almost all infrastructure would be severely damaged or destroyed in the event of a landslide occurring nearby.
Environment	Long-term severe impacts are unlikely, but short-term impacts may include limited destruction of habitat or degradation of stream water quality
Economic Condition	The small impact area of landslides leads to minor economic impacts.
Public Confidence	Not likely to be impacted.

6.11 Land Subsidence

Hazard	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
Land Subsidence	High	NR	Low	Low	Medium	NR	Low

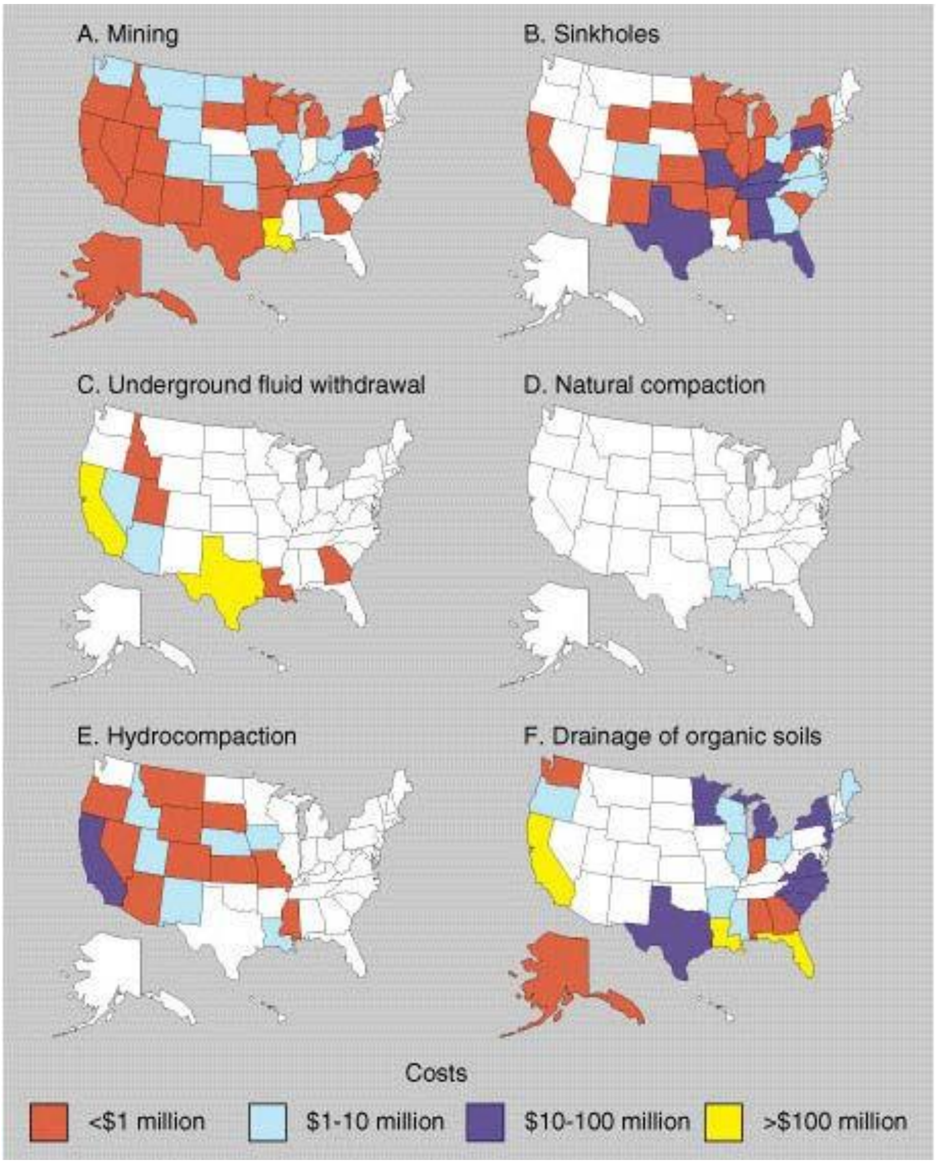
6.11.1 Hazard Characteristics

Land subsidence is the loss of surface elevation and affects nearly every U.S. State. Land subsidence has several causes such as 1) underground fluid withdrawal, 2) collapse of subsurface caverns, 3) collapse of underground mines, 4) hydrocompaction of collapsible soils, or 5) compaction of organic soils. Subsidence can occur uniformly over large areas or as localized sinkholes. Wide-area compaction commonly occurs when large amounts of groundwater have been withdrawn from certain types of rocks, such as unconsolidated fine-grained sediments. The sediments compact because the water is partly responsible for bearing the weight of overlying sediments. When the water is withdrawn, the sediment compacts. Subsidence may occur abruptly or over many years. It can occur uniformly over large areas or as localized sinkholes.

Common causes of land subsidence from human activity are pumping water, oil, and gas from underground reservoirs; dissolution of limestone, gypsum, or other soluble rocks to form sinkholes; collapse of underground mines; drainage of organic soils; and initial wetting of dry soils under load (hydro compaction). Land subsidence from pumping of fluids is usually not noticeable because it occurs over a large area over a period of time, but the ground surface may subside several feet. However, differential subsidence may form along hydrogeologic boundaries when subsidence is caused by regional pumping. Figure 6-122 shows various forms of land subsidence across the United States and shows the associated costs of subsidence-related property damage. The formation of sinkholes in dissolved soluble rocks, collapse of underground mines, drainage of organic soils and hydrocompaction cause local subsidence that is hazardous for structures and, in rare cases for sinkhole collapse and mine collapse, may endanger human life. Subsidence from sinkholes, mining collapse and in organic soils is formed by the increase in void space through dissolution, excavation or drying that leads to loss of structural integrity. Collapsible, or hydrocompactive soils, however, are formed by collapse of original porosity due to loss of structural integrity of clays on combined wetting and loading.

In areas where communities nearly exclusively rely on pumped groundwater for freshwater, such as New Mexico, Colorado, Arizona, Utah, Nevada, and California, major aquifers include compressible clay and silt that can compact when the groundwater is pumped. This is especially the case in regions where the aquifer is confined (overpressured). Increased groundwater demand from population growth may likely accelerate land subsidence in areas already subsiding. Land subsidence arising from the depletion of underground petroleum has not been reported from any of the regions of the State where the petroleum industry is active.

Figure 6-122 Subsidence Problems in the U.S.



Land subsidence presents major problems in California, Arizona, Texas, and Florida, all of which have experienced hundreds of millions of dollars of damage over the years. In many areas of the southwest, earth fissures, which can be over 100 feet deep, are associated with land subsidence. They begin as narrow cracks and can erode to widths of over 15 feet. According to Subject Matter Expert, Dr. Dave Love from the New Mexico Institute of Mining and Technology, fissures are evident in the Deming, New Mexico area (Preparedness Area 6).

Figure 6-123 shows the known locations in New Mexico that have experienced subsidence in collapsible soils on a Statewide map, and Figure 6-124 and Figure 6-125 show the same data by Preparedness Area. Only Preparedness Areas 3 and 5 contain known locations of collapsible soils.

Figure 6-123 Past Incidences of Collapsible Soil Locations in New Mexico

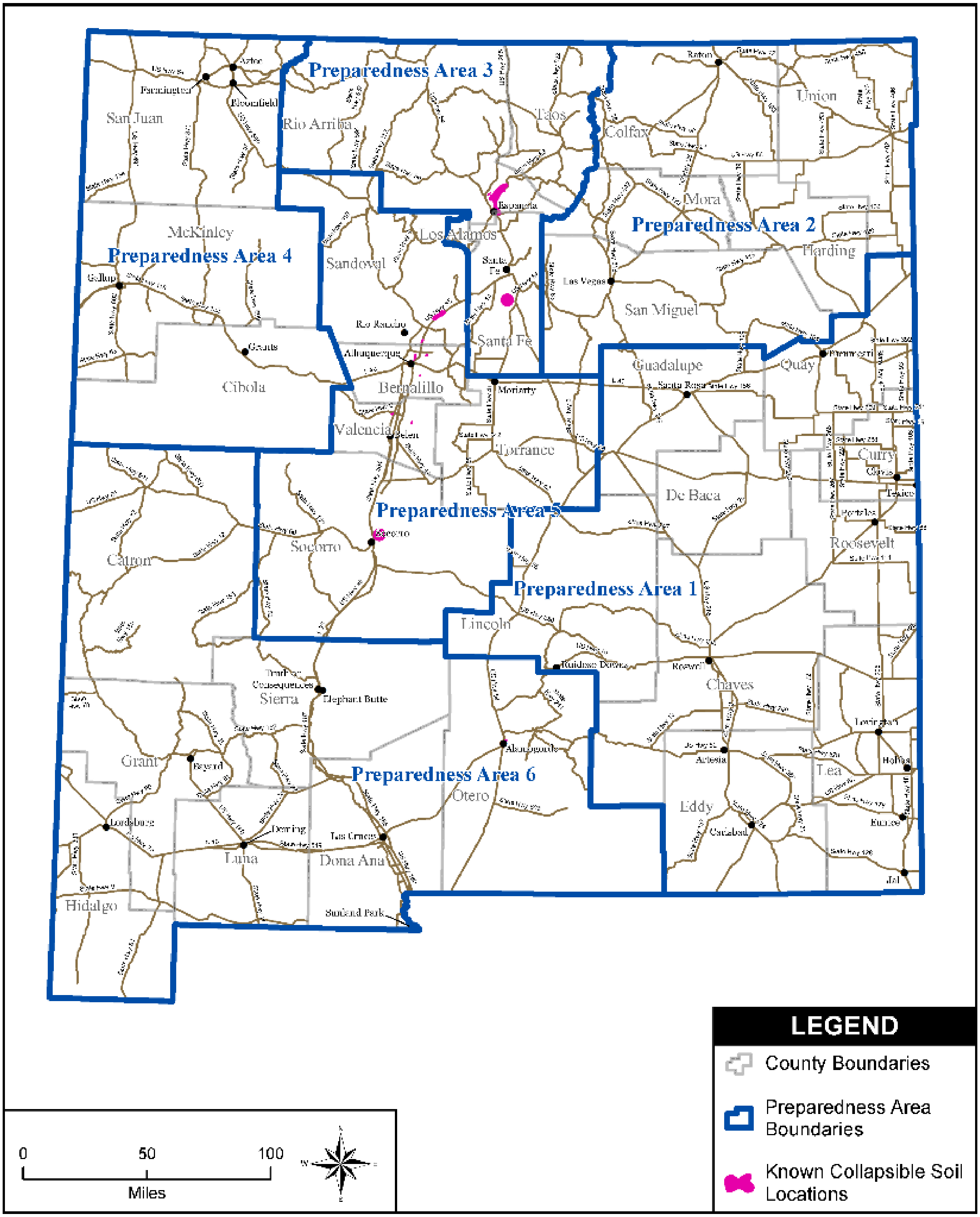


Figure 6-124 Preparedness Area 3 Known Collapsible Soils

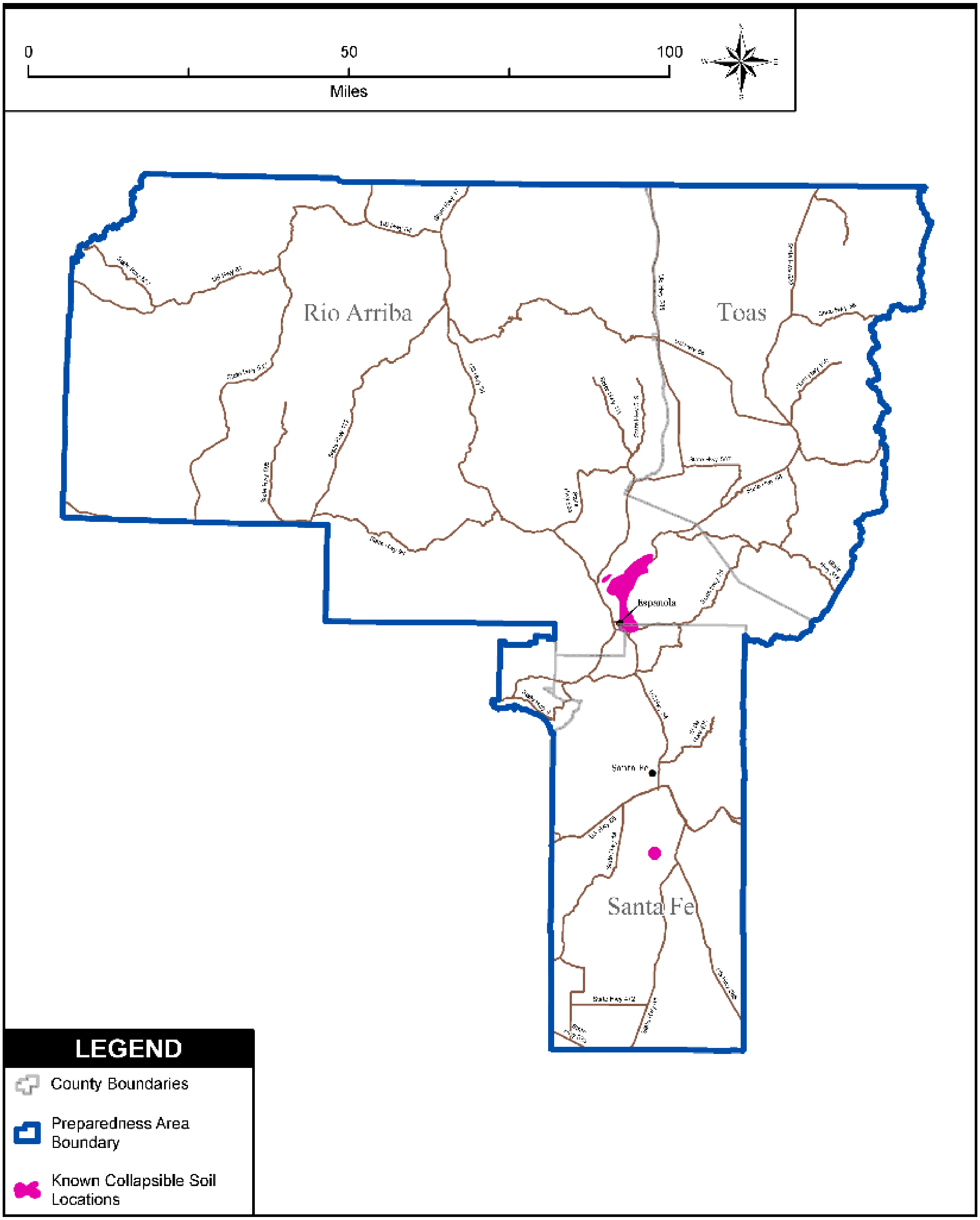
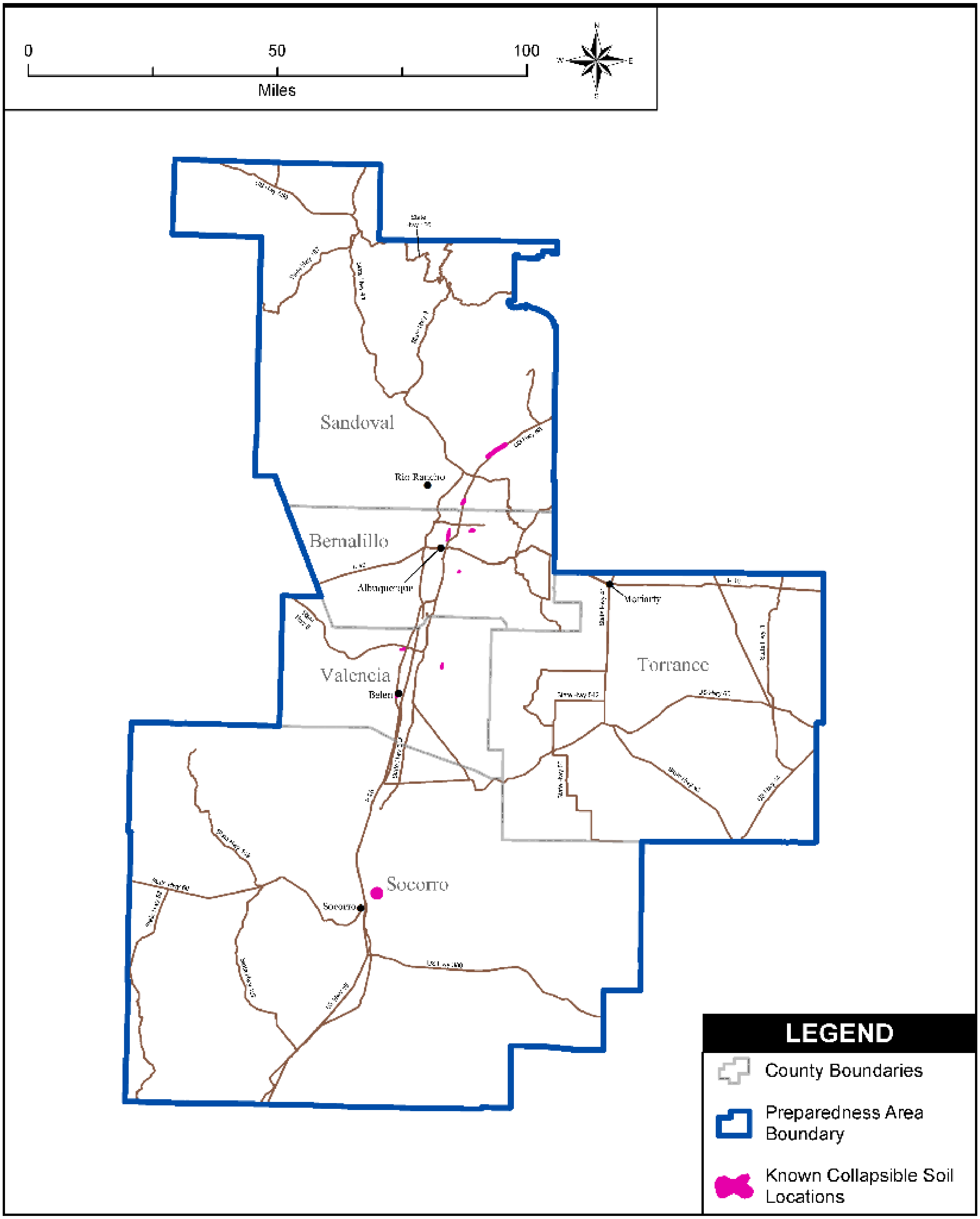


Figure 6-125 Preparedness Area 5 Known Collapsible Soils



Sinkholes — When land subsidence is isolated in a small area, it appears as sinkholes. Some areas of the State are particularly prone to sinkhole formation, such as the region between Carlsbad and Santa Rosa, and the Vaughn area in Guadalupe County (Preparedness Area 1), as shown in Figure 6-126. The locations of these sinkholes are controlled by the underlying bedrock type.

Limestone and gypsiferous units can dissolve into karst cavities, which then collapse. Numerous sinkholes are visible from highways in the region. Highway damages have been reported from this hazard, and the potential for sinkhole formation should not be overlooked in planning highways, pipelines, and electric transmission lines. Figure 6-127 is a photograph illustrating sinkholes alongside U.S. Highway 285 near Vaughn.

Figure 6-126 Sinkhole Formation Area between Santa Rosa, NM and Carlsbad, NM 2016

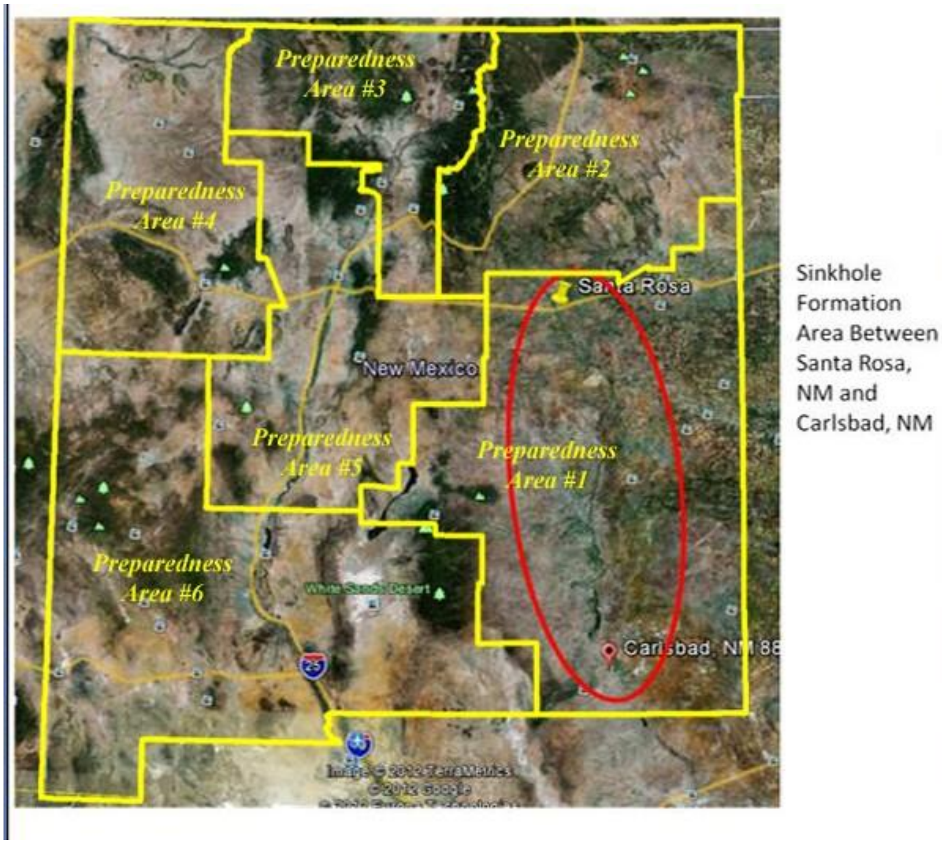
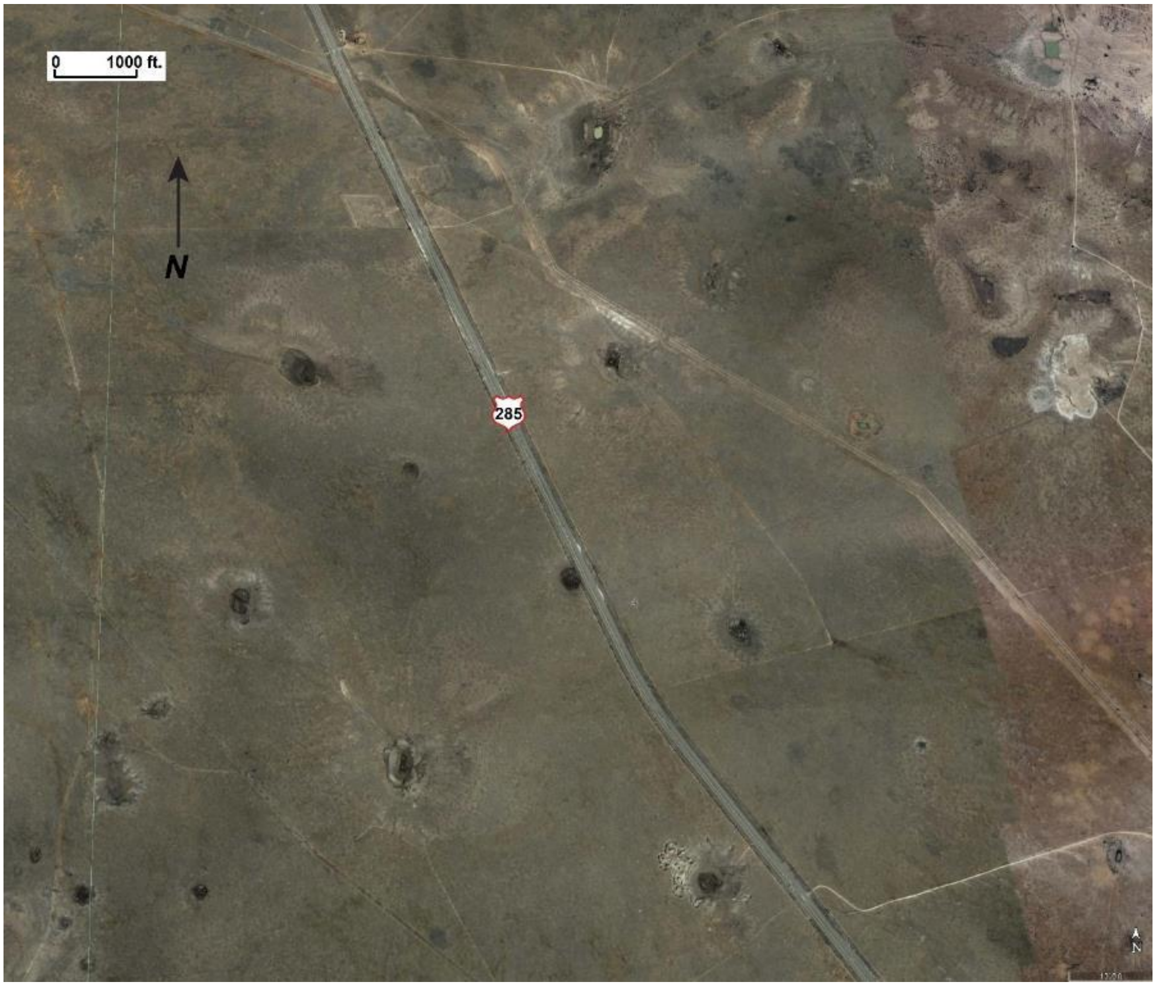


Figure 6-127 Sinkholes along US Highway 285 corridor, about 30 miles southeast of Vaughn, NM



Collapsible Soils – Another type of subsidence, collapsible soils, are soils that compact and collapse after they get wet. The soil particles are originally loosely packed combinations of clay-sized to sand-sized grains 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 clay and silty or sandy soil particles and allows them to slip past each other to become more tightly packed.

Collapsible soils develop on valley margins where soil particles move from the foothills toward the valleys and are rapidly deposited. They commonly accumulate to tens of feet thick. The valley margin also protects these deposits from collapse because it is uncommon for them to be wetted extensively under natural conditions. As New Mexico's population has moved out of the well-watered and irrigated valleys with compact soils to develop the valley margins and foothills, the collapsible soils have made their presence known as the newcomers add water to the drier soils.

Compaction of Organic Soils – Wetland soils developed in marshes may lose water and compact as they become buried by other sediments. The organic matter may become peat with further compaction. Marshes along major river valleys such as the Rio Grande are known to have been buried by later floods.

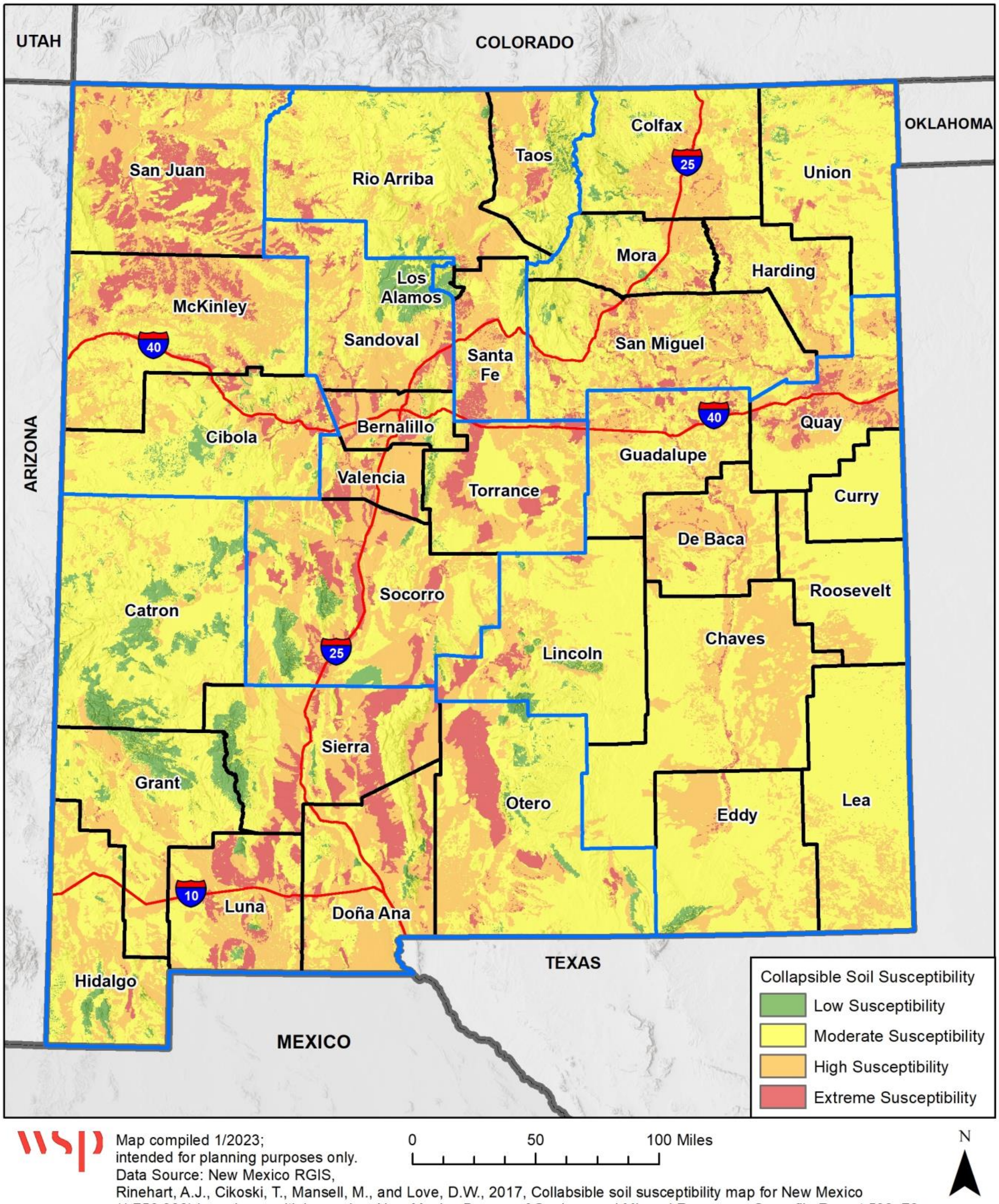
Another cause of organic soil compaction is cyclic drying and rewetting of organic horizons caused by groundwater level fluctuations. The organics lose volume after drying, and the overlying sediments collapse after being re-wetted. In Albuquerque's north valley, several buildings were damaged as buried organic soils were drained and compacted beneath the buildings.

New Mexico Tech (NM Tech) has constructed a 500-m resolution collapsible soils susceptibility map for the entire State of New Mexico. Given the lack of required reporting of hydrocompactive subsidence events, this study chose to use an expert-driven spatial weighted average of multiple indirect proxies, or an overlay method, to estimate collapsible soil susceptibility. This included several sets of proxies: climate zone proxies derived from spatially distributed air temperate and precipitation products; landform age, style of emplacement, depositional environment, source lithology and grain size; NRCS soil map-derived parent material texture and soil taxonomic order, suborder and great group; NLCD land-use; and depth-to-water maps derived from New Mexico Office of the State Engineer Water Rights Report System database. A quality factor was assigned for each proxy based on both the reliability of the proxy and the degree of correlation of the proxy with collapsible soils. A susceptibility value for all of the proxy values was assigned through expert judgement and iterative comparison of the proxy and final susceptibility maps with known hydrocompaction incident locations.

The flanks of the Rio Grande valley and closed basins, alluvial fans, and areas with windblown sediment in the San Juan basin and along the Canadian river have high to extreme susceptibilities. Most of the remaining State has moderate susceptibilities—this is likely an overestimate to compensate for the map coarseness and the general arid conditions of the State. Wetlands and mountain uplands have low susceptibilities. The majority of the State has very good to high quality and also has most of the proxies present. Each proxy has a different correlation with known hydrocompaction incidents, but the final susceptibilities show a strong correlation (>95%) of high to extreme susceptibilities at and around known locales.

Figure 6-128 shows susceptibility for collapsible soils. Redder areas are more susceptible to this hazard, while greener shades are less susceptible.

Figure 6-128 Susceptibility for Collapsible Soils in New Mexico



Map compiled 1/2023;
intended for planning purposes only.
Data Source: New Mexico RGIS,
Rinehart, A.J., Cikoski, T., Mansell, M., and Love, D.W., 2017, Collabsible soil susceptibility map for New Mexico (1:750,000) based on multiple proxies, New Mexico Bureau of Geology and Mineral Resources Open-file Report 593, 72 p.

6.11.2 Previous Occurrences

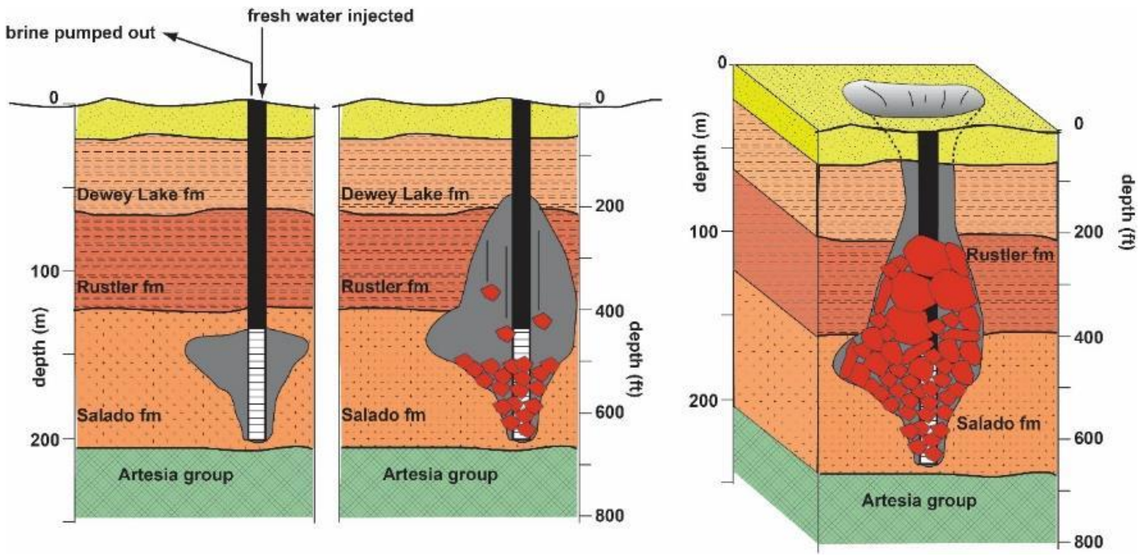
Previous occurrences of land subsidence in New Mexico have been recorded, however, data on the extent of such events is extremely limited. NCDC does not provide any data on previous occurrences. One large event that has been in the news and huge concern in recent years is the collapse of two North Eddy County brine wells in the oil fields in northern Eddy County in 2008 (Figure 6-129). The operators were pumping fresh water into salt beds in the subsurface and pumping out the resulting brine for use as drilling fluid, creating an artificial cavern in the salt beds (Figure 6-130). In the aftermath of those events a third brine well was discovered at the South Y intersection in Carlsbad, sparking fears that a similar collapse might occur in that more densely populated area (Preparedness Area 1). The third brine well operation created a large subsurface void beneath the intersection of US Highways 285 and 62-180. If a collapse occurred, it would destroy the highway intersection, several businesses, an irrigation canal, a church, and a trailer park.

Figure 6-129 JWS sinkhole in northern Eddy County, about three weeks after initial brine well collapse. Pickup truck in lower right corner for scale.

Carlsbad, a city of about 30,000 residents, declared an emergency and said that government-installed sensors should provide several hours of warning before collapse occurs, providing enough time to evacuate the area. However, such a collapse would probably destroy the Carlsbad Irrigation Canal, which provides water for irrigated farming south of Carlsbad, and would also disrupt oil field traffic that is integral to the economy of the area. Without remediation, engineers and scientists predicted that a collapse would be inevitable in the next few years, with an economic impact on the community of greater than $1 billion.

After several years of negotiation, the city of Carlsbad ultimately secured the release of $40 million from the state government for remediation of the South Y brine well. The remediation involved drilling 26 wells around the perimeter of the cavity for injection of grout. The Carlsbad Brine Well Remediation Project was completed in 2022. On-site monitoring of the area will continue for two more years to detect any movement.

Figure 6-130 Brine Well Operation and Subsequent Sinkhole Formation



Most of the land subsidence occurrences in the country have been due to sinkholes that are a subhazard of land subsidence. The most recent event in Carlsbad was directly related to the mining in the area and the US Environmental Protection Agency has taken the lead due to the high amount of brine (hazardous substance).

In mid-April of 2021, a sinkhole occurred in the town of San Mateo, north of Grants in Cibola County. Even after being filled in with topsoil, the subsidence continued so that by August of 2021 the hole measured 1.5x1.7 m in area and was 1.3 m deep. Careful investigation of Cibola County records indicated there was no spatial correspondence of utility lines with the sinkhole location (collapsed utility lines are a common source of soil subsidence). At the request of County officials, personnel from the New Mexico Bureau of Geology and Mineral Resources (NMBGMR) and National Cave and Karst Research Institute (NCKRI) conducted site investigations, with NCKRI performing a detailed electrical resistivity survey. The results of that study indicated there was no large void in the subsurface and that soil piping was probably the cause of the collapse. This report recommended excavating down to the base of loose material in the sinkhole, followed by back-filling of the excavation by a sequence of cobbles, pea-gravel, and topsoil. There was no damage to property nor injuries-deaths associated with this feature, and direct costs would be the Cibola County labor involved in excavating and backfilling the depression, and $10,000 that Cibola County paid to NCKRI to investigate the cause of the sinkhole.

Land subsidence due to hydrocompactive soils has been identified and verified in a number of locations across New Mexico, affecting roads, residences, water lines and sewer lines. These include regions north of Española, on tribal lands along the Rio Grande corridor, along Interstate 25 near Algodones, in the Tanoan Communities in Albuquerque, along the western flank of the Rio Grande valley in Albuquerque, in Tijeras Canyon in Albuquerque, in subdivisions in Los Lunas, in subdivisions in western Belen, in housing area west of Socorro, and in subdivisions north of Alamogordo. Possible hydrocompaction features have been observed along road around the Navajo Agriculture Products Industry irrigated fields south of Farmington, but have not been verified.

6.11.3 Past Frequency

Local land subsidence will episodically continue as more water is pumped, or roads and buildings extend into new regions. Earth fissures at the ground surface will become more frequent and will damage infrastructure as well as individual structures, as in the situation in Carlsbad. Because a full dataset is not available on past occurrence, frequency can only be determined based on the few occurrences described here. Based on anecdotal reporting, land subsidence occurs at least occasionally in the state.

6.11.4 Climate Change Impacts

Changing weather patterns and climate could affect land subsidence in New Mexico. Areas with collapsible soils that already have structures built on them may be more likely to subside due to greater focused run-off with increased precipitation magnitude and intensity. New Mexico will likely see an increased incidence of subsidence from groundwater withdrawal as climate changes. As the climate warms, increases in irrigation and water use will lead to greater reliance on groundwater reserves, likely lowering groundwater levels below historical levels. When groundwater levels drop, the likelihood of subsidence increases.

6.11.5 Probability of Future Occurrence

Because full historical data is not available, the probability of experiencing future land subsidence could not be calculated. Based on anecdotal reporting, land subsidence occurs at least occasionally in the state.

6.11.6 Vulnerability Assessment

Property Exposure from LHMPs

Table 6-86 Exposure to Land Subsidence Susceptible Areas by Preparedness Area

Preparedness Area and Jurisdiction	Total Dollar Value Exposure	Total Exposed Structures/Parcels
PA 1	**$558,105,000**	**3,763**
Eddy County	$558,105,000	3,763
PA 4	**$244,166,000**	**1,173**
McKinley County	$84,282,000	453
Zuni Pueblo	$159,884,000	720
PA 5	**$6,860,425,000**	**29,081**
Bernalillo County	$6,860,425,000	29,081
Grand Total	**$7,662,696,000**	**34,017**

Land subsidence areas were assessed in three (3) PAs with a total of approximately 34,000 structures/parcels exposed worth $7.6 billion. Over 85% of these structures/parcels, 29,000, and 89% of the value are located in PA 5, totaling $6.9 billion. Of the remaining structures/parcels identified, 11% or 3,700, were reported in PA 1 and have a value of $558 million. No exposure data was reported for PAs 2, 3, or 6.

State Assets

A geospatial analysis of state owned assets potentially at risk of subsidence was conducted based on the susceptibility categories in Figure 6-128. For purposes of this analysis, the State assumed losses up to 10% of total asset value for assets at extreme risk of collapsible soils, 5% for assets at high risk, and 1% for assets at moderate risk; risk ratings were based on the ratings in Table 6-3 Hazard Risk Rankings by Preparedness Area. Table 6-87 shows estimated losses for state assets from collapsible soils; these estimates are for planning purposes only and should not be used for insurance purposes.

Table 6-87 Potential Losses to State Assets From Collapsible Soils

	County	Preparedness Area	Total Assets	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
Extreme Risk	**Bernalillo**	5	2	1	1	-	$342,407,000	**$34,240,700**
	Santa Fe	3	1	-	1	-	$168,265,000	**$16,826,500**
	Socorro	5	1	-	1	-	$3,026,251	**$302,625**
	Taos	3	1	-	1	-	$501,000	**$50,100**
	Total	---	**5**	**1**	**4**	**0**	**$514,199,251**	**$51,419,925**
High Risk	**Bernalillo**	5	3	1	1	1	$26,797,167	**$1,339,858**
	Chaves	1	2	-	2	-	$20,031,000	**$1,001,550**
	Cibola	4	2	-	1	1	$39,102,000	**$1,955,100**
	Colfax	2	2	1	1	-	$61,021,000	**$3,051,050**
	Dona Ana	6	2	-	2	-	$76,250,000	**$3,812,500**
	Luna	6	1	-	-	1	$9,553,000	**$477,650**
	McKinley	4	1	-	1	-	$2,807,000	**$140,350**
	Rio Arriba	3	1	-	1	-	$558,985	**$27,949**
	San Miguel	2	3	1	1	1	$152,965,000	**$7,648,250**
	Santa Fe	3	11	-	9	2	$222,851,704	**$11,142,585**
	Valencia	5	3	1	2	-	$148,620,000	**$7,431,000**
	Total	---	**31**	**4**	**21**	**6**	**$760,556,856**	**$38,027,843**
Moderate Risk	**Bernalillo**	5	1	1	-	-	$24,140,000	**$241,400**
	Chaves	1	3	1	1	1	$28,166,000	**$281,660**
	Colfax	2	1	-	1	-	$28,289,000	**$282,890**
	Curry	1	1	-	1	-	$933,000	**$9,330**

	County	Preparedness Area	Total Assets	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
	Grant	6	1	1	-	-	$0	**$0**
	Sandoval	5	1	-	1	-	$17,085,000	**$170,850**
	Santa Fe	3	4	-	4	-	$211,796,000	**$2,117,960**
	Sierra	6	1	1	-	-	$24,528,000	**$245,280**
	Total		**13**	**4**	**8**	**1**	**$334,937,000**	**$3,349,370**

Preparedness Area 1

In Preparedness Area 1, there are limited regions mapped with high to extreme collapsible soil susceptibility. These regions are limited to eolian sediments, young alluvial fan, and river deposits. The highly to extremely susceptible areas in eolian sediments occur in a north-south band east of the Pecos River in Chaves, Eddy, Lea, and Roosevelt counties. Much of Quay and Guadalupe Counties have highly to extremely susceptible soils in clay-rich badland areas, and in regions neighboring the Pecos and Canadian Rivers. A trend of highly to extremely susceptible collapsible soils continues along the Pecos River south through De Baca, Chaves, and Eddy counties, with tributary catchments sometimes also having high likelihoods. Lincoln County has highly to extremely hydrocompaction susceptible soils on the medial and distal portions of alluvial fans coming off the Capitan Mountains, Oscura Mountains and other solitary peaks.

Preparedness Area 2

Preparedness Area 2 has high susceptibilities through much of its central and southern portions, with scattered extreme susceptibilities throughout. The high susceptibilities are commonly associated with fine-grained alluvial fan deposits to the east of the Sangre de Cristo Mountains and below other ridge lines and local peaks; this is the case in Colfax, Mora, Harding, and San Miguel Counties. Other high and most of the extreme susceptibilities in these counties are associated with streams and creeks, likely from local incision and deposition of clay-rich sediments. In Union County, the relative restricted regions of high to extreme susceptibilities are associated with streams and rivers.

Preparedness Area 3

Preparedness Area 3 has broad swathes of regions mapped as highly to extremely susceptible to collapsible soils. All of these regions are associated with alluvial fans, primarily flanking the north-south trending mountain trains in along the river valleys or closed-based margins in Taos, Sandoval, and Santa Fe Counties. Rio Arriba also has a significant proportion of highly susceptible soils and fewer extremely susceptible soils, mostly in canyon and valley bottoms of the mountains and badlands of the region. Extremely susceptible regions occur on alluvial fans in the western portion of Rio Arriba County.

Preparedness Area 4

Preparedness Area 4 has much of the region mapped as highly to extremely susceptible to collapsible soils, particularly in San Juan County, in northern McKinley County, and along the I-40 corridor in McKinley and Cibola counties. In San Juan and northern McKinley County, the extremely susceptible regions are associated with badlands, broad ephemeral streams, clay-rich sedimentary rocks and extensive eolian deposits. Along the I-40 corridor, high to extreme susceptibilities are found in alluvial fans coming off of the Zuni Mountains, Mt. Taylor and from the canyon edges.

Preparedness Area 5

Preparedness Area 5 has a similar distribution of mapped highly to extremely susceptible deposits as Preparedness Area 3. High to extreme susceptibilities are found along valley margins in alluvial fans being deposited along the edges of the north-south trending mountain chains, both bordering the Rio Grande valley and in the closed basins. This pattern holds for all of Bernalillo, Torrance, Valencia, south and eastern Sandoval, and Socorro counties. In western Sandoval County, high susceptibilities are found along valley margins draining from the Jemez and Nacimiento Mountains, and cover much of the regions.

Preparedness Area 6

Much of the southern half of Preparedness Area 6 is mapped as highly to extremely susceptible to collapsible soils. The extremely susceptible areas are all alluvial fan deposits on the alluvial fan margins of mountains, primarily in the more arid southern half of the Area, including Otero, Dona Ana, Sierra, and Luna counties. Much of these counties, more distally in the fan deposits and at high elevations in these fan deposits, have high susceptibilities. Hidalgo and Grant counties have few extremely susceptible areas, but have extensive highly susceptible areas, once again associated with alluvial fan deposits on the margins of the closed basins and large river valleys of the regions. Catron County has relatively few highly or extremely susceptible soils. These are mostly on valley margins of the San Francisco River and other, smaller streams, and in alluvial fans on the northern flank of the western San Agustin Plains.

6.11.7 Data Limitations

Data needs to be collected and compiled on past occurrence of the various types of land subsidence. Once that information is collected and mapped, analysis of Preparedness Area risk can be evaluated.

6.11.8 What Can Be Mitigated?

For hydrocompactive soils, better building ordinances and special care for all surface and subsurface water sources is essential. This includes better testing of the subsurface before construction.

Other mitigation activities can include better identification and analysis of at risk areas, adoption and enforcement of building codes and land use regulations, reinforcing critical facilities or removing them from hazard areas, and public education.

6.11.9 Risk Summary

Sinkholes are secondary hazards related to land subsidence. Land Subsidence can result in serious structural damage to roads, buildings, irrigation channels, utilities, and pipelines. Table 6-88 identifies impacts from Land Subsidence in New Mexico.

Table 6-88 Impacts of Land Subsidence

Subject	Impacts
Agriculture	With any kind of indication of pending occurrence of land subsidence, agriculture should experience little to no loss long term. Short term access issues could occur.
Health and Safety of The Public	The sinkhole situation under Carlsbad is a concern. There is an anticipated a health and safety hazard to the public and to responders as well as property, facilities, and infrastructure.
Health and Safety of Responders	None likely.
Continuity of Operations	None likely.
Delivery of Services	None likely.
Property, Facilities, Infrastructure	The slow nature of this type of event causes the impacts to be almost imperceptible, however damages to the built environment may occur, that can be very costly over time. Hydrocompaction deforms miles of paved highways in New Mexico over decades.
Environment	Pollution of groundwater is a possibility.
Economic Condition	The only anticipated impacts are repair costs but for both fissures and for collapsible soils, the results are catastrophic for whole subdivisions of homeowners.
Public Confidence	Very little impact anticipated.

6.12 Severe Winter Storms

Hazard	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
Severe Winter Storm	High	High	Medium	Medium	High	High	Medium

6.12.1 Hazard Characteristics

Winter storms have significant snowfall, ice, and/or freezing rain, with the quantity of precipitation variable by elevation. Winter storms vary in size and strength and include heavy snowfalls, blizzards, freezing rain, sleet, ice storms, blowing and drifting snow conditions, and extreme cold.

A variety of weather phenomena and conditions can occur during winter storms. For clarification, the following are NWS approved definitions of winter storm elements:

- Heavy snowfall - snowfall accumulating to 4" or more in depth in 12 hours or less; or snowfall accumulating to 6" or more in depth in 24 hours or less
- Blizzard - the occurrence of sustained wind speeds in excess of 35 mph accompanied by heavy snowfall or large amounts of blowing or drifting snow.
- Ice storm – an ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Significant accumulations of ice pull down trees and utility lines resulting in loss of power and communication. These accumulations of ice make walking and driving extremely dangerous.
- Freezing drizzle/freezing rain - a drizzle that falls as a liquid but freezes into glaze or rime upon contact with the cold ground or surface structures; Rain that falls as a liquid but freezes into glaze upon contact with the ground.
- Sleet - sleet is defined as pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes. These pellets of ice usually bounce after hitting the ground or other hard surfaces.
- Wind chill - an apparent temperature that describes the combined effect of wind and low air temperatures on exposed skin.

Extremely cold temperatures accompanied by strong winds can result in wind chills that cause bodily injury such as frostbite and death. Winter storm occurrences tend to be very disruptive to transportation and commerce. Trees, cars, roads, and other surfaces develop a coating or glaze of ice, making even small accumulations of ice extremely hazardous to motorists and pedestrians. The most prevalent impacts of heavy accumulations of ice are slippery roads and walkways that lead to vehicle and pedestrian accidents, collapsed roofs from fallen trees and limbs, heavy ice and snow loads, and downed telephone poles and lines, electrical wires, and communication towers. Such storms can also cause exceptionally high rainfall that persists for days, resulting in heavy flooding.

Most winter precipitation in New Mexico is associated with Pacific Ocean storms as they move across the State from west to east. As the storms move inland, moisture falls on the coastal and inland mountain ranges of California, Nevada, Arizona, and Utah. If conditions are right, the remaining moisture falls on the slopes of New Mexico's high mountain chains.

Much of the precipitation that falls as snow in the mountain areas may occur as either rain or snow in the valleys. The average annual snowfall ranges from about three inches in the southern desert and southeastern plains to over 100 inches in the northern mountains. It can, on rare occasions, exceed 300 inches in the highest mountains. January is usually the coldest month, with average daytime temperatures ranging from the middle 50s in the southern and central valleys to the middle 30s in the higher elevations. Minimum temperatures below freezing are common in all sections of the State during the winter. The following two maps (Figure 6-131 and Figure 6-132) depict Statewide snowfall distributions by average inches and average numbers of days with snowfall over one inch. Figure 6-133 shows the 30-year snow climatology from 1981-2010 for the State.

Figure 6-131 Average Annual Snowfall in Inches

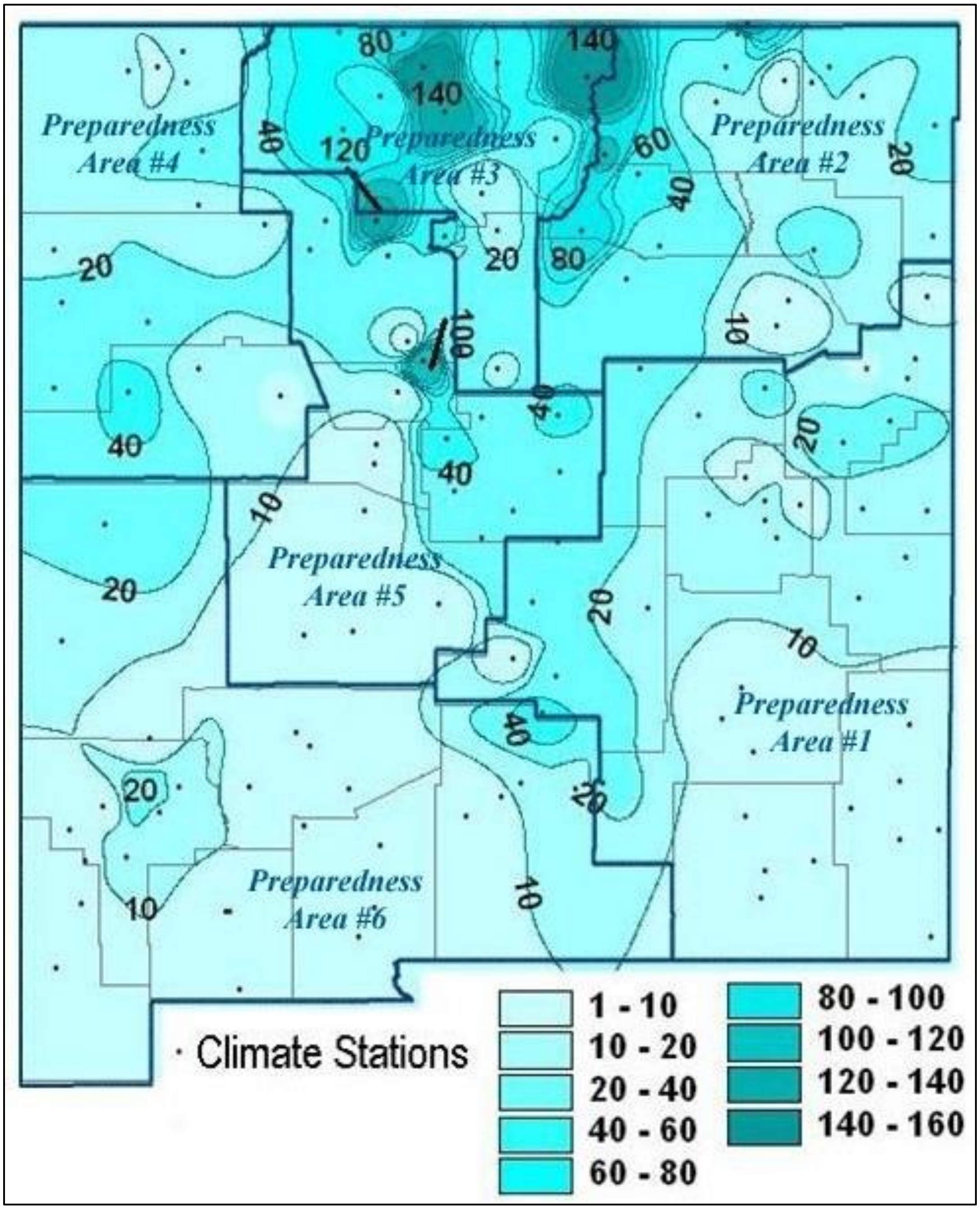


Figure 6-132 Average Annual Number of Days with Snowfall 1 Inch or Greater

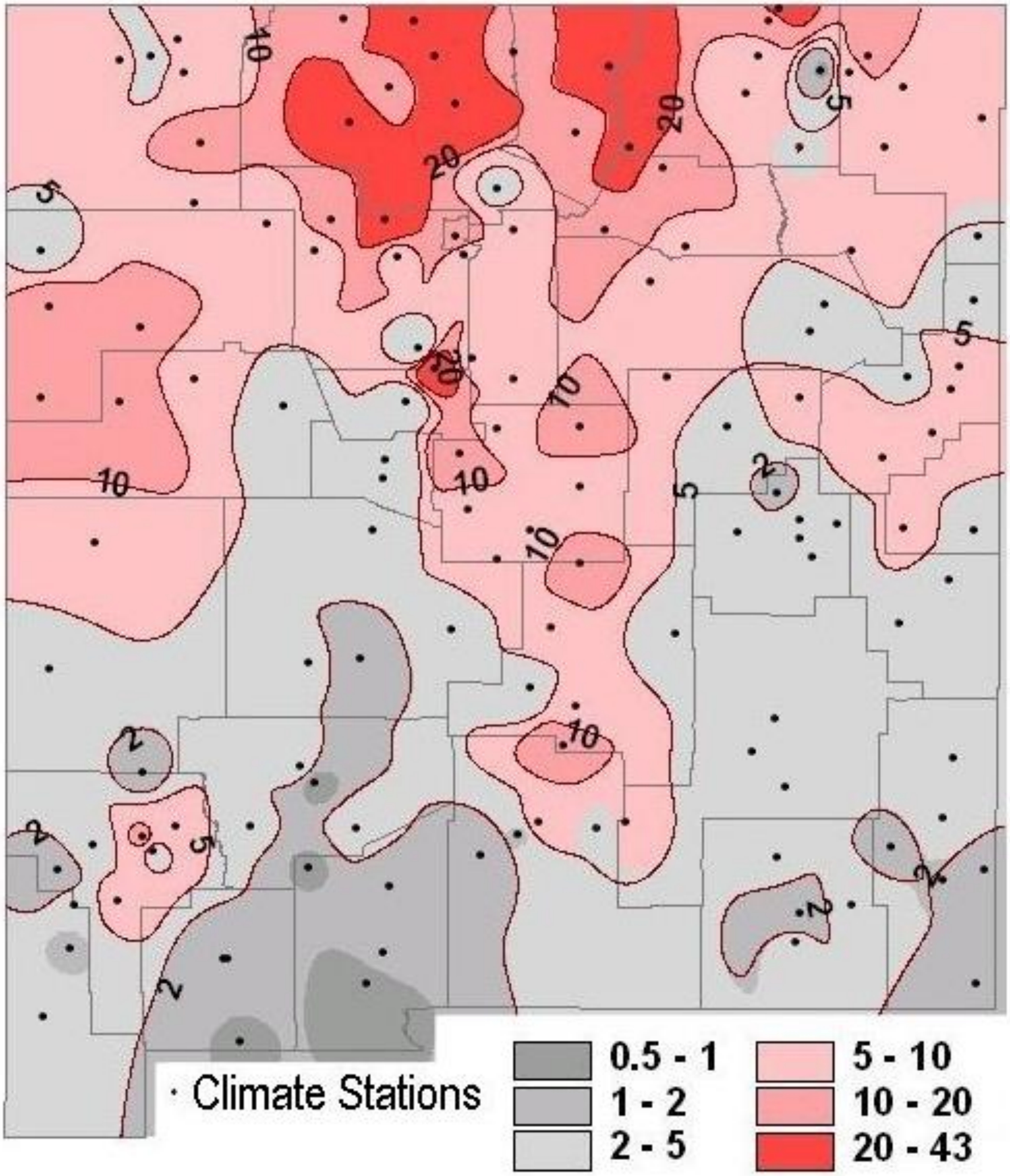
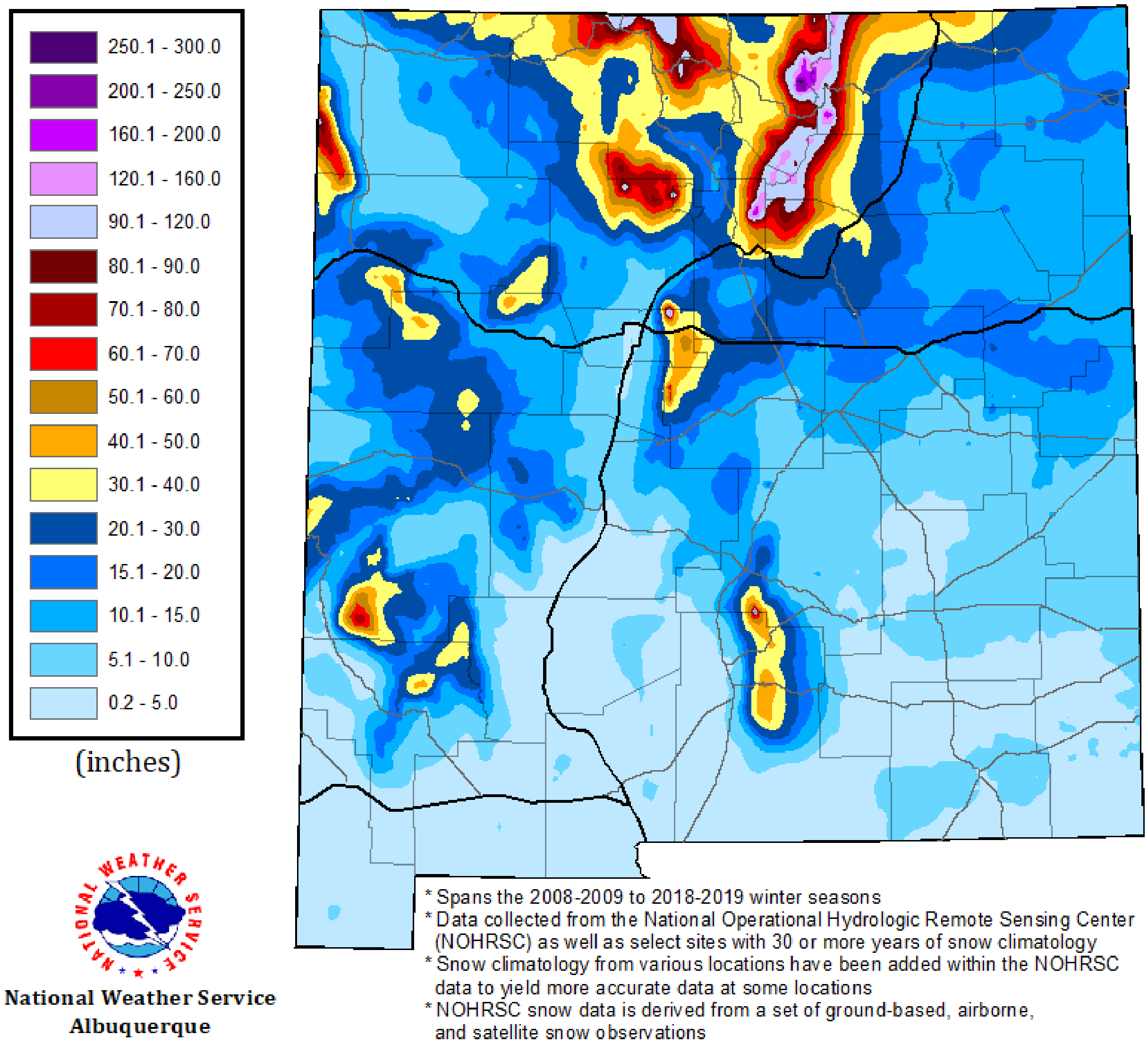


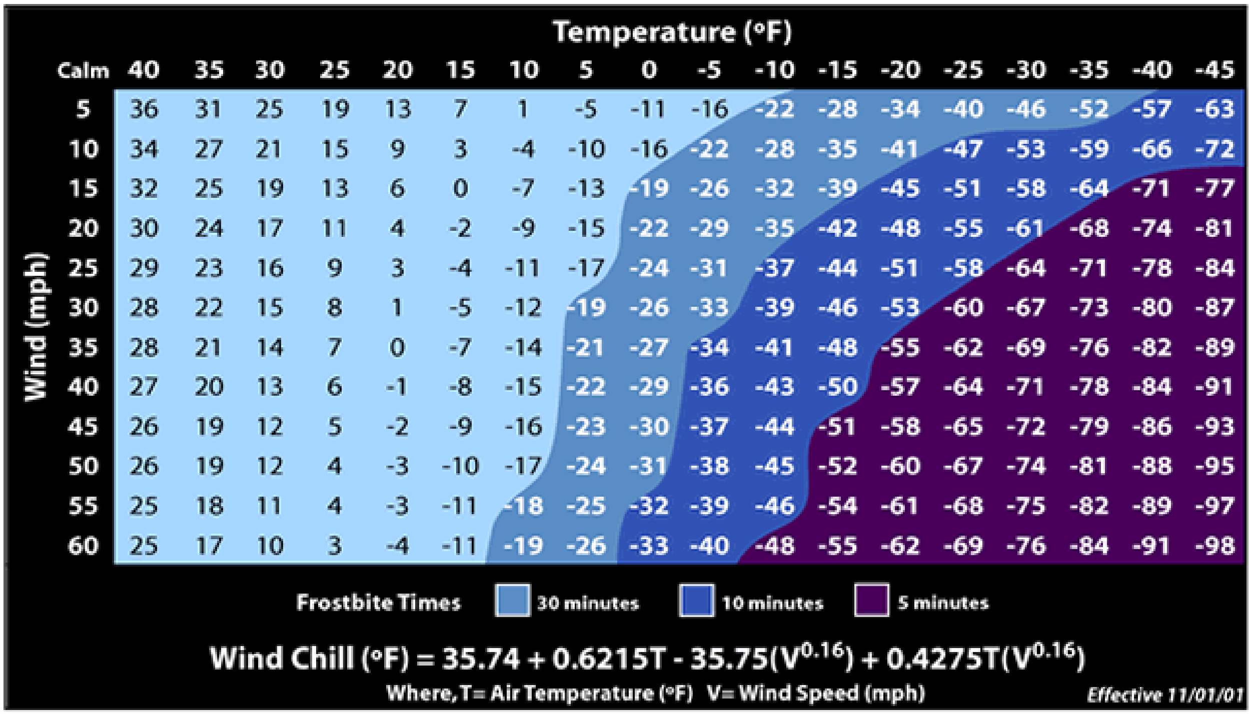
Figure 6-133 30-year Snow Climatology from 1981-2010 for the State of New Mexico



Severe winter storms can vary in size and strength and include heavy snowstorms, blizzards, ice storms, freezing drizzle or rain, sleet, and blowing and drifting snow. Extremely cold temperatures accompanied by strong winds result in potentially lethal wind chills.

The Wind Chill is the temperature your body feels when the air temperature is combined with the wind speed. It is based on the rate of heat loss from exposed skin caused by the effects of wind and cold. As the speed of the wind increases, it can carry heat away from your body much more quickly, causing skin temperature to drop. The Wind Chill chart (Figure 6-134) shows the difference between actual air temperature and perceived temperature, and amount of time until frostbite occurs.

Figure 6-134 Wind Chill Chart



Temperature (°F)

Wind (mph)	Calm 40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

Wind Chill (°F) = $35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Extreme cold occurs when temperatures drop below normal and wind speeds increase, as this occurs, the body is cooled at a faster rate than normal, causing the skin temperature to drop, which can lead to frostbite (when body tissues freeze) and hypothermia (abnormally low body temperature, <95°F). Extreme cold is measured by the wind chill temperature index. The index is based on heat loss from exposed skin and includes a frostbite indicator.

In New Mexico, January is the coldest month. Day-time temperatures range from the mid-50s in the southern and central valleys to the mid-30s in the north's higher elevations. Minimum temperatures below freezing are common throughout the State; however, subzero temperatures are rare, even in the mountains. The lowest temperature ever officially recorded was -50 degrees at Gavilan on February 1, 1951. An unofficial low temperature of negative 57 degrees at Ciniza was reported by the press on January 13, 1963.

The entire State of New Mexico experiences some form severe winter storm event. Based on the topography of the State, such as elevation and land contours, this all plays a significant part in how winter weather affects a particular area. The effects of severe winter storm events vary according to the type of hazard. Winter storms often have the effect of disrupting transportation and commerce. Injury to people and property result from heavy loads of snow and ice causing collapse of roofs of buildings, falling trees and telephone poles, knocking down electrical lines, and creating slippery conditions for pedestrians and vehicles.

6.12.2 Previous Occurrences

The State of New Mexico experiences severe winter storm events annually. Referencing the NCEI, New Mexico experienced a total of 410 winter storm events between January 1997 and December 2022, resulting in five deaths, 11 injuries, $5.28 million in property damage, and $5.27 in crop damage. For the same time period, NCEI reports 61 extreme cold/wind chill events resulting in one death and $1.175 million in property damage. In addition, there have been a total of 15 freezing fog events resulting in three deaths, one injury, and $50,000 in property damage. Reviewing severe winter storm events by Preparedness Area, Figure 1-4 in Appendix A briefly explains those significant winter storm events that have occurred throughout the State of New Mexico. The location of the event is identified by both the city/county and Preparedness Area. Source information is from the NCEI and data provided by local authorities.

Table 6-89 shows State winter storm disaster information. One of the 11 State severe winter storm disasters was also a federally declared disaster (Table 6-90). The total Public Assistance dollar losses from Federal, State, and Local government entities and all Tribal entities was $2,393,376. The State contributed 12.5% of the total cost for this disaster. Data is not broken out by Preparedness Area. Research into locations and costs for each county for this disaster would need to be completed prior to breaking-out the figures by Preparedness Area. However, for this one disaster damage was calculated from Preparedness Areas 1, 3, 5 and 6.

Table 6-89 State Disaster Event Information 2003 through 2022

Event Type	State Executive Order	Dollar Loss
Severe Winter Storm	2004-031	$176,513
Snowstorm	2005-012	$384,269
Snowstorm	2005-016	$906,396
Snowstorm	2006-070	$2,013,953
Snowstorm	2008-005	$1,386,815
Snowstorm	2009-001	$71,427
Snow/Windstorm	2009-048	$54,040
Snowstorm	2010-005	$209,456
Severe Cold	2011-014	$750,000
Navajo Freeze	2013-004	$100,000
Severe Winter Storm	2013-034	$100,000
Severe Winter Storm	2015-021	$750,000
Severe Winter Storm	2016-035	$2,000,000
Severe Winter Storm	2019-008	$5,150,000
Snow Squall	2022-002	$450,000
Snow Squall	2022-014	$350,000
Severe Winter Weather	2022-148	$200,000
Total		**$15,052,869**

Table 6-90 Federal Disaster Event Information 2003 through 2022

Event Type/Name	Event Number	Federal Share	State Share	Total Cost	State % of Total
Severe Winter Storm and Extreme Cold Temperatures	1962	$1,795,032	$299,172	$2,393,376	12.50%
Total	**1**	**$1,795,032**	**$299,172**	**$2,393,376**	

Another source of severe winter storm damage information is from the NCEI. Below is a tally of severe winter storm damage as reported by NCEI broken out by Preparedness Area (Table 6-91). According to NCEI, Statewide property damage from winter storm damage was $2,870,000 from 1997 through December 2022. Note the information in the table below only includes data presented by county, and does not include data presented by National Weather Service Forecast Zones.

Table 6-91 Severe Winter Storm Events by Preparedness Area, 1997 - December 2022

Preparedness Area 1 **Counties:** Chaves, Curry, De Baca, Eddy, Guadalupe, Lea, Lincoln, Quay, and Roosevelt						
Hazard Type	**# of Events**	**Mag**	**Deaths**	**Injuries**	**Property Damage**	**Crop Damage**
Extreme Cold/Wind Chill	15	-	0	0	$0	$0
Freezing Fog	5	-	0	0	$0	$0
Heavy Snow	235	-	0	0	$100,000	$0
Ice Storm	23	-	0	0	$350,000	$0
Winter Storm	18	-	0	0	$0	$0
Winter Weather	38	-	1	2	$470,000	$0
Total	334	-	1	**2**	**$920,000**	**$0**
Preparedness Area 2 **Counties:** Colfax, Harding, Mora, Union, and San Miguel						
Hazard Type	**# of Events**	**Mag**	**Deaths**	**Injuries**	**Property Damage**	**Crop Damage**
Extreme Cold/Wind Chill	13	-	0	0	$0	$0
Freezing Fog	9	-	2	0	$0	$0
Heavy Snow	468	-	0	0	$205,000	$0
Ice Storm	1	-	0	0	$0	$0
Winter Storm	27	-	0	0	$0	$0
Winter Weather	27	-	0	21	$1,000,000	$0
Total	545	-	**2**	**21**	**$1,205,000**	**$0**

Preparedness Area 3 **Counties:** Los Alamos, Rio Arriba, Santa Fe and Taos **Pueblos:** Nambe, Ohkay Owingeh, Picuris, Pojoaque, San Ildefonso, Santa Clara, Tesuque, and Taos **Tribal Nations:** Jicarilla Apache						
Hazard Type	**# of Events**	**Mag**	**Deaths**	**Injuries**	**Property Damage**	**Crop Damage**
Extreme Cold/Wind Chill	11	-	0	0	$0	$0
Freezing Fog	2	-	2	0	$0	$0
Heavy Snow	583	-	0	0	$150,000	$0
Ice Storm	0	-	0	0	$0	$0
Winter Storm	24	-	0	0	$0	$0
Winter Weather	19	-	0	1	$30,000	$0
Total	**639**	-	**2**	**1**	**$180,000**	$0

Preparedness Area 4 **Counties**: Cibola, McKinley, and San Juan **Pueblos**: Acoma, Laguna, Zuni **Tribal Nations**: Navajo Nation						
Hazard Type	**# of Events**	**Mag**	**Deaths**	**Injuries**	**Property Damage**	**Crop Damage**
Extreme Cold/Wind Chill	5	0	0	0	$0	$0
Freezing Fog	1	0	1	1	$50,000	$0
Heavy Snow	160	0	0	0	$50,000	$0
Ice Storm	0	0	0	0	0	0
Winter Storm	3	0	0	0	$0	$0
Winter Weather	**0**	**0**	**0**	**0**	$0	$0
Total	**169**	**0**	**1**	**1**	**$100,000**	$0

Preparedness Area 5 **Counties:** Bernalillo, Sandoval, Socorro, Torrance, and Valencia **Pueblos:** Cochiti, Isleta, Jemez, Sandia, Santa Ana, Santo Domingo, San Felipe, and Zia						
Hazard Type	**# of Events**	**Mag**	**Deaths**	**Injuries**	**Property Damage**	**Crop Damage**

Extreme Cold/Wind Chill	8	0	0	0	$0	$0
Freezing Fog	2	0	2	0	$0	$0
Heavy Snow	320	0	2	0	$130,000	$0
Ice Storm	3	-	0	0	$200,000	$0
Winter Storm	9	0	0	0	$0	$0
Winter Weather	12	0	0	1	$120,000	$0
Total	354	**0**	**4**	**1**	**$450,000**	**$0**

Preparedness Area 6 **Counties:** Catron, Dona Ana, Grant, Hidalgo, Luna, Otero, and Sierra **Tribal Nation:** Mescalero Apache						
Hazard Type	**# of Events**	**Mag**	**Deaths**	**Injuries**	**Property Damage**	**Crop Damage**
Extreme Cold/Wind Chill	3	0	0	0	$0	$0
Freezing Fog	0	0	0	0	$0	$0
Heavy Snow	58	0	0	0	$0	$0
Ice Storm	0	0	0	0	$0	$0
Winter Storm	3	0	0	0	$15,000	$0
Winter Weather	**5**	**-**	**0**	**0**	$0	$0
Total	68	**0**	**0**	**0**	**$15,000**	**$0**

Preparedness Area 2 has suffered the highest levels of property damage. The impacts of 468 Heavy Snow events led to $205,000 worth of property damage. The impacts of 27 Winter Weather events led to $1,205,000 worth of property damage. Preparedness Area 5 suffered the most amount of deaths with a reported four deaths due to severe winter storm events. The deaths were attributed to heavy snow (320 heavy snow events were recorded) and freezing fog. Uneven distribution of the magnitude and types of impacts winter storms have on Preparedness Areas is closely related to the capacity of the people and communities who live there.

6.12.3 Past Frequency

No part of the State is immune from the severe winter storms, whether extreme cold, heavy snow, ice storm, or other cold weather condition. The mountainous areas of the State, which includes all Preparedness Areas, are more likely to receive snow and cold than the plains and desert, and residents of high altitude areas are more likely to be prepared for these conditions, even if they become extreme.

6.12.4 Climate Change Impacts

As the atmosphere holds more moisture, winter storms may become more intense, producing heavier than normal precipitation, including heavier snowfall. But winter has become increasingly unpredictable in recent decades due to climate change, scientists and ski industry experts say. As mid-winter temperatures increase, warmer oceans may fuel stronger winter storms, but snow cover may not stay around as long. Shorter winters are sure to have significant impacts for the local economy and snow sports industry, including resorts, hotels, restaurants and ski shops and the individuals they employ.

According to recent findings published by Environmental Defense Fund (EDF), more periodic and high-intensity snowfall and rain events during winter storms is an expected outcome of climate change, because a warmer planet is evaporating more water into the atmosphere. The added moisture means more precipitation in the form of heavy snowfall or precipitation in the form of rain rather than snow due to warmer temperatures. Moreover, climate change may be expected to lead to more frequent extreme weather conditions in the future. A recent article published on Union of Concerned Scientists on February 1, 2023 also agrees with EDF's conclusion. More evaporation provides more moisture for storms, resulting in more frequent heavy precipitation events, which in turn increases the intensity of the impacts of winter storms.

While climate researchers cannot determine if climate change caused a specific extreme winter storm, or even a specific seasonal change, climate warming will continue to cause a decrease in annual snowfall amounts overall and a shortening of the length of the snow season. However, when severe winter storms do occur, there may be added moisture in the air to generate more intense rates of snowfall.

6.12.5 Probability of Future Occurrence

To determine the probability of New Mexico experiencing severe winter storms in the future, the probability or chance of occurrence was calculated based on historical data identified the NCEI database from a period of December 2022 (324 months/27 years) and from local emergency management officials. Probability was determined by dividing the number of events observed by the number of years (27 years) and multiplying by 100. This gives the percent chance of the event happening in any given year. Table 6-92 provides the probability of occurrence in each Preparedness Area based on the probability formula.

Table 6-92 Probability of Occurrence - Severe Winter Storms

Preparedness Area	Extreme Cold/Wind Chill	Freezing Fog	Heavy Snow	Winter Storm
PA 1	56%	19%	100%	85%
PA 2	48%	33%	100%	4%
PA 3	41%	7%	100%	0%

Preparedness Area	Extreme Cold/Wind Chill	Freezing Fog	Heavy Snow	Winter Storm
PA 4	19%	4%	100%	0%
PA 5	30%	7%	100%	11%
PA 6	11%	0%	100%	0%

6.12.6 Vulnerability Assessment

As discussed in the sections above, severe winter storm activity in New Mexico is consistent. The entire State is susceptible to a full range of winter weather conditions, including extreme cold/wind chill, freezing fog, heavy snow, ice storm, and winter storm. All areas of State are susceptible to winter weather conditions, although local topography, such as elevation and land contours, plays a significant part in how weather affects a particular area. Extreme variations in damages due to thunderstorm events across the Preparedness Areas can be attributed to differences in the concentration of population and infrastructure.

State Assets

Because winter storms can occur in any part of the state, all state assets are assumed to be at risk (see Table 6-7). For purposes of this analysis, the State assumed losses up to 20% of total asset value for assets at high risk of drought, 10% for assets at medium risk, and 5% for assets at low risk; risk ratings were based on the ratings in Table 6-3 Hazard Risk Rankings by Preparedness Area. Table 6-93 shows estimated losses for state assets from drought; these estimates are for planning purposes only and should not be used for insurance purposes.

Table 6-93 Potential Losses to State Assets From Winter Storms

County	Preparedness Area	Total Assets	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
Bernalillo	5	6	3	2	1	$393,344,167	**$78,668,833**
Chaves	1	5	1	3	1	$48,197,000	**$9,639,400**
Cibola	4	2	-	1	1	$39,102,000	**$3,910,200**
Colfax	2	3	1	2	-	$89,310,000	**$17,862,000**
Curry	1	1	-	1	-	$933,000	**$186,600**
Dona Ana	6	2	-	2	-	$76,250,000	**$15,250,000**
Grant	6	1	1	-	-	$0	**$0**
Luna	6	1	-	-	1	$9,553,000	**$1,910,600**
McKinley	4	1	-	1	-	$2,807,000	**$280,700**
Rio Arriba	3	1	-	1	-	$558,985	**$55,899**
Sandoval	5	1	-	1	-	$17,085,000	**$3,417,000**
San Miguel	2	3	1	1	1	$152,965,000	**$30,593,000**

County	Preparedness Area	Total Assets	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
Santa Fe	3	16	-	14	2	$602,912,704	**$60,291,270**
Sierra	6	1	1	-	-	$24,528,000	**$4,905,600**
Socorro	5	1	-	1	-	$3,026,251	**$605,250**
Taos	3	1	-	1	-	$501,000	**$50,100**
Valencia	5	3	1	2	-	$148,620,000	**$29,724,000**
Total	**---**	**49**	**9**	**33**	**7**	**$1,609,693,107**	**$257,350,453**

Preparedness Area 1

The NCEI database has recorded 1 fatality, 2 injuries, and $920,000 in property damages in Preparedness Area 1. In total, 334 severe winter weather events were recorded in this area from 1955-2022. Although Preparedness Area 1 does not have the greatest frequency of events in the state, the area has experienced the second highest property damage due to winter weather events in the State, which could be due to the moderate population size. One significant event that occurred on December 17, 2016 in Quay County, involving a 40 car pile-up, resulted in $400,000 property damage and accounted for almost half of the total damages in Preparedness Area 1.

Preparedness Area 2

The NCEI database has recorded 2 fatality, 21 injuries, and over $1.2 million in property damages in Preparedness Area 2. In total, 545 severe winter weather related events were recorded in this area from 1955-2022. Like Preparedness Area 1, the counites in Preparedness Area 2 are in the eastern portion of New Mexico and therefore experience a greater frequency of thunderstorm events than the rest of the state. Preparedness Area 2 has the highest number of documented events as well as highest property damage in the State. As mentioned above, one significant event that occurred on January 15, 2018 near Las Vegas area involving a 20 car pile-up, resulted in $1,000,000 property damage and accounted for 83 percent of the total damages in Preparedness Area 2.

Preparedness Area 3

The NCEI database has recorded 2 fatalities, 1 injury, and $180,000 in property damages in Preparedness Area 3. In total, 639 severe winter weather related events were recorded in this area from 1955-2022. Preparedness Area 3 has the lowest reported property damage within the state but the highest number of winter weather events in the state. This area is located in the northern portion of the state, where damaging events are less frequent. Most of the damages recorded in this area occurred in the Jemez Mountains Area as well as Santa Fe County due to its dense concentration of population and infrastructure.

Preparedness Area 4

The NCEI database has recorded 1 fatality, 1 injury and $100,000 in property damages in Preparedness Area 4. In total, 169 severe winter weather related events were recorded in this area from 1955-2022.

Preparedness Area 4 has the second lowest amount of property damages due to severe winter weather events in the State and also the second lowest amount of total documented events. This is mainly due to the location of the area in the northwest portion of the state where events and especially damaging events are less frequent.

Preparedness Area 5

The NCEI database has recorded 4 fatalities, 1 injury, and $450,000 in property damages in Preparedness Area 5. In total, 354 severe winter weather related events were recorded in this area from 1955-2022. Preparedness Area 5 has the largest population in the state, concentrated in Bernalillo County. Due to this dense concentration of infrastructure and people, the damages reported in this Preparedness Area are the third most significant in the State. Preparedness Area 5 also has the third highest number of event occurrences. This also makes the people living in this area more vulnerable to injury and death from these events, as indicated by the fact that Preparedness Area 5 has the highest number of fatalities during past events.

Preparedness Area 6

The NCEI database has recorded no fatalities or injuries but $15,000 in property damages in Preparedness Area 6. In total, 68 thunderstorm related events were recorded in this area from 1955-2022. Preparedness Area 6 had the lowest documented property damages as well as the lowest number of event occurrences in the State. The winter storm event that happened in December 2015 in Cloudcroft, Otero County resulted in $10,000 property damage and accounted for 67 percent of the total property damage.

6.12.7 Data Limitations

The SHMT could not quantify vulnerability of individual structures to damage from severe winter storm events. Accurate methods to quantify potential future damages are not readily available. The amount of business lost due to winter storms and road closures has not been calculated due to the difficulty of attaining this information. The SHMT could also not specify which critical facilities were vulnerable to severe winter storms. Subsequent versions of this Plan Update will need to incorporate and respond to these data deficiencies.

6.12.8 What Can Be Mitigated?

One important part of mitigating severe winter storm hazards is forecasting and warning so that people can prepare. Communities can prepare for disruptions of utilities and transportation due to severe winter storm by advising people to stay home or to use caution if they must go out, and by recommending that people stock up on food, water, batteries, and other supplies. The National Weather Service, combined with local television stations, have an effective strategy for notifying residents about impending storms. Consistently enforcing building codes provides the greatest benefit for new construction to mitigate damages due to severe winter storm weather. For existing structures and critical facilities, follow-up inspections and retrofits provide effective mitigation. For supporting road closure mitigation, a State regulation was added to provide safety to the public. The regulation regarding road closure is as follows:

> **66-7-11. New Mexico State Police power to close certain highways in emergencies.** Notwithstanding any rule, regulation, or agreement of the NMDOT, the New Mexico State police, in cases of emergency where the condition of a State highway presents a substantial danger to

vehicular travel by reason of storm, fire, accident, spillage of hazardous materials or other unusual or dangerous conditions, may close such highway to vehicular travel until the New Mexico State Police determines otherwise. The NMDOT shall be notified of the highway closure as soon as practicable.

This regulation is broad enough to allow for closure for any type of severe winter storm event, but it is also difficult to define what constitutes "dangerous conditions."

Other mitigation activities can include building code adoption and enforcement, retrofitting structures to handle increased snow load, hardening of power lines and other utilities, insulating water lines, identifying at risk populations, establishing safe rooms and shelters, ensuring backup power at critical facilities, and public education.

6.12.9 Risk Summary

Severe winter storms are difficult to predict precisely in pattern, frequency, and degree of severity. The impact from severe winter storm events (heavy snowfall, blizzard, ice storm, freezing drizzle/freezing rain, sleet, wind chill, and extreme temperatures) has been moderate with impact to widespread area of crops and livestock depending on the time of year when it occurs. Highly vulnerable populations include those in mobile home parks, recreational vehicles, and aged or dilapidated housing, but no area is safe.

Severe winter weather is much more likely to have a serious impact on major population centers and transportation routes, most of which are not located in the high mountains. This occurred on January 15, 2018. There were areas of freezing drizzle, freezing fog, and very light snow over eastern New Mexico. The strongest forcing for frozen precipitation occurred around the Las Vegas area (Preparedness Area 2) where reports of around one tenth of an inch of freezing rain accumulated. A vehicle traveling northbound on Interstate 25 crashed into the median in the center of the interstate. A tractor trailer jack knifed trying to avoid the vehicle and begun a chain reaction. Twenty vehicles piled up causing two fatalities and 20 injuries. The interstate was closed down for more than 12 hours. This event resulted in an estimate of $1 million property losses. This also occurred on December 24, 2011 during a severe snowstorm when motorists traveling through Albuquerque, NM (Preparedness Area 5) Interstate system were stranded for up to 18 hours. The plains and desert areas (Preparedness Areas 1 and parts of Preparedness Area 6) are more susceptible to high winds that contribute to the drifting of snow, and a snowstorm that would hardly be noticed in the higher altitudes could present a serious hazard to people in the lower altitudes. If a severe winter storm were to cause a power failure, as would be likely with an ice storm, the effect could be very serious anywhere in the State. Any accumulation of ice or snow on the roads is a hazardous situation and can lead to widespread road and highway closures, which can strand motorists. Table 6-94 outlines Impacts from severe winter storm events for each Preparedness Area to consider when planning for these types of events.

Table 6-94 Severe Winter Storm Impacts

Subject	Impacts
Agriculture	Typically, there is some advance notice to a pending cold front and potential winter storm impacts. Even with that, those impacts can be devastating to agriculture, particularly to the milk industry. The milk industry has timed inputs and outputs and closed roads can severely impact that industry.
Health and Safety of The Public	Injuries and death have resulted from winter storm events. Individuals caught outdoors can suffer frostbite, hypothermia, and death from low temperatures.

Subject	Impacts
Health and Safety of Responders	Responders face the same impacts as the public.
Continuity of Operations	Travel to key facilities and places of employment may be impossible, and those entities may not be able to function.
Delivery of Services	Facilities that are unable to be reached or if supply lines are blocked, widespread denial of services may result.
Property, Facilities, Infrastructure	Winter storms can cause ice to form on roads and bridges rendering them impassible, can accumulate on power lines and cause them to break, can cause water pipes to burst, and heavy snows can collapse roofs.
Environment	Winter storms can cause damages to trees and plants as well as to crops and animals.
Economic Condition	The negative effects to the economic condition are generally from the damages the hazard causes to infrastructure and agriculture. Individuals and businesses can suffer unanticipated expenses.
Public Confidence	Winter storms are an expected event in the State, but a slow response such as road clearing or restoration of utilities can cause an erosion of the public's confidence in the government.

6.13 Thunderstorms (Including Lightning and Hail)

Hazard	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
Thunderstorm	**High**	**High**	**Medium**	**High**	**Medium**	**High**	**High**

6.13.1 Hazard Characteristics

Thunderstorms (Thunderstorm Wind and Heavy Rain)

Thunderstorms are produced when warm moist air is overrun by dry cool air. As the warm air rises, thunderheads form and cause strong winds, lightning, hail, and heavy rains. Atmospheric instability can be caused by surface heating or by upper tropospheric (>50,000 feet) divergence. Rising air parcels can also result from airflows over mountainous areas. Generally, the former "air mass" thunderstorms form on warm-season afternoons and are not severe. The latter "dynamically driven" thunderstorms, which generally form in association with a cold front or other regional atmospheric disturbance, can become severe, thereby producing strong winds, frequent lightning, hail, downburst winds, heavy rain, and occasional tornadoes.

All areas of the State have thunderstorms. According to the National Weather Service (NWS), the thunderstorm season in New Mexico begins over the high plains in the eastern part of the State in mid- to late April, peaks in May and June, declines in July and August, and then drops sharply in September and October. In the western part of the State, thunderstorms are infrequent during April, May, and June, increase in early July and August, and then decrease rapidly in September. Over the central mountain chain, thunderstorms occur almost daily during July and August, especially over the northwest and north central mountains.

Thunderstorms tend to have different characteristics in different regions of the State. Across the eastern plains, thunderstorms tend to be more organized, long-lived, and occasionally severe, producing large hail, high winds, and tornadoes. Thunderstorms in the western part of the State tend to be less severe on average, occasionally producing life-threatening flash floods and small hail accumulations. Most of the storms in western New Mexico are associated with the southwest monsoons, which mainly produce flash floods.

Severe thunderstorms are reported each year in nearly all New Mexico counties. The NWS definition of a severe thunderstorm is a thunderstorm with any of the following attributes: downbursts with winds of 58 miles (50 knots) per hour or greater (often with gusts of 74 miles per hour or greater), hail 0.75 of an inch in diameter or greater, or a tornado. Typical thunderstorms can be three miles wide at the base, rise to 40,000-60,000 feet into the troposphere, and contain half a million tons of condensed water.

The impacts of thunderstorms vary according to the types of secondary hazards they produce. Thunderstorms can cause substantial rainfall leading to localized flash flooding. Additionally, thunderstorms can cause lightning strikes that have the potential to ignite wildfires and lead to injury and death. Hailstorms are another potential result of thunderstorms, and they can sometimes damage agricultural crops and cause property damage.

Lightning

Lightning is defined as a sudden and violent discharge of electricity, usually from within a thunderstorm, due to a difference in electrical charges. Lightning is a flow of electrical current from cloud to cloud or cloud to ground. Nation-wide, lightning is the cause of extensive damage to buildings and structures, death or injury to people and livestock, the cause of wildfires, and the disruption of electromagnetic transmissions. Lightning is extremely dangerous during dry lightning storms because people often remain outside, rather than taking shelter.

To the general public, lightning is often perceived as a minor hazard. However, lightning-caused damage, injuries, and deaths establish lightning as a significant hazard associated with any thunderstorm. Damage from lightning occurs four ways:

1. Electrocution or severe shock of humans and animals;
2. Vaporization of materials along the path of the lightning strike;
3. Fire caused by the high temperatures (10,000-60,000°F); and
4. A sudden power surge that can damage electrical or electronic equipment.

Large outdoor gatherings (sporting events, concerts, campgrounds, etc.) are particularly vulnerable to lightning strikes. Vaisala reported that in 2022, the state of New Mexico ranked 17th in the nation for total lighting count and 30th in the nation for lightning density (event per km2). Jal was reported to be the lightning capital of New Mexico.

The Lightning Activity Level is a scale from one to six, which describes frequency and character of cloud-to- ground (cg) lightning (Table 6-95).

Table 6-95 Lightning Activity Level Scale

Cloud and Storm Development		Areal Coverage	Counts cg/5 min	Counts cg/15 min	Average cg/min
1	No thunderstorms.	None	-	-	-
2	Cumulus clouds are common but only a few reach the towering stage. A single thunderstorm must be confirmed in the rating area. Light rain will occasionally reach ground. Lightning is very infrequent.	<15%	1-5	1-8	<1
3	Cumulus clouds are common. Swelling and towering cumulus cover less than 2/10 of the sky. Thunderstorms are few, but 2 to 3 occur within the observation area. Light to moderate rain will reach the ground, and lightning is infrequent.	15% to 24%	6-10	9-15	1-2
4	Swelling cumulus and towering cumulus cover 2-3/10 of the sky. Thunderstorms are scattered but more than three must occur within the observation area. Moderate rain is commonly produced, and lightning is frequent.	25% to 50%	11-15	16-25	2-3
5	Towering cumulus and thunderstorms are numerous. They cover more than 3/10 and occasionally obscure the sky. Rain is moderate to heavy, and lightning is frequent and intense.	>50%	>15	>25	>3
6	Dry lightning outbreak. (LAL of 3 or greater with majority of storms producing little or no rainfall.)	>15%	-	-	-

Based on the Lightning Activity scale, all Preparedness Areas consistently experience storms of LAL5 or higher, specifically during the monsoon seasons. The North American Monsoon System (NAMS) is a large-scale shift in the atmospheric circulation that results in a summertime maximum of precipitation across portions of Mexico, Arizona, and New Mexico. The monsoon season, broadly defined from mid- June to late September, is comprised of "bursts" and "breaks," or periods of rainy and dry weather. The average onset occurs around July 3rd for the southwest corner of the State (Preparedness Area 6, around July 9th for the Middle Rio Grande valley (Preparedness Area 5), and around July 12th for the Four Corners region (Preparedness Area 4).

Hail

Hail is frozen water droplets formed inside a thunderstorm cloud. They are formed during the strong updrafts of warm air and downdrafts of cold air, when the water droplets are carried well above the freezing level to temperatures below 32 degrees F, and then the frozen droplet begins to fall, carried by cold downdrafts, and may begin to thaw as it moves into warmer air toward the bottom of the thunderstorm. This movement up and down inside the cloud, through cold then warmer temperatures, causes the droplet to add layers of ice and can become quite large, sometimes oval shaped and sometimes irregularly shaped, before it finally falls to the ground as hail.

Hail usually occurs during severe thunderstorms, which also produce frequent lightning, flash flooding and strong winds, with the potential of tornadoes. The hail size ranges from smaller than a pea to as large as a softball, and can be very destructive to buildings, vehicles, and crops. Even small hail can cause significant damage to young and tender plants. Hail usually lasts an average of 10 to 20 minutes but may last much longer in some storms. Hail causes $1 billion in damage to crops and property each year in the U.S.

No part of the State is immune to hailstorms. Once the summer monsoon starts, thunderstorms often develop in the afternoons and evenings. Mountainous areas usually see more storms than the plains and desert, although mountain storms tend to be less severe and produce smaller hail. In the plains and over the desert, monsoon thunderstorms sometimes reach severe levels and can produce large hail.

Table 6-96 combines the NOAA and TORRO hailstorm intensity scales as a way of describing the size of hail based on the intensity and diameter of the hail.

Table 6-96 Combined NOAA/TORRO Hailstorm Intensity Scale

	Intensity Category	Typical Hail Diameter (mm)	Probable Kinetic Energy, J-m^2	Description	Typical Damage Impacts
H0	Hard Hail	5	0-20	Pea	No damage
H1	Potentially Damaging	5-15	>20	Mothball	Slight general damage to plants, crops
H2	Significant	10-20	>100	Marble, grape	Significant damage to fruit, crops, vegetation
H3	Severe	20-30	>300	Walnut	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25-40	>500	Pigeon's Egg > Squash ball	Widespread glass damage, vehicle bodywork damage
H5	Destructive	30-50	>800	Golf ball > Pullet's egg	Wholesale destruction of glass, damage to tiled roofs, significant

	Intensity Category	Typical Hail Diameter (mm)	Probable Kinetic Energy, J-m^2	Description	Typical Damage Impacts
					risk of injuries
H6	Destructive	40-60		Hen's egg	Bodywork of grounded aircraft dented, brick walls pitted
H7	Destructive	50-75		Tennis ball > cricket ball	Severe roof damage, risk of serious injuries
H8	Destructive	60-90		Large orange > Softball	(Severest recorded in the British Isles) Severe damage to aircraft bodywork
H9	Super Hailstorms	75-100		Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	>100		Melon	Extensive structural

6.13.2 Previous Occurrences

Thunderstorm events characterized by high wind/hail events are common throughout New Mexico and occur hundreds of times each year. Analysis of the number of reported occurrences for the six Preparedness Areas from May 1955 to December 2022 by the NCEI shows a clear concentration of thunderstorm activity in Preparedness Areas 1, 2, 5, and 6. Conversely, concentrated areas of low thunderstorm occurrence were found in Preparedness Areas 3 and 4.

The current online NCEI database is limited in past events and contains data from May 1955 to December 2022, as entered by NOAA's National Weather Service (NWS). According to the NCEI database 6,968 total thunderstorm events (including hail, heavy rain, lightning, and thunderstorm wind events) have occurred in the State of New Mexico since 1955. These events have resulted in a total of 18 fatalities, 161 injuries, over $173.5 million in property damages, and over $12.6 million in crop losses across the State. Table 6-97 displays a summary of losses recorded by the NCEI dataset by Preparedness Area.

Table 6-97 Thunderstorm History by Preparedness Area, 1955 –2022

Preparedness Area 1 **Counties:** Chaves, Curry, De Baca, Eddy, Guadalupe, Lea, Lincoln, Quay, and Roosevelt							
Hazard Type	**# of Events**	**Mag**	**Deaths**	**Injuries**	**Property Damage**	**Crop Damage**	
Hail	2,550	.75 – 4.25"	1	26	$51,831,950	$6,096,600	
Heavy Rain	55	0	0	0	$2,000	$0	
Lightning	16	-	3	6	$302,000	$0	
Thunderstorm Wind	1,077	0-90 Kts	3	16	$18,773,400	$5,330,500	

Total	**3,698**	**-**	**7**	**48**	**$70,909,350**	**$11,427,100**

Preparedness Area 2
Counties: Colfax, Harding, Mora, Union, and San Miguel

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Hail	1,123	.25 – 4.5”	0	13	$6,198,900	$1,000
Heavy Rain	7	0	0	0	$0	$0
Lightning	4	0	1	3	$0	$0
Thunderstorm Wind	187	0-68 kts	0	3	$410,500	$3,000
Total	**1,321**	**-**	**1**	**19**	**$6,609,400**	**$4,000**

Preparedness Area 3
Counties: Los Alamos, Rio Arriba, Santa Fe and Taos
Pueblos: Nambe, Ohkay Owingeh, Picuris, Pojoaque, San Ildefonso, Santa Clara, Tesuque, and Taos
Tribal Nations: Jicarilla Apache

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Hail	224	.75 – 2.5”	0	0	$1,410,000	$500
Heavy Rain	3	0	0	0	$0	$0
Lightning	20	-	3	9	$216,000	$100
Thunderstorm Wind	82	0 to 73 kts	0	3	$7,484,500	$0
Total	**329**	**-**	**3**	**12**	**$9,110,500**	**$600**

Preparedness Area 4
Counties: Cibola, McKinley, and San Juan
Pueblos: Acoma, Laguna, Zuni
Tribal Nations: Navajo Nation

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage
Hail	65	.75 – 1.75”	0	3	$1,000	$0
Heavy Rain	8	0	1	5	$215,000	$0
Lightning	6	-	1	4	$70,000	$0

Thunderstorm Wind	70	0 to 90 kts	0	1	$793,000	$1,000	
Total	**149**	**-**	**2**	**13**	**$1,079,000**	**$1,000**	

Preparedness Area 5
Counties: Bernalillo, Sandoval, Socorro, Torrance, and Valencia
Pueblos: Cochiti, Isleta, Jemez, Sandia, Santa Ana, Santo Domingo, San Felipe, and Zia

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage	
Hail	435	.75-4.5"	0	21	$56,905,500	$375,000	
Heavy Rain	23	0	1	9	$1,529,000	$0	
Lightning	21	-	2	22	$232,000	$500	
Thunderstorm Wind	244	0 to 87 kts	0	6	$3,726,000	$101,000	
Total	**723**	**-**	**3**	**58**	**$62,392,500**	**$476,500**	

Preparedness Area 6
Counties: Catron, Dona Ana, Grant, Hidalgo, Luna, Otero, and Sierra
Tribal Nation: Mescalero Apache

Hazard Type	# of Events	Mag	Deaths	Injuries	Property Damage	Crop Damage	
Hail	388	.75 – 3"	1	0	$20,998,010	$727,010	
Heavy Rain	51	0	0	0	$0	$0	
Lightning	2	0	1	6	$1,000	$0	
Thunderstorm Wind	307	0 to 100 kts	0	5	$2,484,000	$50,000	
Total	**748**	**-**	**2**	**11**	**$23,483,010**	**$777,010**	

Based on these records, hail has resulted in the greatest property damage in the State, accounting for $137.3 million (79%) of the property damages in the state, followed by thunderstorm winds. Figure 6-135 displays a map of past hail events by magnitude in the State of New Mexico. The map indicates that counties in Preparedness Areas 1 and 2 experience the greatest frequency and magnitude of hail events. However, most property damages from hail events occurred in Preparedness Areas 1 and 5. Details on significant hail events were provided by the NCEI in Table 6-98 below.

Figure 6-135 New Mexico Hail Events by Magnitude 1950-2021

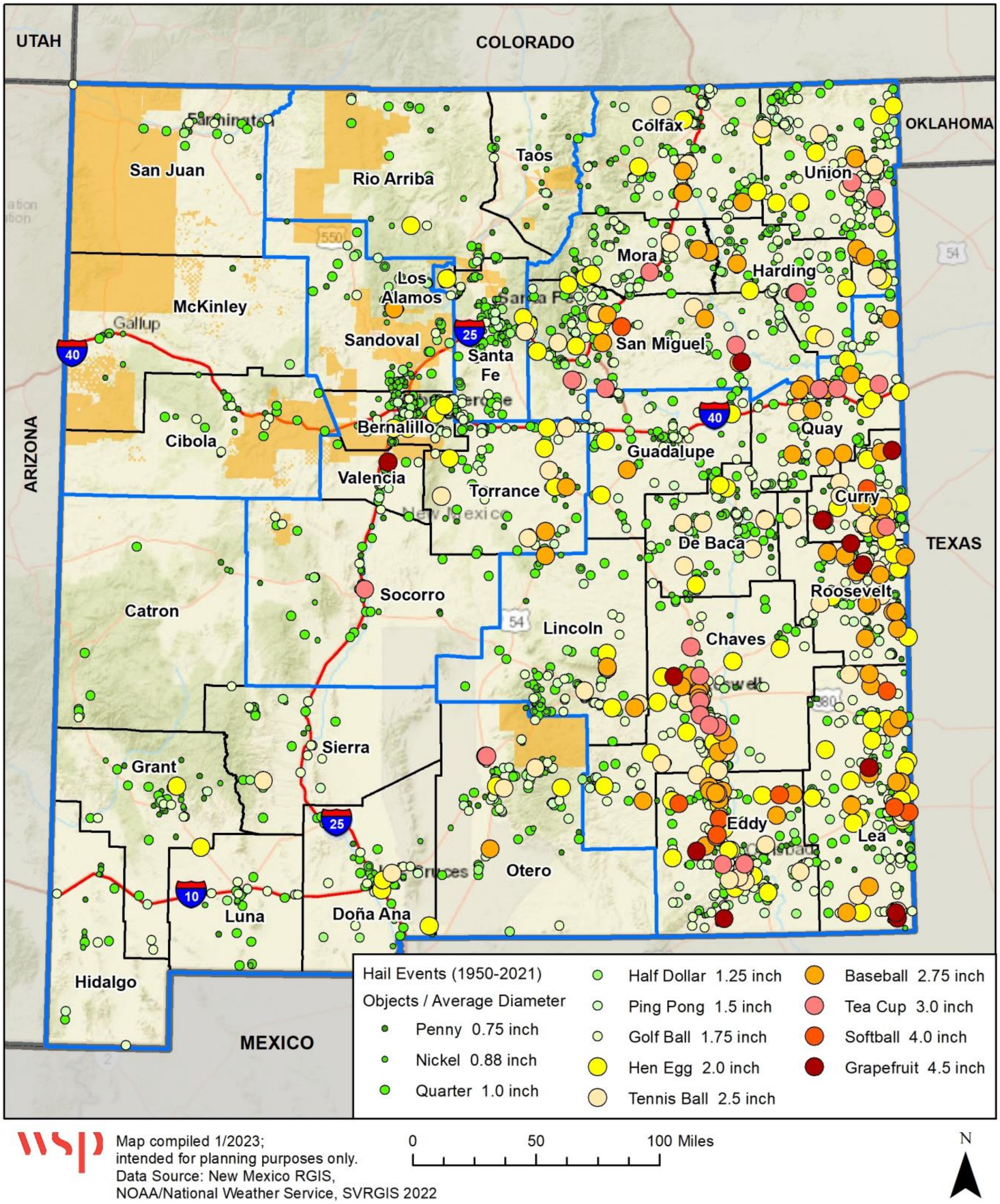


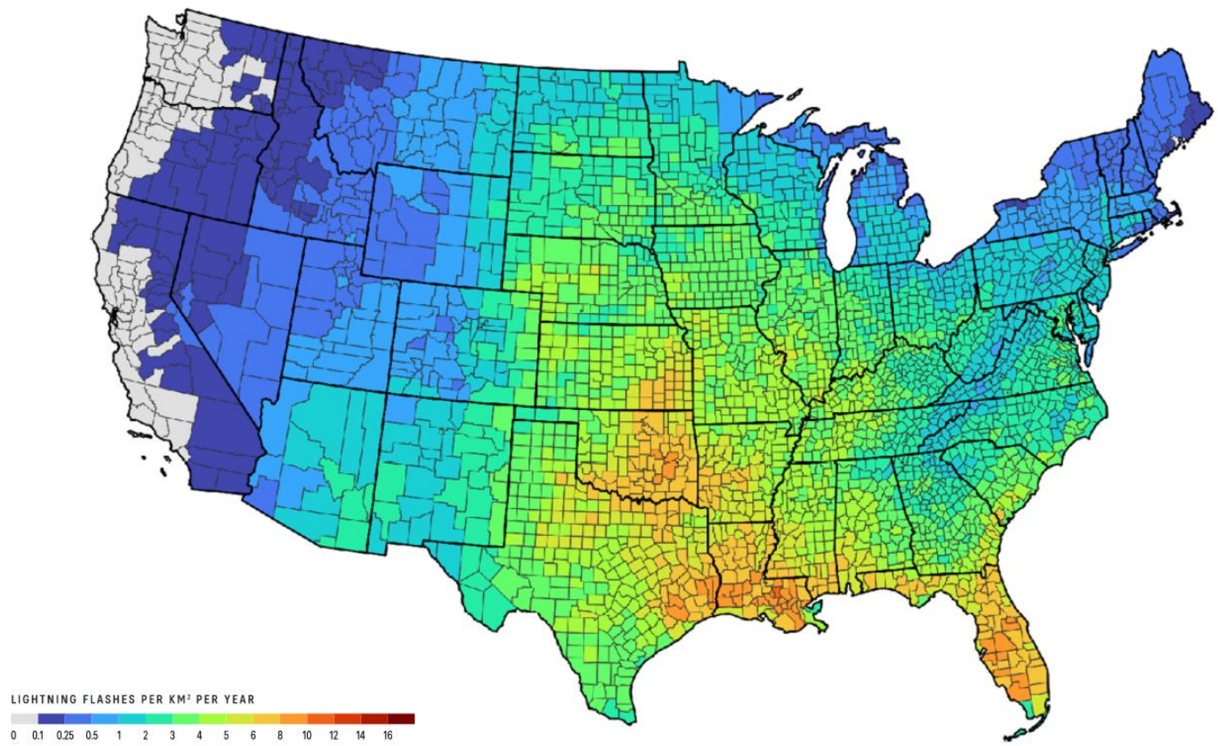
Table 6-98 Significant Hail Events in New Mexico (1996-2022)

Date	Location	Significant Event
April 26, 2022	Dona Ana County (PA 6)	Hail up to golf ball size fell in Santa Teresa up toward La Union. Several houses around the intersection of McNutt and the Domenici Highway sustained destroyed roofs and numerous vehicles had significant hail damage including at the local NWS office. Damages were estimated to total $500,000.
July 31, 2018	Ponderosa County (PA 5)	Hail up to the size of golf balls slammed the area around Jemez Springs and Jemez Pueblo. Flash flooding closed SR-4. Significant damage occurred to vehicles, windows, and crops. $500,000 in damages was estimated for dozens of vehicles.
June 26, 2017	Sant Fe County (PA 3)	Tennis ball size produced major damage between Glorieta and Pecos. House windows and skylights were blown out. Vehicle windshields smashed and significant damage to vehicles. Damages were estimated to total $1 million.
October 5, 2004	Socorro County (PA 5)	The City of Socorro was pounded by 5 to 10 minutes of baseball size hail with estimated terminal velocities of near 100 mph. This record hailstorm produced widespread and intense damage to automobiles, broken windows and screens as well has destroying home and commercial roofs. Damage estimates included $15 million to the New Mexico Tech campus where nearly every building was damaged, and the fleet of university vehicles was almost a total loss. County wide insurance claims had reached $40 million.
May 28, 1997	Lea County (PA 1)	By the time the storm arrived over the southern parts of town, hail up to tennis ball size was falling along with strong winds. Most of the trees over the southern 1/3 of town were stripped of their leaves, and numerous houses and cars suffered damage. Streets had hail stacked up over one foot deep in some areas. Damages were estimated to total $27 million.

The NCEI reported that lightning has caused 11 fatalities and 50 injuries in the State since 1996. As mentioned above, all Preparedness Areas consistently experience storms of LAL5 or higher. While the entire State is at risk for lightning events, some areas of the State have higher concentrations of them. Figure 6-136 shows areas of lightning flash density, indicating that Union, Curry, Roosevelt, and Lea Counties experience the greatest number of lightning flashes per square kilometers a year in New Mexico.

The two most damaging lightning events occurred in Preparedness Area 1 and 5, both of which resulted in an estimated $100,000 in property damage. The NCEI database reported that on August 8th, 2015, in Curry County, fire crews responded to lightning caused blaze at a duplex home that resulted in significant damage to the property. A lightning event on August 3rd, 2001, in Sandoval County caused significant damages to an entire pumping system on the Rio Rancho city water reservoir. The 7.5-million-gallon reservoir dropped to less than 600 thousand gallons before the pump system was restored. The lightning event that caused the greatest number of injuries in one strike was recorded in Preparedness Area 6 in Dona Ana County on August 19, 2014, when six people, including several middle school football players were injured from the initial lightning strike from a nearby thunderstorm. No fatalities occurred, but one student was in the hospital with injuries for over a week.

Figure 6-136 Cloud-to-Ground Lightning Flash Density 2016-2021



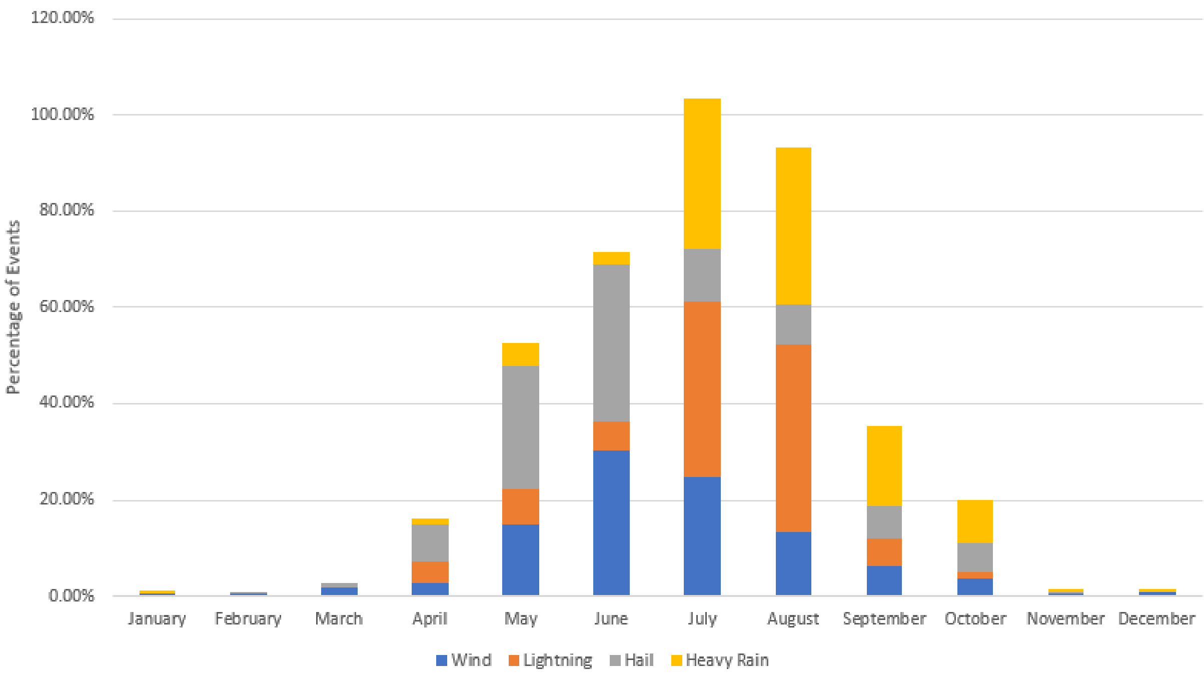
6.13.3 Past Frequency

Thunderstorm frequency is measured in terms of incidence of thunderstorm days or days on which thunderstorms are observed. Any county (or Preparedness Area) may experience 10 or more thunderstorm days per year. According to the NWS Publication, Storm Data, in the past 26 years New Mexico has experienced 119 reported events 75 mph or higher associated with thunderstorms, with a single occurrence of 104 mph winds. This means that in New Mexico winds similar to a Category One Hurricane (Saffir-Simpson Scale) are experienced on average about 5 days somewhere in the state every year.

The NCEI database reported 4,785 hail and 1,967 thunderstorm wind events in the State since 1955. Additionally, 147 heavy rain events and 69 damaging lightning events have been reported since 1996. This totals to 6,968 events over the past 67 years, some of which occur simultaneously. The NCEI reported that most events occurred in the month of July, followed by the months of August then June. Figure 6-137 below displays the distribution of events by month in the State of New Mexico.

According to the NCEI, oversized and severe hailstorms occur most frequently in May and June. Most counties across the eastern half of the State will see large hail ranging from golf ball to softball at least six to eight times during the spring and during the summer thunderstorm season. Smaller hail is much more frequent and common in all counties across the east. Counties in the central and western areas will see damaging hail at least twice each year. Lightning and heavy rain events occur most frequently in the months of July and August. These events are most likely to occur in the afternoon and evenings. Thunderstorm winds peak in the month of June, followed by July.

Figure 6-137 Percentage of Thunderstorm Events by Month



6.13.4 Climate Change Impacts

As the atmosphere warms further due to climate change, the increased heat in the atmosphere provides more energy for severe storms. The frequency of severe weather events has increased steadily over the last century. The number of weather- related disasters during the 1990s was four times that of the 1950s, and cost 14 times as much in economic losses. Historical data shows that the probability for severe weather events increases in a warmer climate. The changing hydrograph caused by climate change could have a significant impact on the intensity, duration, and frequency of storm events. A study published in the Journal of Science in November of 2014 showed the possibility of a 12% increase of lightning events for every degree of warming. All of these impacts could have significant economic consequences.

6.13.5 Probability of Future Occurrence

All Preparedness Areas in New Mexico experience severe thunderstorms producing high winds, large hail, deadly lightning, and heavy rains at some time during the year. During the spring, from April through June, storms are at a peak mainly in the eastern areas of the State. Storms become more numerous Statewide from July through August. Although the vulnerability is Statewide, those areas with a larger vulnerability to the effects include places where the population is concentrated, and buildings have not been updated to meet current building code standards.

To determine the probability of New Mexico experiencing thunderstorm occurrences, the probability or chance of occurrence was calculated based on historical data identified the NCEI database from a period of 1955 to 2022 (67 years) for hail and thunderstorm wind, and a period of 1996 to 2022 (26 years) for heavy rain and lightning. Probability was determined by using the Poisson Model to analyze the rate of exceedance. The Poisson model is the most commonly used model for the occurrence of random point events in time. This gives the percent chance of the event happening in any given year. In applying this formula, Preparedness Areas probabilities to the following hazards are identified in Table 6-99. It is important to note that all Preparedness Areas are likely to experience these events on an annual basis, but these percentages reflect the frequency of damaging or fatal thunderstorm events.

Table 6-99 Probability of Occurrence (Thunderstorm Events)

Preparedness Area	Hail	Heavy Rain	Lightning	Thunderstorm Wind
PA 1	100%	100%	61.5%	100%
PA 2	100%	26.9%	15.4%	100%
PA 3	100%	11.5%	76.9%	100%
PA 4	97%	30.8%	23.1%	100%
PA 5	100%	88.5%	80.8%	100%
PA 6	100%	100%	7.7%	100%

6.13.6 Vulnerability Assessment

Thunderstorm activity in New Mexico is consistent due to seasonal meteorological patterns and local topographical conditions. The entire State is susceptible to a full range of weather conditions, including thunderstorms, lightning, and hail. All areas of State are susceptible to thunderstorm conditions, although local topography, such as elevation and land contours, plays a significant part in how weather affects a particular area. Extreme variations in damages due to thunderstorm events across the Preparedness Areas can be attributed to differences in the concentration of population and infrastructure.

State Assets

Because thunderstorms can occur in any part of the state, all state assets are assumed to be at risk (see Table 6-7). For purposes of this analysis, the State assumed losses up to 25% of total asset value for assets at high risk of thunderstorms, 15% for assets at medium risk, and 5% for assets at low risk; risk ratings were based on the ratings in Table 6-3 Hazard Risk Rankings by Preparedness Area. Table 6-100 shows estimated losses for state assets from thunderstorms; these estimates are for planning purposes only and should not be used for insurance purposes.

Table 6-100 Potential Losses to State Assets From Thunderstorms

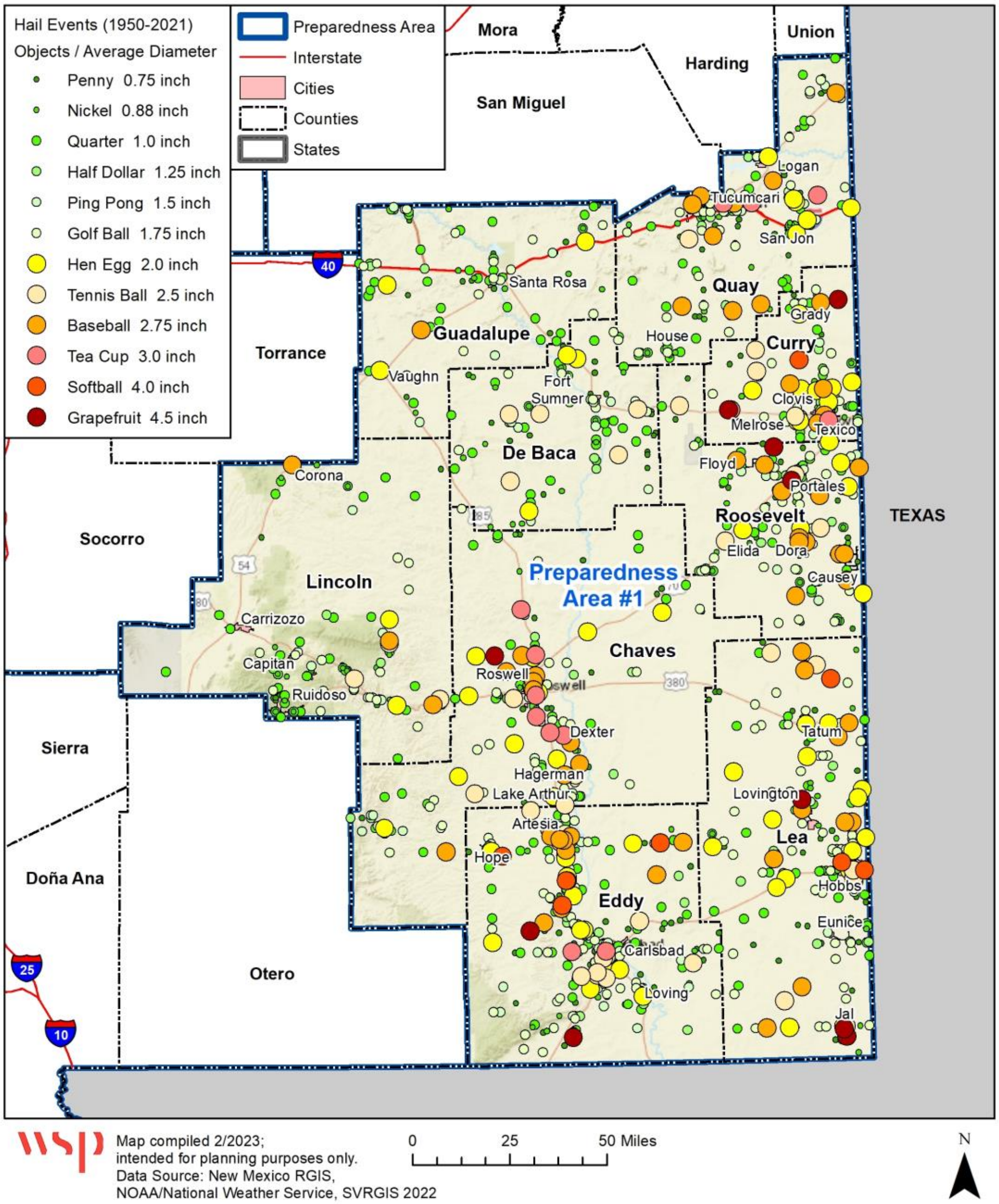
County	Preparedness Area	Total Assets	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
Bernalillo	5	6	3	2	1	$393,344,167	**$59,001,625**
Chaves	1	5	1	3	1	$48,197,000	**$12,049,250**
Cibola	4	2	-	1	1	$39,102,000	**$9,775,500**
Colfax	2	3	1	2	-	$89,310,000	**$22,327,500**
Curry	1	1	-	1	-	$933,000	**$233,250**
Dona Ana	6	2	-	2	-	$76,250,000	**$19,062,500**

County	Preparedness Area	Total Assets	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
Grant	6	1	1	-	-	$0	**$0**
Luna	6	1	-	-	1	$9,553,000	**$2,388,250**
McKinley	4	1	-	1	-	$2,807,000	**$421,050**
Rio Arriba	3	1	-	1	-	$558,985	**$83,848**
Sandoval	5	1	-	1	-	$17,085,000	**$2,562,750**
San Miguel	2	3	1	1	1	$152,965,000	**$38,241,250**
Santa Fe	3	16	-	14	2	$602,912,704	**$90,436,906**
Sierra	6	1	1	-	-	$24,528,000	**$6,132,000**
Socorro	5	1	-	1	-	$3,026,251	**$453,938**
Taos	3	1	-	1	-	$501,000	**$75,150**
Valencia	5	3	1	2	-	$148,620,000	**$22,293,000**
Total	**---**	**49**	**9**	**33**	**7**	**$1,609,693,107**	**$285,537,766**

Preparedness Area 1

The NCEI database has recorded 7 fatalities, 48 injuries, over $51.8 million in property damages, and over $6 million in crop damages in Preparedness Area 1. In total, 3,698 thunderstorm related events were recorded in this area from 1955-2022. Preparedness Area 1 has the greatest frequency of events in the state. The counties in this area are located along the eastern portion of the state, where the most frequent thunderstorm events tend to occur. Additionally, this planning area had significant documented property and crop damages due to the moderate population size and one significant event, which accounted for over half of the total damages in the area. The figure below displays the location of documented hail events in Preparedness Area 1.

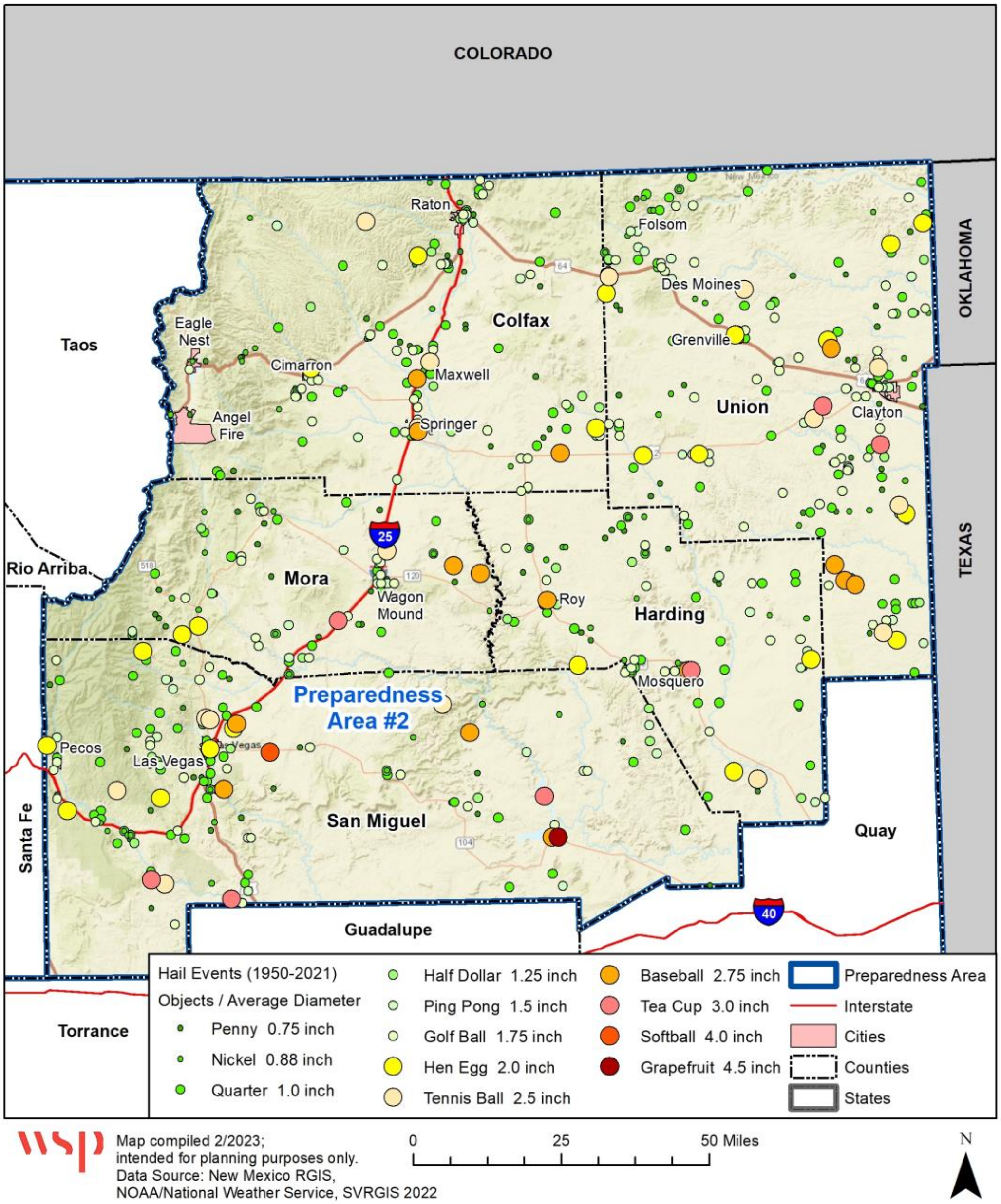
Figure 6-138 Preparedness Area 1 Historic Hail Events (1950-2021)



Preparedness Area 2

The NCEI database has recorded 1 fatality, 19 injuries, over $6.6 million in property damages, and $4,000 in crop damages in Preparedness Area 2. In total, 1,321 thunderstorm related events were recorded in this area from 1955-2022. Like Preparedness Area 1, the counites in Preparedness Area 2 are in the eastern portion of New Mexico and therefore experience a greater frequency of thunderstorm events than the rest of the state. Documented damages are much smaller here than in Preparedness Area 1 and 5 because counties in this area have smaller populations and less infrastructure to be damaged. The figure below displays the location of documented hail events in Preparedness Area 2.

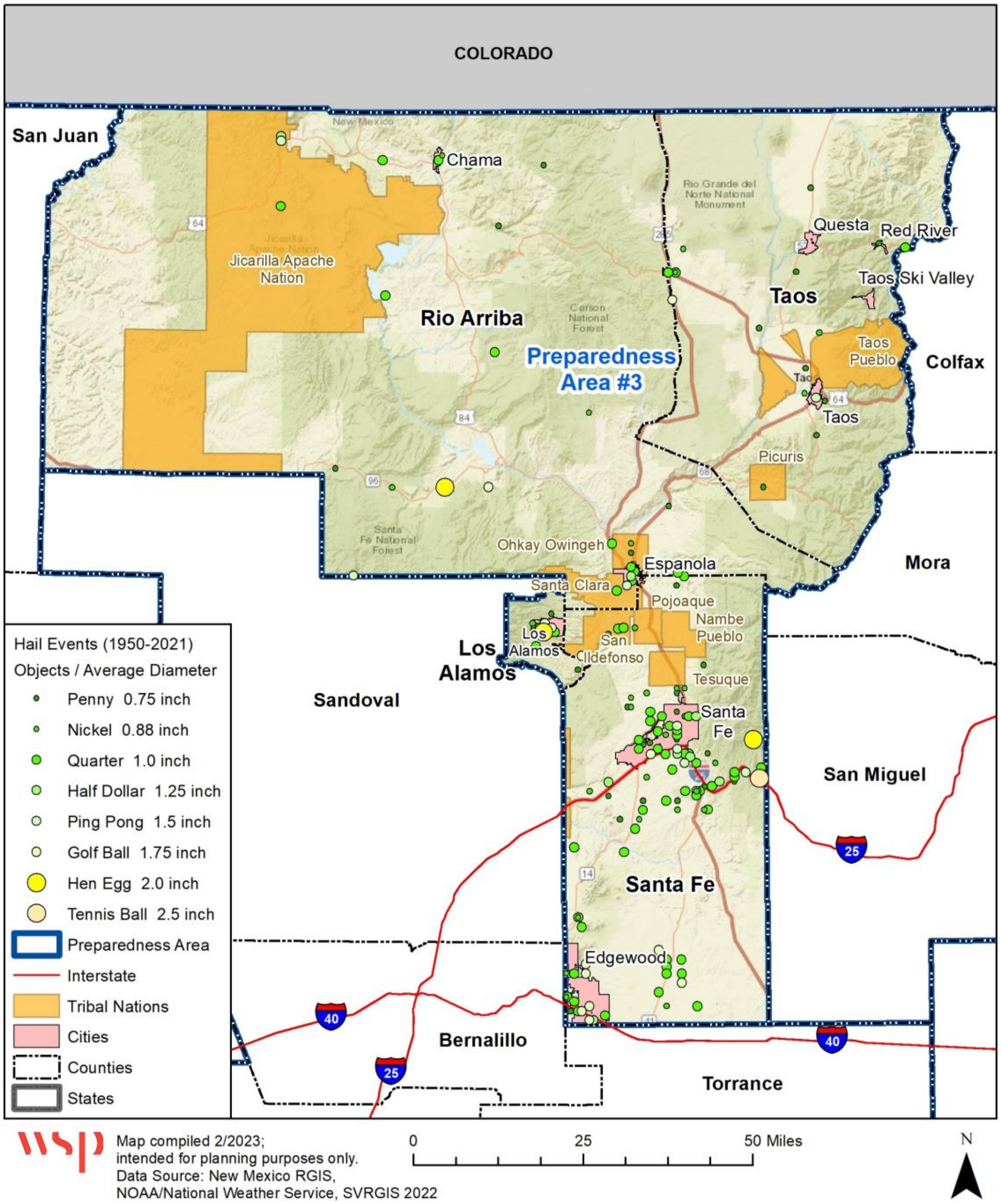
Figure 6-139 Preparedness Area 2 Historic Hail Events (1950-2021)



Preparedness Area 3

The NCEI database has recorded 3 fatalities, 12 injuries, over $9.1 million in property damages, and $600 in crop damages in Preparedness Area 3. In total, 329 thunderstorm related events were recorded in this area from 1955-2022. Preparedness Area 3 has a relatively low number of reported damages and injuries in comparison to other areas in the state. This area is located in the northern portion of the state, damaging where events are less frequent. Most of the damages recorded in this area occurred in Santa Fe County due to its dense concentration of population and infrastructure. The figure below displays the location of documented hail events in Preparedness Area 3.

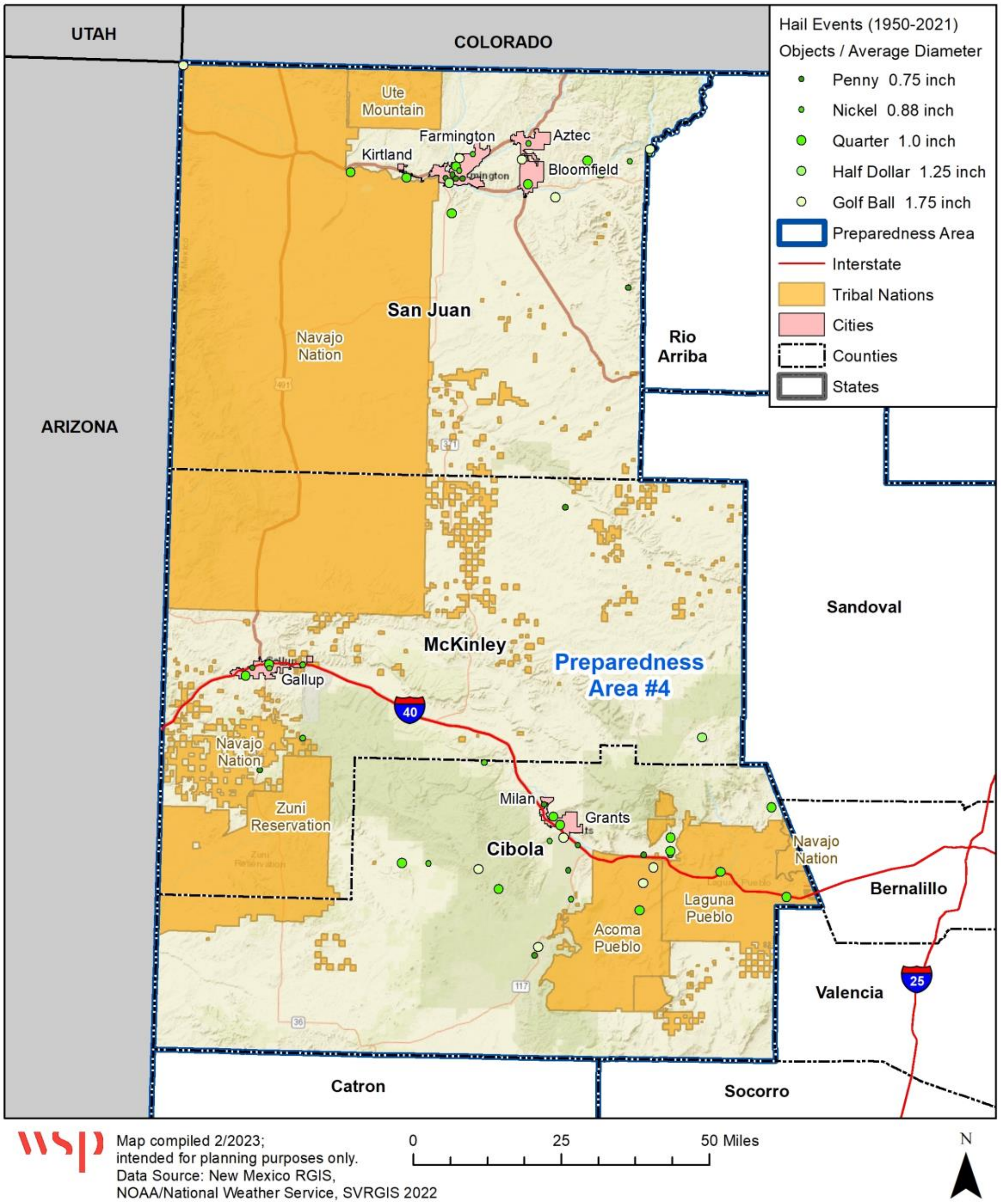
Figure 6-140 Preparedness Area 3 Historic Hail Events (1950-2021)



Preparedness Area 4

The NCEI database has recorded 2 fatalities, 13 injuries, over $1.0 million in property damages, and $1,000 in crop damages in Preparedness Area 4. In total, 149 thunderstorm related events were recorded in this area from 1955-2022. Preparedness Area 4 has the least amount of property damages due to thunderstorm wind events in the State and the least amount of total documented events. This is mainly due to the location of the area in the northwest portion of the state where events are less frequent. The figure below displays the location of documented hail events in Preparedness Area 4.

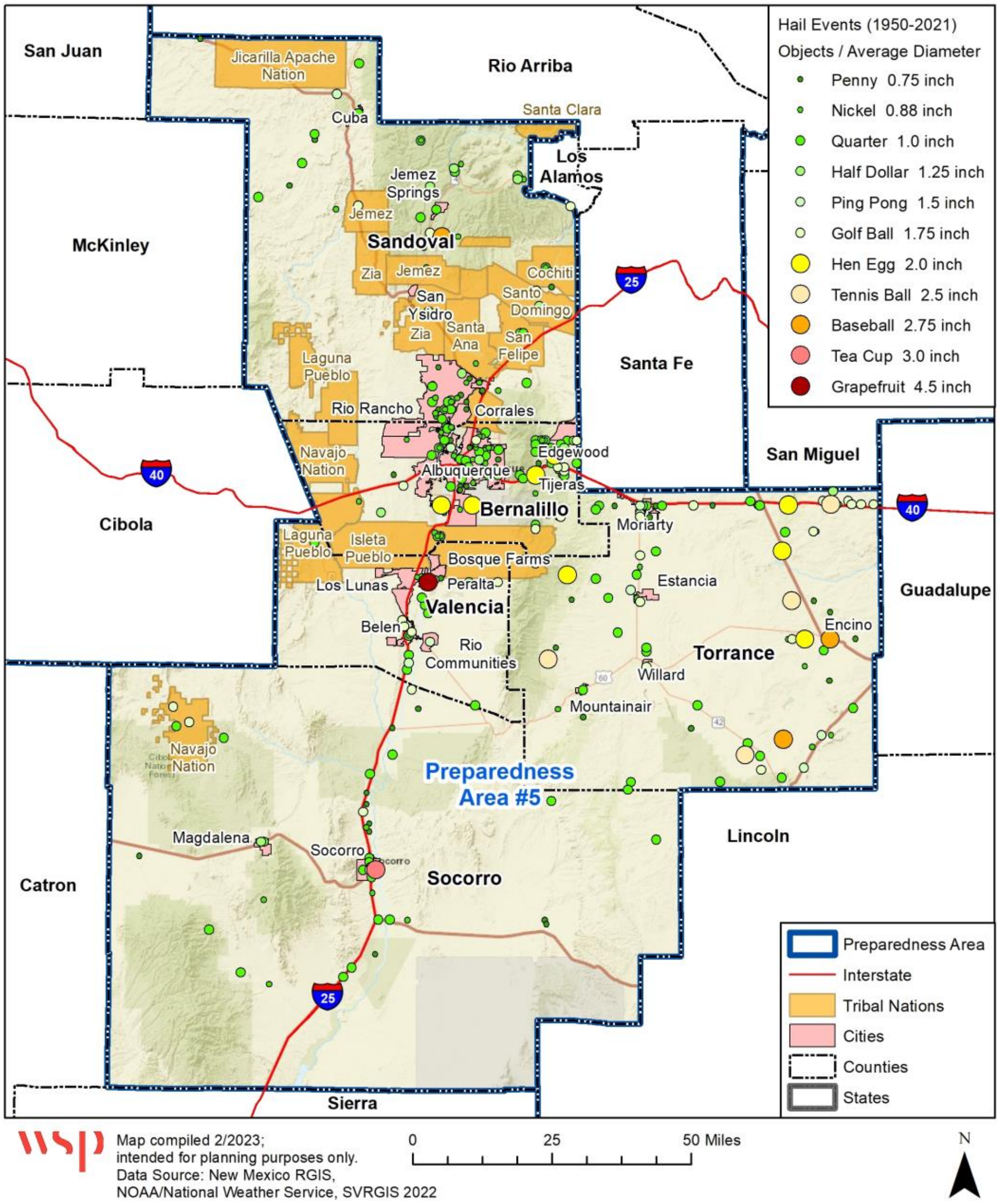
Figure 6-141 Preparedness Area 4 Historic Hail Events (1950-2021)



Preparedness Area 5

The NCEI database has recorded 3 fatalities, 58 injuries, over $62.3 million in property damages, and $476,500 in crop damages in Preparedness Area 5. In total, 723 thunderstorm related events were recorded in this area from 1955-2022. Preparedness Area 5 has the largest population in the state, concentrated in Bernalillo County. Due to this dense concentration of infrastructure and people, the damages reported in this Preparedness Area are the second most significant in the State, despite the lower number of event occurrences. This also makes the people living in this area more vulnerable to injury and death from these events, as indicated by the high number of injuries during past events. The figure below displays the location of documented hail events in Preparedness Area 5.

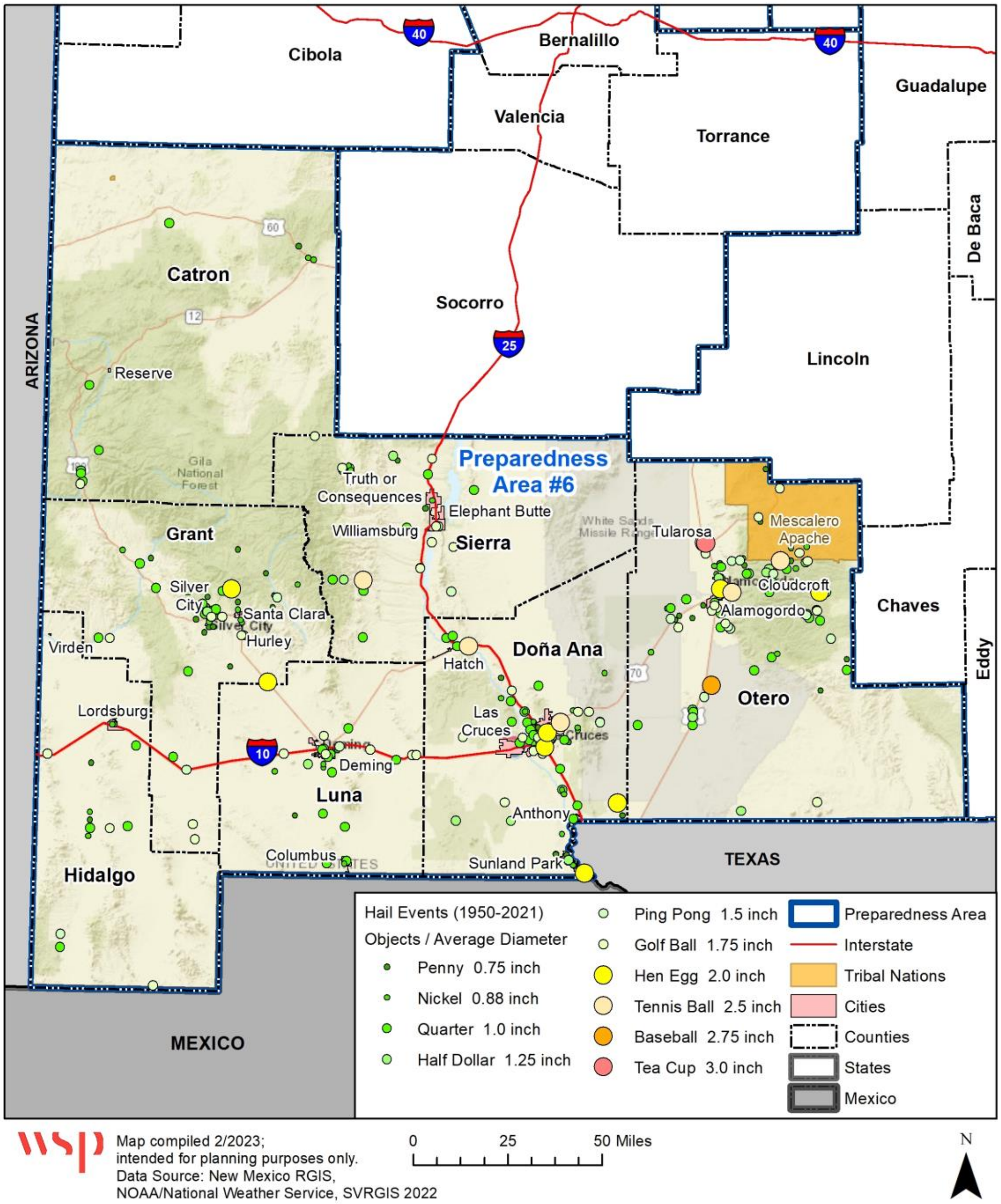
Figure 6-142 Preparedness Area 5 Historic Hail Events (1950-2021)



Preparedness Area 6

The NCEI database has recorded 2 fatalities, 11 injuries, over $23.4 million in property damages, and $777,010 in crop damages in Preparedness Area 5. In total, 748 thunderstorm related events were recorded in this area from 1955-2022. Preparedness Area 6 had the third greatest documented property damages in the State, half of which can be attributed to one event in September of 2006, when a hailstorm cause four car accidents and resulted in estimated $10 million in property damages. The figure below displays the location of documented hail events in Preparedness Area 6.

Figure 6-143 Preparedness Area 6 Historic Hail Events (1950-2021)



6.13.7 Data Limitations

Raw data is available dating back to 1955 for thunderstorm, lightning, and hailstorms in the State. Further analysis of the historical data could be accomplished for the next Mitigation Plan update.

6.13.8 What Can Be Mitigated?

One important part of mitigating thunderstorm hazards is forecasting and warning so that people can prepare. Each Preparedness Area can prepare for disruptions of utilities and transportation by advising people to stay home or to use caution if they must go out, and by recommending that people stock up on food, water, batteries, and other supplies. The National Weather Service, combined with local television stations, have an effective strategy for notifying residents about impending storms. Consistently enforcing building codes provides the greatest benefit for new construction to mitigate damages due to severe weather. For existing structures and critical facilities, follow-up inspections and retrofits provide effective mitigation. Other mitigation activities can include building code adoption and enforcement, hardening of power lines and other utilities, insulating water lines, identifying at risk populations, establishing safe rooms and shelters, ensuring backup power at critical facilities, and public education.

6.13.9 Risk Summary

Severe weather is difficult to predict precisely in pattern, frequency, and degree of severity. The impact from thunderstorm events (thunderstorms, hail, and lightning) has been moderate, with localized flooding occurring from severe thunderstorms and minor damages from lightning and moderate to heavy damage to specific locations from hail. Highly vulnerable populations include those in mobile home parks, recreational vehicles, and aged or dilapidated housing, but no area is safe. Table 6-101 identifies potential impacts from thunderstorms.

Table 6-101 Potential Thunderstorm Impacts

Subject	Potential Impacts
Agriculture	Agriculture operations are often times prone to damage by thunderstorm activity. Lightening cause fires, animal and human strikes, high winds and hail can ruin both livestock and crop production.
Health and Safety of the Public	The component elements of a thunderstorm (lightning and hail) can and have impacted the public in the State. Lightning strikes have caused hospitalizations and fatalities. Individuals struck by hail have also sustained injury.
Health and Safety of Responders	Similar to the impacts to the public, any responders who are out of doors at the time of a lightning strike or hailstorm have and can receive serious injuries. Responders are at a higher risk due to the fact that they are often outside during major events assisting the public.
Continuity of Operations	Little to no impacts anticipated, except for facilities that may be damaged or have power failures during an event.
Delivery of Services	Little to no impacts anticipated, except for facilities that may be damaged or have power failures during an event.
Property, Facilities, Infrastructure	Property, facilities, and infrastructure can be impacted by thunderstorm events. Lightning and the subsequent fires may destroy a facility or property. Heavy damage to roofs, windows and utilities components may be inflicted by hail.
Environment	Thunderstorms can cause crop or plant damages. Lightning caused fires may burn large areas.
Economic Condition	The overall economic condition is expected to be impacted only slightly.
Public Confidence	Not impacted by the event itself, but may be damaged if the response to an event is poor.

6.14 Tornadoes

Hazard	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
Tornado	Medium	Medium	Low	Low	Low	NR	Medium

6.14.1 Hazard Characteristics

A tornado is an intense rotating column of air, extending from a thunderstorm cloud system. Average winds in a tornado, although never accurately measured, are thought to range between 100 and 200 mph, but some may have winds exceeding 300 mph. The following are NWS definitions of a tornado and associated terms:

- **Tornado** – A violently rotating column of air that is touching the ground.
- **Funnel cloud** – A rapidly rotating column of air that does not touch the ground.
- **Downburst** – A strong downdraft, initiated by a thunderstorm, which induces an outburst of straight-line winds on or near the ground. They may last anywhere from a few minutes in small-scale microbursts to periods of up to 20 minutes in larger, longer macro-bursts. Wind speeds in downbursts can reach 150 mph and therefore can result in damages similar to tornado damages.

Tornadoes are classified by the degree of damage they cause. Prior to 2007, tornadoes were classified using the Fujita Scale. The Fujita Scale is used to rate the intensity of a tornado by examining the damage caused by the tornado after it has passed over a man-made structure.

Table 6-102 Fujita Tornado Damage Scale

F-Scale Number	Intensity Phrase	Wind Speed	Type of Damage
F0	Gale tornado	40-72 mph	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages signboards.
F1	Moderate tornado	73-112 mph	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant tornado	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	Severe tornado	158-206 mph	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
F4	Devastating tornado	207-260 mph	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.
F5	Incredible tornado	261-318 mph	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile sized missiles fly through the air in excess of 100 meters; trees debarked; steel reinforced concrete structures badly damaged.
F6	Inconceivable tornado	319-379 mph	These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 wind that would surround the F6 winds. Missiles, such as cars and refrigerators would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies.

On February 1, 2007, the Fujita scale was replaced by the more accurate Enhanced Fujita (EF) Scale, shown in Table 6-103. The Enhanced Fujita Scale is the scale for rating the strength of tornadoes in the United States estimated via the damage they cause. The scale has the same basic design as the original Fujita scale, six categories from zero to five representing increasing degrees of damage. It was revised to reflect better examinations of tornado damage surveys, so as to align wind speeds more closely with associated storm damage. The new scale takes into account how most structures are designed, and is thought to be a much more accurate representation of the surface wind speeds in the most violent tornadoes. Therefore, maintaining the Fujita scale is still necessary when referring to previous events.

Table 6-103 Enhanced Fujita (EF) Scale

Enhanced Fujita Category	Wind Speed (mph)	Potential Damage
EF0	65-85	**Light damage**: Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1	86-110	**Moderate damage**: Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	**Considerable damage**: Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136-165	**Severe damage**: Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	**Devastating damage:** Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	>200	**Incredible damage:** Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yd.); high-rise buildings have significant structural deformation; incredible phenomena will occur.

Tornadoes cause an average of 70 fatalities and 1,500 injuries in the U.S. each year. The strongest tornadoes have rotating winds of more than 250 mph and can be one mile wide and stay on the ground over 50 miles. Tornadoes may appear nearly transparent until dust and debris are picked up or a cloud forms within the funnel. The average tornado moves from southwest to northeast, but tornadoes have been known to move in any direction. The average forward speed is 30 mph but may vary from nearly stationary to 70 mph.

Damages from tornadoes result from extreme wind pressure and windborne debris. Because tornadoes are generally associated with severe storm systems, they are often accompanied by hail, torrential rain, and intense lightning. Depending on their intensity, tornadoes can uproot trees, bring down power lines, and destroy buildings. Flying debris is the main cause of serious injury and death. New Mexico lies along the southwestern edge of the nation's maximum frequency belt for tornadoes, often referred to as "tornado alley," which extends from the Great Plains through the central portion of the U.S. Broadly speaking, the eastern portions of New Mexico have a higher frequency of tornadoes; however, every county in the State has the potential to experience tornadoes. The publication "FEMA 320 Taking Shelter from the Storm," December 2014, presents a method whereby residents can determine their tornado risk. The majority of New Mexico is located in Wind Zone II while the western most portions of the state are located in Zone I. The FEMA publication recommends consideration for safe rooms in wind zone II while wind zone I is considered a matter or preference due to the limited risk.

Table 6-104 describes the risks associated to tornadoes for determining shelter requirements.

Table 6-104 Tornado Risk Table

		Wind Zone			
		I	II	III	IV
Tornadoes Per 3,700 Square Miles	<1	Low Risk	Low Risk	Low Risk	Moderate Risk
	1-5	Low Risk	Moderate Risk	High Risk	High Risk
	6-10	Low Risk	Moderate Risk	High Risk	High Risk
	11-15	High Risk	High Risk	High Risk	High Risk
	>15	High Risk	High Risk	High Risk	High Risk
	Low Risk		Moderate Risk		High Risk
	High-wind Shelters are a matter of homeowner preference		Shelter should be considered for protection from high winds		Shelter is the preferred method of protection from high winds

New Mexico's complex terrain favors the formation of numerous small landspouts, a weak and short-lived variation of the tornado similar to a dust devil. Landspouts may form without the presence of a strong thunderstorm.

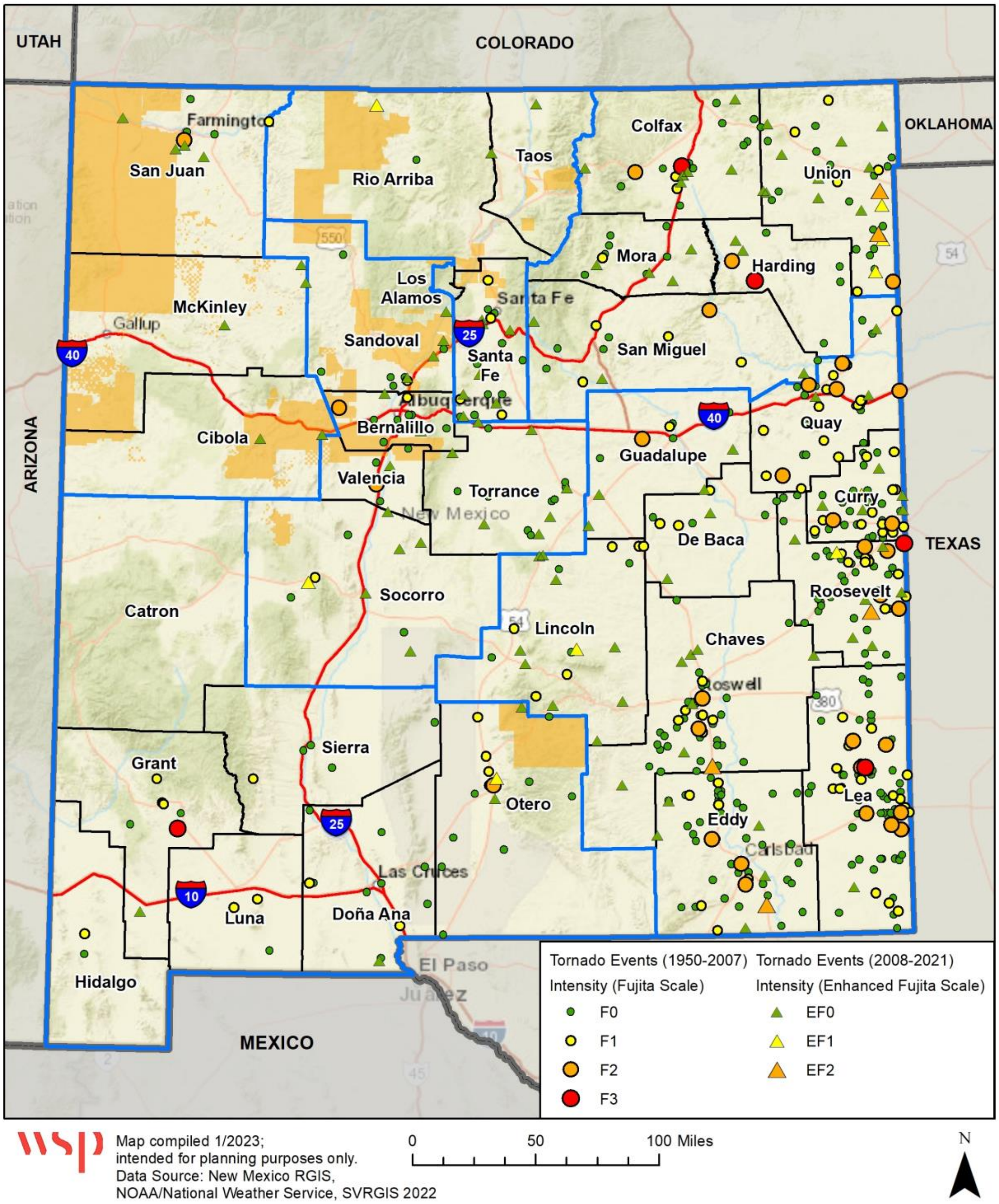
6.14.2 Previous Occurrences

Tornadoes have been verified in most New Mexico counties. The highest risk of tornadoes is in the east during April through July, but tornadoes are possible with any thunderstorm. New Mexico averages about 10 tornadoes in a year.

New Mexico experiences mostly weak, short-lived tornadoes. Strong tornadoes, while rare, are possible and occur about once every 10 years. Seventy-five (75) percent of severe storms with tornadoes occur in eastern New Mexico and are most likely to occur between April and July. However, the latest tornado fatalities in New Mexico occurred on March 23, 2007, when two people died, one near Clovis (and 33 were injured) and one in Quay County. Another fatality occurred west of Albuquerque in October 1974 and a rare winter tornado was reported southwest of Roswell in December 1997. This shows that tornadoes can be deadly at any time and nearly anywhere within the State, at both low and high elevations. No fatalities have occurred since the previous plan update, however, two tornado events in 2019 resulted in injury. Detail of these events can be found in Table 6-105 below.

Figure 6-144 illustrates past tornado activity in New Mexico as provided by the National Weather Service.

Figure 6-144 New Mexico Tornado Events by Magnitude, 1950 to 2021



The NCEI database reports a total 644 tornado events in New Mexico from 1950 through 2022. These events resulted in five deaths, 163 injuries, $65,501,180 million in property damage, and $260,000 thousand in crop damage.

Table 6-105 briefly explains the most significant tornado events that have occurred in the State of New Mexico. The location of the event is identified by both the city and county and Preparedness Area. Source information is from the NCEI and data provided by local authorities.

Table 6-105 Significant Tornado Occurrences in New Mexico

Date	Location	Significant Event
March 13, 2020	Otero County (PA 6)	A EF0 tornado touched down in Otero County in March of 2020. At least six homes sustained damage, mainly associated with their roofs. The tornado likely lifted and then touched back down on the north end of the community where it did its most significant damage to a home. It removed the homes back porch, lifted a large section of the roof, and spread the debris in a 120-degree swath downwind. Damages were estimated to total $25,000.
December 27, 2019	Curry County (PA 1)	Three large power transmission poles were snapped and toppled to the ground, no less than three center pivot irrigation sections were flipped over or destroyed, several sections of range land fencing were damaged, and dozens of small yucca plants were uprooted. The tornado missed a nearby residence by only 300 yards and barely missed the nearby Palla West Dairy. Damage amounts are estimated for utility and property losses at $300,000.
June 04, 2019	Otero County (PA 6)	Storm survey showed a mobile home was completely destroyed with 3 other residences receiving moderate damage due mainly to flying debris. Several outbuildings including sheds and barns were either completely destroyed or heavily damaged. One outbuilding was shifted off its foundation and moved approximately 9 feet north. A metal silo used for storage was lifted off its foundation and traveled airborne for approximately 400 feet before striking one of the residential structures. One injury was reported and $250,000 was estimated in property damages.
May 26, 2019	Roosevelt County (PA 1)	A spectacular wedge tornado developed near Dora during a violent supercell thunderstorm event. The tornado lasted nearly 30 minutes and tracked about 10 miles over predominately rural ranch/farmland in southern Roosevelt County. No injuries were reported. Two known properties were impacted: one 4 miles southeast of Dora and another approximately 5 miles east-northeast of Dora. Additionally, considerable damage to electrical infrastructure was noted including ten consecutive power poles snapped several feet above the ground 1-2 miles east of Rogers on the north side of NM 237. Damages were estimated to total $2,000,000.
March 12, 2019	Eddy and Chaves County (PA 1)	Just before 6 pm MDT on Tuesday, March 12, 2019, a tornado touched down in Chaves County, about 15 miles south southwest of Dexter. The tornado moved north northeast for approximately 15 minutes before dissipating about one half mile northeast of the community of Dexter. Six people suffered minor injuries, and six homes were substantially damaged or completely destroyed. An additional dozen homes and structures also sustained minor to moderate damage. $2,000,000 were reported in estimated damages. At nearly the same time in Eddy County, a second tornado touched down west of U.S. Highway 285, approximately two to three miles south of Malaga and progressed northeast. Approximately ten power poles that were damaged to some degree as the tornado crossed Highway 285. The observed damage is

Date	Location	Significant Event
		consistent with damage of an EF2 tornado, with winds estimated at approximately 112 mph. The cost of damage is a very rough estimate. $20,000 in estimated damages were reported.
August 09, 2018	Colfax County (PA 2)	A tornado produced a narrow swath of damage near Eagle Nest. The tornado crossed U.S. 64 very near Elk Lane Rd. Approximately 180 feet of barbed wire/picket fence was downed and damaged. Several steel t-posts were sheared or bent nearly 90-degrees. All 10 units that comprise the Pepper Sauce Camp property suffered damage. All but two of sixteen west-facing windows were partially or completely destroyed by flying debris. The front windshield of an old Chevrolet C65 truck was struck no less than 75 times by flying debris. An old hay barn was collapsed and roofing material found 300 feet away. An unoccupied fifth wheel recreational vehicle with an estimated weight of 12,000 pounds was partially lifted, shifted, and rolled on its side at the Eagle Nest Campground. Two other RVs sustained damage to include busted windows, including a Class A diesel pusher (dry weight 32,000 pounds) that was oriented nearly perpendicular to the tornado`s path. Damage amounts have been estimated to total $300,000.
May 09, 2017	Torrance County, Santa Fe County, Lincoln County, Mora County (PAs 1, 2, 3, 5	A potent upper level low pressure system moving slowly east across the desert southwest for several days combined with abundant moisture and instability on the 9th to generate a widespread, significant severe weather outbreak over central and eastern New Mexico. Isolated thunderstorms developed shortly after midnight in the area from Santa Fe to Farmington and produced quarter size hail with heavy rain and strong winds. A large area of showers and thunderstorms developed shortly after sunrise over central New Mexico and moved north across the Albuquerque and Santa Fe metro areas through the early afternoon. Several funnel clouds and large hail were reported around the Estancia Valley. A brief tornado develops near the Santa Fe airport shortly after noon with minor damage reported. A major hailstorm struck the Interstate 25 corridor near Kewa Pueblo, resulting in damage to homes and vehicles. The next wave of storms that developed over central New Mexico produced tornadoes near Carrizozo, Clines Corners, and Wagon Mound. Large hail up to the size of golf balls was also reported with these storms. More storms firing up around the Albuquerque metro area produced nickel to quarter size hail from Rio Rancho north into the Jemez Mountains. Severe thunderstorms continued to pound eastern New Mexico well into the evening hours with golf ball to hen egg size hail producing damage in areas around Roswell and Tucumcari.
August 13, 2016	Union County (PA 2)	A back door cold front surged southwest across New Mexico and interacted with a very rich plume of monsoon moisture surging northward into the State. A strong thunderstorm around Ojo Encino produced a brief landspout tornado. This tornado captured lots of attention at a nearby baseball field. Another tornado was reported near Capulin on a distant mesa. No damage was reported from either storm. A funnel cloud was also spotted near Ocate. The most impactful thunderstorm of the day occurred along Interstate 40 near San Fidel. Several inches of penny size hail accumulated on the interstate. Brief rope tornado touched down on a distant mesa near Capulin Volcano National Monument.
July 07, 2015	Rio Arriba County, Sante Fe County, San Juan County, Torrance County (PAs 3, 4, and 5)	Monsoon moisture firmly in place over New Mexico focused another round of very heavy rainfall and severe thunderstorms. Storms with torrential rainfall and strong winds erupted over the State. A storm that developed around Shiprock moved northeast over La Plata and produced flash flooding along U.S. 170. Law enforcement reported that 12 inches of water was flowing over the roadway. A thunderstorm that moved southeast along two colliding outflow boundaries near Edgewood produced a brief tornado. A metal barn for storing hay was tossed a

Date	Location	Significant Event
		quarter mile and slammed into a house where a woman was injured by flying glass. This same storm also produced quarter size hail.
October 21, 2010	Roswell, NM (PA 1)	Tornado tracked just north of Roswell.
May 23, 2010	Union County (PA 2)	Swarm of tornadoes tracked through Union County.
October 11, 2009	Stanley, NM (Santa Fe County) (PA 3)	Two miles east of Stanley a tornado touched down (Santa Fe County) causing $12K in damage it registered as a F0. There were no injuries or deaths.
July 13, 2009	Tres Piedras, NM (Taos County) (PA 3)	Two miles south of Tres Piedras a tornado touched down (Taos County) causing $10K in damage; it registered as a F0. There were no injuries or deaths.
March 23, 2007	Clovis, Logan, Lovington, Arch, Rogers, Portales, and McDonald, NM (PA 1)	Widespread severe weather ignited over much of the eastern plains. Large hail was reported at several locations, stretching from southeast New Mexico to central Kansas. In addition, 13 tornadoes where observed across the eastern plains of New Mexico. The two tornadoes that provided the most significant damage in eastern New Mexico were located at Logan and Clovis. The Logan tornado created damage that fit within the EF0 to EF1 range on the enhanced Fujita scale. Meanwhile, the damage in Clovis was rated to fit within the EF0 to EF2 range. "The Logan tornado created an intermittent three-mile damage track. The heaviest damage was noted on the south end of 4th Street, from Lake Drive north for approximately five blocks. RVs and trailers sustained the most significant damage in the Logan area. The Clovis tornado also created an intermittent three-mile damage track, with the most significant damage noted in the southern and northern sections of the city. Preliminary, estimated maximum winds for this particular tornado ranged from 120 to 125 mph. Mobile homes were destroyed, trees knocked down, power poles snapped, and roofs of substantial buildings and homes heavily damaged or blown off. Other verified tornadoes were reported 16 miles north/northwest of Lovington, 10 miles north of McDonald, seven miles northwest of Tatum, 12 miles north of Tatum, three miles north of Crossroads, one mile south of Milnesand, two miles north of Arch, Rogers, 10 miles northeast of Portales, 10 miles east/southeast of Lakewood, and 15 miles east of Lakewood." The damages (493 structures in Clovis and 97 in Logan) two fatalities and 35 injuries, led to a State Declaration of disaster for Quay, Curry and Roosevelt counties. On April 2, 2007, the president declared disaster 1690, at that time damages were approximately $20 million. Figure 6-145 shows damage from the Clovis tornado.107F
June 4, 2003	Portales, NM (PA 1)	Damage from brief tornado reported east side of Portales. A small thunderstorm that formed over south central San Miguel County at midafternoon moved eastward into northwest Quay County where it intensified. Near Tucumcari, the storm developed strong meso-cyclone radar signatures. A front continued east and northeast towards San Jon and Logan while the core of the storm headed southeast of Tucumcari. The storm then spread southward into western Curry County and continued through north central and southeast Roosevelt County with frequent reports of large hail and a number of brief tornado and funnel cloud sightings. Reported damages: $20,000.
May 28, 1997	Hobbs, NM (PA 1)	Damage occurred just west of the Hobbs City. The damage included a 15x20 ft. wooden roof taken off an old shed, parts of two other roofs damaged, an awning from a trailer destroyed, a trailer pushed 3-4 feet off its foundation, and two utility poles downed. The tornado was sighted, and a faint trail of it could be traced in the debris pattern upon inspection. Over $20 thousand in damages were reported.

Date	Location	Significant Event
May 6, 1997	Hobbs, NM (PA 1)	A strong meso-cyclone on the leading edge of the severe thunderstorm moving to the southeast produced a tornado on the southeast flank of the storm. Tornadoes ranged from F0 on the southern end to F1 damage in the heart of the tornado path. Damage included travel trailers overturned, mobile homes pushed from foundation and roof sections missing, and a barn was leveled. Approximately $60 thousand in damages were reported.
July 25, 1996	Cimarron, NM (Colfax County) (PA 2)	An F2 tornado destroyed 11 homes and seven businesses in Cimarron. Another 43 structures were damaged. Among the building destroyed was the Post Office, which was sliced by the air-borne frame of a mobile home. Of the five injuries, two were serious, requiring hospitalization. All injuries occurred in mobile homes or portable buildings without permanent foundations. The tornado developed as convection moved over a horizontal shear axis created by southeast surface winds and northwest winds aloft above the foothills located just northwest of Cimarron. Reported damages approached $2 million. 108F

New Mexico has not had a Federal Disaster Declaration for tornadoes. The Governor issued a State Disaster Declaration for the March 23, 2007 Clovis tornado described above.

Figure 6-145 Clovis Tornado Damage

Below, Table 6-106 totals the impacts of past tornado events in New Mexico by Preparedness Area. Magnitude has been updated to represent the Enhanced Fujita Scale. Preparedness Area 1 experienced 60% of tornado events and 90% or tornado damages in the State.

Table 6-106 Tornado History by Preparedness Area, July 1950 to December 2022

Preparedness Area	# of Events	Magnitude	Deaths	Injuries	Property Damage	Crop Damage
1	389	EF0 - EF3	2	99	$54,943,170	$260,000
2	102	EF0 - EF3	1	51	$3,213,210	$0
3	31	EFO - EF1	0	1	$552,280	$0
4	16	EF0 - EF2	1	3	$275,000	$0
5	56	EF0 - EF2	1	8	$831,930	$0
6	50	EF0 - EF3	0	0	$1,365,590	$0
Statewide	**644**	**EF0 - EF3**	**5**	**162**	**$61,181,180**	**$260,000**

6.14.3 Past Frequency

The complex terrain in New Mexico to the high mountains across the northern and western regions, creates weather regimes that change quickly over relatively short distances. Highway travelers, especially truckers, hit by strong gusts of wind that can make driving hazardous. New Mexico experiences mostly weak, short-lived tornadoes. Strong tornadoes, while rare, are possible and occur about once every 10 years.

Based on the data collected by the National Weather Service – Albuquerque, tornado frequency is seen most in the May and June time frame. This is consistent with the NWS' assessment in that:

- During the spring, from April through June, storms are at a peak mainly in the eastern areas of the State. Storms become more numerous Statewide from July through August.
- Tornadoes have been verified in most New Mexico counties. The highest risk of tornadoes is in the east during April through July, but tornadoes are possible with any thunderstorm. New Mexico averages about 10 tornadoes in a year.

6.14.4 Climate Change Impacts

Ongoing research compiled in the recent climate assessment has resulted in different conclusions on the effect of climate change on wind regimes. The August 2021 IPCC report argues that in most places, wind speeds will be drastically reduced because of climate change, whereas in 2019, Scientific American reported that winds across the world were speeding up. Unusual wind patterns combined with other climate change issues, such as hotter water temperatures, can also cause problems. At this time, these changing factors are not well understood and are still being incorporated into state and regional research and risk analysis (Garrison 2022).

6.14.5 Probability of Future Occurrence

To determine the probability of each Preparedness Area experiencing future tornado occurrences, the probability or chance of occurrence was calculated based on historical data identified in the NCEI from a period of July 1950 to December 2022 (72 years). Probability was determined by dividing the number of events observed by the number of years and multiplying by 100. This gives the percent chance of the event happening in any given year. Table 6-107 provides the probability of each Preparedness Area experiencing a tornado event in any given year, indicating that Preparedness Area 1 and 2 are likely to experience at least one tornado every year.

Table 6-107 Probability of Tornado Occurrences

Preparedness Area	Tornado
PA 1	100%
PA 2	100%
PA 3	42.5%
PA 4	21.9%
PA 5	76.7%
PA 6	68.5%

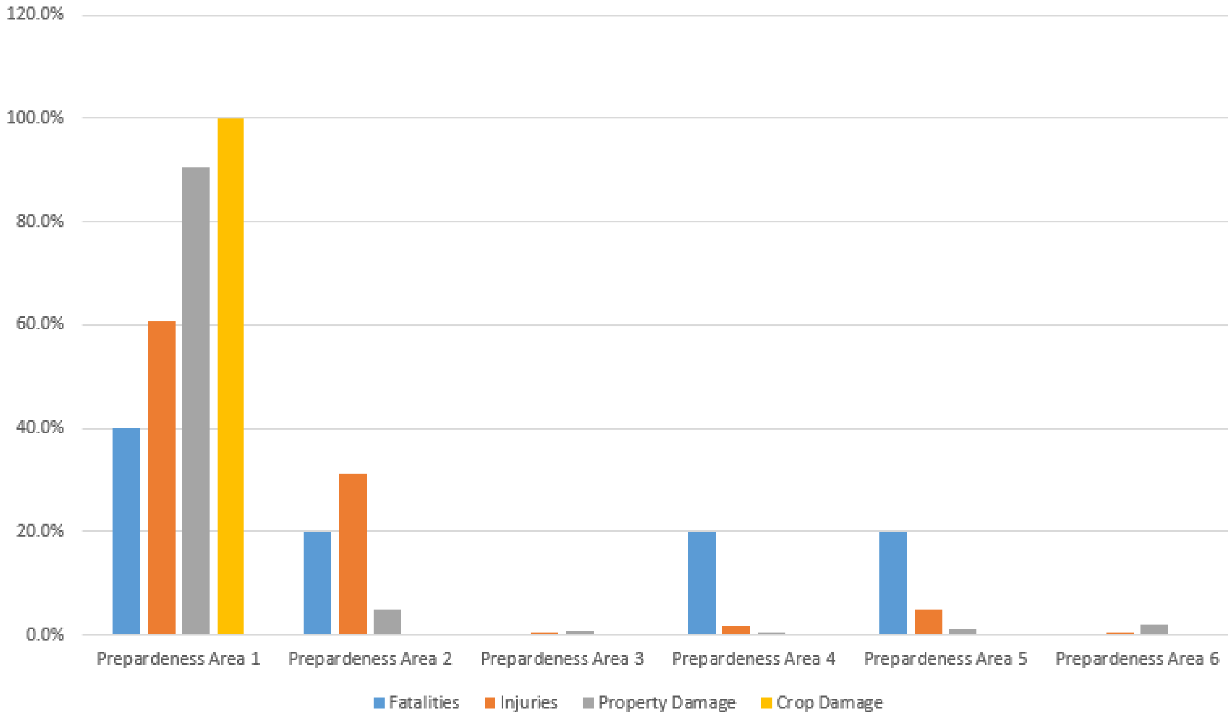
6.14.6 Vulnerability Assessment

Based on the assessment from data collected in Table 6-107 above, Preparedness Area 1 and 2 have the greatest risk of experiencing a tornado in any given year. On average, Preparedness Area 1 is likely to experience 5 tornadoes per year, and Preparedness Area 2 is likely to experience 1 to 2 tornadoes per year. Preparedness Area 5 and 6's risk of experiencing a tornado event in any given year is greater than those in the Preparedness Areas 3 and 4. For those Preparedness Areas with the greatest risk, assessments should be taken in consideration and determine what mitigation actions are appropriate for that location. Risks for consideration include manufactured homes that are not adequately anchored are the most vulnerable structures for damage from tornado events. Other risks for consideration include:

- **Environmental Risks**: Tornadoes pose several risks to the environment. The potential for property damage and disruption of vital, natural resources as a result of a tornado is often very high and increases in proportion to the strength of the storm. Tornadoes produce winds that are strong enough to destroy whole towns. These storms can damage water treatment facilities, block roadways, and destroy animal habitats.
- **Biological Risks**: Tornadoes also pose great risks to living things. The most powerful tornadoes are capable of killing hundreds of people. People are not only killed by the strong winds, flooding and debris, but also by fires, exposure to the elements and loss of electricity. Endangered animals and plants in national parks and forests are also killed during tornadoes.

The figure below displays the percentage of losses by Preparedness Area in the state. Vulnerability by Preparedness area is described below.

Figure 6-146 Percentage of Losses from Tornados by Category and Preparedness Area



State Assets

Because tornadoes can occur in any part of the state, all state assets are assumed to be at risk (see Table 6-7). For purposes of this analysis, the State assumed losses up to 25% of total asset value for assets at high risk of tornadoes, 15% for assets at medium risk, and 5% for assets at low risk; risk ratings were based on the ratings in Table 6-3 Hazard Risk Rankings by Preparedness Area. Table 6-100 shows estimated losses for state assets from tornadoes; these estimates are for planning purposes only and should not be used for insurance purposes.

Table 6-108 Potential Losses to State Assets From Tornadoes

County	Preparedness Area	Total Assets	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
Bernalillo	5	6	3	2	1	$393,344,167	**$59,001,625**
Chaves	1	5	1	3	1	$48,197,000	**$12,049,250**
Cibola	4	2	-	1	1	$39,102,000	**$9,775,500**
Colfax	2	3	1	2	-	$89,310,000	**$22,327,500**
Curry	1	1	-	1	-	$933,000	**$233,250**
Dona Ana	6	2	-	2	-	$76,250,000	**$19,062,500**
Grant	6	1	1	-	-	$0	**$0**
Luna	6	1	-	-	1	$9,553,000	**$2,388,250**

County	Preparedness Area	Total Assets	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
McKinley	4	1	-	1	-	$2,807,000	**$421,050**
Rio Arriba	3	1	-	1	-	$558,985	**$83,848**
Sandoval	5	1	-	1	-	$17,085,000	**$2,562,750**
San Miguel	2	3	1	1	1	$152,965,000	**$38,241,250**
Santa Fe	3	16	-	14	2	$602,912,704	**$90,436,906**
Sierra	6	1	1	-	-	$24,528,000	**$6,132,000**
Socorro	5	1	-	1	-	$3,026,251	**$453,938**
Taos	3	1	-	1	-	$501,000	**$75,150**
Valencia	5	3	1	2	-	$148,620,000	**$22,293,000**
Total	**---**	**49**	**9**	**33**	**7**	**$1,609,693,107**	**$285,537,766**

Preparedness Area 1

While all six preparedness areas are vulnerable to tornadoes, Preparedness Area 1 accounts for the greatest losses in all four categories (fatalities, injuries, property damage, and crop damage). The most damaging tornado event in preparedness Area 1 occurred in Curry County on March 23rd, 2007, and accounted for 2 deaths, 33 injuries, and an estimated $16,500,000 in property damages. The greatest frequency of events occurred in Lea County. Figure 6-147 displays tornado events by magnitude.

Figure 6-147 Frequency of Tornado Events in Preparedness Area 1 by County

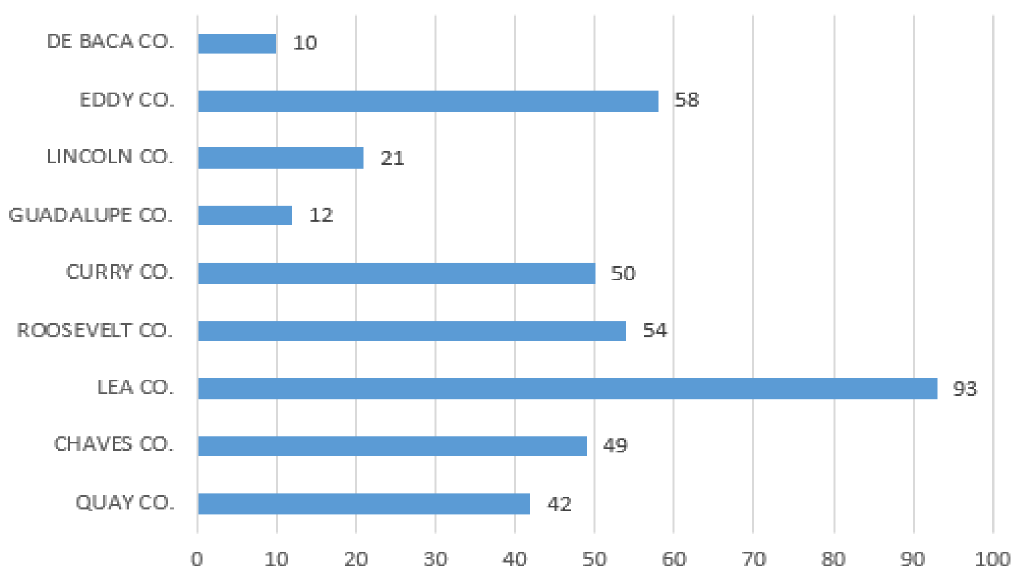
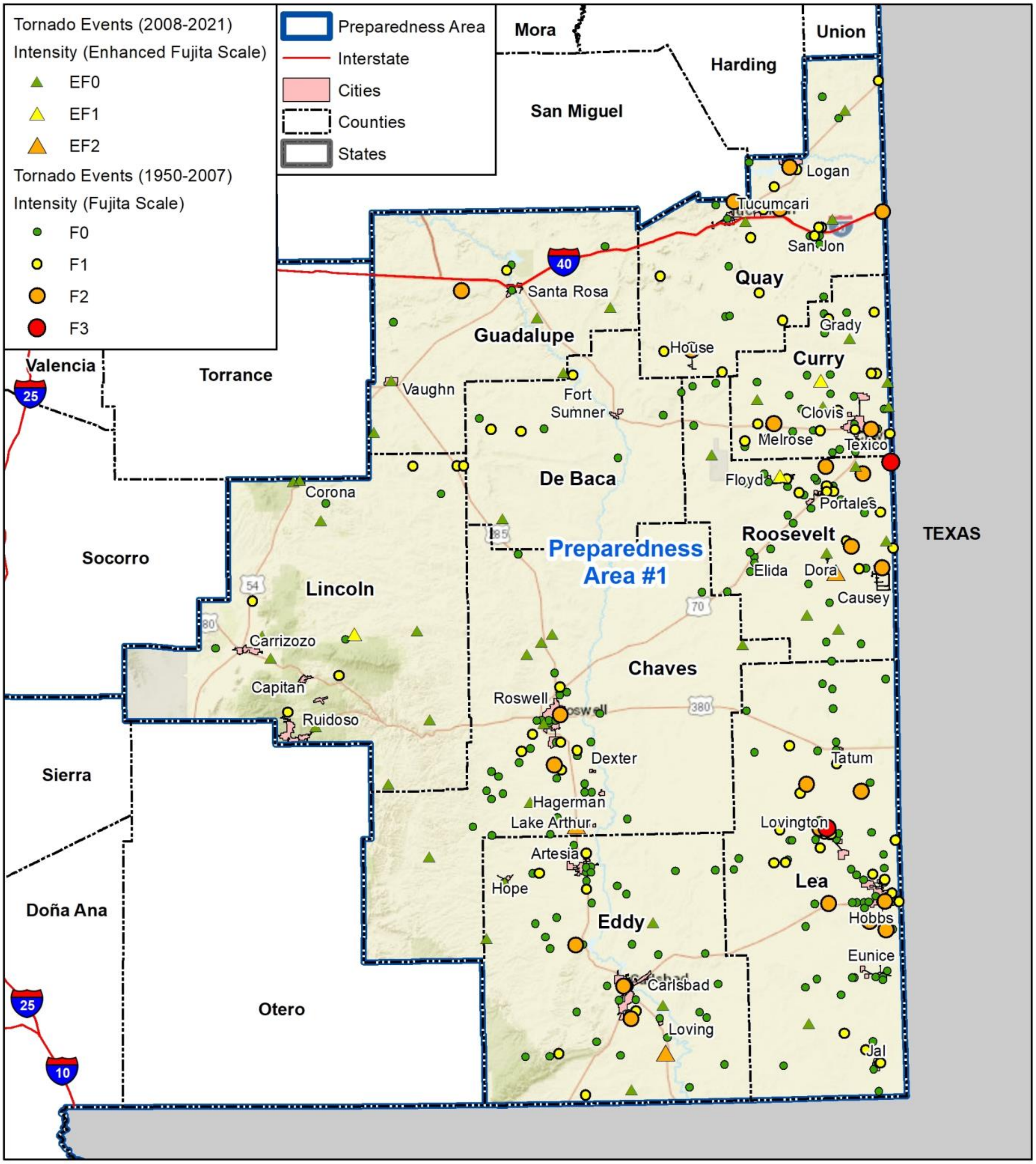


Figure 6-148 Preparedness Area 1 Tornado Events by Magnitude



Map compiled 2/2023;
intended for planning purposes only.
Data Source: New Mexico RGIS,
NOAA/National Weather Service, SVRGIS 2022

0 25 50 Miles

N

Preparedness Area 2

Preparedness Area 2, also located in the eastern portion of the state, accounts for the second greatest losses. The most damaging tornado event in preparedness Area 2 occurred in Colfax County on July 25th, 1996. The NCEI reported that an F2 tornado destroyed 11 homes and 7 business in Cimarron. Another 43 structures were damaged. Among the building destroyed was the Post Office which was sliced by the air-borne frame of a mobile home. Of the 5 injuries, 2 were serious, requiring hospitalization. The estimated losses totaled $1,680,000. Union County experiences the most frequent tornado events. Figure 6-150 displays tornado events by magnitude in the Preparedness Area.

Figure 6-149 Frequency of Tornado Events in Preparedness Area 2 by County

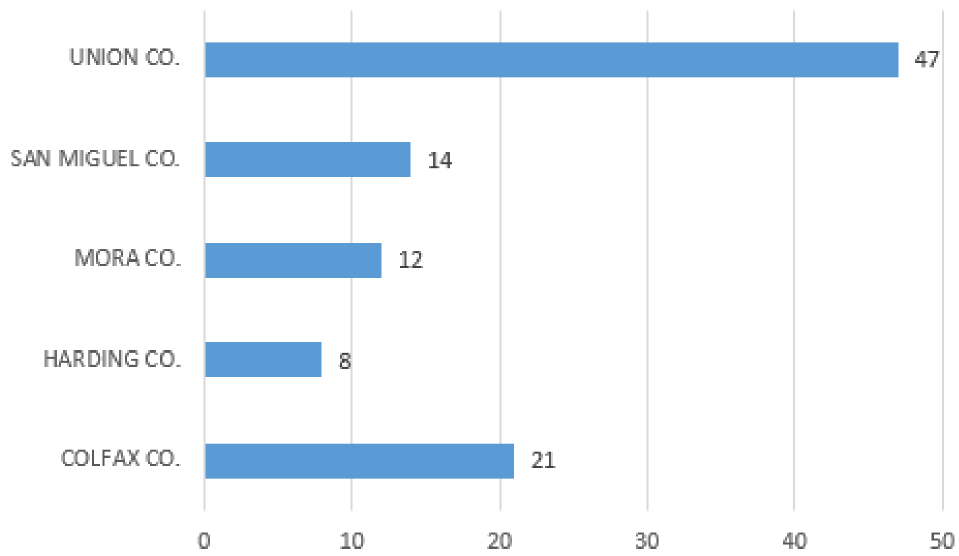
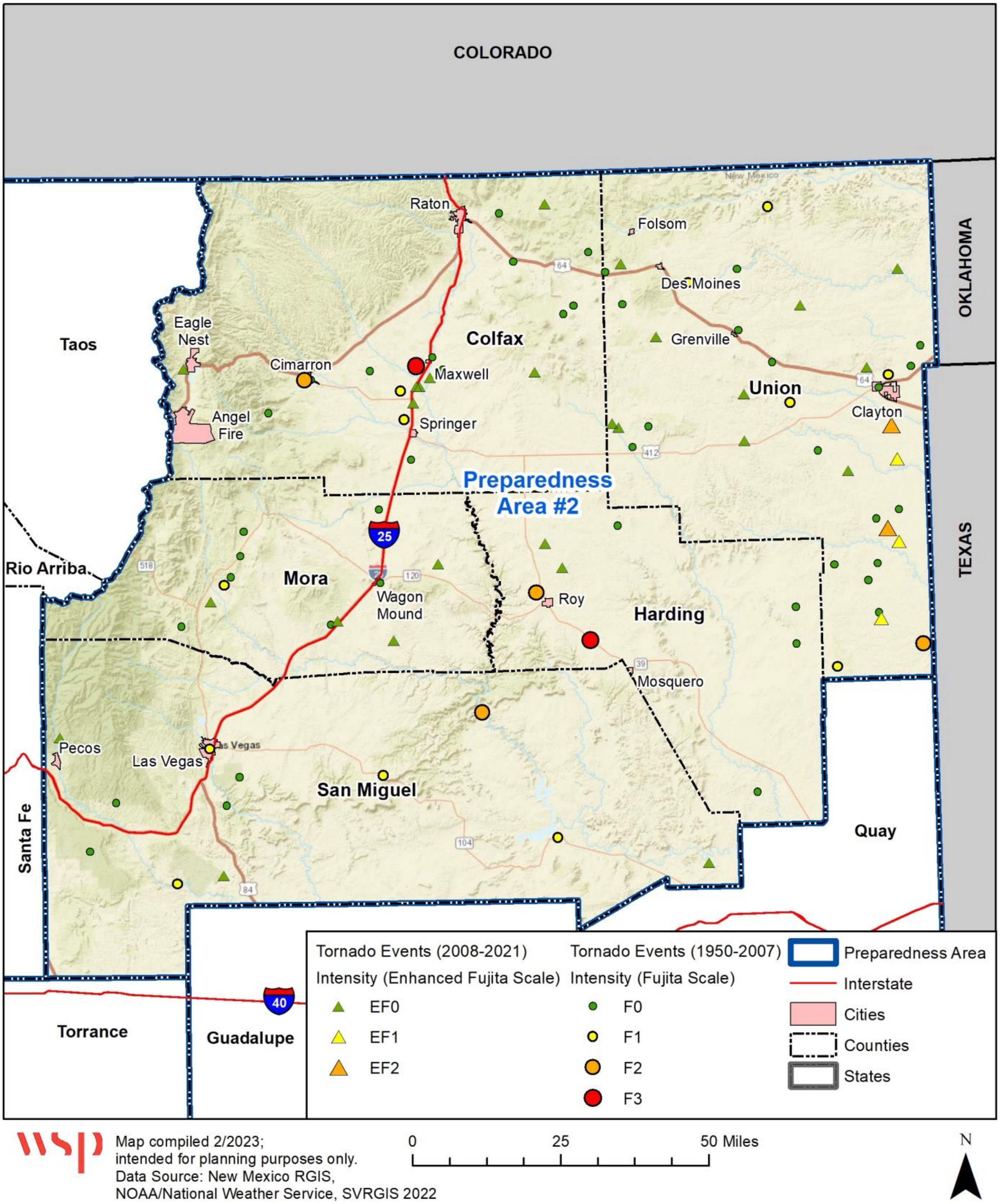


Figure 6-150 Preparedness Area 2 Tornado Events by Magnitude



Preparedness Area 3

Preparedness Area 3 experiences less frequent and severe tornadoes than most other Preparedness Areas in the State. With only 31 previously reported events, these counties are less likely to experience damages than most others in the State. Los Alamos County has no documented tornados in the past, and Santa Fe County has experienced the most frequently documented tornado events. The most damaging tornado event recorded in the Preparedness Area occurred on December 26th, 1966, in Santa Fe County when an F1 tornado resulted in an estimated $250,000 in property damage. Figure 6-152 displays tornado events by magnitude in the Preparedness Area.

Figure 6-151 Frequency of Tornado Events in Preparedness Area 3 by County

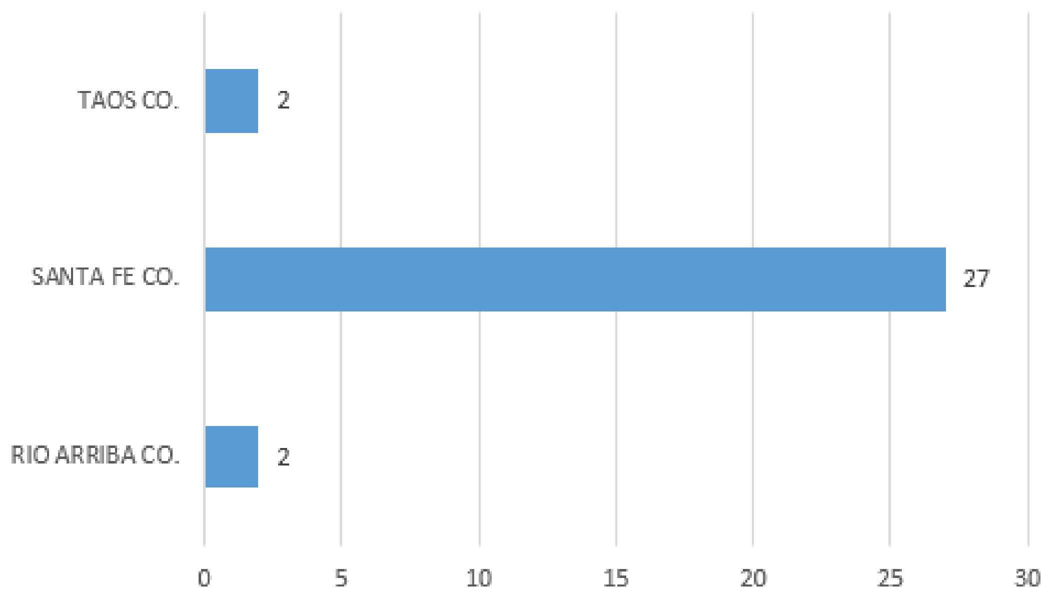
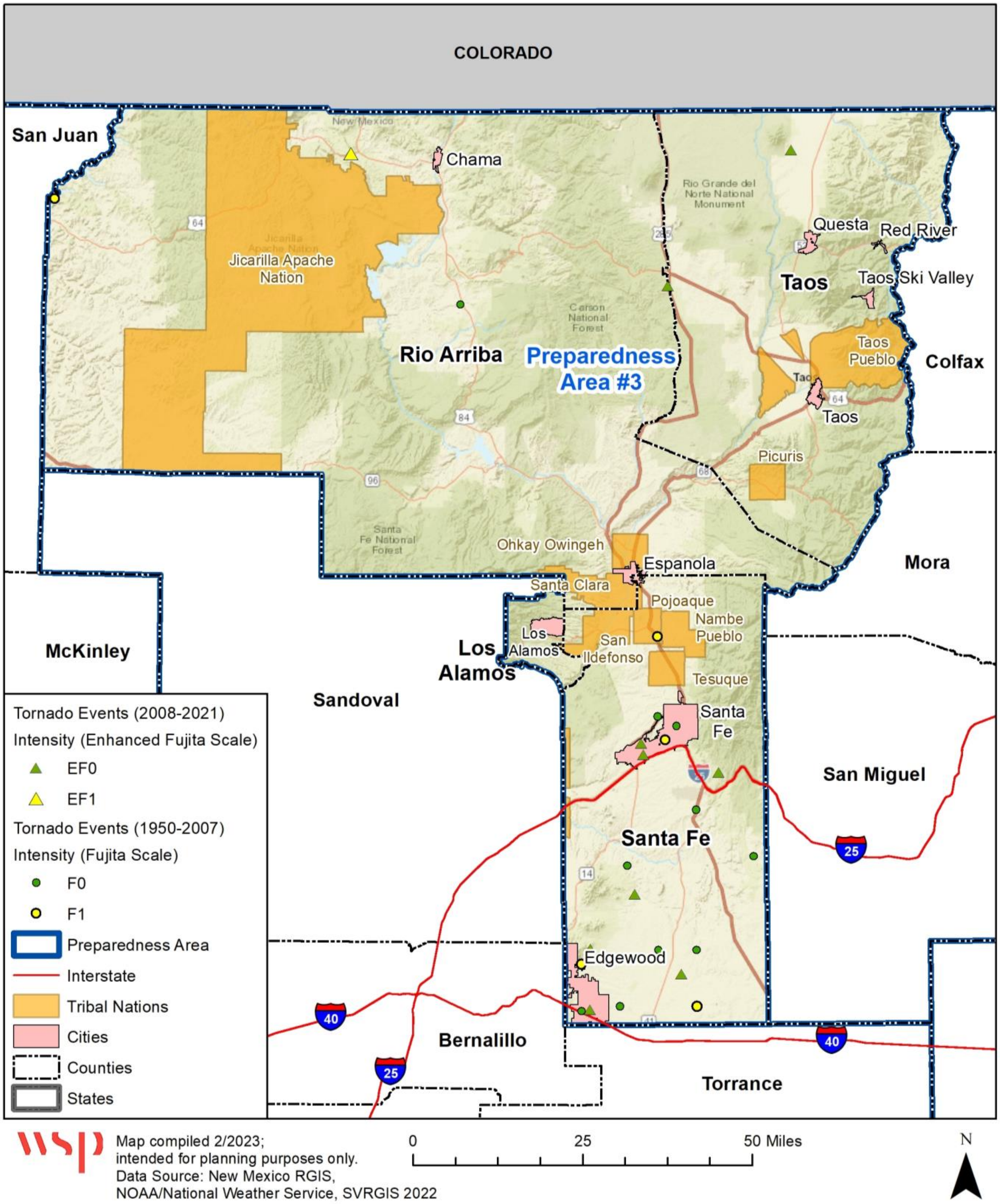


Figure 6-152 Preparedness Area 3 Tornado Events by Magnitude



Preparedness Area 4

Preparedness Area 4 experiences the lowest frequency of tornado events in the State, with only 16 reported events since 1950, and also accounts for the least amount of property damage in the state. Most of these events took place in San Juan County. The most damaging event in the Preparedness Area took place on June 18, 1968, in San Juan County. The NCEI reported that an F2 tornado caused three injuries and an estimated $250,000 in property damage. Figure 6-154 displays tornado events by magnitude in the Preparedness Area.

Figure 6-153 Frequency of Tornado Events in Preparedness Area 4 by County

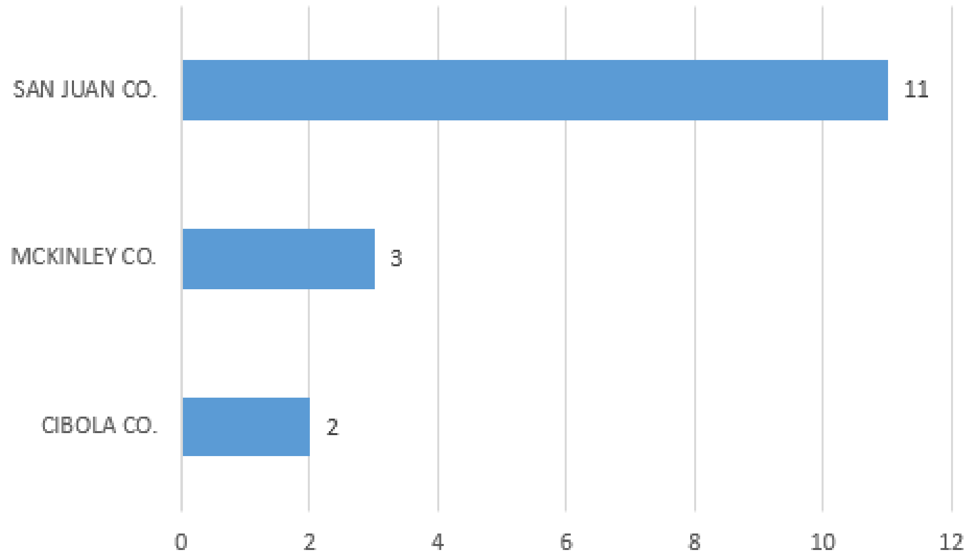
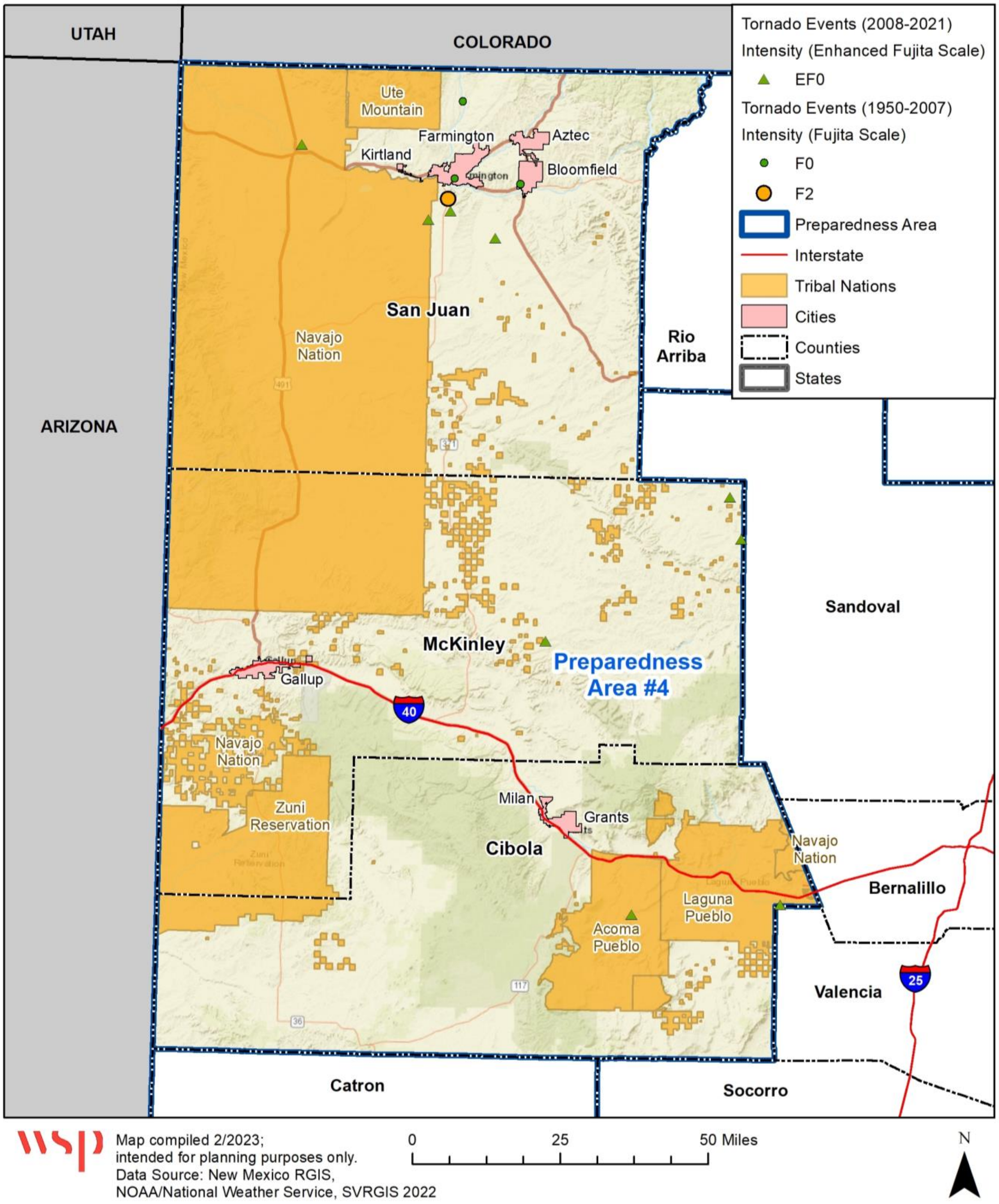


Figure 6-154 Preparedness Area 4 Tornado Events by Magnitude



Preparedness Area 5

Preparedness Area 5 experiences moderate frequency of tornado events in the State, with 56 events since 1950. The most damaging event in the Preparedness Area took place on October 10, 1974, in Valencia County. The NCEI reported that an F2 tornado caused 8 injuries, one death, and an estimated $250,000 in property damage. Counties in this Preparedness Area experience comparable frequency of tornados, with Torrance County having the most reported events. Figure 6-155 displays tornado events by magnitude in Preparedness Area 5.

Figure 6-155 Frequency of Tornado Events in Preparedness Area 5 by County

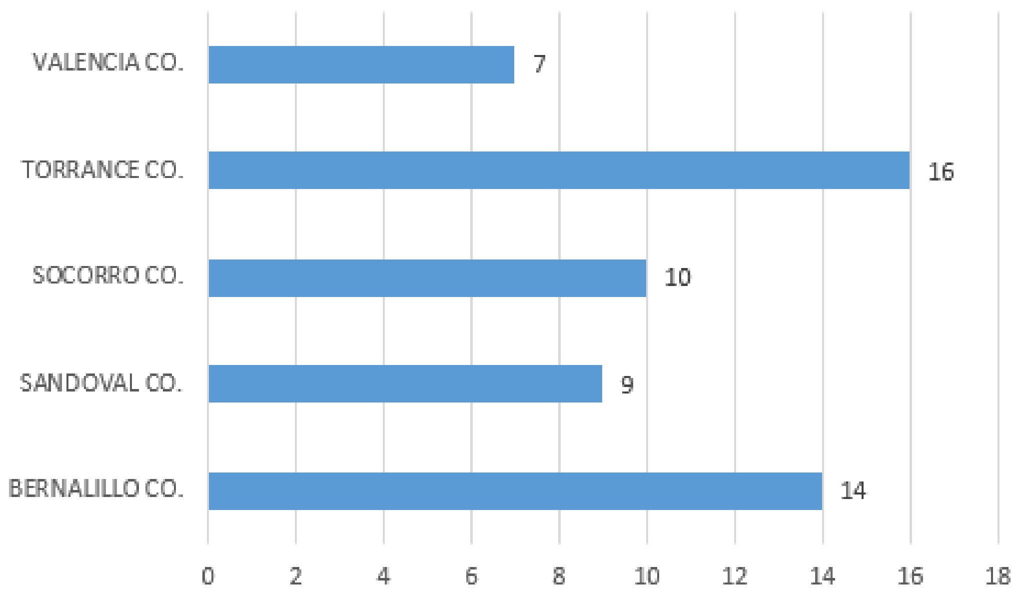
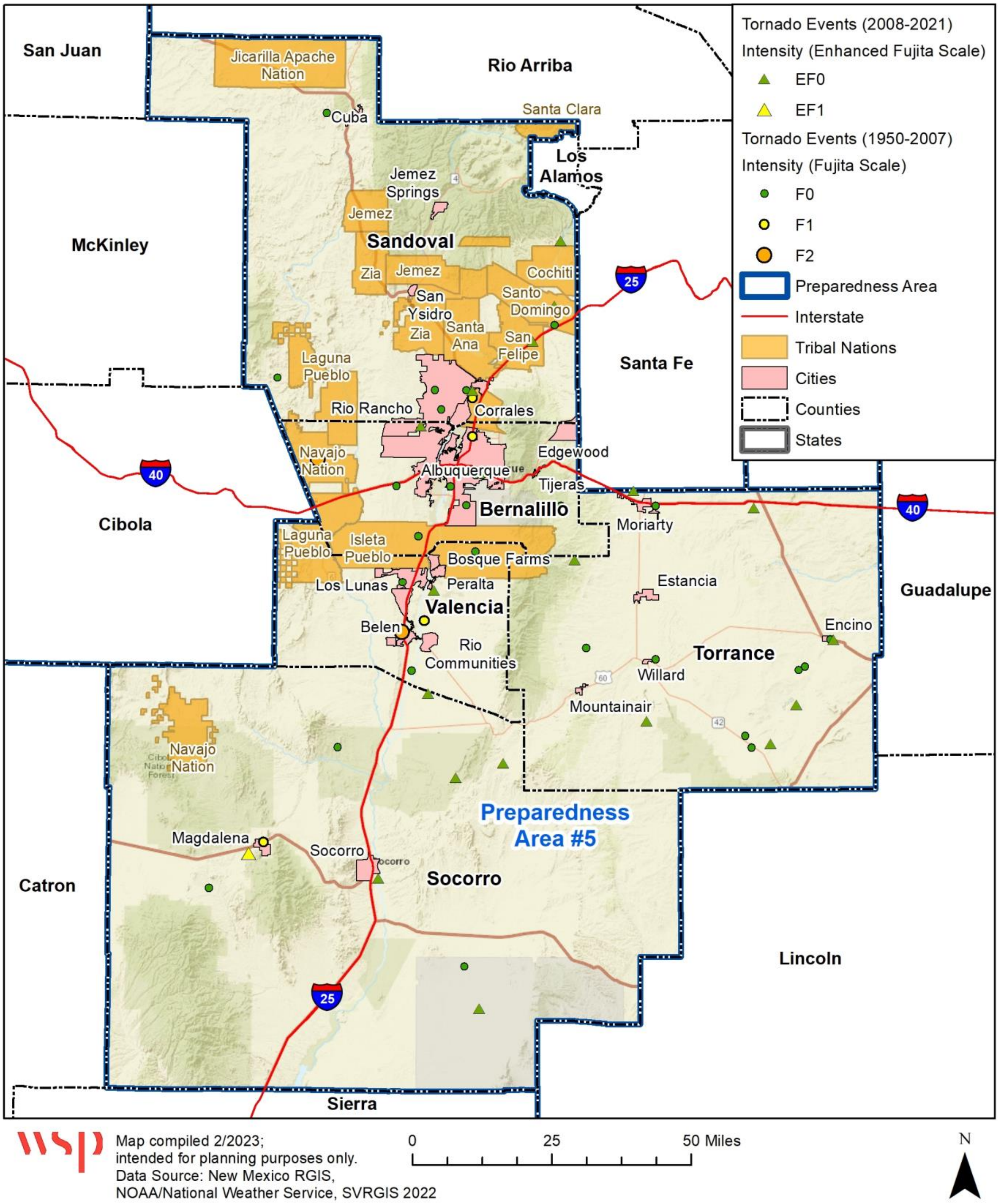


Figure 6-156 Preparedness Area 5 Tornado Events by Magnitude



Preparedness Area 6

Preparedness Area 6 experiences a moderate frequency of tornado events when compared to other counties in the State, with 50 events since 1950. Most of these events took place in Otero County. The most damaging tornado event in Preparedness Area 6 was an F3 tornado, which resulted in $250,000 in property damages. The area has experienced five tornado events resulting in $250,000, one of them which also resulted in one injury on June 4th, 2019, when a mobile home was destroyed. Figure 6-158 shows tornado events in Preparedness Area 6.

Figure 6-157 Frequency of Tornado Events in Preparedness Area 6 by County

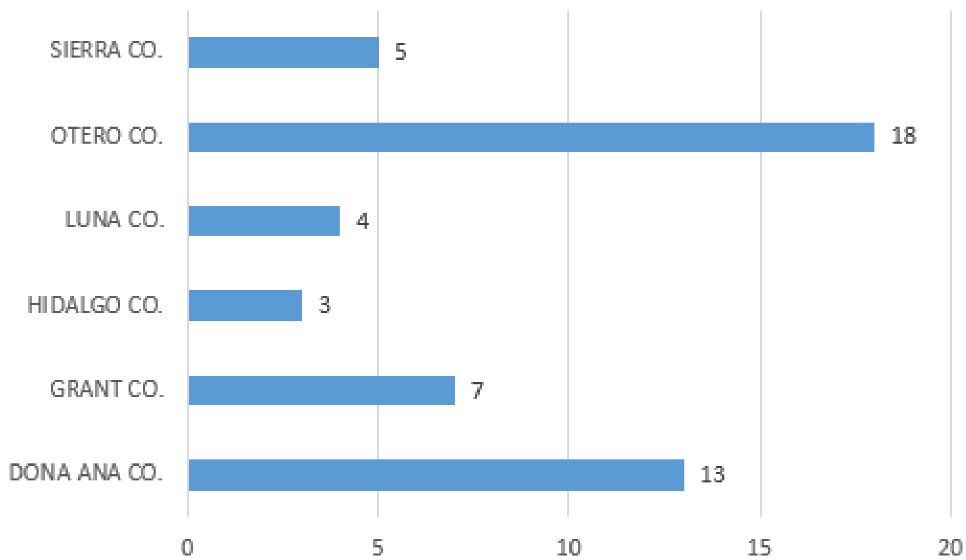
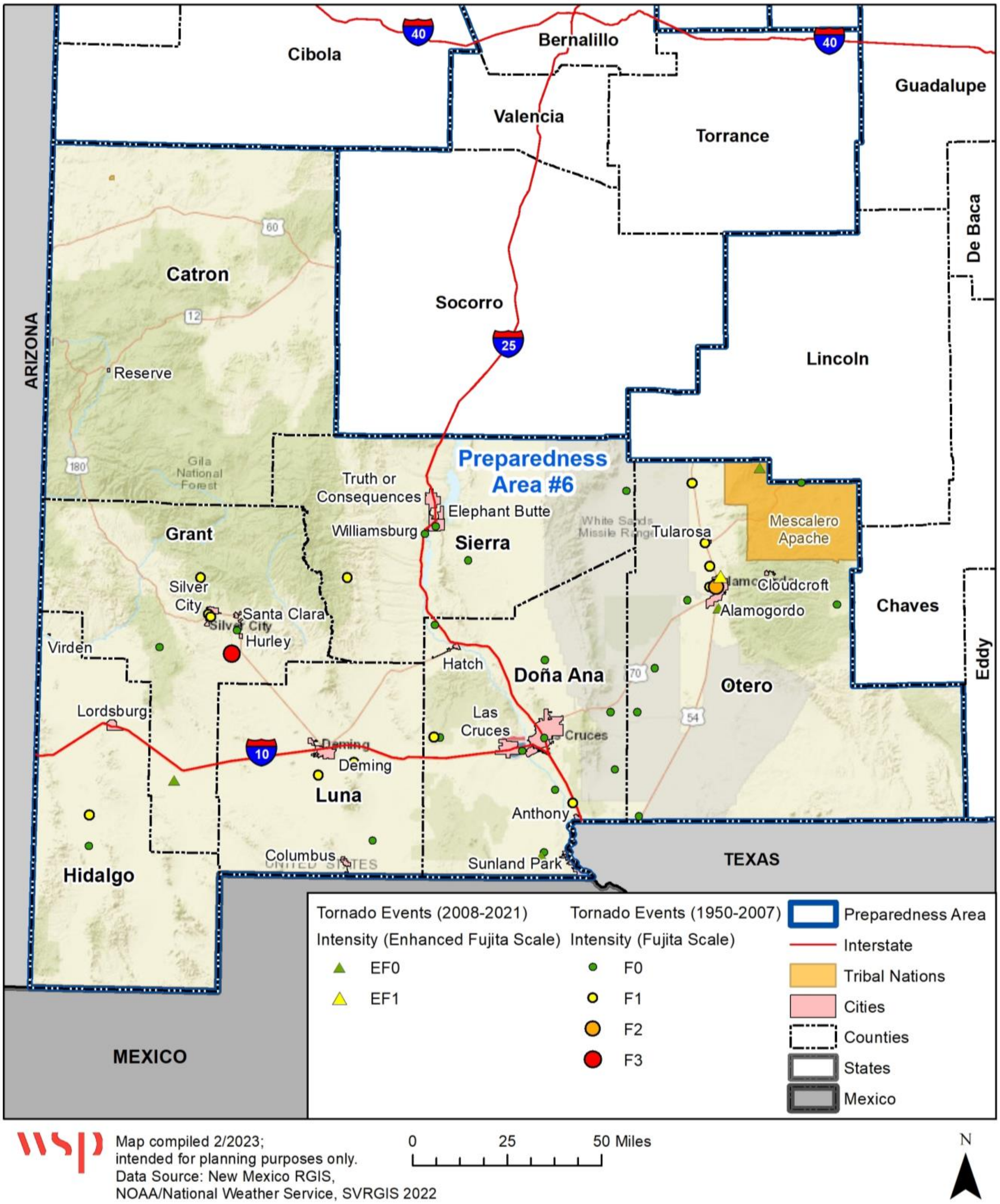


Figure 6-158 Preparedness Area 6 Tornado Events by Magnitude



6.14.7 Data Limitations

The information necessary to determine the location and condition of aged or dilapidated structures in areas where tornadoes have touched down was not available during the development of this mitigation plan. Consequently, the SHMT could not quantify vulnerability of individual structures to damage from tornadoes. Maps and data of past tornado occurrence were not readily available. Numerous sources exist with conflicting information. Clarifying and source checking maps and data is an activity that can be performed for future updates of the State Mitigation Plan.

In addition, accurate methods to quantify potential future damages are not readily available. The amount of business lost due to tornado events has not been calculated due to the difficulty of attaining this information. The SHMT could also not specify which critical facilities were vulnerable to high wind events.

6.14.8 What Can Be Mitigated?

One important part of mitigating tornado hazards is forecasting and warning so that people can prepare. Communities can prepare for disruptions of utilities and transportation due to high wind events by advising people to stay home or to use caution if they must go out, and by recommending that people stock up on food, water, batteries, and other supplies. The National Weather Service, combined with local television stations, have an effective strategy for notifying residents about impending tornado events. Consistently enforcing building codes provides the greatest benefit for new construction to mitigate damages due to tornado events. The State of New Mexico requires that all modular homes conform to local zoning and State building codes. Governing jurisdictions shall continue to regulate modular homes so that they meet the latest building code requirements, and are built with structural integrity so as to mitigate damage from potential tornado events. For existing structures and critical facilities, follow-up inspections and retrofits provide effective mitigation.

Other mitigation activities can include adoption and enforcement of building codes, retrofit of existing structures, surge protectors and lightning protection, construction of safe rooms and shelters, hardening power lines and other utilities, and public education of the risk.

6.14.9 Risk Summary

Table 6-109 identifies potential impacts from tornadoes.

Table 6-109 Impacts from Tornadoes

Subject	Potential Impacts
Agriculture	Agriculture infrastructure including those types that have height such as grain silos and windmills are most vulnerable to tornados. Livestock and crop losses have been recorded in the past as well.
Health and Safety of the Public	Injuries and deaths have occurred in the State due to tornadoes. There is no reason to expect that the impacts will not continue.
Health and Safety of Responders	Responders face the same risks as the public.
Continuity of Operations	Little to no impacts anticipated, except for facilities that may be damaged or during an event.
Delivery of Services	Little to no impacts anticipated, except for facilities that may be damaged or during an event.
Property, Facilities,	A tornado can cause anywhere from minor damage to total destruction of

Subject	Potential Impacts
Infrastructure	facilities and infrastructure depending on the size of the event. Extensive damages are anticipated.
Economic Condition	A small community can be completely destroyed and by a tornado. The economic base (businesses) and individuals can lose everything, and recovery may require substantial investment.
Public Confidence	Not impacted by the event itself, but may be damaged if the response to an event is poor.

6.15 Volcanoes

Hazard	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
Volcano	NR	Low	Low	NR	Low	Low	Low

6.15.1 Hazard Characteristics

A volcano is a vent through which molten rock and hot gases escape to the earth's surface. Unlike other mountains, which are pushed up from below, volcanoes are built by surface accumulation of their eruptive products (e.g., lava, pyroclastic flows, and surges, and ashfall). When pressure from gases within a magma chamber becomes too great to be contained, an eruption occurs. Volcanic hazards include lava flows, pyroclastic flows, and surges, ashfall, volcanic mudflows (lahars), landslides, earthquakes, and those related to gas emissions. Volcanoes produce a wide variety of hazards that can harm and kill people, destroy property, and disrupt vital transportation infrastructure. Large explosive eruptions can endanger people and property hundreds of miles away as well as affect global climate patterns.

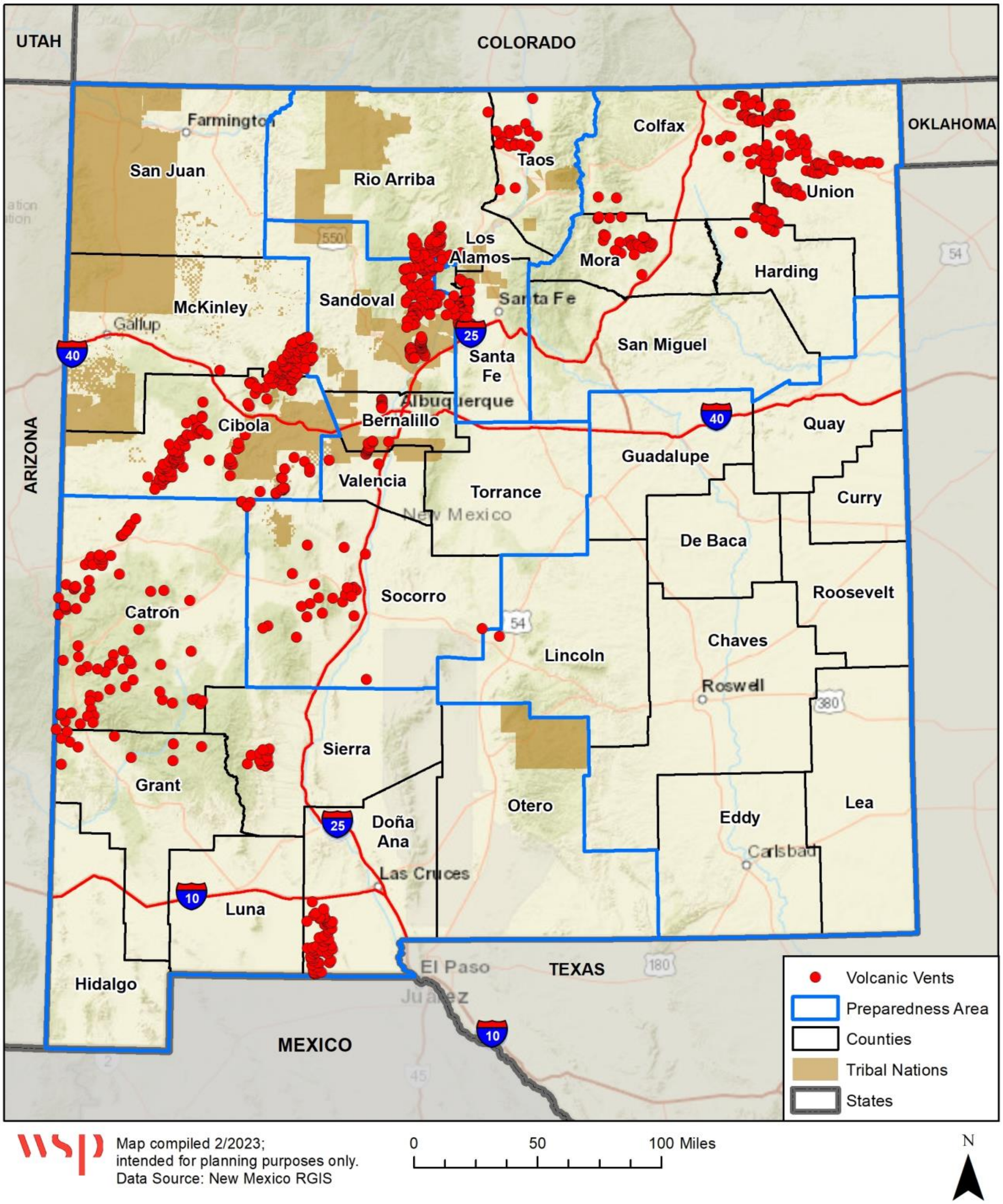
Eruption characteristics (size, style, and duration) are variable for different types of volcanoes and even for a single volcano at different times throughout its history. Eruptions are grouped into one of two categories, effusive and explosive. Eruptions are relatively passive producing lava flows that commonly creep across the land at speeds of two to 10 mph. Explosive eruptions can shoot columns of gases and rock fragments tens of miles into the atmosphere, producing devastating pyroclastic flows and surges, or depositing volcanic ash hundreds of miles downwind. A single eruptive episode can include both effusive and explosive components. The eruptive styles of volcanoes in New Mexico encompass the entire severity range from dangerously explosive to passive.

Lava flows are streams of molten rock that either pour from a vent quietly or through mildly explosive lava fountains. Lava flows destroy virtually everything in their path, but most move slowly enough that people and some property can be moved out of the way. The speed at which lava moves across the ground depends on several factors, including the type of lava erupted, which influences the viscosity, the steepness of the ground, and the rate of lava production at the vent. Lava flows are typically not dangerous to human life, but are a significant fire hazards because of their intense heat. Because lava is fluid the flows typically follow topographic lows and thus detailed knowledge of the topography surrounding dormant and active volcanoes is important for hazard preparedness.

The United States is third in the world, after Japan and Indonesia, for the number of active volcanoes. Since 1980, as many as five volcanoes have erupted each year in the United States. Eruptions are most likely to occur in Hawaii and Alaska. For the Cascade Range in Washington, Oregon, and California, volcanoes erupt on the average of once or twice each century.

Two magma bodies have been imaged in the crust beneath New Mexico. The Socorro magma body is one of only four large mid-crustal active magma bodies in the country; the others are Long Valley (California), Three Sisters (Oregon) and Yellowstone (Wyoming). The inflation of this magma body and fluid circulation above the magma body are responsible for elevated seismic hazards in the Socorro region (see Earthquakes section). In addition to the mid-crustal Socorro Magma Body, a smaller partially crystallized magma chamber has been imaged in the shallow crust beneath the western margins of the Valles Caldera, north-central New Mexico.

Figure 6-159 Map of Volcanic Fields in New Mexico



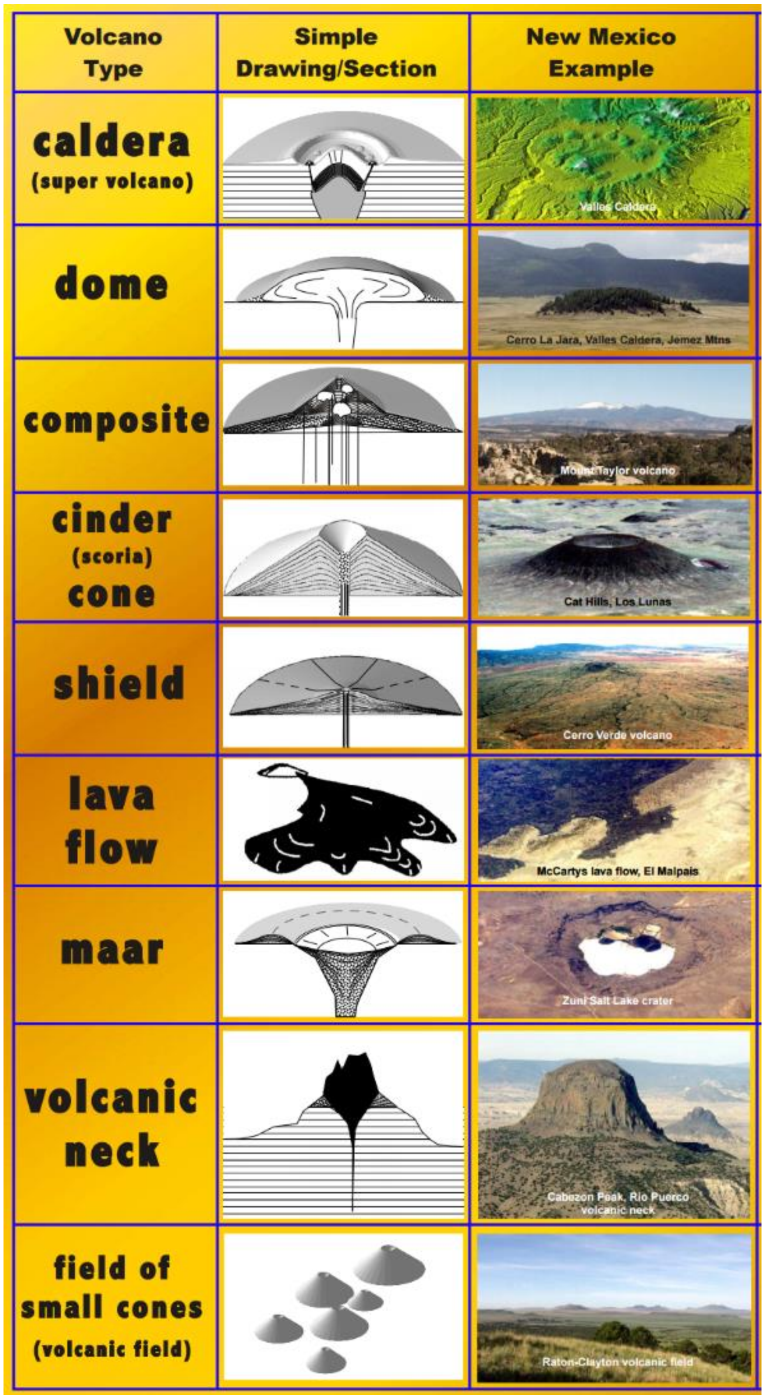
Although there are currently no active volcanoes in New Mexico, examples of many types of volcanoes are present in the State. Table 6-110 below includes a description of the different types of volcanoes found in the State.

Table 6-110 Description of Types of Volcanoes Found in New Mexico

Volcano Type	Description
Calderas	The type example and one of the largest young calderas in the world (Valles Caldera) is in New Mexico. Calderas are large volume volcanoes many miles in diameter produced from the collapse of the overlying crust into an evacuating magma chamber. Smaller volume eruptions both proceed and postdate the caldera eruption for an extended time interval. Valles caldera is the type example and one of the youngest calderas in the western United States. A cluster of about 20 extinct calderas are located in southwestern NM.
Cinder Cones	There are several large concentrations of young cinder cones are in New Mexico. Cinder cones are small-volume volcanoes built from the accumulation of erupted fragmented material. Cinder cones typically erupt only once and the duration of that eruption lasts days to years. In many cases, a lava flow is associated with the eruption.
Composite Volcano	A volcano consisting of a variety of eruption materials (ash, lava, mudflows, debris flows, and volcanoclastic deposits). Built from many eruptions over time. Also known as stratovolcano. Mount Taylor is an example.
Dome	A circular mound-shaped protrusion resulting from the slow extrusion of viscous lava from a volcano. The geochemistry of lava domes can vary from basalt to rhyolite although most preserved domes tend to have high silica content. Magdalena Peak, in Socorro County is an example.
Fissure Eruptions	Good young examples of a fissure eruption (Albuquerque Volcanoes) are found in New Mexico. Fissure eruptions are typically small volume eruptions that occur along preexisting fractures in the crust. In many cases, a lava flow is associated with the eruption.
Lava Flows	Two of the largest young basaltic lava flows in the continental U.S. (Carrizozo and McCartys) are in New Mexico. Lava flows are highly variable, ranging in composition, volume, and flow length. Lava flows are associated with nearly every type of volcano.
Maars - Steam Explosion Craters	A number of young volcanic steam explosion craters (referred to as "maars" by geologists) occur in New Mexico. Zuni Salt Lake Crater and Kilbourne Hole Crater are two maars in New Mexico often used as type examples in textbooks. The remains of maars literally fill White Rock Canyon and they pepper the surfaces of many of the other volcanic fields, like the Mount Taylor and Potrillo fields. A significant eruption occurred from Isleta Volcano near Albuquerque. They are more abundant, better preserved, and more diversely exposed than those in the type area (Eifel district of Germany). Maar volcanoes are produced when rising magma interacts with groundwater producing a short-lived, extremely violent steam explosion that generates a shallow crater.
Shield Volcano	A large volcano with a broad summit area and low-angle sloping sides (shield shape) because the extruded products are mainly low viscosity basaltic lava flows. Jornada del Muerto Volcano in Socorro County is a good example.
Volcanic Fields	A collection of volcanoes in a particular region. Great diversity of young volcanic rock types and classic suites of volcanic rocks are present (for example, the Mount Taylor and the Raton-Clayton volcanic fields) occur in New Mexico.
Volcanic Necks	Well-exposed examples of young volcanic necks are found in New Mexico (Rio Puerco Valley).

Figure 6-160 below shows a diagram and photograph of the different types of volcanoes found in the State.

Figure 6-160 Illustration of Types of Volcanoes found in New Mexico



One way to quantify the magnitude of a volcanic eruption is the Volcanic Explosivity Index (VEI), which is proportional to the logarithm of ejecta volume, as shown in Figure 6-161 and Table 6-111.

Figure 6-161 Volcanic Explosivity Index (VEI) Visual Graphic

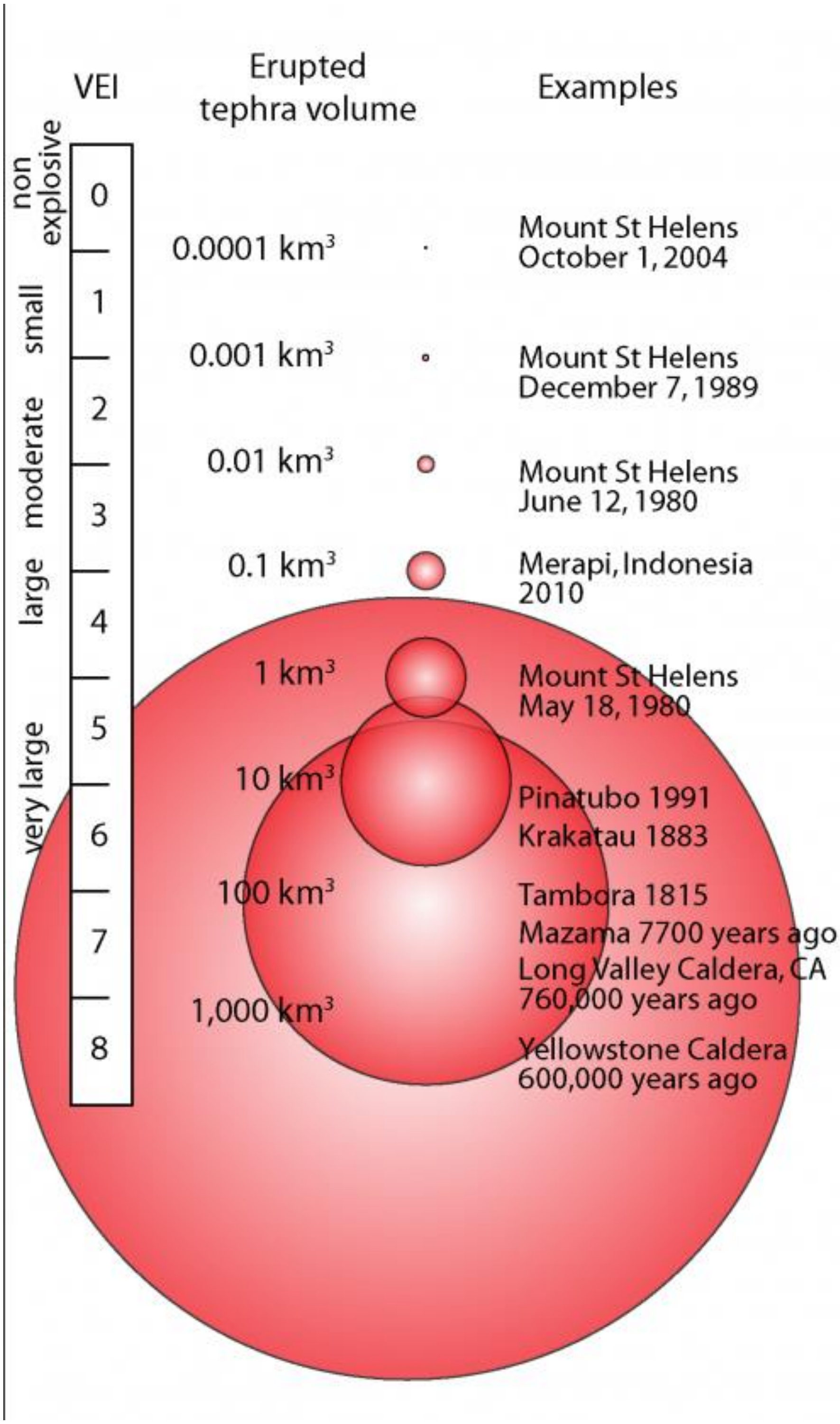


Table 6-111 Volcanic Explosivity Index

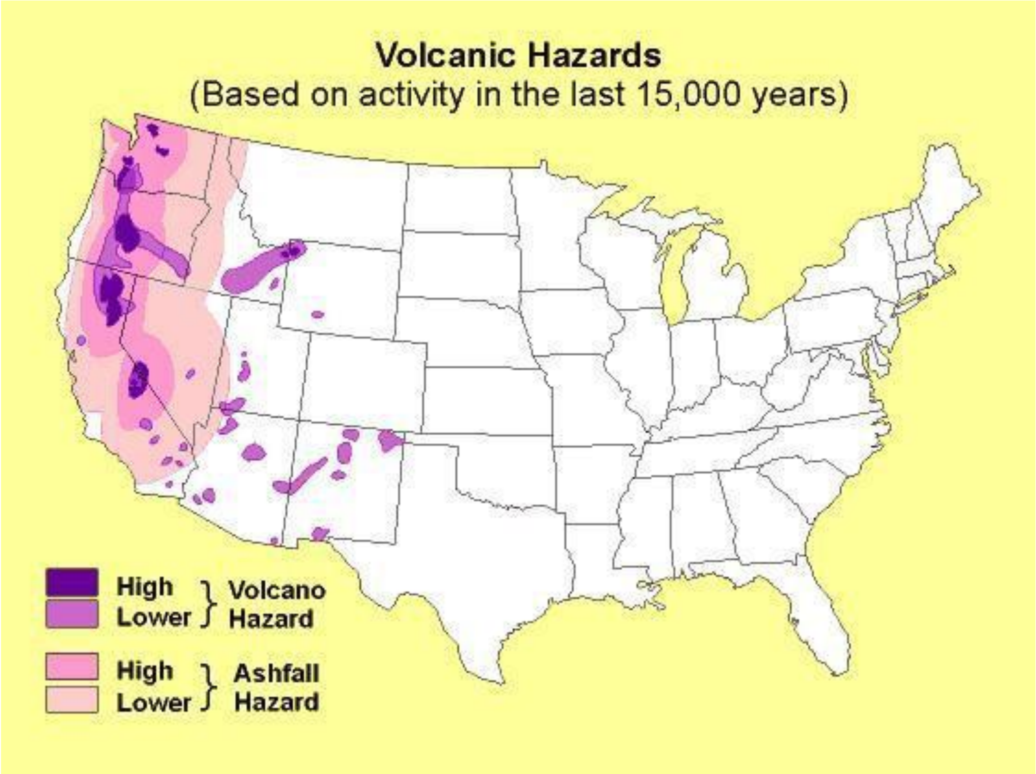
VEI	Description	Plume	Ejecta volume	Frequency
0	non-explosive	< 100 m	> 1000 m^3	daily
1	Gentle	100-1000 m	> 10,000 m^3	daily
2	explosive	1-5 km	> 1,000,000 m^3	weekly
3	Severe	3-15 km	> 10,000,000 m^3	yearly
4	cataclysmic	10-25 km	> 0.1 km^3	≥ 10 yrs.
5	paroxysmal	> 25 km	> 1 km^3	≥ 50 yrs.
6	colossal	> 25 km	> 10 km^3	≥ 100 yrs.
7	super-colossal	> 25 km	> 100 km^3	≥ 1000 yrs.
8	mega-colossal	> 25 km	> 1,000 km^3	≥ 10,000 yrs.

Prior to an eruption, magma (molten rock) migrates into a magma chamber, or reservoir, beneath a volcano. As magma moves toward the surface, it (1) releases gases such as water, sulfur dioxide and carbon dioxide, (2) produces small earthquakes, and (3) causes subtle swelling above the magma chamber and on the flanks of the volcano. Scientists can watch for these warning signs by monitoring gases emitted by the volcano, determining the location, size, and migration of small earthquakes under the volcano by using seismographs, and measuring changes on the slopes or inflation of the volcano using tiltmeters and geodetic methods especially permanent and temporarily deployed GPS receivers.

6.15.2 Previous Occurrences

Figure 6-162 illustrates the volcanic hazard areas in the continental United States based on events over the last 15,000 years. Areas in purple and dark pink show regions at greater or lesser risk of local volcanic activity, including lava flows, ashfalls, lahars (volcanic mudflows), and debris avalanches. Approximately six regions in New Mexico have been classified with lower risk volcanic hazards. Areas in light pink show regions at risk of receiving five centimeters or more of ashfall from large or very large explosive eruptions, originating at the volcanic centers. These projected ashfall extents are based on observed ashfall distributions from an eruption ("large") of Mt. St. Helens that took place 3,400 years ago, and the eruption of Mt. Mazama ("very large") that formed Crater Lake, Oregon, 6,800 years ago.

Figure 6-162 Volcanic Hazard areas based on events over the last 15,000 years



New Mexico has one of the greatest concentrations of young, well-exposed, and un-eroded volcanoes in North America. Volcanism during the last five-million-years is distributed into about 10 major volcanic fields located throughout New Mexico and numerous isolated vents (shown in red on Figure 6-159). Although somewhat challenging to determine, because younger flows commonly cover older flows, an estimated 700 volcanoes have erupted during this time period. These volcanoes are located across all Preparedness Areas with a majority of volcanic concentration in Preparedness Areas 4 through 6 (Figure 6-159). Figure 6-163 shows the principal types of volcanoes based on their locations by Preparedness Area in the State. The last volcanic episode in the State occurred approximately 3,900 years ago with the eruption of several cubic kilometers of basalt (McCartys lava flow of El Malpais.)

6.15.3 Past Frequency

With respect to volcanic activity, New Mexico has one of the largest number, largest range of ages, largest diversity of types, largest range of preservation, and some of the best types of examples in North America. The question remains as to how likely it is that an eruption will actually occur in New Mexico in the near future, and what type of eruption this might be. There have been more than 700 volcanic eruptions in New Mexico in the last five million years. At least three eruptions have occurred in the last 10,000 years.

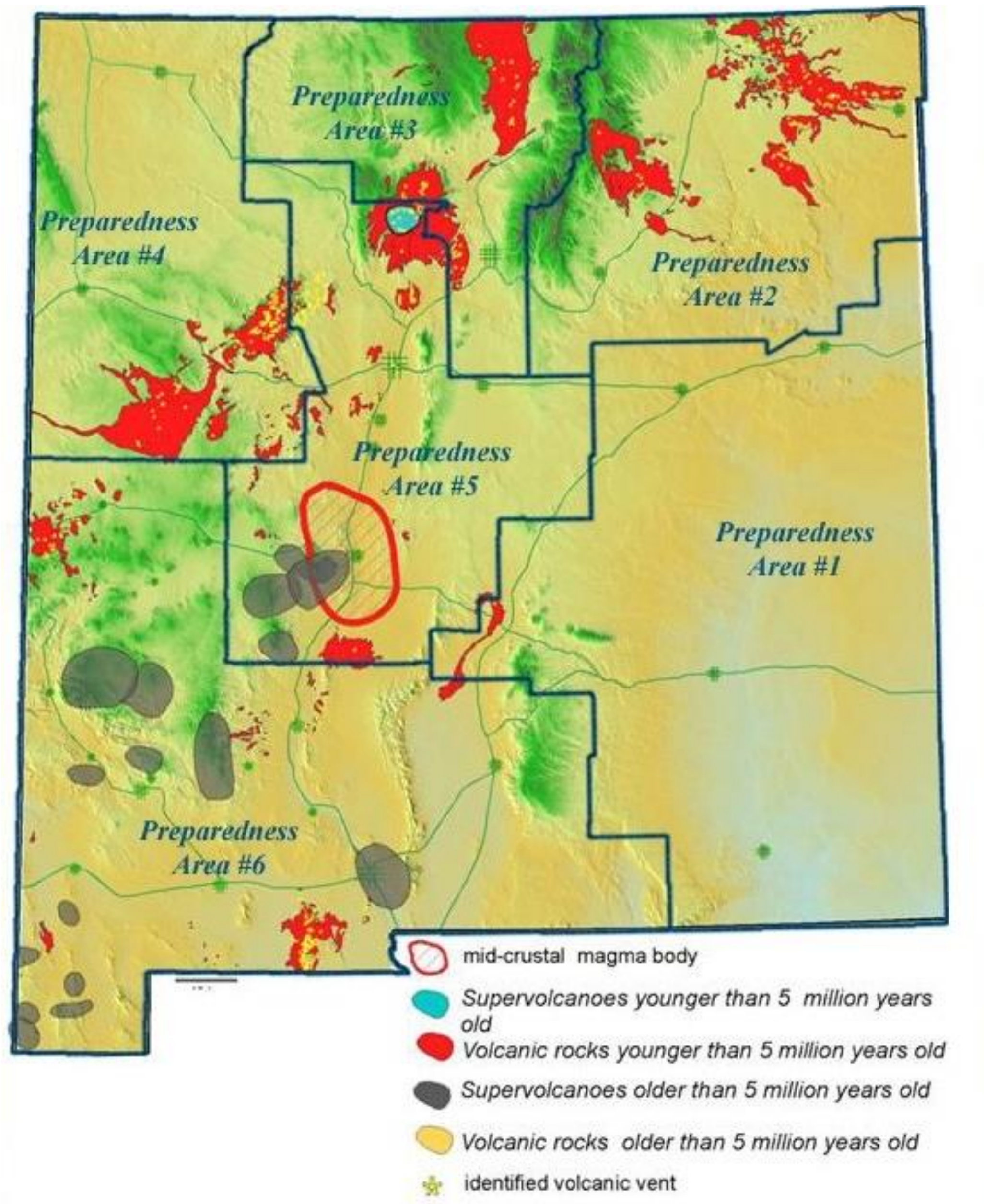
6.15.4 Climate Change Impacts

At the time, no link has been determined between long-term, changing weather patterns and an increase or decrease in the frequency or severity of volcanic activity in the State of New Mexico.

6.15.5 Probability of Future Occurrence

To date, there are few estimates of future occurrence of volcanic eruptions in New Mexico in recent history. Volcanism in New Mexico is not "extinct," but is dormant. As stated previously, the last volcanic episode in the State occurred approximately 3,900 years ago. Based on past occurrence of volcanism in the State (Figure 6-163), it can be crudely estimated that there is roughly a 1% chance that some type of volcanic eruption could occur somewhere in New Mexico in the next 100 years, and a 10% chance that an eruption will occur in the next 1,000 years. Due to this extremely low probability of occurrence (0.1% chance in 10 years), this hazard will not be discussed in further detail. If circumstances warrant, future versions of the plan will elaborate.

Figure 6-163 New Mexico Volcanic Activity by Preparedness Area



6.15.6 Vulnerability Assessment

Overall volcanic activity is considered a low significance hazard throughout the State of New Mexico due to the long recurrence intervals between events and the significant length of time since the last period of volcanic activity in the state. While the probability is low, effects could be widespread and cause serious impacts, as well as the state experiencing possible impacts of eruptions which have occurred outside New Mexico.

All of New Mexico's volcanoes are considered dormant, rather than extinct, so while there is potential for future eruptive activity in the state, it is currently considered unlikely. Figure 6-163 above show the locations of volcanic areas and activity in the state by Preparedness Area. In the following sections, tables list the specific known volcanoes in New Mexico organized by the Preparedness Area they are located in. Table 6-112 through Table 6-117 describe New Mexico's volcanos by type and by Preparedness Area. The data was provided by the New Mexico Museum of Natural History and Science.

State Assets

A geospatial analysis of state owned assets potentially at risk of volcanoes was not conducted. The state does not have a record of any damages to state facilities due to volcanic activity, and the nature of the hazard makes impacts difficult to quantify.

Preparedness Area 1

Table 6-112 Volcanoes in Preparedness Area 1

Name	Type	Volume
Carrizozo-Broken Back Craters	Scoria cone/silicic dome fields	Intermediate
Carrizozo Lava Flow	Large lava flows	Small

Preparedness Area 2

Table 6-113 Volcanoes in Preparedness Area 2

Name	Type	Volume
Raton-Clayton: Capulin Volcano	Scoria cone/silicic dome fields	Intermediate
Ocate Volcanic Field	Scoria cone/silicic dome fields	Intermediate
Sierra Grande	Small shield volcano	Small

Preparedness Area 3

Table 6-114 Volcanoes in Preparedness Area 3

Name	Type	Volume
Agua Fria	Composite volcano	Large
Taos Plateau Volcanic Field	Scoria cone/silicic dome fields	Intermediate
Cerros del Rio Volcanic Field	Scoria cone/silicic dome fields	Intermediate
Tusas-Brazos Volcanoes	Scoria cone/silicic dome fields	Intermediate
Cerros del Rio	Scoria cone/silicic dome fields	Small

Preparedness Area 4

Table 6-115 Volcanoes in Preparedness Area 4

Name	Type	Volume
Mount Taylor Necks	Composite volcanoes	Large
Navajo Volcanic Field: Ship Rock	Composite volcanoes	Large
Mount Taylor Field	Scoria cone/silicic dome fields	Intermediate
Bandera and other El Malpais	Scoria cone/silicic dome fields	Intermediate
McCartys Lava Flow	Large lava flows	Small
Navajo Volcanic Field (Chuska Narbona Pass)	Maars and tuff rings	Small
Mesa Chivato	Maars and tuff rings	Small
Navajo Volcanic Field	Small shield volcano	Small

Preparedness Area 5

Table 6-116 Volcanoes in Preparedness Area 5

Name	Type	Volume
Mid-Tertiary (Mogollon-Gila)	Ashflow calderas	Large
Valles Caldera, Jemez Volcanic Field	Ashflow calderas	Large
Los Lunas	Composite volcano	Large
Cat Hills Volcanic Field	Scoria cone/silicic dome fields	Intermediate
Santa-Ana—San-Felipe	Scoria cone/silicic dome fields	Intermediate
Albuquerque Volcanoes	Scoria cone/silicic dome fields	Intermediate
Lucero Volcanic Field	Scoria cone/silicic dome fields	Intermediate
Isleta Tuff Ring	Maars and tuff rings	Small
Cerro Verde	Small shield volcano	Small
Cienega Volcanic Filed	Small shield volcano	Small
San Felipe Volcano Field	Small shield volcano	Small
Jornada del Muerto Volcano	Small shield volcano	Small
Tome-Black Butte – Los Pinos Volcanoes	Small shield volcano	Small
Socorro Magma Body	Active Magma Body	Magma Body
Valle Caldera	Possibly active magma body	Magma Body

Preparedness Area 6

Table 6-117 Volcanoes in Preparedness Area 6

Name	Type	Volume
Bootheel Volcanic Field	Ashflow caldera	Large
Sierra Blanca	Composite volcano	Large
Red Hill Volcanic Fields	Scoria cone/silicic dome fields	Intermediate
Potrillo Volcanic Field	Scoria cone/silicic dome fields	Intermediate
Kilbourne Hole	Maars and tuff rings	Small
Hunts Hole, Potrillo Maar	Maars and tuff rings	Small
Elephant Butte-Engle Field	Maars and tuff rings	Small
Red Hill Tuff Rings	Maars and tuff rings	Small
Zuni Salt Lake Maar	Maars and tuff rings	Small
Caballo (Engle) Volcanic Field	Small shield volcano	Small
Palomas Volcanic Field	Small shield volcano	Small

6.15.7 Data Limitations

Due to the prolonged inactivity of the volcanic fields in New Mexico, there is a low probability of eruption in the foreseeable future. Field studies tend to focus on understanding the circumstances of previous events, rather than focusing on predicting future events. The current level of seismic monitoring in the State is limited, but may provide some level of precursory warning of an impending eruption. However, this cannot be assured at this time.

6.15.8 What Can Be Mitigated?

Mitigation options for volcano eruptions should address the lack of detailed, hazard-specific information at the State and Local jurisdiction level. A possible mitigation action may be to assist in conducting mapping and delineation of areas vulnerable to volcano eruption in and around the State. Currently, the database for volcanism in the State is relatively robust as it relates to age and rock type, two factors useful to assessing the level of risk. However, data pertaining to the styles of eruption, longevity, and scope of their influences depending on type of products, including gases, is poorly constrained. Additional focus on these data areas going forward is important to a better understanding of the risk present. Providing education about possible eruption scenarios, volcano alert system, and the aviation color code warning systems is another possible mitigation action item.

6.15.9 Risk Summary

Table 6-118 identifies potential impacts from volcanic eruptions.

Table 6-118 Potential Impacts from Volcanic Eruptions

Subject	Potential Impacts
Agriculture	Agriculture infrastructure, supplying utilities, crops and livestock would be devastated in proximity to a volcanic type eruption. While that may seem impossible, some of the most fertile livestock grazing areas are in location of prior volcanic activity.
Health and Safety of The Public	Severe injuries even death possible for individuals in or near the impact areas. Health issues may persist for extended durations after the eruption has stopped (e.g., redistribution of ash from winds).
Health and Safety of Responders	Same impacts as the public.
Continuity of Operations	In the event of a large event operations may be severely hampered; absenteeism expected to rise, severe impacts to facilities.
Delivery of Services	With a large area of damages or large numbers or absentees service delivery may be severely impacted.
Property, Facilities, Infrastructure	Most everything in the path of a volcanic eruption would be destroyed.
Environment	Severe damages anticipated to large areas, depending on the type of eruption.
Economic Condition	If the community is severely impacted, the public may be forced to evacuate effectively shutting down the local economy for an extended period. In addition to local economies, ash clouds could disrupt distant economies particularly those tied to aviation.
Public Confidence	Volcanic eruption is potentially the most devastating natural event for the State. Similarly to other large scale catastrophic events (Katrina, Rita, and Wilma) the public may lose all confidence in the government, if warnings are not issued in anticipation to the event or if response is slow.

6.16 Wildfire

Hazard	PA 1	PA 2	PA 3	PA 4	PA 5	PA 6	Statewide
Wildfire	**High**	**High**	**High**	**High**	**High**	**High**	**High**

6.16.1 Hazard Characteristics

As defined by the National Interagency Fire Center (NIFC), a wildland fire is any non-prescribed, non-structure fire that occurs in the wildland. Other key terms include:

- Wildland-Urban Interface (WUI) describes any area where man-made structures are constructed close to or within a boundary of natural terrain and fuel, where high potential for wildland fires exists. WUI fires are a particular concern because they pose risks to human lives, property, structures, and critical infrastructure more directly than the other types of wildland fires.
- Fuel consists of combustible material, including vegetation, such as grass, leaves, ground litter, plants, shrubs, and trees that feed a fire.
- Aspect refers to the direction in which a slope faces.

Wildfires have potential to cause significant injury, death, and damage to property. The potential for property damage from fire increases each year as more properties are developed on forested land and increased numbers of people use these areas and adjacent wildland. Fires can have a serious negative impact on the economy of an affected area, especially the logging, recreation, and tourism industries, upon which many counties depend. Major costs associated with wildfires may include the salvage and removal of downed timber and debris, the restoration of the burned area, replacement of lost infrastructure like fencing, transmission lines and communication towers, and preparation for or recovery from post-fire flooding. Additionally, agricultural production and food processing systems are highly vulnerable to the effects of wildfire.

Wildfires can occur at any time of the year, but are most likely to occur during the spring, summer, or fall. Thunderstorms that contain lightning frequently start wildfires. Wildfires are often also sparked by utilities and vehicles as well. It should be noted that wildfires are also an important natural component of the natural ecosystem. Wildlands need to burn periodically to naturally maintain viable environments. Fuel maintenance (controlled burns, mowing, cattle grazing, and other means) is a necessary replacement to uncontrolled wildland fires because of threats to human habitation.

Generally, there are three major factors that sustain wildfires and predict a given area’s potential to burn. These factors are fuel, topography, and weather.

- **Fuel:** Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree leaves, twigs, and branches to dead standing trees, live trees, brush, and cured grasses. Also, to be considered as a fuel source are manmade structures, such as homes and other associated combustibles. The type of prevalent fuel directly influences the behavior of wildfire. Fuel is the only factor that can be modified by humans.
- **Topography:** An area’s terrain and slopes affect its susceptibility to wildfire spread. Both fire intensity and rate of spread increase as slope increases due to the tendency of heat from a fire to rise via convection. The arrangement and types of vegetation throughout a hillside can also contribute to increased fire activity on slopes.

- **Weather:** Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out fuels that feed wildfires, creating a situation where fuel will more readily ignite and burn more intensely. Thus, during periods of drought, the threat of wildfire increases. Wind is the most influential weather factor of the three and its influence can increase rates of spread regardless of temperature and relative humidity.

A wildland fire may be concurrently managed for one or more objectives, and objectives can change as the fire spreads across the landscape. Objectives are affected by changes in fuels, weather, topography; varying social understanding and tolerance; and involvement of various governmental jurisdictions having different missions and objectives. Management response to wildland fire on State and private land is laid out in the NM EMNRD Forestry Division Fire Policy and Procedures Manual. The Division is responsible for suppression of wildland fires on non-Federal, non-Municipal and non-Tribal lands.

Management response on Federal land is based on objectives established in the applicable Land/ Resource Management Plan and/or the Fire Management Plan. Initial action on human-caused wildfire will be to suppress the fire at the lowest cost with the fewest negative consequences with respect to firefighter and public safety. Management response on municipal lands is the responsibility of municipal and/or county fire departments. Management response on Tribal lands is the responsibility of BIA and/or Tribal fire departments and/or County fire departments.

Every fire season, catastrophic losses occur as a result of wildfire in WUI areas in the western United States. Homes are lost, businesses are destroyed, community infrastructure is damaged, and most tragically, lives are lost. Precautionary action taken before a wildfire occurs often makes the difference between saving and losing a structure. Creating defensible space and reducing the ignitability of homes, businesses, and other structures are important components in wildfire hazard reduction. The Firewise Communities Network explains the basics of defensible space and the home ignition zone on the Fire Adapted Communities website: http://www.firewise.org/wildfire-preparedness/be-firewise/home-and-landscape/defensible-space.aspx?sso=964a1cae-4b28-4cbd-9769-7027bc160427.

WUI studies suggest that the intense radiant heat of a wildfire is unlikely to ignite a structure that is more than 30 feet away as long as there is no direct flame impingement. Studies of home survivability indicate that homes with noncombustible roofs and a minimum of 30 feet of defensible space have an 85-percent survival rate (Cohen and Saveland 1997). Conversely, homes with wood shake roofs and less than 30 feet of defensible space have a 15 percent survival rate. The National Fire Protection Associations Standard NFPA 1144 provides a methodology for assessing wildland fire ignition hazards around existing structures, residential developments, and subdivisions and improved property or planned property improvement that will be located in a wildland/urban interface area, and provides minimum requirements for new construction to reduce the potential of structure ignition from wildland fires. See http://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1144.

Wildfires can occur at any time of day and during any month of the year, but the peak fire season in New Mexico is normally from March through July. The length of the fire season and the peak months vary appreciably from year to year. Land use, vegetation, amount of combustible materials present, and weather conditions such as wind, low humidity, and lack of precipitation are the chief factors in determining the number of fires and acreage burned. Generally, fires are more likely when vegetation is dry from a winter with little snow and/or a spring and summer with sparse rainfall, especially if wet conditions in seasons prior produced an abundance of fine fuels.

Wildfires also have many related or cascading hazards which can occur in their aftermath, such as mudslides, floods, and debris flows in areas where the fire removes the vegetative covering along slopes or burns hot enough to create hydrophobic soils (heat damaged soils that resist water penetration). These indirect effects of wildfires can also be catastrophic. Large, intense fires can harm the soil, waterways, and the land itself. Soil exposed to intense heat may become hydrophobic (lose its capability to absorb moisture and support life). Post-fire impacts may include widespread soil erosion and sedimentation leading to physical degradation of waterways, harm to aquatic life, degraded water quality, and increased risk of flooding and debris flows. Lands stripped of vegetation by wildfires are also subject to increased landslide hazards. Smoke from wildfire threatens air quality and can affect both human and livestock production and health. The New Mexico Environment Department's Smoke Management Program maintains a web page with information and resources for protecting public health. See https://www.env.nm.gov/air-quality/smp/.

Wildfire has greater consequences in some ecosystems than in others. In New Mexico, the interactions between forests, water, and fire are complex and sensitive to disturbance. High elevation forested watersheds produce most of the perennial flow in New Mexico's rivers and recharge underground aquifers. High severity fires in these watersheds can have negative impacts on downstream water supplies.

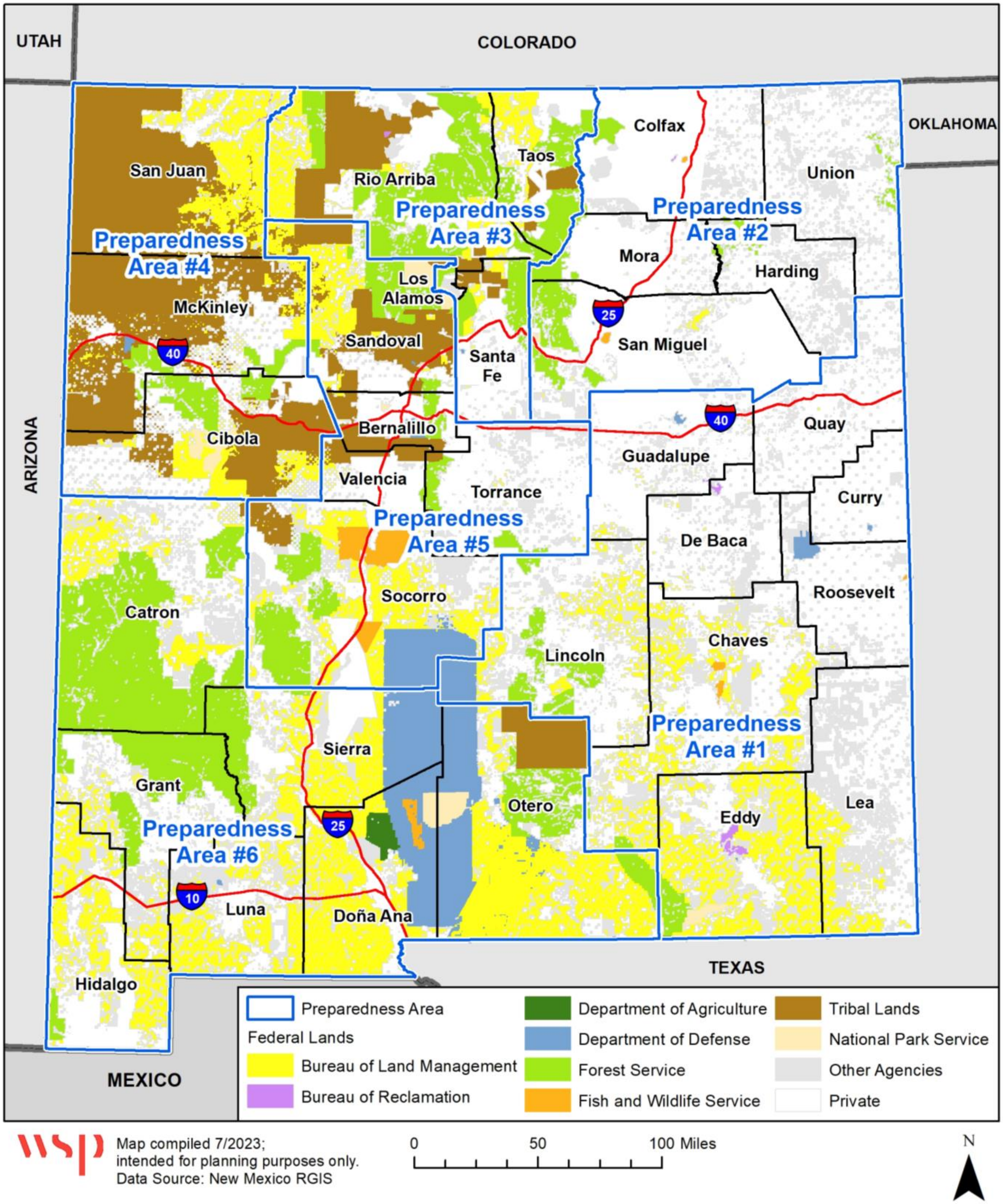
The Rio Grande, the second largest river in the southwestern United States, features a substantial bosque, or riverside cottonwood forest, which extends some 200 miles through New Mexico, from Santa Fe south to the Bosque del Apache National Wildlife Refuge. The Bosque of the Rio Grande is one of the largest continuous cottonwood gallery forests in the world. This riparian forest ecosystem consists largely of cottonwoods, willows, salt cedar, and other native and invasive species. When these areas are stressed by drought, as has happened in recent years, they become tinderboxes. While increased rainfall over the past three years has reduced the drought conditions throughout the bosque, conditions in this ecosystem continue to be affected by the extensive drought conditions in the last decade. The increase in fuels coupled with invasive species in recent years have contributed to the elevated risk of wildfire in the Rio Grande bosque and other riparian forests throughout New Mexico. The appearance of Tamarisk leaf beetle adds another, albeit poorly understood, wildfire risk factor in areas with significant populations of salt cedar.

Landownership

Wildfires that occur in New Mexico affect lands of various ownership types including State, private, Tribal and/or Federal lands. Diverse and complex landownership presents many different challenges when dealing with wildfires.

As discussed in Section 3.3, the majority of the land acreage in New Mexico is publicly owned (55.9%). Approximately 34% of the land is Federally owned. Privately owned forest land covers 10.7 million acres, or 43% of New Mexico's total forest land area. About 32% of New Mexico's total forest land area, or 7.9 million acres, is administered by the USDA Forest Service. Approximately 9% of forest and woodlands are under state ownership, while Native American tribes own 15%.

Figure 6-164 Land Ownership in New Mexico



Responsibility for stewardship and management of the forests and woodlands in New Mexico falls primarily to Federal agencies and about 43% of the State's acreage is managed by Federal agencies. New Mexico's forest land area totals 24.7 million acres. Forest lands comprise 32% of the State's land area. New Mexico's forests blanket a wide variety of environments from the mesquite and juniper woodlands in the southern deserts and steppes, to the timber forests in the southern Rocky Mountains.

The State Forestry Division does not own and manage forest land within New Mexico, but works with partners to promote healthy, sustainable forests in New Mexico through its various programs, encouraging sustainable economic growth while protecting and enhancing watershed health and community safety. The Forestry Division provides technical and financial assistance to State, private, non-Federal public and Tribal landowners and land managers. In recent years, State Forestry has also partnered with the US Forest Service and other agencies to enhance forest management in important watersheds located on Federal lands through the Division's Watershed Restoration Initiative.

Firefighters use several methods to express fire potential. Some of the indicators are:

Relative Humidity (RH): the ratio of the amount of moisture in the air to the amount of moisture necessary to saturate the air at the same temperature and pressure. Relative humidity is expressed in percent. RH is measured directly by automated weather stations or manually by wet and dry bulb readings taken with a psychrometer and applying the National Weather Service, psychrometric tables applicable to the elevations where the reading were taken.

Fuel Moisture: Fuel moistures are measured for live Herbaceous (annual and perennial), Woody (shrubs, branches, and foliage) fuels, and Dry (dead) fuels. These are calculated values representing approximate moisture content of the fuel. Fuel moisture levels are measured in 1, 10, 100 and 100-hour increments.

The Lower Atmosphere Stability Index or Haines Index: is computed from the morning (12Zulu) soundings from Radiosonde Observation (RAOB) stations across North America. It is used to indicate the potential for wildfire growth by measuring the stability and dryness of the air over a fire. It is calculated by combining the stability and moisture content of the lower atmosphere into a number that correlates well with large fire growth. The stability term is determined by the temperature difference between two atmospheric layers; the moisture term is determined by the temperature and dew point difference. This index has been shown to correlate with large fire growth on initiating and existing fires where surface winds do not dominate fire behavior. Haines Indexes range from two to six for indicating potential for large fire growth:

1. Very Low Potential (Moist Stable Lower Atmosphere)
2. Very Low Potential
3. Low Potential
4. Moderate Potential
5. High Potential (Dry Unstable Lower Atmosphere)

Keetch-Byram Drought Index (KBDI): used to measure the effects of seasonal drought on fire potential. The actual numeric value of the index is an estimate of the amount of precipitation (in 100ths of inches) needed to bring soil back to saturation (a value of zero being saturated). The index, as shown in Table 6-119, describes the top eight inches of soil profile. Therefore, the maximum KBDI value is 800 (eight inches), the amount of precipitation needed to bring the soil back to saturation. The index's relationship to fire is that as the index values increase, the vegetation is subjected to greater stress because of moisture deficiency. At higher values, living plants die and become fuel, and the duff/litter layer becomes more susceptible to fire.

Table 6-119 Keetch-Byram Drought Index Fire Rating System

KBDI Index (hundredths of an inch)	Conditions
0 – 200	Soil and fuel moisture are high. Most fuels will not readily ignite or burn. However, with sufficient sunlight and wind, cured grasses and some light surface fuels will burn in spots and patches.
200 – 400	Fires more readily burn and will carry across an area with no gaps. Heavier fuels will still not readily ignite and burn. Also, expect smoldering and the resulting smoke to carry into and possible through the night.
400 – 600	Fire Intensity begins to significantly increase. Fires will readily burn in all directions exposing mineral soils in some locations. Larger fuels may burn or smolder for several days creating possible smoke and control problems.
600-800	Fires will burn to mineral soils. Stumps will burn to the end of underground roots and spotting will be a major problem. Fires will burn through the night and heavier fuels will actively burn and contribute to fire intensity.

The Energy Release Component (ERC): the estimated potential available energy released per unit area in the flaming front of a fire. The day-to-day variations of the ERC are caused by changes in the moisture contents of the various fuel classes, including the 1,000-hour time lag class. The ERC is derived from predictions of the rate of heat release per unit area during flaming combustion and the duration of flaming.

The Ignition Component: a number that relates the probability that a fire will result if a firebrand is introduced into a fine fuel complex. The ignition component can range from zero, when conditions are cool and damp, to 100 on days when the weather is dry and windy. Theoretically, on a day when the ignition component registers a 60, approximately 60% of all firebrands that encounter wildland fuels will require suppression action.

The Spread Component: a numerical value derived from a mathematical model that integrates the effects of wind and slope with fuel bed and fuel particle properties to compute the forward rate of spread at the head of the fire. Output is in units of feet per minute. A Spread Component of 31 indicates a worst-case, forward rate of spread of approximately 31 feet per minute. The inputs required in to calculate the SC are wind speed, slope, fine fuel moisture (including the effects of green herbaceous plants), and the moisture content of the foliage and twigs of living, woody plants. Since the characteristics through which the fire is burning are so basic in determining the forward rate of spread of the fire front, a unique SC table is required for each fuel type.

Another is the International Fire Code Institute susceptibility index (Table 6-120), which combines slope and fuel levels:

Table 6-120 Wildfire Susceptibility Matrix

Fuel Class	Critical Fire Weather Frequency								
	<1 day per year			2-7 days per year			8+ days per year		
	Slope %			Slope %			Slope %		
	<40	41-40	61+	<40	41-40	61+	<40	41-40	61+
Light	M	M	M	M	M	M	M	M	H
Medium	M	M	H	H	H	H	E	E	E
Heavy	H	H	H	H	E	E	E	E	E
Note: M = Medium, H = High, E = Extreme.									
Source: International Fire Code Institute, January 2000									

All these indicators are taken into account when determining the fire danger for a specific area. These indicators can change daily, which is why the Fire Danger Rating System (Table 6-121) was created. It is a method of conveying in a simple way the relative danger level to the public. Note that the National Wildfire Coordinating Group announced that the National Fire Danger Rating System 2016 (NFDRS2016) will replace the existing 1978 and 1988 NFDRS models by May 2020. Additional information can be found at https://www.nwcg.gov/sites/default/files/memos/eb-m-18-001.pdf

Table 6-121 Fire Danger Rating System

Rating	Basic Description	Detailed Description
CLASS 1: Low Danger (L) COLOR CODE: **Green**	Fires not easily started	Fuels do not ignite readily from small firebrands. Fires in open or cured grassland may burn freely a few hours after rain, but wood fires spread slowly by creeping or smoldering and burn in irregular fingers. There is little danger of spotting.
CLASS 2: Moderate Danger (M) COLOR CODE: **Blue**	Fires start easily and spread at a moderate rate	Fires can start from most accidental causes. Fires in open cured grassland will burn briskly and spread rapidly on windy days. Woods fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel – especially draped fuel -- may burn hot. Short-distance spotting may occur, but is not persistent. Fires are not likely to become serious and control is relatively easy.
CLASS 3: High Danger (H) COLOR CODE: **Yellow**	Fires start easily and spread at a rapid rate	All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High intensity burning may develop on slopes or in concentrations of fine fuel. Fires may become serious and their control difficult, unless they are hit hard and fast while small.
CLASS 4: Very High Danger (VH) COLOR CODE: **Orange**	Fires start very easily and spread at a very fast rate	Fires start easily from all causes and immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high-intensity characteristics - such as long-distance spotting - and fire whirlwinds when they burn into heavier fuels. Direct attack at the head of such fires is rarely possible after they have been burning more than a few minutes.
CLASS 5: Extreme (E) COLOR CODE: **Red**	Fire situation is explosive and can result in extensive property damage	Fires under extreme conditions start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high-intensity burning will usually be faster and occur from smaller fires than in the Very High Danger class (4). Direct attack is rarely possible and may be dangerous, except immediately after ignition. Fires that

Rating	Basic Description	Detailed Description
		develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions, the only effective and safe control action is on the flanks, until the weather changes or the fuel supply lessens.

Wildland Fire Readiness Levels

The State Forestry Division's Fire Policy and Procedures established the Wildland Fire Readiness Levels as a method for dictating the overall preparedness levels for the Division. District Foresters and District Fire Management Officers shall assess the following criteria in determining readiness levels:

- Current and long-range forecasted weather;
- Current and forecasted fire behavior;
- Current and trend of five-day average energy release component (ERC);
- Comparison of current and trend of the seasonal ERC chart;
- Southwest Area preparedness levels; and
- Individual agency or district fire activity.

Because of the extreme geographical and topographical differences in the State, the Division's districts may be at different levels of fire readiness throughout the year. District Foresters and District Fire Management Officers shall determine fire readiness levels for their respective districts as determined by the following criteria and notify the State Fire Management Officer of the situation.

Fire Readiness Level 1:

- Most areas have low fire danger.
- Fire activity is light (occasional A, B, and C class fires) and all wildland fires are of short duration, usually lasting only one burning period.
- Moisture content in light fuels is high and heavy fuels are moist.
- State resources and interagency dispatch center cooperators are capable of handling fire incidents with minimum staffing levels.
- Initial attack forces are suppressing wildland fires.
- There is little or no commitment of State resources besides volunteer fire departments.
- ERC-5 day mean average is consistently below 30.

Fire Readiness Level 2:

- Fire danger is moderate.
- Class A, B, and C fires may occur and the potential exists for escapes to become larger but only have a potential duration of two burning periods.
- Heavy fuels are drying; frontal system winds increase the potential for rapid fire spread over a 36 to 48 hour period.
- State and volunteer fire department resources with limited assistance from the individual dispatch centers are capable of handling the situation.
- Fire department cooperators provide initial attack.
- High wind warnings and "Red Flag" alerts the National Weather Service issues are indicators that the districts may need additional resources.
- ERC-5-day mean average is consistently between 30 and 45.

Fire Readiness Level 3:

- Generally, all agencies are experiencing high fire danger.
- Numerous A, B, and C class fires, with a high potential for wildland fires to become Class D or larger in size, that may require additional resources.
- Light fuels are cured and heavy fuels are rapidly drying.
- Fires are escaping initial attack on a consistent basis and require extended attack support.
- The initial attack dispatch centers are requesting additional resources to increase initial attack capabilities.
- Federal cooperators provide critical initial attack and extended attack support during fire suppression.
- FEMA Fire Suppression Grants apply to urban/interface fires. The State Forester initiates FEMA Presidential Emergency Declaration requests.
- ERC-5 day mean average is consistently between 45 and 60.

Fire Readiness Level 4:

- Division and cooperating agencies are experiencing very high or greater fire danger.
- Numerous A, B, C, and D class fires that have the potential to exhaust dispatch area, State, Southwest Area, and national resources are common within the region.
- Division personnel implement and enforce fire restrictions.
- The Division may have Type 1 and Type 2 Incident Management Teams committed to incidents under this readiness level within the State.
- ERC-5 day mean average is consistently between 60 and 80.

Fire Readiness Level 5:

- All criteria for Fire Readiness Level 4 plus the following additional criteria are met:
- Fire danger is extreme throughout the State and region.
- Several dispatch centers and agencies are experiencing major fires and national resources are exhausted.
- Air resources are in short supply.
- Fire restrictions require closures.
- EOC is activated.
- Area Command has been implemented.
- High potential for catastrophic fires exists.
- Extreme fire behavior, scarce resources, and extremely unsafe working conditions for fire fighters hinder efforts of Type 1 and 2 Incident Management Teams.
- A multi-agency Coordination (MAC) Group is allocating resources to high priority fires.
- ERC-5 day average is consistently at or above 80.

6.16.2 Previous Occurrences

Data from the National Interagency Fire Center (NFIC) reports a total of 2,758 wildfires in New Mexico from 1950 through May 2023. Table 6-122 displays those fires by size class. Class A fires (0.25 acres or smaller) have been excluded from this analysis due to inconsistent reporting.

Table 6-122 New Mexico Wildfire History by Size Class, 1950 – May 2023

Fire Size Class	Size in Acres	# of Fires	Total Acres Burned
B	0.26 to 9.9	191	871
C	10.0 to 99.9	952	33,888
D	100 to 299	317	57,766
E	300 to 999	339	203,413
F	1,000 to 4,999	636	1,433,916
G	5,000 to 9,999	150	1,051,165
H	10,000 to 49,999	148	2,889,188
I	50,000 to 99,999	20	1,408,388
J	100,000 to 499,999	5	1,260,123
Total		**2,758**	**8,338,718**

Source: National Interagency Fire Center NIFC

Table 6-123 and Figure 6-165 show previous occurrences of wildland and WUI fires in New Mexico from 2000 through May of 2023.

Table 6-123 Historical Fire Data (2000 – May 2023)

Fire Year	# of Fires	Acres Burned
2023	48	100,449
2022	141	1,010,030
2021	62	116,500
2020	24	18,718
2019	42	65,900
2018	55	241,544
2017	40	103,212
2016	53	111,940
2015	22	42,740
2014	26	36,175
2013	29	187,027
2012	45	384,829

Fire Year	# of Fires	Acres Burned
2011	210	811,227
2010	121	140,137
2009	131	457,057
2008	106	339,232
2007	50	88,344
2006	95	561,490
2005	57	244,220
2004	36	141,829
2003	84	351,534
2002	62	310,119
2001	60	96,859
2000	150	452,415
Total	**1,749**	**6,413,527**

Figure 6-165 New Mexico Wildfire History, 1950 – May 2023

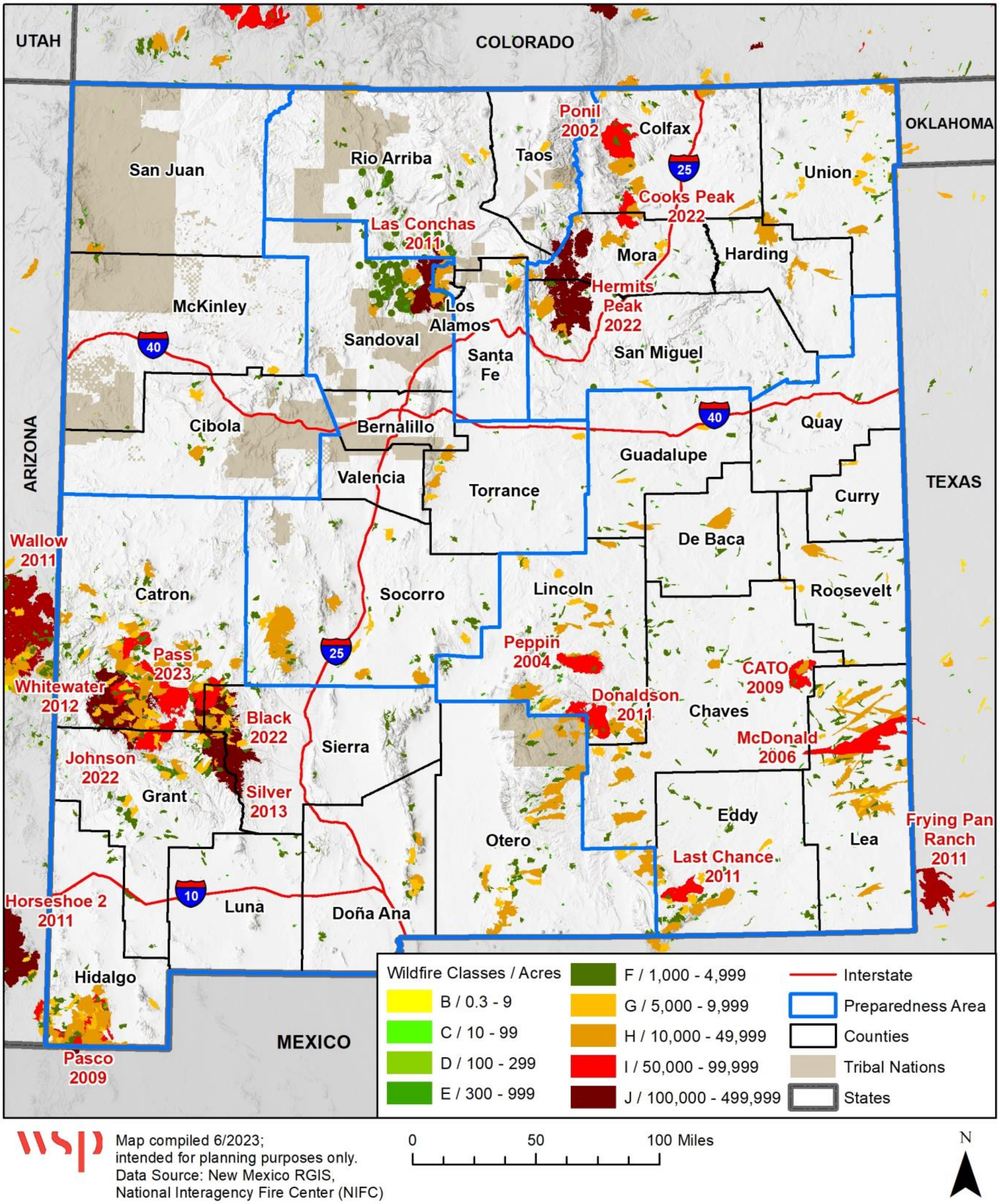
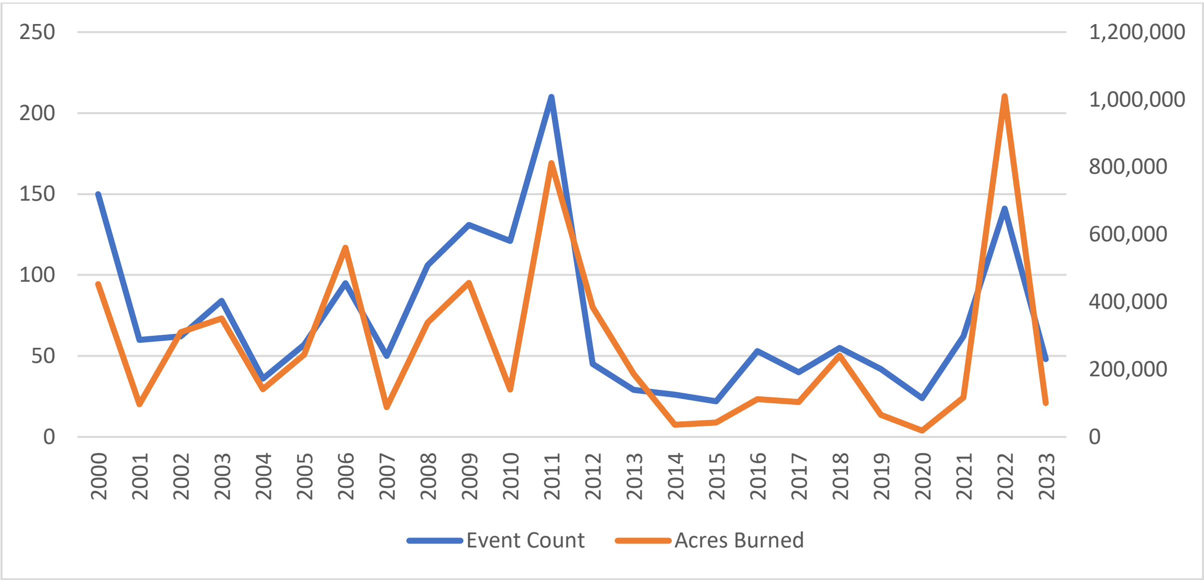


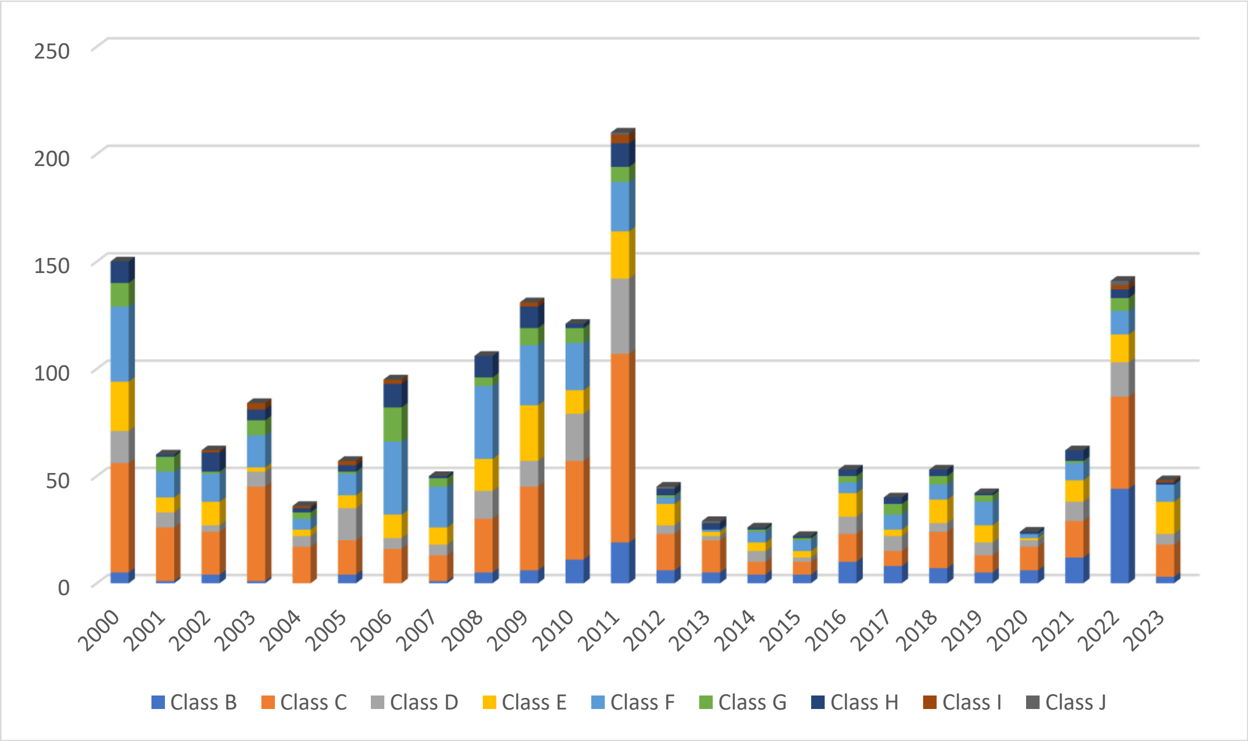
Figure 6-166 displays the number of wildfires (left axis) and the total number of acres burned (right axis) per year from 2000 through May 2023. Figure 6-167 further breaks this data down by size class. Note that despite a high number of fires and acres burned in 2022, overall the trend has been to see relatively fewer wildfires over the last ten years compared to the previous decade.

Figure 6-166 New Mexico Wildfire History by Year, 2000 – May 2023



Source: National Interagency Fire Center NIFC

Figure 6-167 New Mexico Wildfire History by Year and Size, 2000 – May 2023



Declared Disasters from Wildfire

There have been 57 Federal Fire Management Assistance Grants from 2000 through 2022. Table 6-124 summarizes the number of wildfires and acreage for each Preparedness Area. Preparedness Area 6 has experienced the highest number of wildfire events and acres burned, followed by Preparedness Area 1. The largest wildfire was the Whitewater Baldy Complex in Preparedness Area 6, burning 297,801 acres. The second largest wildfire burned was the Las Conchas in Preparedness Areas 3 and 5, burning 156,593 acres.

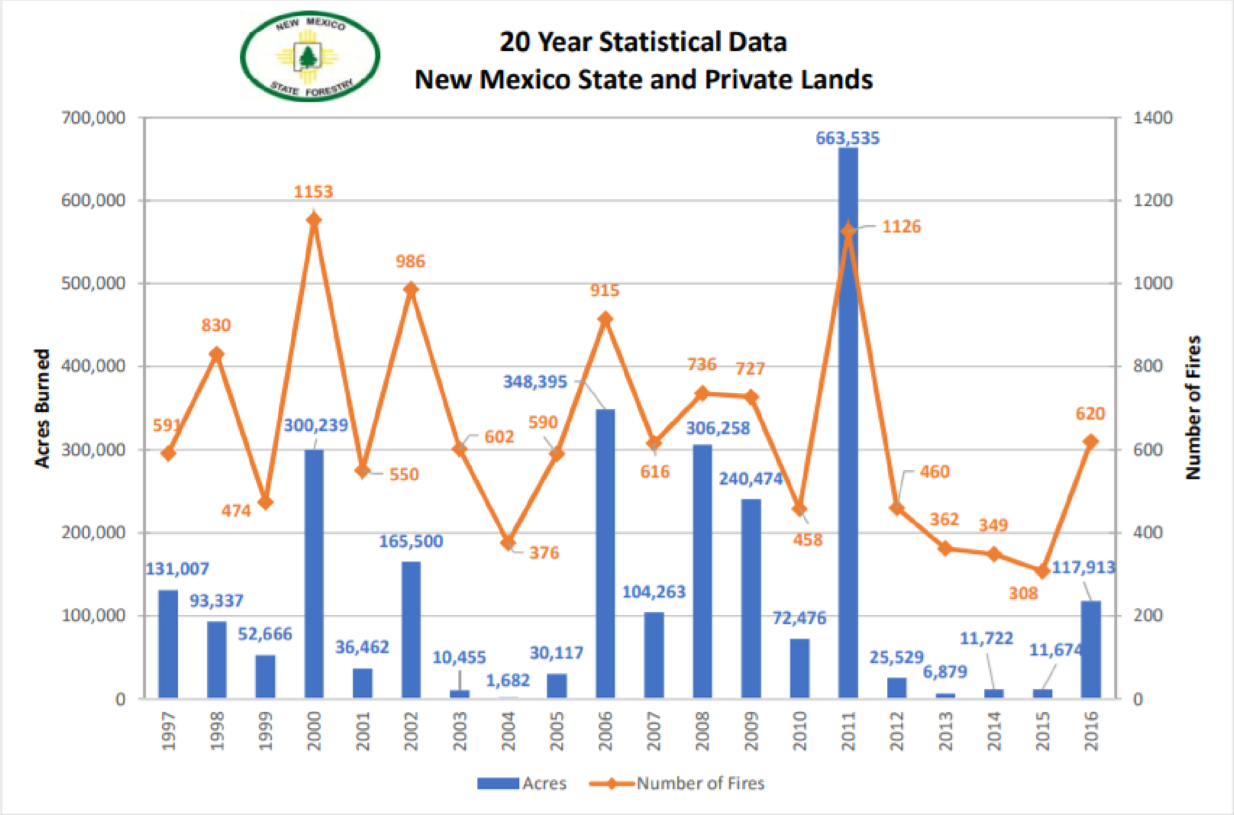
Table 6-124 Summary of Wildfires and Acreage by Preparedness Area, 2000-2022

Preparedness Area	Number of Fires	Number of Acres
PA 1	540	1,464,616
PA 2	145	973,181
PA 3	140	208,107
PA 4	101	88,393
PA 5	203	498,904
PA 6	750	3,180,330
Total	**1,879**	**6,413,531**

6.16.3 Past Frequency

Figure 6-168 shows 20+ years of statistical data for the number of fires and acres burned Statewide. From 1997 to 2016, 12,829 fires have burned 2,730,583 acres Statewide. The average results in 641 wildland fires each year that burn an average of 136,529 acres per year. The number of wildland fires and acres burned vary widely from year to year depending on fuel and weather conditions.

Figure 6-168 20-Year New Mexico Fire History



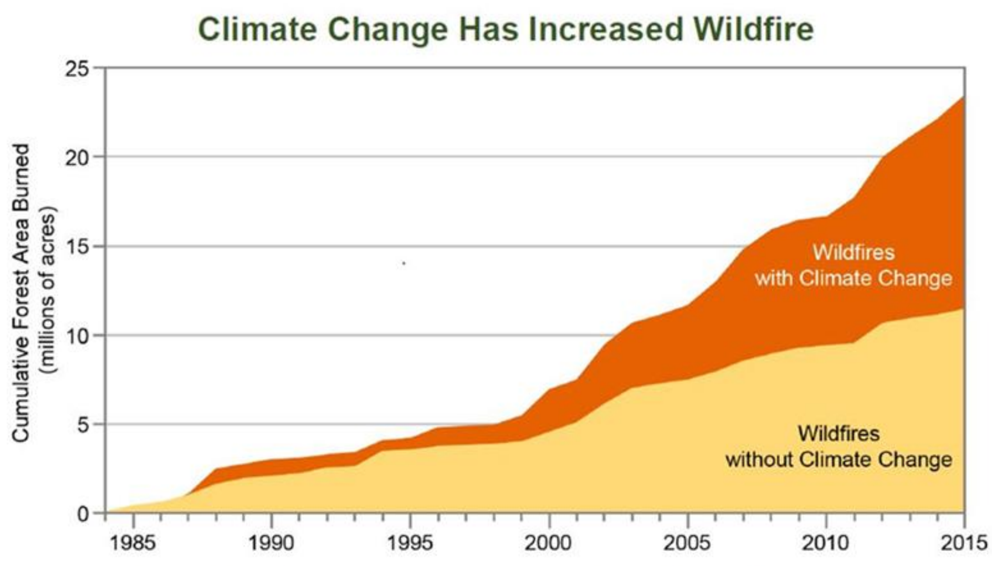
6.16.4 Climate Change Impacts

The effects of climate change can already be seen in the Southwest region of the United States; including rising temperatures, intensified drought events, and increased susceptibility to invasive species. According to the Fourth National Climate Assessment (2018), wildfires have burned twice as many acres across the western United States between 1985 and 2015 than would have burned had climate change not been occurring. Climate change is also creating a year-round wildfire season.

Climate is a major determinant of wildland fire through its control of weather, as well as through its interaction with fuel availability, fuel distribution and flammability at the global, regional, and local levels. With hotter temperatures, drier soil and worsening drought conditions in the entire Western US, wildland fires have the potential to become more extreme. Currently humans are the main cause of fire ignition globally, although lightning has been predominantly responsible for large fires nearby in the Front Range. Western states have seen significant increases in forest area burned in recent years, and the risk of wildland fires in the future are expected to increase due to a lengthening fire season and drier conditions.

According to a report from the Intergovernmental Panel on Climate Change, fire season has already lengthened by 18.7% globally between 1979 and 2013, with statistically significant increases across 25.3% but decreases only across 10.7% of Earth's land surface covered with vegetation; with even sharper changes being observed during the second half of this period. Correspondingly, the global area experiencing long fire weather season has increased by 3.1% per annum or 108.1% during 1979–2013. Fire frequencies under 2050 conditions are projected to increase by approximately 27% globally, relative to the 2000 levels, with changes in future fire meteorology playing the most important role in enhancing global wildland fires, followed by land cover changes, lightning activities and land use, while changes in population density exhibit the opposite effects.

Figure 6-169 Climate Change and Wildfire Events



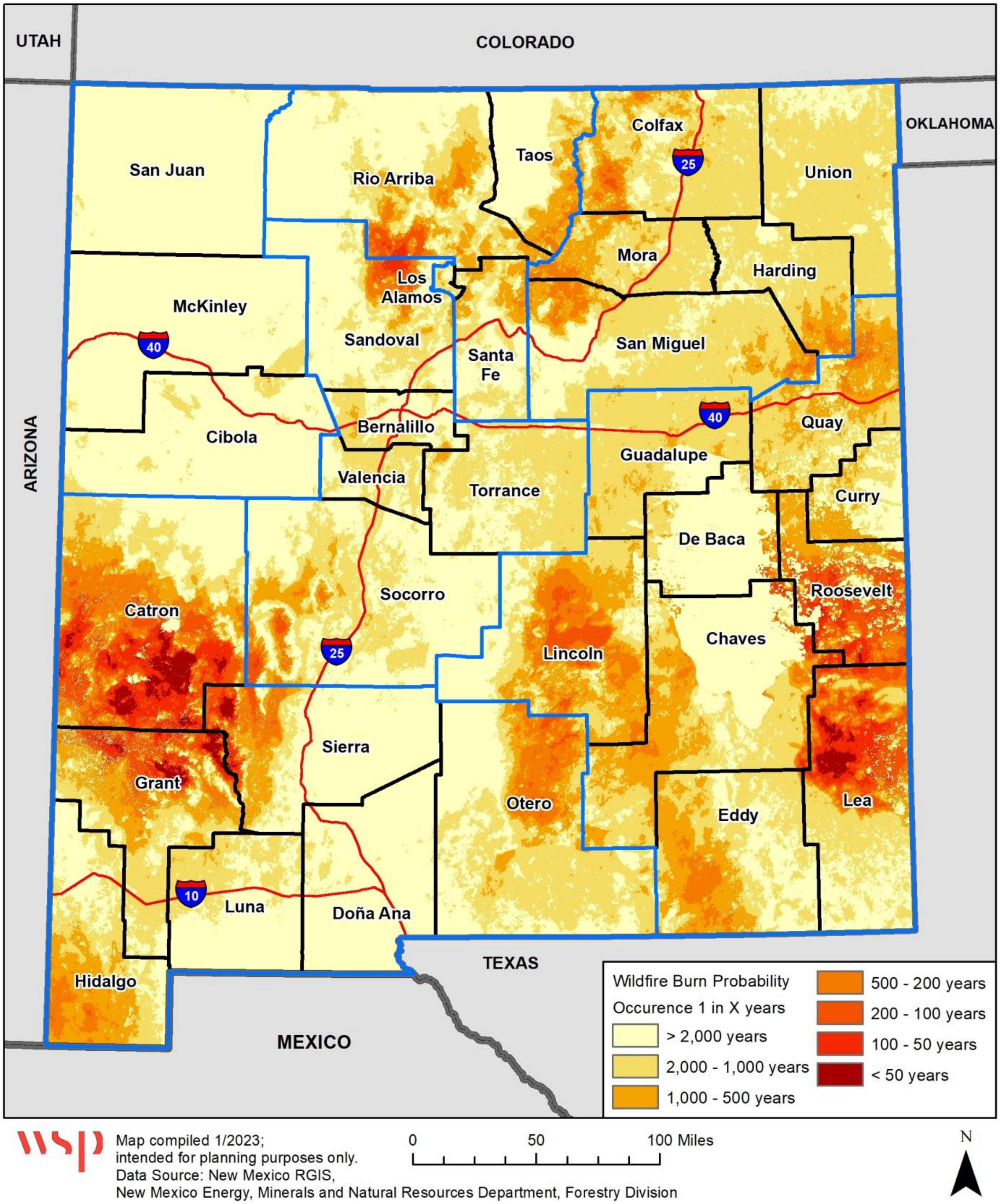
Source: Fourth National Climate Change Assessment, 2018

Land use, vegetation, available fuels, and weather conditions (including wind, low humidity, and lack of precipitation) are chief factors in determining the number and size of fires each year. Generally, fires are more likely when vegetation is dry from a winter with little snow and/or a spring and summer with sparse rainfall. As a result, climate-induced hazards (specifically, a pattern of extended drought conditions) have contributed to increased concern about wildland fire across the Southwest.

6.16.5 Probability of Future Occurrence

The threat of wildland-urban interface fires continues to be the number one natural hazard facing the State. Each Preparedness Area has experienced the effects of wildfire. The annual probability of a large fire event is 100%. There are hundreds of communities that are embedded in or surrounded by flammable vegetation, or have their major routes of egress surrounded by flammable vegetation. This greatly increases the amount of people and infrastructure that are exposed to wildfire risks. With drought conditions persisting and more people locating their residences in the wildland-urban interface, it seems inevitable that all Preparedness Areas will become more susceptible to fires occurring with increased consequences to the population, property, and natural resources.

Figure 6-170 New Mexico Wildfire Burn Probability



6.16.6 Vulnerability Assessment

Wildland fire poses a significant threat to the citizens, structures, infrastructure, and natural resources within New Mexico. Figure 6-171 shows the Wildland Urban Interface (WUI) Statewide in New Mexico on a map.

Figure 6-171 Statewide WUI in New Mexico

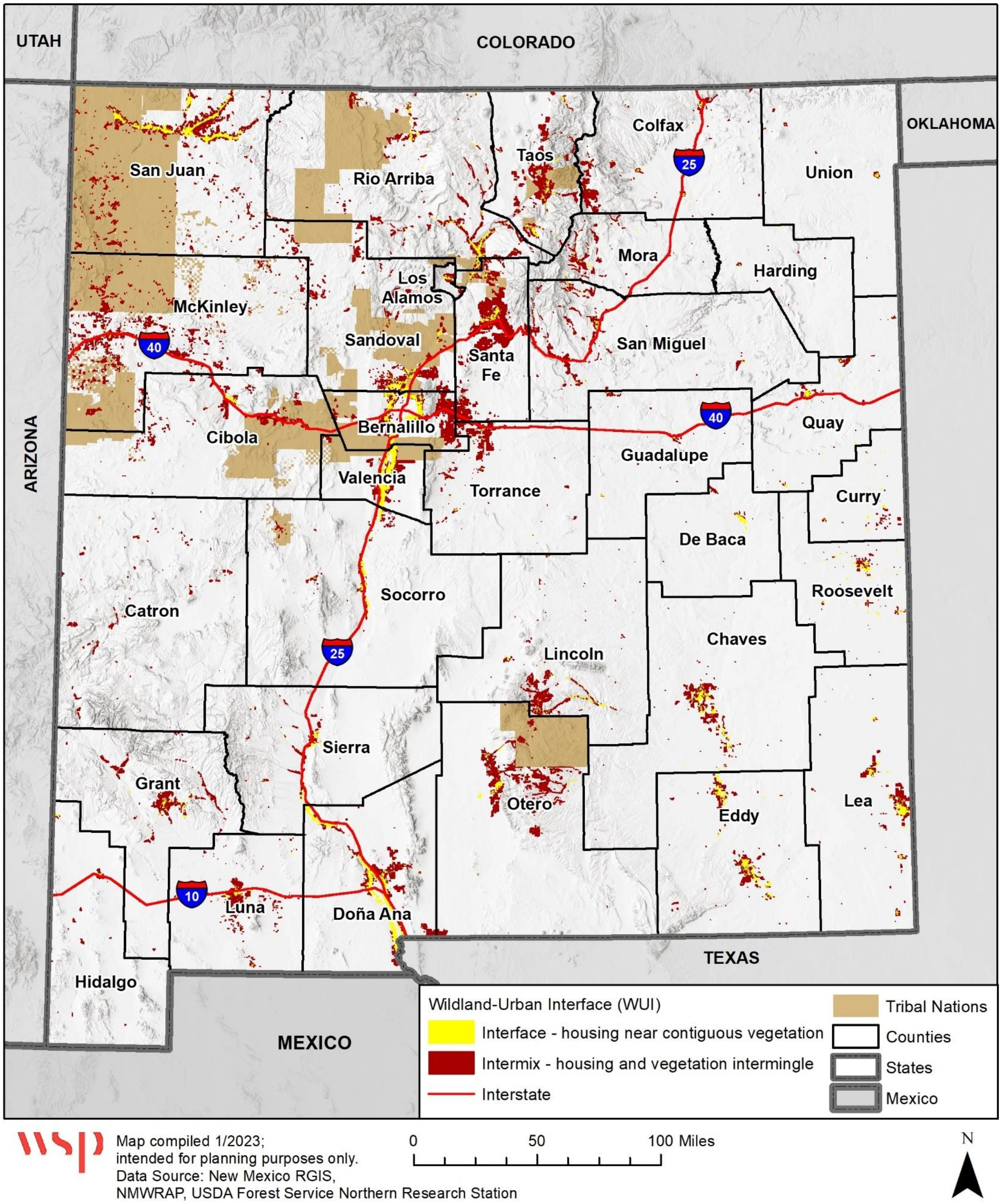
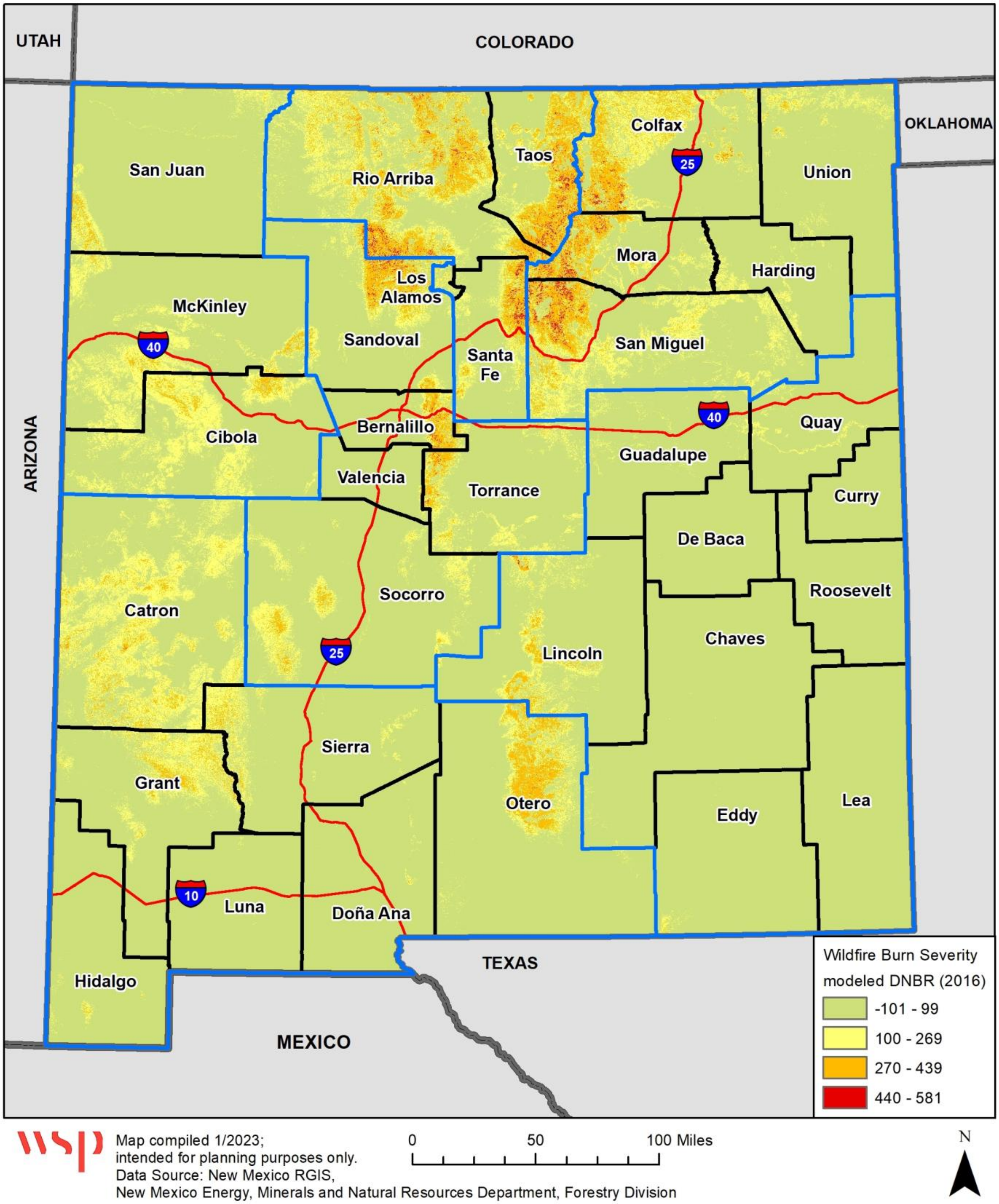


Figure 6-172 New Mexico Wildfire Burn Severity



In 2021, the New Mexico Forestry Division updated the Community at Risk Assessment Plan, which ranks communities and Tribal areas by how vulnerable they are to wildland-urban interface fires.

- The vulnerability criteria used to rank the communities include:
- Proximity of vegetation types to homes
- Availability of water
- Ease of evacuation
- Topography – ridge, valley, slope, and exposure
- Types of fuel (vegetation type)
- Number and size of previous fires
- Direction of prevailing and local winds in each community
- Ability of community/subdivision to protect homes

Currently, there are 69 Community Wildfire Protection Plans (CWPPs) in the State. These 69 CWPPs identify 847 communities at risk from wildland fire. Of the 847 communities, 405 are listed as high risk, 290 are listed as moderate risk and 152 are listed as low risk from wildland fire. Figure 6-173 below shows the communities at risk throughout the state by their risk level, and Figure 6-174 illustrates the CWPP coverage of communities in the state.

The New Mexico Fire Planning Task Force requires that CWPPs be updated within five years of adoption. In 2021, the Fire Planning Task Force adopted new guidelines for updating Community Wildfire Protection Plans. The guidelines outline the process, requirements, and recommendations for updating a CWPP in New Mexico.

Figure 6-173 Communities at Risk to Wildfire

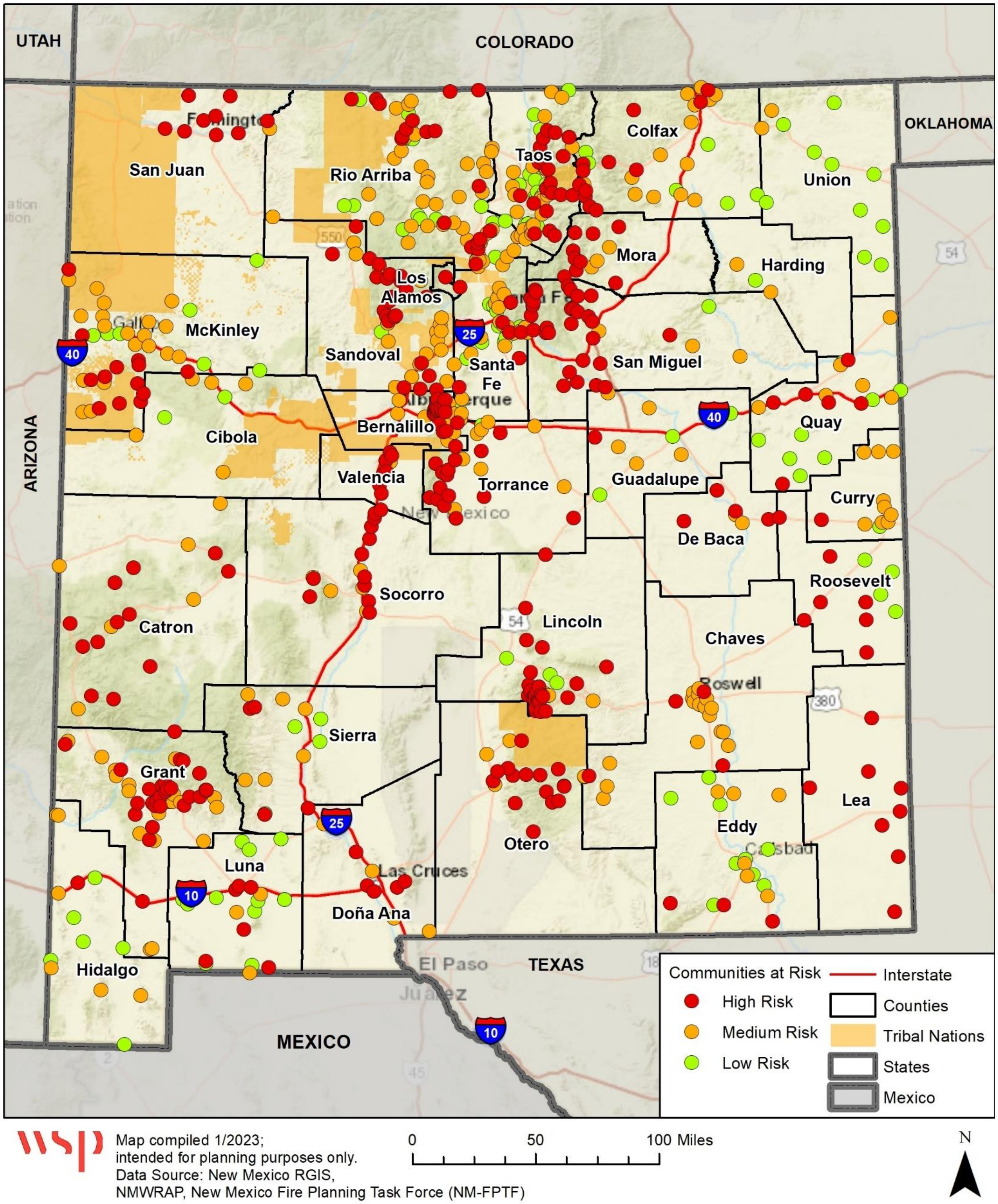
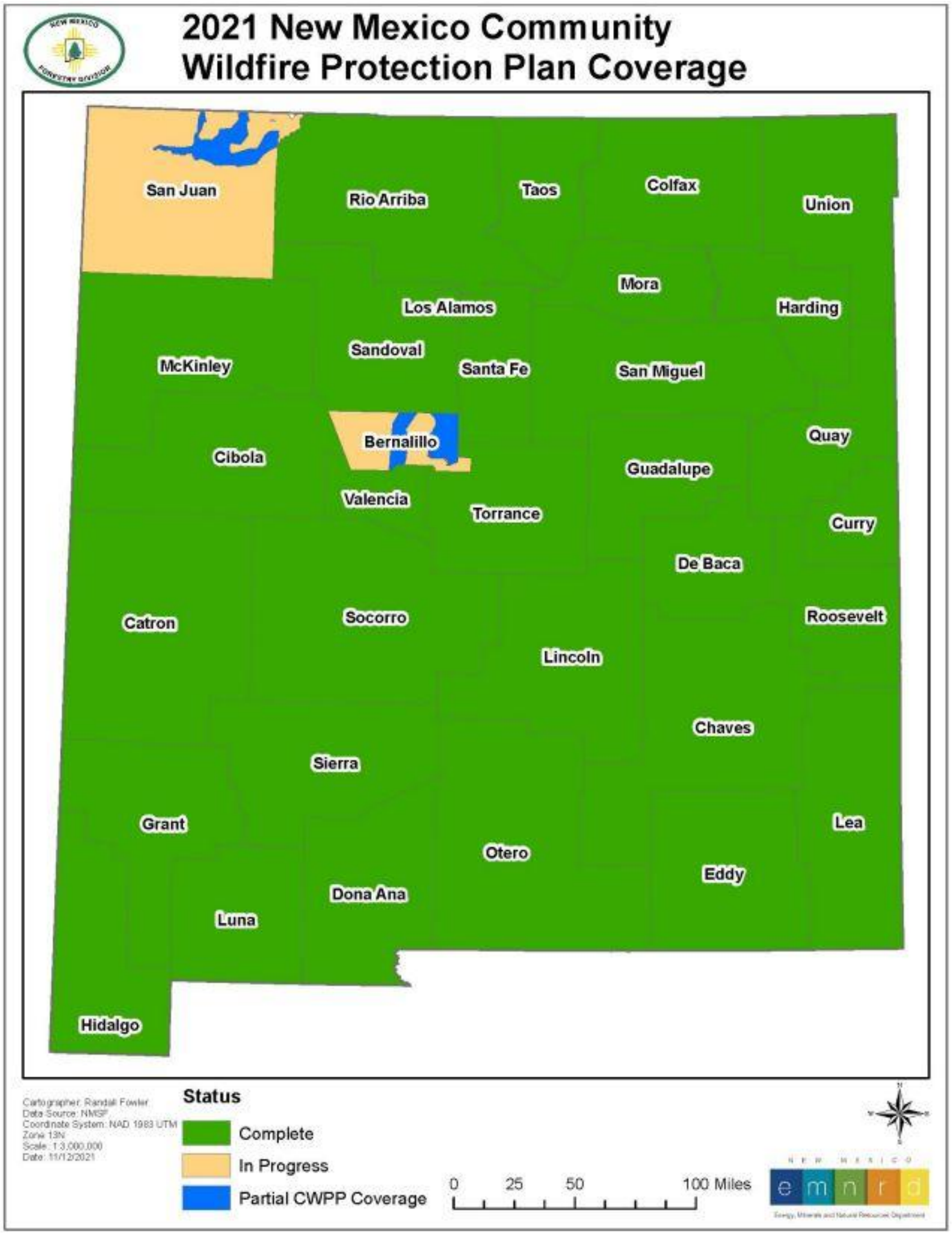


Figure 6-174 Community Wildfire Protection Plan Communities



Community Wildfire Protection Plan Summary and Checklist

Step One: Convene Decision Makers

- Form a core team made up of representatives from the appropriate local governments, local fire authority, and State agency responsible for forest management.

Step Two: Engage Interested Parties

- Contact and encourage active involvement in plan development from a broad range of interested organizations and stakeholders.

- Identify and engage local representatives of the USFS and BLM.
- Contact and involve other land management agencies as appropriate.

Step Three: Establish a Community Base Map

- Work with partners to establish a baseline map of the community that defines the community's WUI and displays inhabited areas at risk, forested areas that contain critical human infrastructure, and forest areas at risk for large-scale fire disturbance.

Step Four: Identify Problems to Be Addressed

- Work with partners to identify problems to be addressed, including fuel hazards; risk of wildfire occurrence; structural ignitability; local preparedness capability; and location of homes, businesses, essential infrastructure, and other community values at risk.
- This "community risk assessment" can be simple or complex depending on the resources available to the community and partners.

Step Five: Establish Community Priorities and Recommendations

- Use the base map and community risk assessment to facilitate a collaborative community discussion that leads to the identification of local priorities for fuel treatment, reducing structural ignitability, and improving fire response capability.
- Clearly indicate whether priority projects are directly related to protection of communities and essential infrastructure or to reducing wildfire risks to other community values.

Step Six: Develop an Action Plan and Assessment Strategy

- Consider developing a detailed implementation strategy to accompany the CWPP, as well as a monitoring plan that will ensure its long-term success.

Step Seven: Complete the Community Wildfire Protection Plan

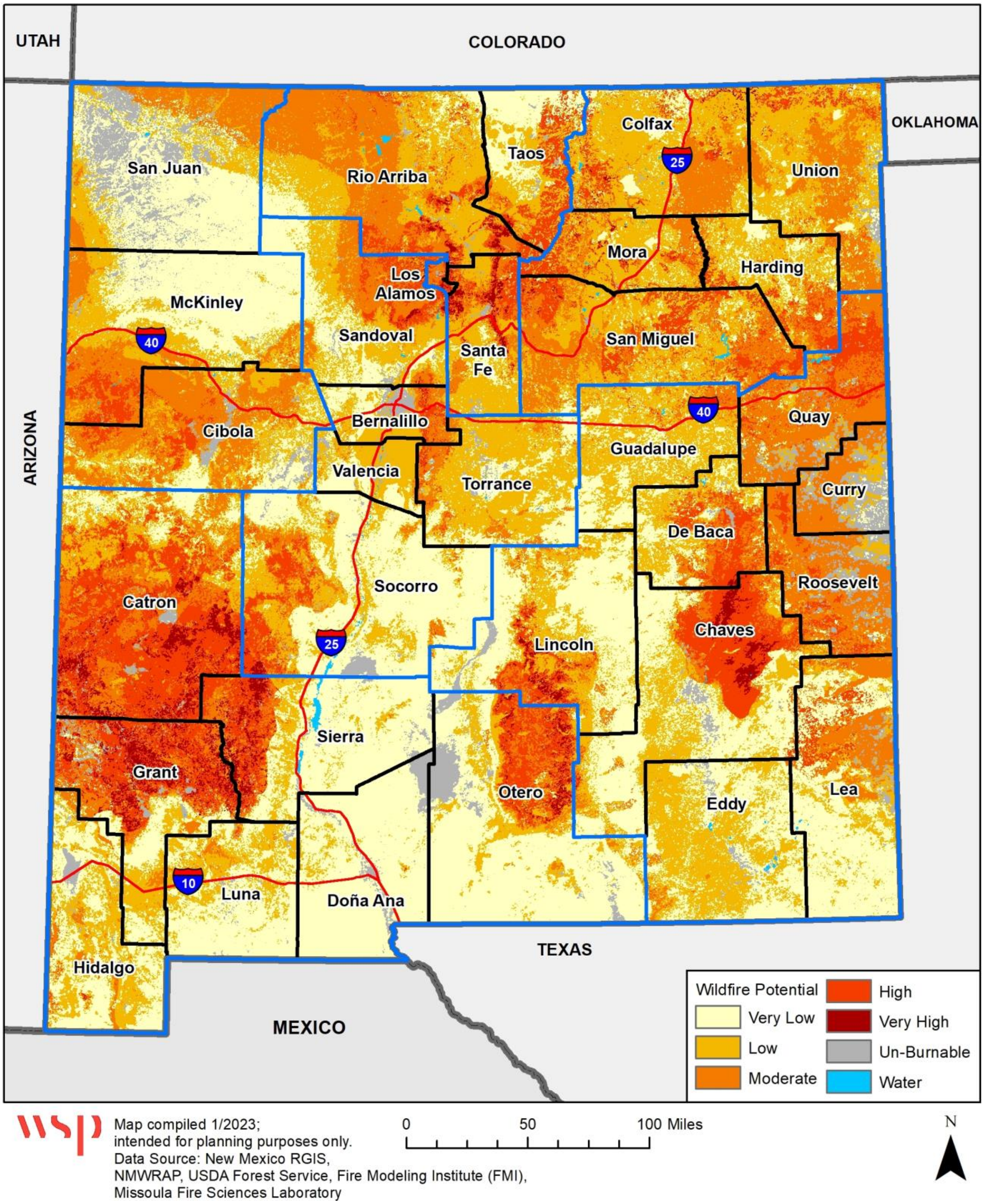
- Consider the CWPP complete for the year and date stamp the document.
- Communicate the results to the community and partners.
- Collect information to update the plan for revision the following year.

The New Mexico Forest Action Plan (originally published as the Statewide Natural Resource Assessment & Strategy and Response Plans by New Mexico State Forestry in June 2010) includes an analysis of wildfire risk. The document explains several data gaps that would need to be addressed in order to improve the wildfire risk map. The document also includes a wildfire risk analysis for each of the six State Forestry Districts. The data models will be reviewed and revised as necessary in the next update of the Forest Action Plan, slated for 2020.

The map below shows updated (2014) Wildfire Hazard Potential based on models produced by the U.S. Forest Service Rocky Mountain Research Station (https://www.firelab.org/project/wildfire-hazard-potential). The map depicts the relative potential for wildfire that would be difficult for suppression resources to contain.

Figure 6-175 displays the Statewide wildfire hazard potential model results by Preparedness Area.

Figure 6-175 Wildfire Hazard Potential Model Results



Property Exposure from LHMPs

Wildfire risk exposure was assessed in 21 LHMPs across five of the six PAs. The total reported value of structures/parcels across the state exposed to wildfire risk is over $56 billion for more than 194,000 structures/parcels. The highest structure exposure was identified in PA Three with 33,000 structures/parcels across four LHMPs and an approximate value of $34 billion. Statewide this accounts for approximately 60% of the total structure values at most risk and 17% of the total structure count. PA Five is where the majority of structures/parcels exposure occurs. 56% of structures/parcels are in five LHMPs, with approximately 110,000 structures/parcels and $17.5 billion, or 31%, of the total statewide value of structures/parcels exposed to the highest wildfire risk. No exposure data was reported in PA 2.

Table 6-125 Exposure to Areas at Risk of Wildfire by Preparedness Area

PAs and Jurisdictions	Total Dollar Value Exposure	Total Exposed Structures/Parcels
One	**$1,993,826,000**	**16,404**
De Baca County	$124,124,000	-
Quay County	$405,000,000	5,545
Lincoln County	$534,527,000	4,586
Eddy County	$930,175,000	6,273
Three	**$33,935,456,000**	**33,388**
Los Alamos	$20,597,000	124
Taos County	$197,228,000	947
Santa Fe County	$1,056,014,000	7,121
City of Santa Fe	$32,661,617,000	25,196
Four	**$2,432,598,000**	**15,570**
Zuni Pueblo	$63,292,000	342
Laguna Pueblo	$534,527,000	4,586
McKinley County	$1,834,779,000	10,642
Five	**$17,584,408,000**	**108,922**
Santa Ana Pueblo	$8,702,000	123
Socorro County	$31,475,000	449
Torrance County	$37,556,000	357
Sandoval County	$1,689,224,000	24,240
Bernalillo County / Albuquerque	$15,817,451,000	83,753
Six	**$1,025,395,000**	**19,824**
Sierra County	-	14,098
Hidalgo County	$8,446,000	82
Otero County	$238,789,000	-
Dona Ana County	$324,252,000	2,781
Catron County	$453,908,000	2,863
Grand Total	**$56,971,683,000**	**194,108**

State Assets

A geospatial analysis of state owned assets potentially at risk of wildfire was conducted based on the risk categories in Figure 6-175. No state assets were identified in areas of very high or high risk. For purposes of this analysis, the State assumed losses up to 75% of total asset value for assets at Moderate risk of wildfire, 50% for assets at low risk, and 25% for assets at very low risk. Table 6-126 shows estimated losses for state assets from wildfire; these estimates are for planning purposes only and should not be used for insurance purposes.

Table 6-126 Potential Losses to State Assets From Wildfire

	County	Preparedness Area	Health and Medical	Safety and Security	Transpor-tation	Total	Total Value	Estimated Losses
Moderate Risk	Grant	6	1	-	-	**1**	**$0**	**$0**
	Total		**1**	**0**	**0**	**1**	**$0**	**$0**
Low Risk	Chaves	1	-	3	-	**3**	**$20,966,000**	**$10,483,000**
	Cibola	4	-	-	1	**1**	**$5,636,000**	**$2,818,000**
	Colfax	2	-	2	-	**2**	**$33,954,000**	**$16,977,000**
	McKinley	4	-	1	-	**1**	**$2,807,000**	**$1,403,500**
	San Miguel	2	1	-	-	**1**	**$137,403,000**	**$68,701,500**
	Sandoval	5	-	1	-	**1**	**$17,085,000**	**$8,542,500**
	Santa Fe	3	-	6	1	**7**	**$136,030,704**	**$68,015,352**
	Valencia	5	1	1	-	**2**	**$48,594,000**	**$24,297,000**
	Total		**2**	**14**	**2**	**18**	**$402,475,704**	**$201,237,852**
Very Low Risk	Dona Ana	6	-	2	-	**2**	**$76,250,000**	**$19,062,500**
	Luna	6	-	-	1	**1**	**$9,553,000**	**$2,388,250**
	Socorro	5	-	1	-	**1**	**$3,026,251**	**$756,563**
	Total	**---**	**0**	**3**	**1**	**4**	**$88,829,251**	**$22,207,313**

The last several years have seen a dramatic increase in the frequency and severity of wildfires or rangeland fires spreading into urban areas, often with disastrous results. Therefore the SHMT also state assets located in developed or non-vegetated areas that are potentially at risk to wildfire. 100% losses were assumed, thus estimated losses equal the total value of the propery and contents. This analysis is shown in Table 6-127

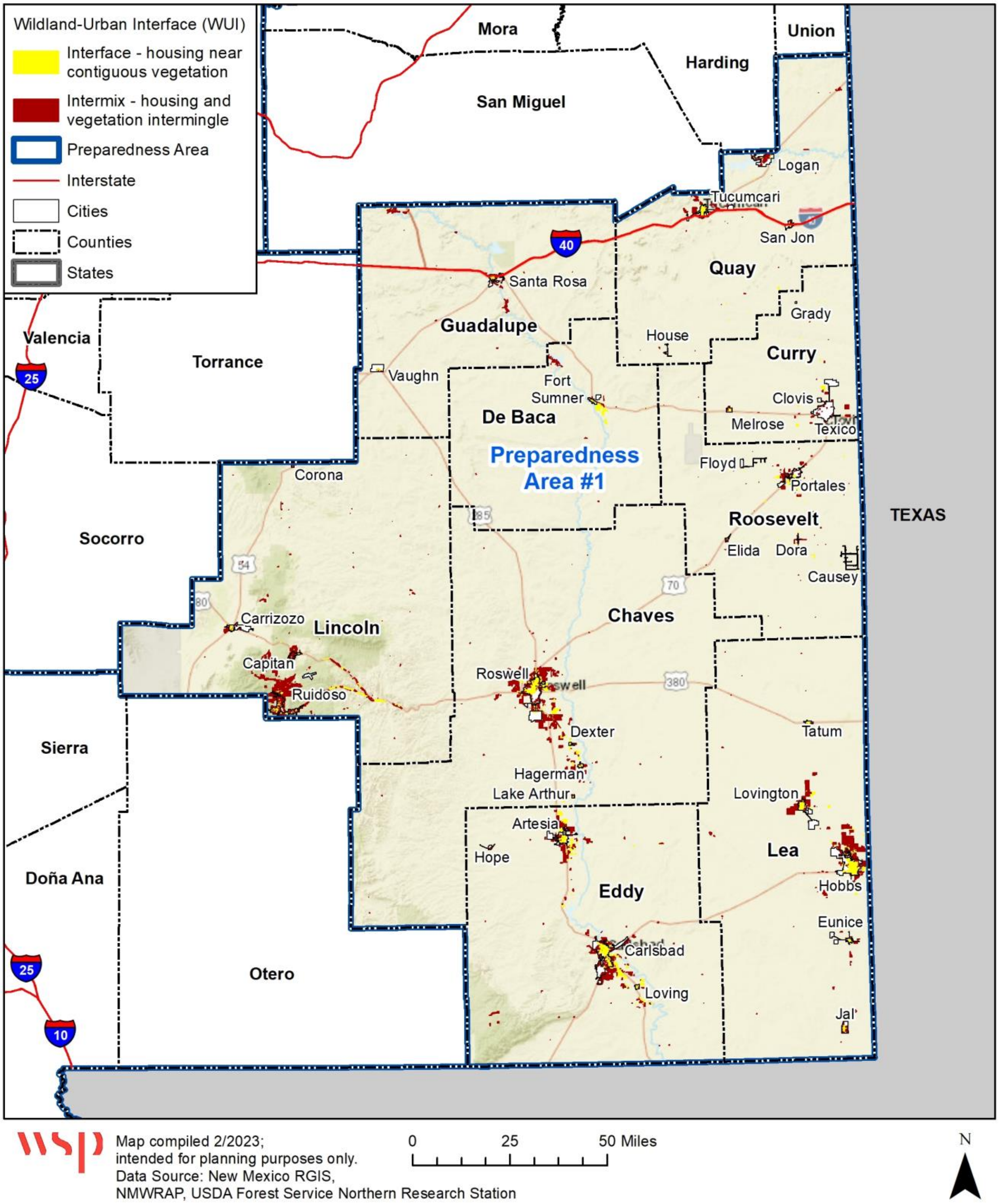
Table 6-127 State Assets in Developed/Non-Vegetated Area at Risk of Wildfire

County	Total Assets	Preparedness Area	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
Bernalillo	6	5	3	2	1	$393,344,167	**$393,344,167**
Chaves	2	1	1	-	1	$27,231,000	**$27,231,000**
Cibola	1	4	-	1	-	$33,466,000	**$33,466,000**
Colfax	1	2	1	-	-	$55,356,000	**$55,356,000**
Curry	1	1	-	1	-	$933,000	**$933,000**
Rio Arriba	1	3	-	1	-	$558,985	**$558,985**
San Miguel	2	2	-	1	1	$15,562,000	**$15,562,000**
Santa Fe	9	3	-	8	1	$466,882,000	**$466,882,000**
Sierra	1	6	1	-	-	$24,528,000	**$24,528,000**
Taos	1	3	-	1	-	$501,000	**$501,000**
Valencia	1	5	-	1	-	$100,026,000	**$100,026,000**
Total	**26**	**---**	**6**	**16**	**4**	**$1,118,388,152**	**$1,118,388,152**

Preparedness Area 1

Figure 6-176 below shows the WUI areas in Preparedness Area 1.

Figure 6-176 Preparedness Area 1 WUI



PA 1 is highly vulnerable to wildfire due to multiple factors including rapid development near forested areas, prolonged drought conditions, and high fuel loads due to pine beetle kill. However, vegetation treatments have been ongoing and are planned to continue to mitigate the high fuel loads in PA 1. Vegetation Treatment Mapping was conducted by NM State Forestry as described in Section 4.2.3.

Vegetation treatments include actions such as prescribed burns and mechanical thinning to decrease the amount of fuel load and mimic frequent, low-intensity burns that are natural to the ecosystem. Table 6-128 shows planned, completed (1996-present), and historic (pre-1996) vegetation treatments in PA 1 by total acres and landowner. A total of 1,880,799 acres of vegetation have been treated and an additional 1,002,482 are planned for treatment, totaling 2,883,281 acres of treated vegetation. This equates to approximately 14% of Preparedness Area 1's total land area. Figure 6-177 shows the breakdown of planned, completed, and historic treatments. Treatment on private land show the most acres of historic treatments, while the BLM completed the most acres of treatment since 1996 and will complete the majority of acres of planned treatments. Figure 6-178 shows the percent of total acres treated by landownership. Overall, the BLM will treat the most acres of vegetation.

Table 6-128 Preparedness Area 1 Planned, Completed, and Historic Vegetation Treatments

Planned Treatments			
Total Acres	**Landowner**	**Acres**	**Percent**
1,002,482 (5.0% of PA 1 land area)	BLM	992,162	98.97%
	Private	396	0.04%
	Private, Municipal	28	0.00%
	State	80	0.01%
	Tribal: Mescalero Apache	508	0.05%
	USFS	9,290	0.93%
	Village of Ruidoso	18	0.00%
Completed Treatments (1996-present)			
Total Acres	**Landowner**	**Acres**	**Percent**
1,600,891 (7.9% of PA 1 land area)	BLM	927,929	57.96%
	BLM, Private	7,318	0.46%
	BOR	4,090	0.26%
	DOE	6,916	0.43%
	Municipal	107	0.01%
	NM Game and Fish	946	0.06%
	Private	310,577	19.40%
	State	165,850	10.36%
	State Park	130	0.01%
	Tribal: Mescalero Apache	395	0.02%
	USFS	176,632	11.03%
Historic Treatments (pre-1996)			
Total Acres	**Landowner**	**Acres**	**Percent**
279,908 (1.4% of PA 1 land area)	BLM	118,000	42.16%
	Private	191,147	68.29%
	State	31,071	11.10%
	USFS	45,890	16.39%

Figure 6-177 Preparedness Area 1 Total Acres of Vegetation Treatment

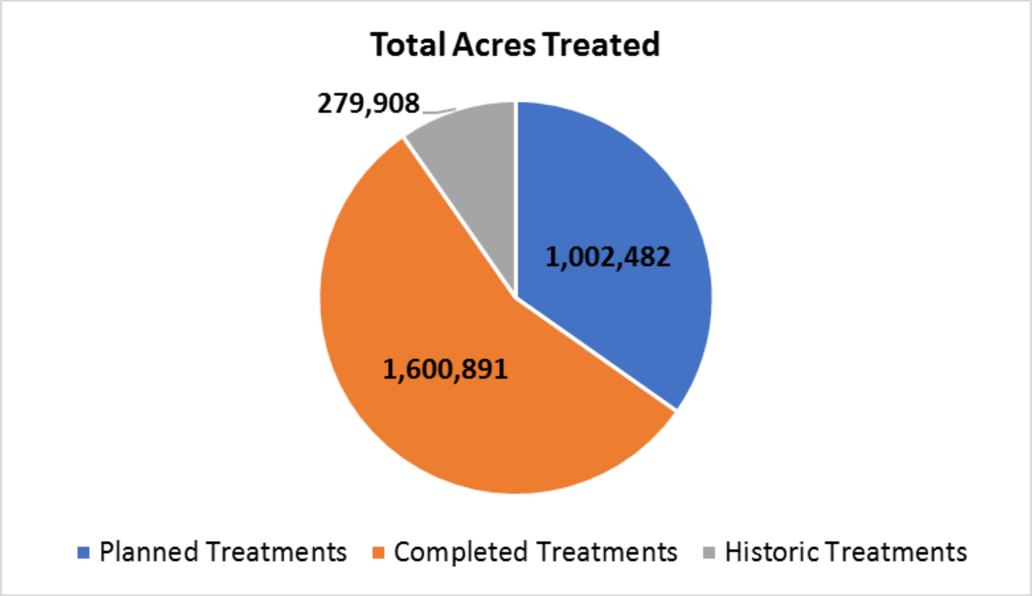
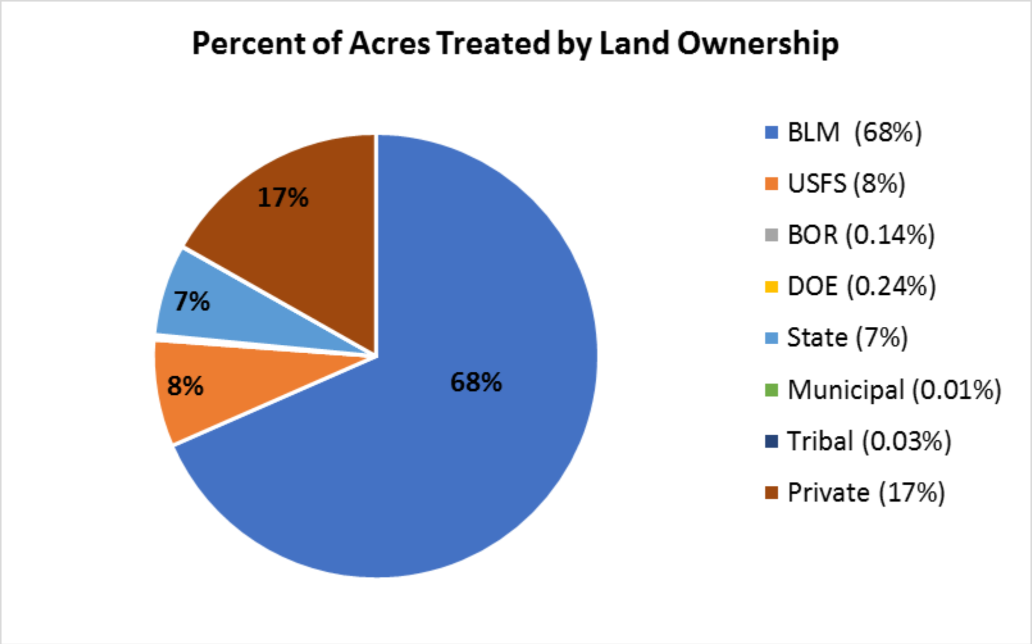


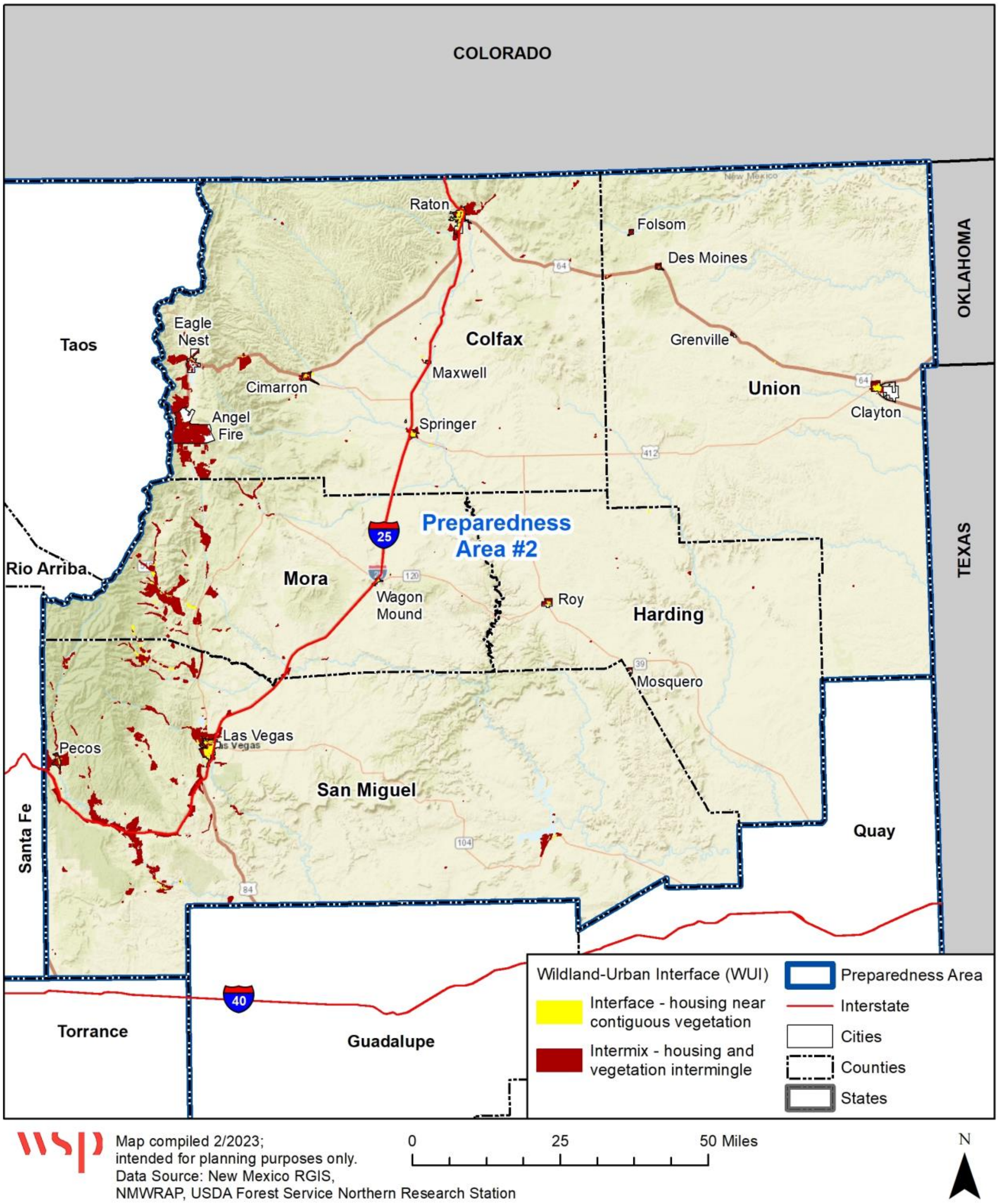
Figure 6-178 Preparedness Area 1 Percent of Total Acres Treated by Landownership



Preparedness Area 2

Figure 6-179 below shows the WUI areas in Preparedness Area 2.

Figure 6-179 Preparedness Area 2 WUI



Preparedness Area 2 is highly vulnerable to wildfire due to multiple factors including prolonged drought conditions and high fuel loads due to pine beetle kill. However, vegetation treatments have been ongoing and are planned to continue to mitigate the high fuel loads in PA 2. Vegetation Treatment Mapping was conducted by NM State Forestry as described in Section 4.2.3. Vegetation treatments include actions such as prescribed burns and mechanical thinning to decrease the amount of fuel load and mimic frequent, low-intensity burns that are natural to the ecosystem. Table 6-129 shows planned, completed (1996-present), and historic (pre-1996) vegetation treatments by total acres and landowner in PA 2. A total of 165,569 acres of vegetation have been treated and an additional 12,355 are planned for treatment, totaling 177,924 acres of treated vegetation This equates to approximately 2% of PA 2's total land area. Figure 6-180 shows the breakdown of planned, completed, and historic treatments. The USFS conducted the most acres of historic and completed treatments, while the State and private landowners will complete the majority of acres of planned treatments. Figure 6-181 shows the percent of total acres treated by landownership. Overall, the USFS will treat the most acres of vegetation.

Table 6-129 Preparedness Area 2 Planned, Completed, and Historic Vegetation Treatments

Planned Treatments			
Total Acres	**Landowner**	**Acres**	**Percent**
12,355 (0.1% of PA 2 land area)	BLM	10	0.08%
	Land Grant	20	0.17%
	Other	240	1.94%
	State	6,189	50.09%
	State, Private	5,310	42.98%
	USFS	586	4.74%
Completed Treatments (1996-present)			
Total Acres	**Landowner**	**Acres**	**Percent**
141,282 (1.3% of PA 2 land area)	Bureau of Reclamation	82	0.06%
	DOD	35	0.02%
	Municipal	49	0.03%
	NM Game and Fish	806	0.57%
	Private	12,043	8.52%
	State	4,749	3.36%
	USFS	123,518	87.43%
Historic Treatments (pre-1996)			
Total Acres	**Landowner**	**Acres**	**Percent**
24,287 (0.2% of PA 2 land area)	BLM	338	1.39%
	Private	3,071	12.65%
	USFS	20,877	85.96%

Figure 6-180 Preparedness Area 2 Total Acres of Vegetation Treatment

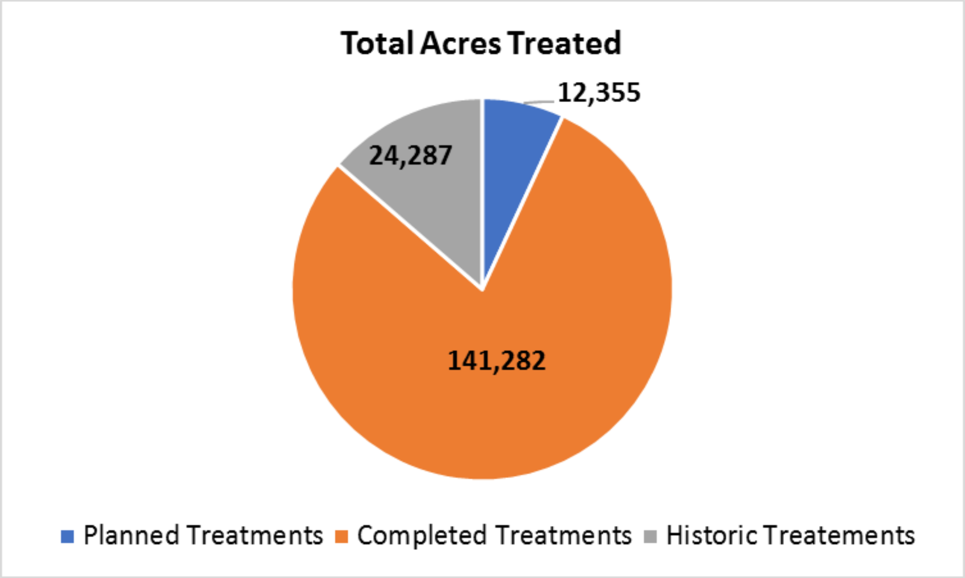
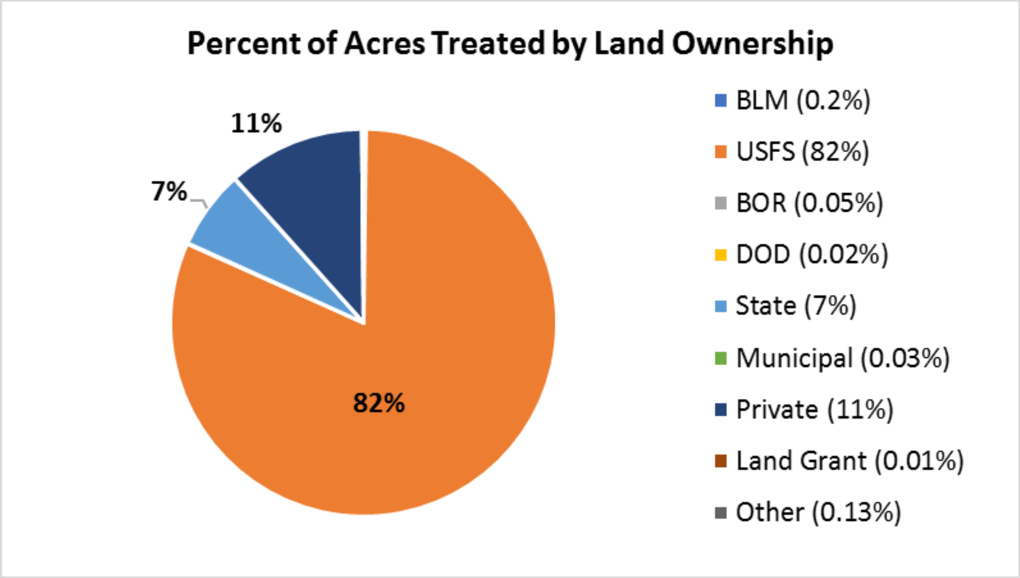


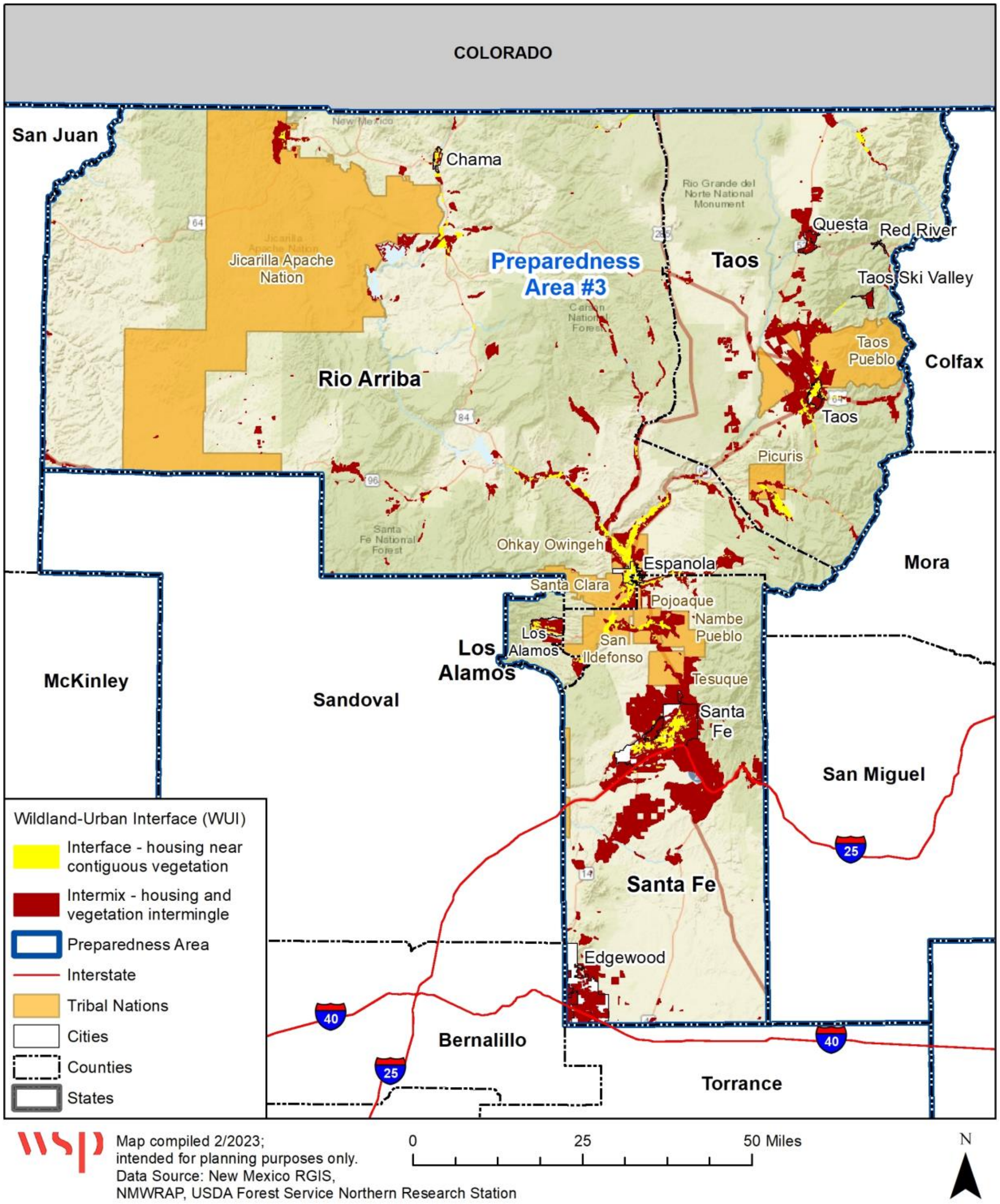
Figure 6-181 Preparedness Area 2 Percent of Total Acres Treated by Landownership



Preparedness Area 3

Figure 6-182 below shows the WUI areas in Preparedness Area 3.

Figure 6-182 Preparedness Area 3 WUI



Based on local mitigation plans, wildfire was ranked as the top priority hazard in PA 3. Every jurisdiction ranked wildfire as a high priority hazard. PA 3 is highly vulnerable to wildfire due to multiple factors including rapid development near forested areas, prolonged drought, and high fuel loads due to pine beetle kill. Currently, drought conditions in PA 3 can be described as severe to extreme. Large numbers of people are exposed to wildfire risks, especially populations living or working in close proximity to forested areas, residents with asthma or other respiratory sensitivity, and very young and elderly residents.

However, vegetation treatments have been ongoing and are planned to continue to mitigate the high fuel loads in Preparedness Area 3. Vegetation Treatment Mapping was conducted by NM State Forestry as described in Section 4.2.3. Vegetation treatments include actions such as prescribed burns and mechanical thinning to decrease the amount of fuel load and mimic frequent, low-intensity burns that are natural to the ecosystem. Table 6-130 shows planned, completed (1996-present), and historic (pre-1996) vegetation treatments by total acres and landowner in Preparedness Area 3. A total of 510,502 acres of vegetation have been treated and an additional 124,089 are planned for treatment, totaling 634,591 acres of treated vegetation. This equates to approximately 10% of Preparedness Area 3's total land area. Figure 6-183 shows the breakdown of planned, completed, and historic treatments. Historic treatments were completed primarily by the USFS, followed by both private landowners and the BLM. The USFS completed a higher percent of treatment acres of more recently completed treatments, however the BLM will complete 99% of the planned acres of treatment. Figure 6-184 shows the percent of total acres treated by landownership. Overall, the USFS will treat the most acres of vegetation.

Table 6-130 Preparedness Area 3 Planned, Completed, and Historic Vegetation Treatments

Planned Treatments			
Total Acres	Landowner	Acres	Percent
124,089 (1.9% of PA 3 land area)	BLM	123,295	99.36%
	Municipal	10	0.01%
	Private	51	0.04%
	SLO	10	0.01%
	State	10	0.01%
	Tribal: BIA Jicarilla Trust	10	0.01%
	USFS	693	0.56%
	USFS, Private	10	0.01%
Completed Treatments (1996-present)			
Total Acres	**Landowner**	**Acres**	**Percent**
387,825 (6.0% of PA 3 land area)	BLM	88,113	22.72%
	Bureau of Reclamation	14	0.00%
	NM Game and Fish	600	0.15%
	Private	19,610	5.06%
	State	7,347	1.89%
	State Park	8	0.00%
	Tribal	2,343	0.60%
	USFS	269,791	69.57%
Historic Treatments (pre-1996)			
Total Acres	**Landowner**	**Acres**	**Percent**
	BLM	30,265	24.67%

Planned Treatments			
Total Acres	Landowner	Acres	Percent
122,677 (1.9% of PA 3 land area)	NM Game and Fish	219	0.18%
	Private	30,725	25.05%
	State	2,509	2.05%
	Tribal	2,158	1.76%
	USFS	56,802	46.30%

Figure 6-183 Preparedness Area 3 Total Acres of Vegetation Treatment

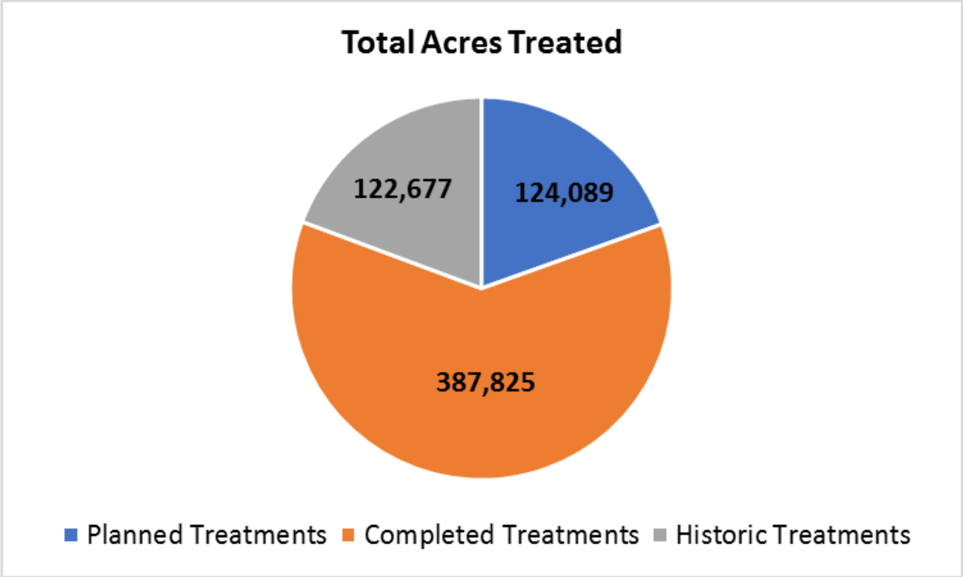
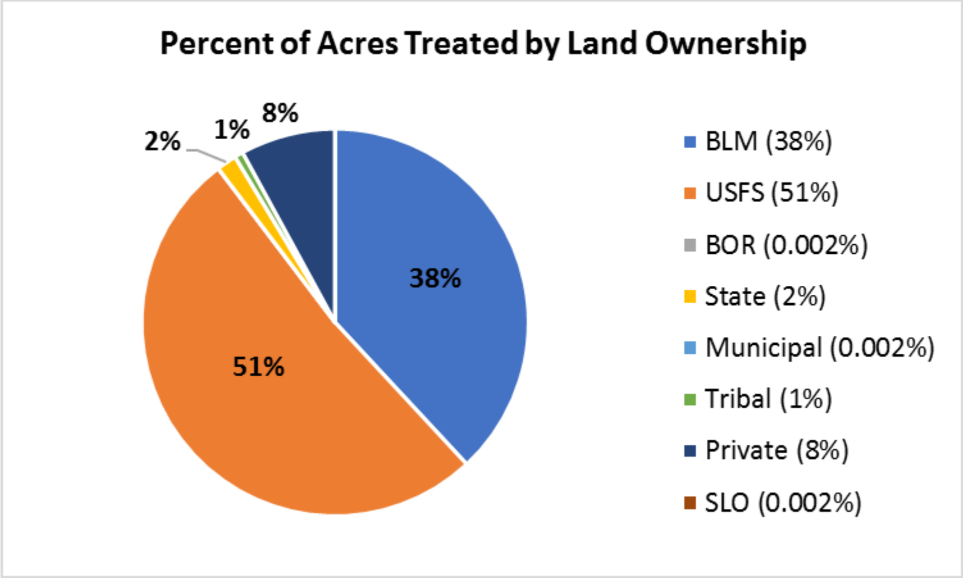


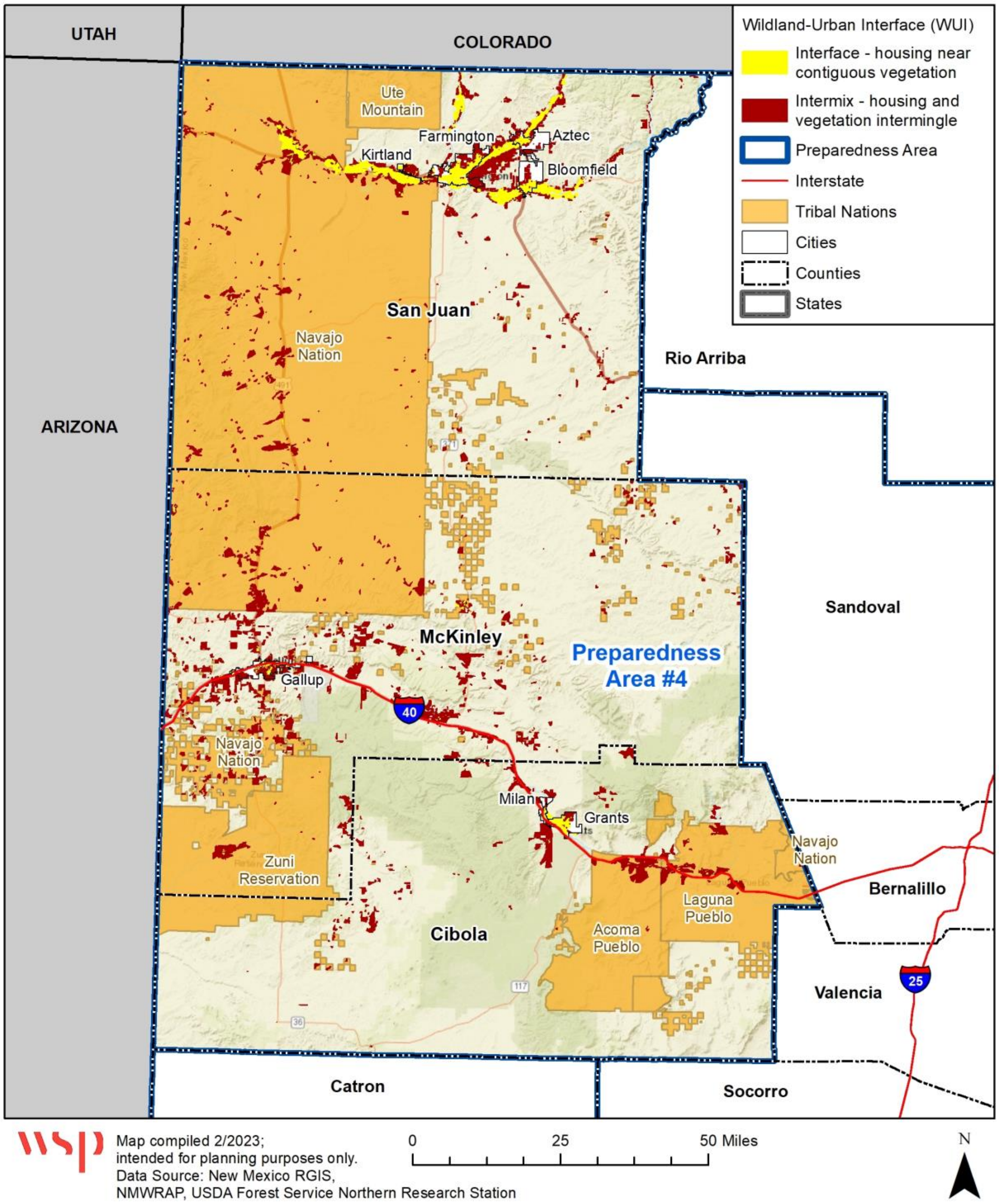
Figure 6-184 Preparedness Area 3 Percent of Total Acres Treated by Landownership



Preparedness Area 4

Figure 6-185 below shows the WUI areas in Preparedness Area 4.

Figure 6-185 Preparedness Area 4 WUI



Wildfire was ranked equally with drought as the second top priority hazard in Preparedness Area 4. PA 4 is in a medium to high priority wildfire risk zone, and is highly vulnerable to wildfire due to multiple factors including development near forested areas, prolonged drought conditions, and high fuel loads due to pine beetle kill. However, vegetation treatments have been ongoing and are planned to continue to mitigate the high fuel loads in PA 4. Vegetation Treatment Mapping was conducted by NM State Forestry as described in Section 4.2.3. Vegetation treatments include actions such as prescribed burns and mechanical thinning to decrease the amount of fuel load and mimic frequent, low-intensity burns that are natural to the ecosystem. Table 6-131 shows planned, completed (1996-present), and historic (pre-1996) vegetation treatments by total acres and landowner in PA 4. A total of 662,182 acres of vegetation have been treated and an additional 20,650 are planned for treatment, totaling 682,832 acres of treated vegetation. This equates to approximately 7% of PA 4's total land area. Figure 6-186 shows the breakdown of planned, completed, and historic treatments. Historically, most acres of treatment were completed by Tribal entities, followed by the BLM and the USFS. The majority of acres of completed treatments were performed by the BLM, followed by the USFS. The majority of acres of planned treatments will be completed by the USFS. Figure 6-187 shows the percent of total acres treated by landownership. Overall, the BLM will treat the most acres of vegetation, followed closely by the USFS.

Table 6-131 Preparedness Area 4 Planned, Completed, and Historic Vegetation Treatments

Planned Treatments			
Total Acres	**Landowner**	**Acres**	**Percent**
20,650 (0.2% of PA 4 land area)	BLM	4,126	19.98%
	State	1,243	6.02%
	USFS	15,282	74.00%
Completed Treatments (1996-present)			
Total Acres	**Landowner**	**Acres**	**Percent**
392,969 (3.9 % of PA 4 land area)	BLM	198,802	50.59%
	BOR	25	0.01%
	Municipal	72	0.02%
	NM Game and Fish	99	0.03%
	Private	15,623	3.98%
	State	9,763	2.48%
	State Park	19	0.00%
	State, NM Game and Fish	148	0.04%
	Tribal	3,651	0.93%
	USFS	164,767	41.93%
Historic Treatments (pre-1996)			
Total Acres	**Landowner**	**Acres**	**Percent**
269,213 (2.7% of PA 4 land area)	BLM	64,585	23.99%
	Private	33,969	12.62%
	Tribal	115,269	42.82%
	USFS	55,389	20.57%

Figure 6-186 Preparedness Area 4 Total Acres of Vegetation Treatment

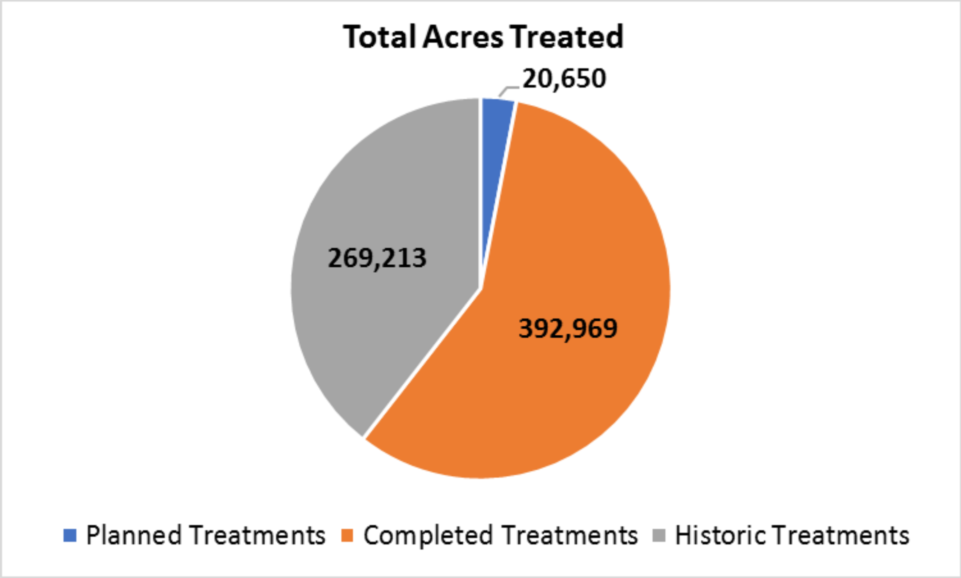
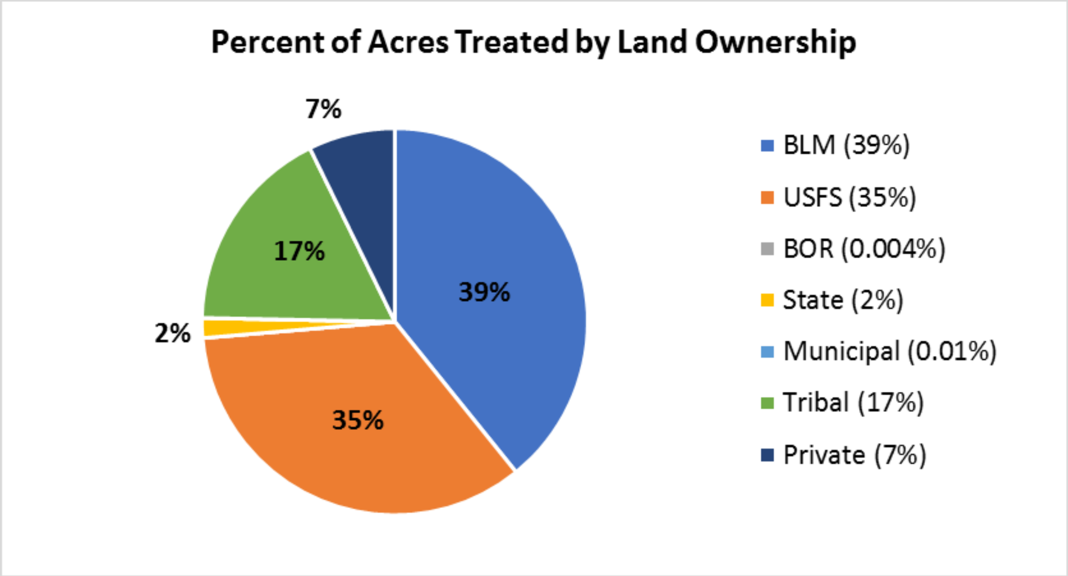


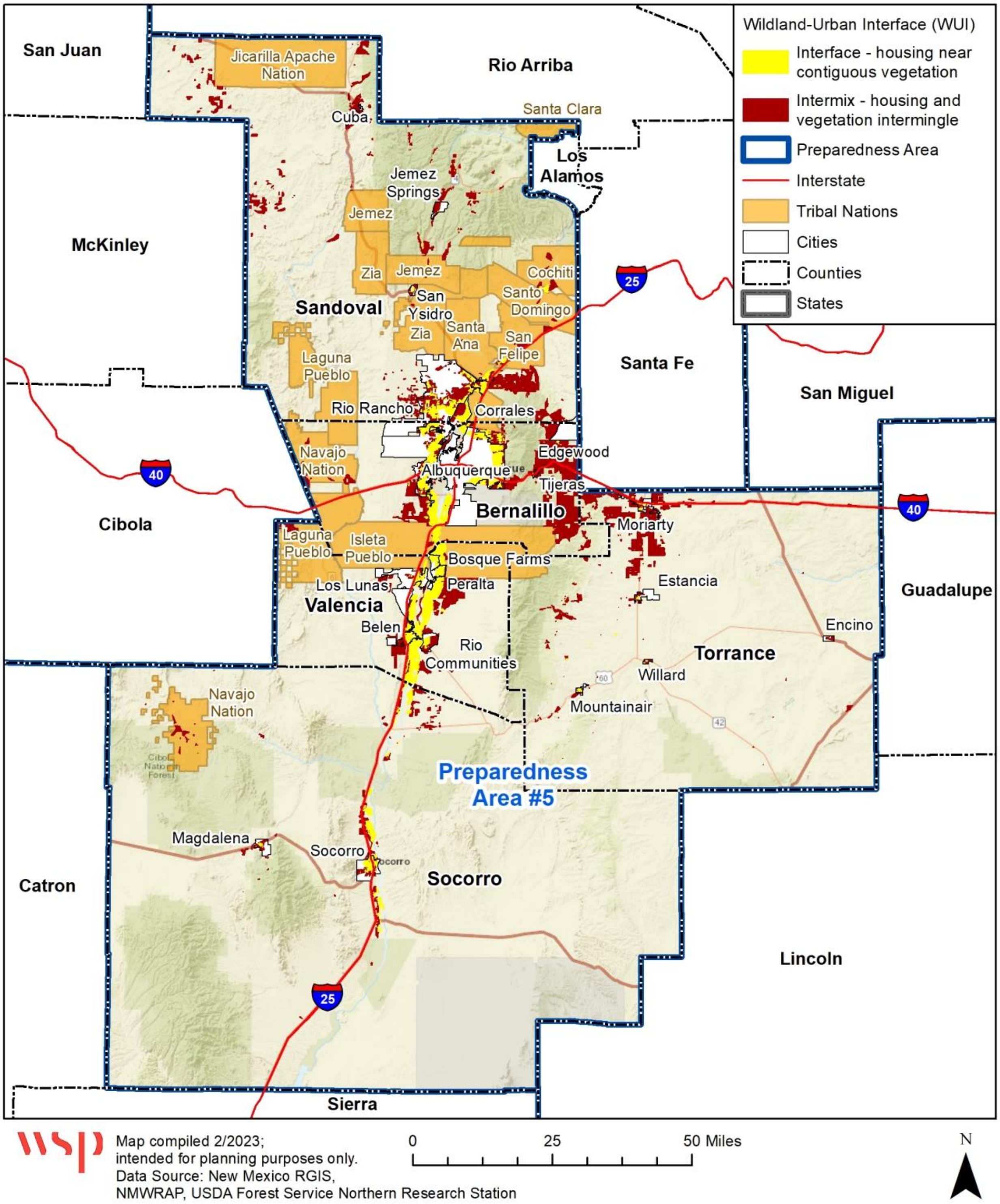
Figure 6-187 Preparedness Area 4 Percent of Total Acres Treated by Landownership



Preparedness Area 5

Figure 6-188 below shows the WUI areas in Preparedness Area 5.

Figure 6-188 Preparedness Area 5 WUI



Preparedness Area 5 is highly vulnerable to wildfire due to multiple factors including rapid development near forested areas, prolonged drought, and high fuel loads due to pine beetle kill. The local plans created by jurisdictions within PA 5 focus their mitigation efforts on education and outreach as well as on existing property protection and wildfire prevention strategies. However, vegetation treatments have been ongoing and are planned to continue to mitigate the high fuel loads in PA 5. Vegetation Treatment Mapping was conducted by NM State Forestry as described in Section 4.2.3. Vegetation treatments include actions such as prescribed burns and mechanical thinning to decrease the amount of fuel load and mimic frequent, low-intensity burns that are natural to the ecosystem. Figure 6-189 shows planned, completed (1996-present), and historic (pre-1996) vegetation treatments by total acres and landowner in PA 5. A total of 845,676 acres of vegetation have been treated and an additional 33,701 are planned for treatment, totaling 879,377 acres of treated vegetation. This equates to approximately 9% of PA 5's total land area. Table 6-132 shows the breakdown of planned, completed, and historic treatments. Historically, most acres of treatment were completed by the BLM and tribal entities. The majority of acres completed treatments were performed by the USFS, followed by the BLM. The majority of acres of planned treatments will be completed by the USFS. Figure 6-190 shows the percent of total acres treated by landownership. Overall, the USFS will treat the most acres of vegetation, followed closely by the BLM.

Table 6-132 Preparedness Area 5 Planned, Completed, and Historic Vegetation Treatments

Planned Treatments			
Total Acres	**Landowner**	**Acres**	**Percent**
33,701 (0.3% of PA 5 land area)	BLM	13,830	41.04%
	MRGDC	374	1.11%
	MRGDC, Village of Corrales	10	0.03%
	Private, State, County	10	0.03%
	State	174	0.51%
	Tribal: Alamo Navajo	10	0.03%
	Tribal: Santa Ana Pueblo	10	0.03%
	USFS	19,262	57.16%
	USFS, BLM	10	0.03%
	Valles Caldera Trust	10	0.03%
Completed Treatments (1996-present)			
Total Acres	**Landowner**	**Acres**	**Percent**
599,839 (5.9% of PA 5 land area)	BLM	221,184	36.87%
	BOR	24	0.00%
	DOD	280	0.05%
	FWS	14,755	2.46%
	Municipal	201	0.03%
	NM Game and Fish	71	0.01%
	NMDOT	50	0.01%
	Private	26,486	4.42%
	Private, State	99	0.02%
	State	11,863	1.98%
	State Park	77	0.01%

	Tribal	9,863	1.64%
	USFS	314,886	52.50%
Historic Treatments (pre-1996)			
Total Acres	**Landowner**	**Acres**	**Percent**
245,837 (2.4% of PA 5 land area)	BLM	77,115	31.37%
	Private	49,300	20.05%
	State	309	0.13%
	Tribal	74,870	30.46%
	USFS	44,242	18.00%

Figure 6-189 Preparedness Area 5 Total Acres of Vegetation Treatment

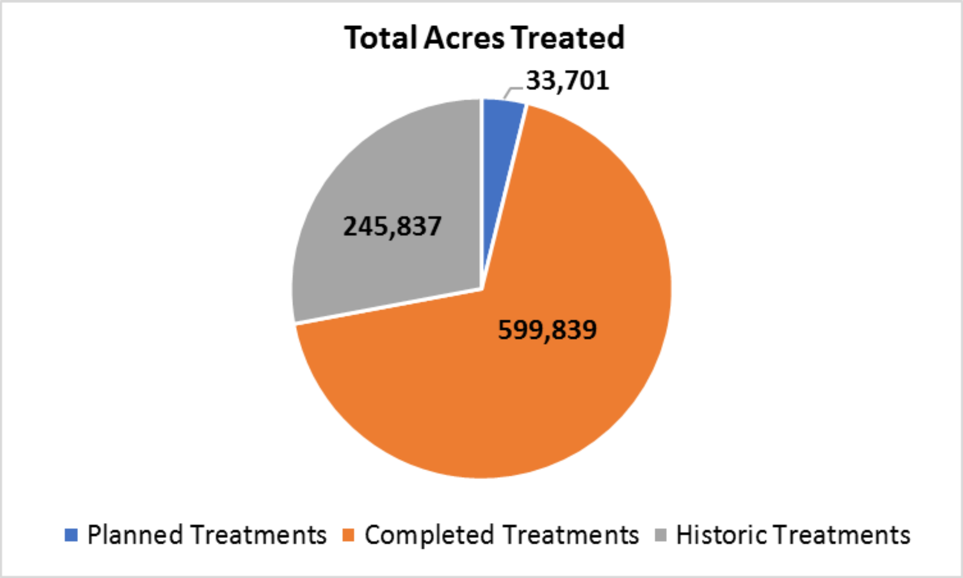
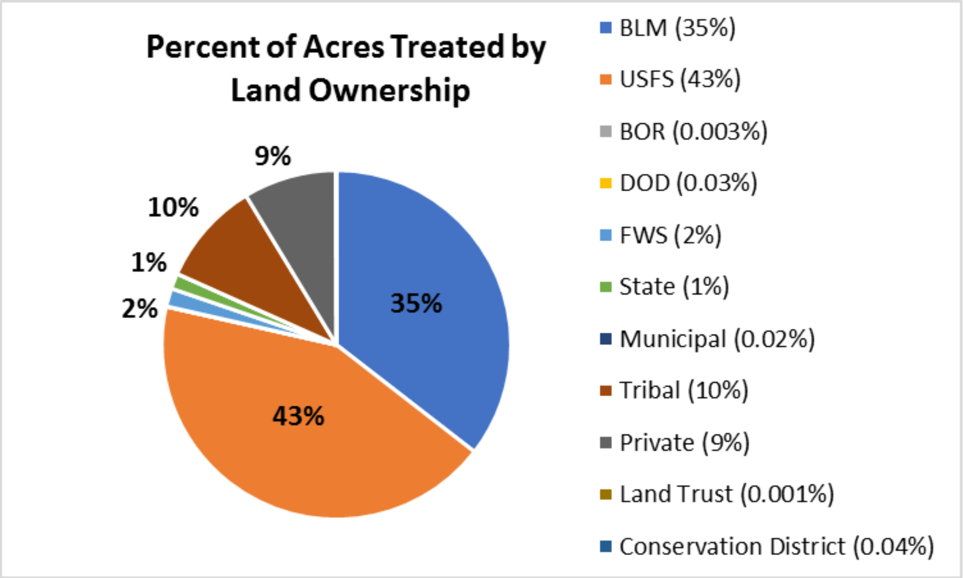


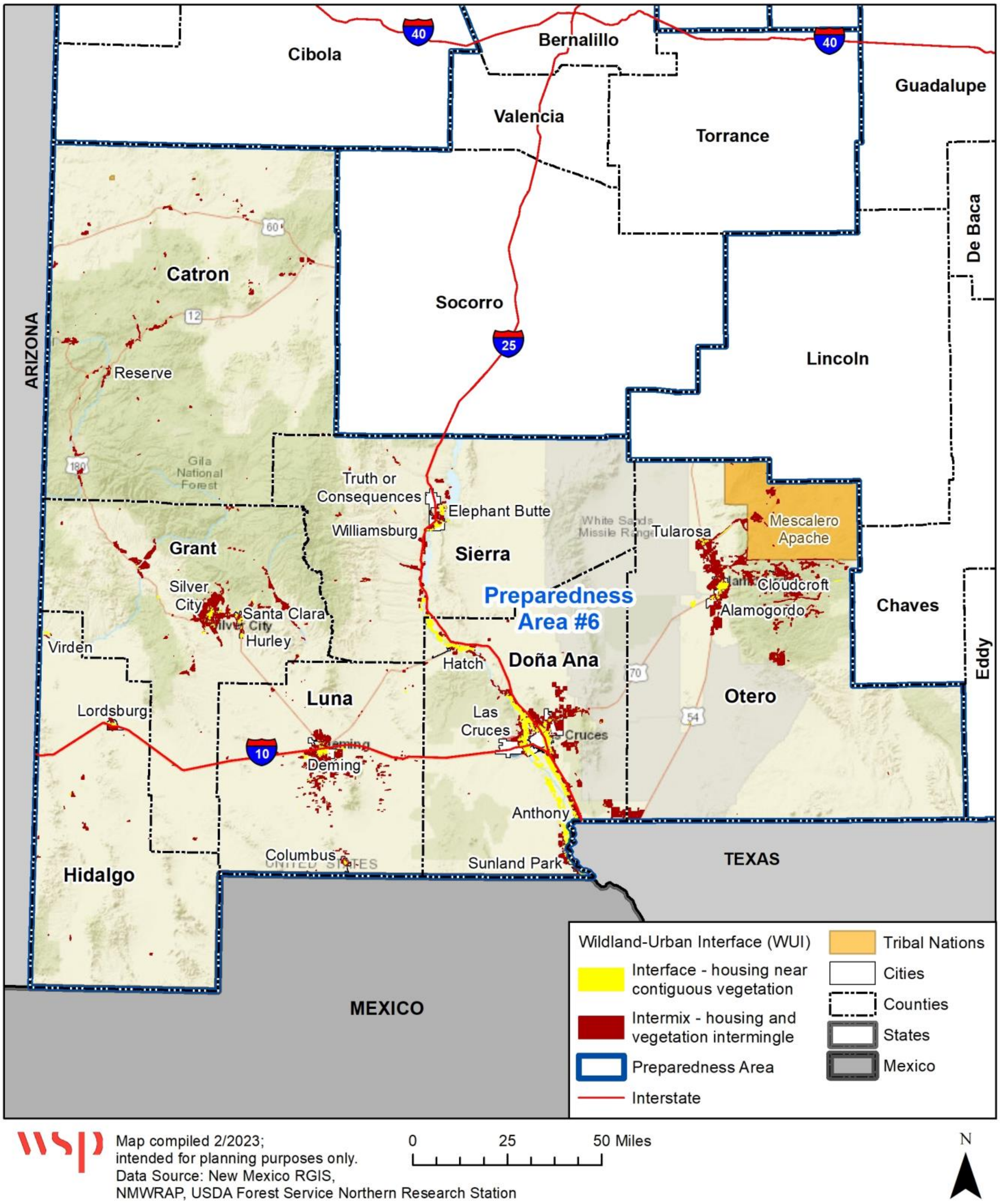
Figure 6-190 Preparedness Area 5 Percent of Total Acres Treated by Landownership



Preparedness Area 6

Figure 6-191 below shows the WUI areas in Preparedness Area 6.

Figure 6-191 Preparedness Area 6 WUI



Preparedness Area 6 did not rank wildfire as one of their top priority hazards, however all preparedness areas in New Mexico are vulnerable to wildfire. Vegetation treatments have been ongoing and are planned to continue to mitigate high fuel loads in PA 6. Vegetation Treatment Mapping was conducted by NM State Forestry as described in Section 4.2.3. Vegetation treatments include actions such as prescribed burns and mechanical thinning to decrease the amount of fuel load and mimic frequent, low-intensity burns that are natural to the ecosystem. Table 6-133 shows planned, completed (1996-present), and historic (pre-1996) vegetation treatments by total acres and landowner in PA 6. A total of 2,753,401 acres of vegetation have been treated and an additional 559,724 are planned for treatment, totaling 3,313,125 acres of treated vegetation. This equates to approximately 16% of PA 6's total land area. Figure 6-192 shows the breakdown of planned, completed, and historic treatments. Historically, most acres of treatment were completed by the USFS. The majority of acres of completed treatments were performed by the USFS, followed by the BLM, and the BLM will perform the most acres of planned treatment. Figure 6-193 shows the percent of total acres treated by landownership. Overall, the USFS will treat the most acres of vegetation.

Table 6-133 Preparedness Area 6 Planned, Completed, and Historic Vegetation Treatments

Planned Treatments			
Total Acres	**Landowner**	**Acres**	**Percent**
559,724 (2.7% of PA 6 land area)	BLM	248,216	44.35%
	Municipal	1,147	0.21%
	Private	6,971	1.25%
	SLO, Private	6,886	1.23%
	State	660	0.12%
	State, Private	52,642	9.41%
	Tribal: Mescalero Apache	33,334	5.96%
	USFS	121,836	21.77%
	USFS, Private	82,705	14.78%
	USFS, State Wildlife Area	5,326	0.95%
Completed Treatments (1996-present)			
Total Acres	**Landowner**	**Acres**	**Percent**
2,288,049 (11.2% of PA 6 land area)	BLM	670,567	29.31%
	BLM, Private	17,145	0.75%
	BLM, State	2,093	0.09%
	DOD	419	0.02%
	Municipal	131	0.01%
	Private	101,814	4.45%
	Private, BLM	12	0.00%
	State	150,271	6.57%
	Tribal	4,734	0.21%
	Tribal: Mescalero Apache	157,399	6.88%
	USFS	1,183,465	51.72%
Historic Treatments (pre-1996)			

Total Acres	Landowner	Acres	Percent
465,352 (2.3% of PA 6 land area)	BLM	18,866	4.05%
	Private	8,354	1.80%
	Tribal	25,076	5.39%
	USFS	413,056	88.76%

Figure 6-192 Preparedness Area 6 Total Acres of Vegetation Treatment

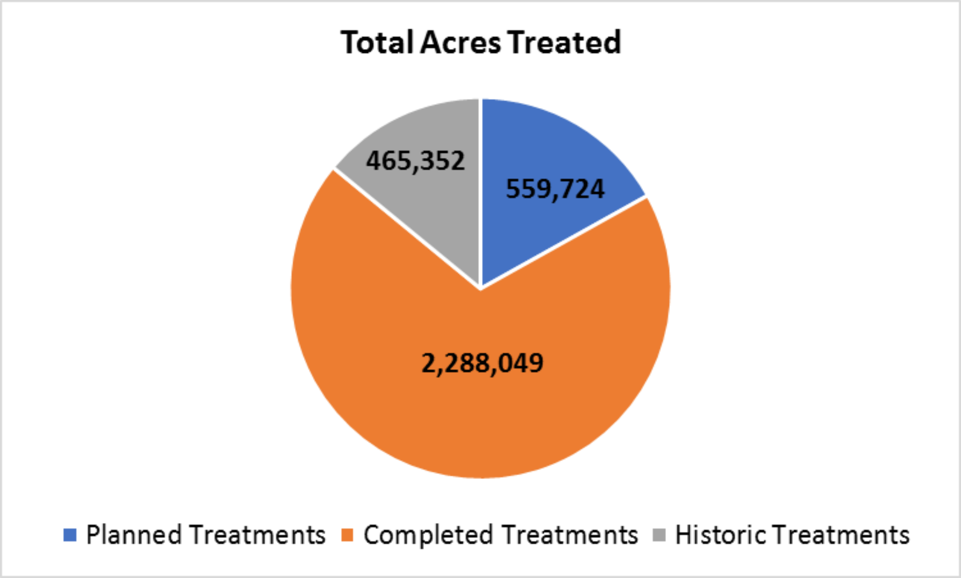
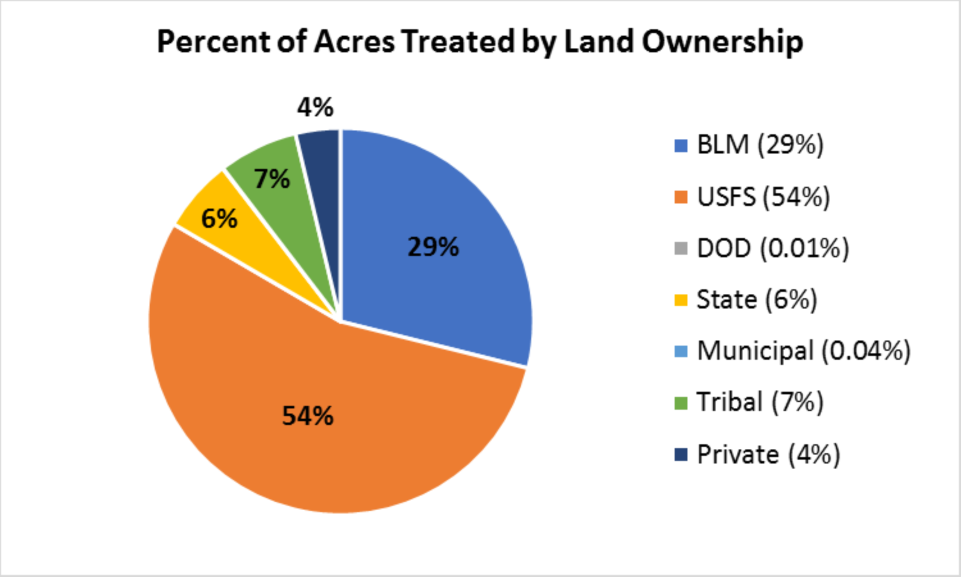


Figure 6-193 Preparedness Area 6 Percent of Total Acres Treated by Landownership



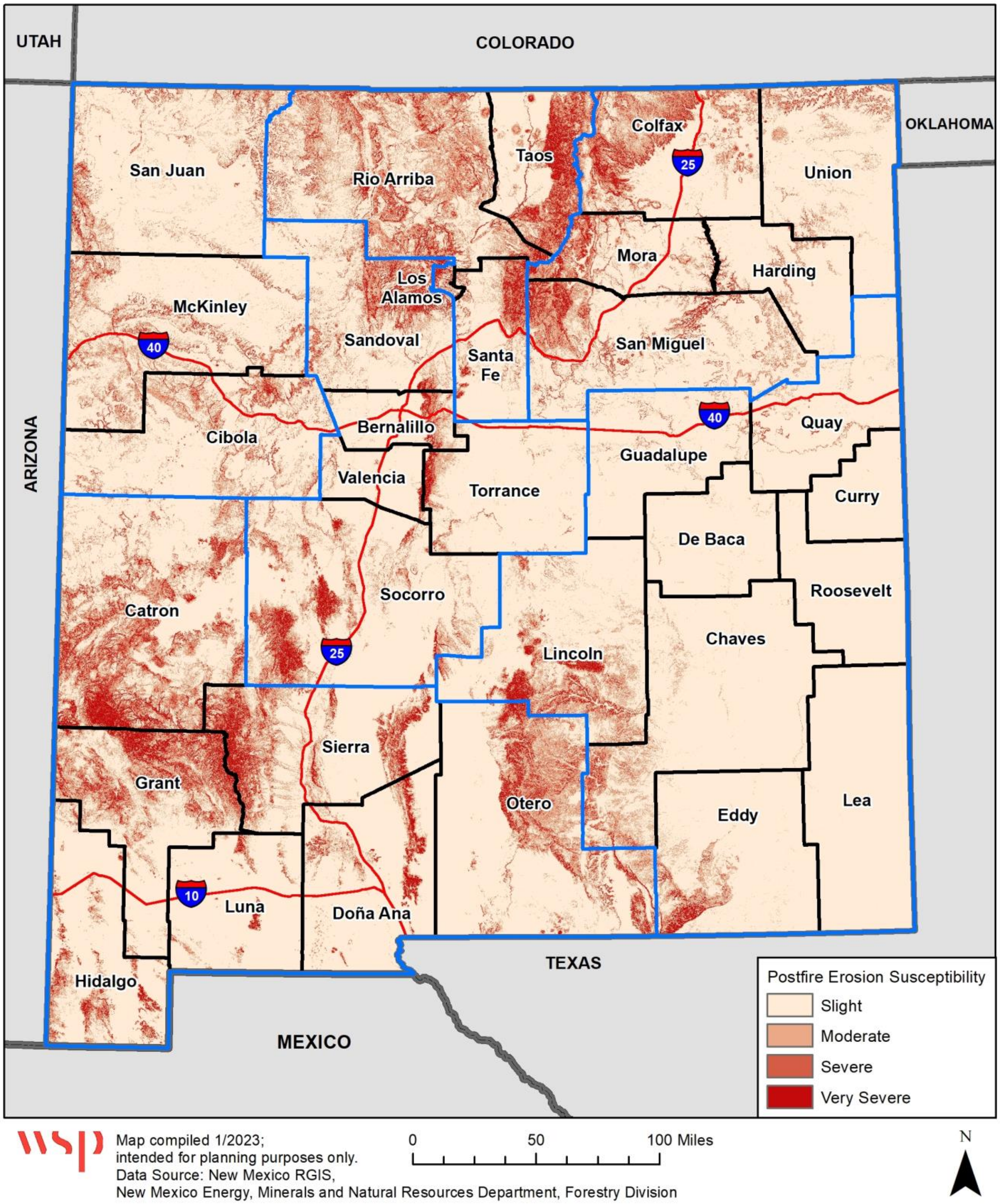
6.16.7 Post-Fire Erosion

Section 6.1.6 discussed the drought – wildfire – flood cycle, and how wildfires can lead to an increase in soil erosion. Extreme soil damage also occurs in watersheds that experience a wildfire. In some areas there is a four- to hundred-fold increase in runoff and debris flow. In these burned areas, large floods result from average monsoon rainstorms. In combination with the damaged soil, the destruction of vegetation by wildfires has created high potential for floods. In general, coniferous trees intercept more rainfall than deciduous trees in full leaf. New Mexico forests are predominantly coniferous and the risk for flooding is increased when these forest types and others are drastically reduced and destroyed by wildfires.

In addition to the increased long-term risk of flooding years after a watershed has experienced a burn, these watersheds are also at risk to destructive flows of sediment and water (debris flows). The US Geologic Survey created a series of studies on the probability and volume of debris flows stemming from the worst extreme fires in New Mexico. Dramatic changes in runoff, erosion, and deposition have been documented by the USACE in watersheds affected by wildfire. These changes have led to loss of life, damage to property, and significant impacts on infrastructure. Ongoing concerns are the increased potential for flooding and debris flow, plus large amounts of sediment being transported from the burn scar areas. Additionally, debris flows could create temporary dams or sediment plugs along drainage courses that could fill and breach, sending flood waves downstream. Life safety concerns are higher in those communities located downstream of burned watersheds.

Figure 6-194 displays areas at elevated risk of post-fire erosion in New Mexico.

Figure 6-194 Post-Fire Erosion Susceptibility



State Assets

A geospatial analysis of state owned assets potentially at an elevated risk of post-fire erosion was conducted based on the risk categories in Figure 6-194. The only state assets identified were in areas of slight risk of post-fire erosion. For purposes of this analysis, the State assumed losses up to 10% for assets at slight risk. Table 6-126 shows estimated losses for state assets from of post-fire erosion; these estimates are for planning purposes only and should not be used for insurance purposes.

Table 6-134 Potential Losses to State Assets From Post-Fire Erosion

County	Preparedness Area	Total	Health and Medical	Safety and Security	Transpor-tation	Total Value	Estimated Losses
Bernalillo	5	6	3	2	1	$393,344,167	**$39,334,417**
Chaves	1	5	1	3	1	$48,197,000	**$4,819,700**
Cibola	4	2	-	1	1	$39,102,000	**$3,910,200**
Colfax	2	3	1	2	-	$89,310,000	**$8,931,000**
Curry	1	1	-	1	-	$933,000	**$93,300**
Dona Ana	6	2	-	2	-	$76,250,000	**$7,625,000**
Grant	6	1	1	-	-	$0	**$0**
Luna	6	1	-	-	1	$9,553,000	**$955,300**
McKinley	4	1	-	1	-	$2,807,000	**$280,700**
Rio Arriba	3	1	-	1	-	$558,985	**$55,899**
San Miguel	2	3	1	1	1	$152,965,000	**$15,296,500**
Sandoval	5	1	-	1	-	$17,085,000	**$1,708,500**
Santa Fe	3	16	-	14	2	$602,912,704	**$60,291,270**
Sierra	6	1	1	-	-	$24,528,000	**$2,452,800**
Socorro	5	1	-	1	-	$3,026,251	**$302,625**
Taos	3	1	-	1	-	$501,000	**$50,100**
Valencia	5	3	1	2	-	$148,620,000	**$14,862,000**
Total	**---**	**49**	**9**	**33**	**7**	**$1,609,693,107**	**$160,969,311**

6.16.8 Data Limitations

Because each agency and organization compiles data and maps using different reference points, it is difficult to collapse all of the information into one comprehensive map or listing. The State of New Mexico reports the number of statistical fires (fires that start on State and private lands, for which State Forestry is responsible) in the Energy, Minerals and Natural Resources Department's Annual Report (published on EMNRD's website: http://www.emnrd.state.nm.us/ADMIN/publications.html). The Southwest Coordination Center publishes year-to-date and historical fire data for other jurisdictions on its website (https://gacc.nifc.gov/swcc/predictive/intelligence/intelligence.htm), but the numbers for State fires differ from the State's data because of different reporting requirements. It would be very helpful to have all large fires and fires that threatened/damaged structures cataloged. It would also be helpful to have all damage estimates cataloged.

It would be helpful to have historical information on the number of fires and acres burned organized by county and information on the cause of fire organized by county. If data were available for several years, trends by county and Preparedness Area could be generalized. Ultimately, mitigation activities could be targeted at the highest risk communities.

It would also be helpful to have an analysis of burn scar areas and increased flood/debris flow maps. This type of analysis would enable wildfire and flood mitigation activities to target high risk areas.

6.16.9 What Can Be Mitigated?

Wildfires can be a significant threat to the citizens, structures, infrastructure, and natural resources within New Mexico. As a result, the SHMT has identified the wildfire hazard as a priority in the Plan Update.

Mitigation options for wildland fire need to address not only the management of fuels, but also the potential for growing population in wildfire threat areas. The State Forestry Division has conducted a Statewide assessment on forest health and outlined mitigation efforts and priorities to reduce fuel loads and create more defensible space.

Wildfire can have lasting impacts on a community, including contributing to the risk of other hazards such as flooding and landslides. To prevent the cycle of drought, wildfire, and flooding, a systematic approach is needed that will institute a proactive method of mitigation. Two sources of information, developed by the USACE, to be evaluated include the Burn Scar Hydrology, and the Debris Flow Impact, which helps to establish non-regulatory corridors in areas where development is discouraged due to risk from increases of debris flow.

Based on statistical information about fire causation and occurrence, the trend has been that human-caused fires cause more fires to occur and burn more acreage than natural caused fires. This trend offers a mitigation opportunity for education and outreach to reduce the number and acreage of fires in the State. However, while human-caused fires are more numerous, wildland fuel loads contribute to the rate of spread and intensity of wildfire regardless of the source. Reduction of wildland fuels and continued maintenance are critical in reducing the spread and damage potential of wildfires.

Other key mitigation activities include developing/regulating defensible space, regulating development in WUI areas, evacuation route development and planning, development, and update of Community Wildfire Protection Plans, encouraging the use of fire-resistant construction techniques, biomass plants, and of course public education.

6.16.10 Risk Summary

Table 6-135 identifies potential impacts from wildfires.

Table 6-135 Potential Impacts from Wildland Fire

Subject	Potential Impacts
Agriculture	Of all the hazards, wildfire is the most concerning to agriculture. Crops can be destroyed, agriculture commodities in storage can be destroyed, grazing land and the animals using it can be destroyed

Subject	Potential Impacts
	and agriculture infrastructure is vulnerable. Agriculture producer lives have been lost combatting wildfire.
Health and Safety of the Public	The public is at risk to injuries from heat and smoke.
Health and Safety of Responders	Responders are at risk from heat exposure, burns, dehydration, smoke inhalation, etc.
Continuity of Operations	Those operations that are in or near the wildfire may be shut down or even destroyed by the fire. Operations outside the fire area may experience loss of electricity or communications if transmission lines and towers are damaged or shut down for safety reasons. Municipal water service may be interrupted if intakes are shut down due to ash or sediment.
Delivery of Services	Service delays are anticipated to operations within or near the fire areas.
Property, Facilities, Infrastructure	Fire can cause damage or destruction of property and infrastructure. Infrastructure near the fire areas may be barricaded or restricted to use by responders.
Environment	High severity fires can cause large areas to be denuded of plant life and subsequently animal life. These bare areas are susceptible to erosion and post-fire runoff that can contaminate water supplies or fill waterways with contaminants or sediment. High temperature fires can cause the soils to be damaged, and plant recovery may be delayed.
Economic Condition	A wildfire can cause damages to residences, businesses, and other highly valued assets in a community that can have lasting effects.
Public Confidence	Not impacted by the event itself, but may be damaged if the response to an event is poor.

7 MITIGATION STRATEGY

44 CFR Part 201.4
[The State plan must include a] Mitigation Strategy that provides the State's blueprint for reducing the losses identified in the risk assessment. This section shall include: *(i) A description of State goals to guide the selection of activities to mitigate and reduce potential losses.* *(ii) A discussion of the State's pre and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including: an evaluation of State laws, regulations, policies, and programs related to hazard mitigation as well as to development in hazard-prone areas; a discussion of State funding capabilities for hazard mitigation projects; and a general description and analysis of the effectiveness of local mitigation policies, programs, and capabilities.* *(iii) An identification, evaluation, and prioritization of cost-effective, environmentally sound, and technically feasible mitigation actions and activities the State is considering and an explanation of how each activity contributes to the overall mitigation strategy. This section should be linked to local plans, where specific local actions and projects are identified.* *(iv) Identification of current and potential sources of Federal, State, local, or private funding to implement mitigation activities.* *(v) [Specific] actions the State has taken to reduce the number of repetitive loss properties (which must include severe repetitive loss properties), and specifies how the State intends to reduce the number of such repetitive loss properties. In addition, the plan must describe the strategy the State has to ensure that local jurisdictions with severe repetitive loss properties take actions to reduce the number of these properties, including the development of local mitigation plans.*

The purpose hazard mitigation planning is to reduce injury and property damage from the impact of natural hazards through a coordinated program that involves state, tribal, and local governments, non-profits, academia, and the private sector. This chapter describes the state's strategy for reducing losses from the hazards identified in Section 6, the Hazard Identification and Risk Assessment (HIRA). It includes the goals that frame the mitigation strategy, specific mitigation action undertaken or proposed by the state, available sources of mitigation funding, and how the state ensures those funds are used effectively and efficiently.

New Mexico's mitigation strategy emphasizes helping communities more resistant to hazards in the long term while improving their residents' overall quality of life. By avoiding unnecessary exposure to hazard risks, communities will save lives, reduce property damages, and minimize the social, economic and environmental disruptions that commonly follow hazard events. This SHMP addresses the needs of current residents as well as the needs of future generations. The focus on an integrated, future-oriented approach will result in more disaster-resilient communities.

7.1 Hazard Mitigation Goals

This section describes the goals that guide New Mexico's mitigation program. Mitigation goals are broad-based public policy statements that:

- Represent basic desires of the community.
- Encompass all aspects of the community, public and private.
- Are nonspecific, in that they refer to the quality (not the quantity) of the outcome.
- Are future-oriented, in that they are achievable in the future.
- Are time-independent, in that they are not scheduled events.

Based upon the risk assessment review and goal setting process, the SHMT re-assessed the goals from the 2018 Plan. The SHMT determined they were still valid, and made only 2 minor changes. Goals 1 and 2 were combined into one goal (2023 Goal #1), and a new goal (#8) was added to specifically address equity and inclusivity.

2023 State of New Mexico Hazard Mitigation Goals:

Goal 1: Reduce the number of injuries and fatalities from natural hazards

Goal 2: Reduce the amount of property damage, both public and private, from natural hazards

Goal 3: Reduce the number of necessary evacuations

Goal 4: Shorten recovery time for community functions and the natural environment after natural hazard events

Goal 5: Improve communication, collaboration and integration among State, Tribal and Local emergency management agencies

Goal 6: Increase awareness and understanding of risks and opportunities for mitigation among the citizens and elected officials of New Mexico

Goal 7: Mitigate repetitive loss and severe repetitive loss structures in the state to reduce impacts of flooding

Goal 8: Promote equity by ensuring vulnerable populations and under-served communities are included in mitigation planning and activities.

The goals listed above were developed by the SHMT to encompass all mitigation needs identified by stakeholders, including local and tribal communities. The goals are not prioritized and are written to be applicable to all hazards identified in the HIRA. Goals are stated without regard for implementation so that the goals are not dependent on the means of achievement. Goal statements form the basis for actions that will be used as means to achieve the goals.

The state encourages local and tribal governments, and other mitigation partners to consider the state's goals when developing their own mitigation strategies.

7.2 Mitigation Actions

This section presents the identification, evaluation, and prioritization of cost-effective, environmentally sound, and technically feasible mitigation actions and activities as confirmed by the SHMT during the 2023 update process. Mitigation actions have been developed to address the goals defined earlier. Many of the actions were developed during legacy planning meetings as the SHMP has been updated over the years. Each update cycle presents an opportunity to review and revise the mitigation actions to reflect changes in development, progress in statewide mitigation efforts and changes in priorities. Key vulnerabilities and problem statements from the updated HIRA were also considered in the update of mitigation actions. Coordinated and integrated mitigation efforts were stressed whenever possible, as is evidenced by the number of multi-agency projects listed in the Mitigation Actions Table.

7.2.1 Progress On Previous Mitigation Actions

The SHMT reviewed and updated the status of the 42 mitigation actions listed in the 2018 SHMP. None of those actions have been fully completed since 2018. In many cases, that is due to the long-term, ongoing nature of many state-level activities. In others, a shortage of staff and resources was cited as a limiting factor. Another major factor cited was the COVID-19 pandemic, which impacted priorities in all departments. The SHMP agreed that an increased focus was needed on these actions, and on mitigation activities in general.

All 42 actions have been carried over into the 2023 Plan, and can be found in Table 7-1.

Additional mitigation activities conducted since 2018 include:

- HB168 passed in 2021, requiring that all development "owned or funded, in whole or in part, by the state" must obtain a floodplain review, obtain any required permits, and must comply with all NFIP requirements.
- NFIP/FM coordination meeting with NFIP State Coordinator, and Construction Industries & Manufactured Housing Division at the NM Regulation and Licensing Department.
- Updated internal documents to include the HMGP Administrative Plan and State Operating Guidelines.
- Developed a new tracking spreadsheet to monitor state and local grant projects from cradle to grave.
- Developed a CRS Recertification Guide for local governments, and delivered an online workshop on CRS recertification and class improvements.
- Delivered grants technical assistance webinars with sub applicants.
- The state was able to re-direct $5 million federal share from Montano Levee to existing HMGP-DR-4199 projects. State Capital Outlay was used for the non-federal match.
- RiskMap:
    - Statewide LiDAR coverage is funded and in progress
    - Multiple BLE studies complete or funded and in progress
    - Engaged in extensive local, state and federal engagement efforts
    - Completed special project Post-Wildfire Debris Flow Resource
    - Communities advancing BLE via city-wide LOMR (Clovis) & FIRM updates (Portales)
    - Presented New Mexico Risk MAP efforts to international community (Canada and Mexico) at Indigenous Perspectives on Flood Costs and Losses workshop

7.2.2 Identifying New Mitigation Actions

The SHMT reviewed each of the hazards in Section 6 to identify and select additional mitigation measures to support the mitigation goals. The SHMT analyzed a comprehensive set of viable mitigation alternatives for both new and existing buildings and infrastructure, starting with the four 'A's' of mitigation:

- **Alter** the physical nature of the hazard: wildfire defensible space and fuels treatments, snow fences etc.
- **Avert** the hazard away from people, buildings, and infrastructure: engineered solutions, drainage, and channel improvements, floodproofing, fuel breaks.

- **Adapt** to the hazard: land use planning, building codes and design standards, warning systems etc.
- **Avoid** the hazard: natural systems protection, open space, acquisition, or relocation of properties out of hazardous areas.

The SHMT reviewed possible mitigation alternatives in the following six categories:

- **Prevention:** Administrative or regulatory actions or processes that influence the way land and buildings are developed and built.
- **Property protection:** Actions that involve the modification of existing buildings or structures to protect them from a hazard or remove them from the hazard area.
- **Structural:** Actions that involve the construction of structures to reduce the impact of a hazard.
- **Natural resource protection:** Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems.
- **Emergency services:** Actions that protect people and property during and immediately after a disaster or hazard event.
- **Public education and awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.

The SHMT also considered the types of mitigation actions being proposed in Local and Tribal HMPs, as summarized in Section 5. Particular attention was given to what types of mitigation projects are shown to be effective at the local level, as well as areas where State assistance is needed to help local and tribal governments accomplish their high priority actions.

Based on these criteria, SHMT members developed 15 additional mitigation actions, which can be found in Table 7-1.

7.2.3 Prioritizing Mitigation Actions

Prioritizing mitigation activities is necessary to help focus limited resources where they will be most effective. The SHMT used the STAPLEE methodology to evaluate and prioritize newly proposed actions along with continuing actions.

- **Social:** Does the measure treat people fairly?
- **Technical:** Will it work? Does it solve the problem? Is it feasible?
- **Administrative:** Is there capacity to implement and manage the project?
- **Political:** Who are the stakeholders? Did they get to participate? Is there public support? Is political leadership willing to support the project?
- **Legal:** Does your organization have the authority to implement? Is it legal? Are there liability implications?
- **Economic:** Is it cost-beneficial? Is there funding? Does it contribute to the local economy or economic development? Does it reduce direct property losses or indirect economic losses?
- **Environmental:** Does it comply with environmental regulations or have adverse environmental impacts?

In accordance with the DMA requirements, an emphasis was placed on the importance of a benefit-cost analysis in determining project priority (the 'economic' factor of STAPLEE). Other criteria used to recommend what actions might be more important, more effective, or more likely to be implemented than another included:

- Does the action protect lives?
- Does the action address high-risk hazards or areas?
- Does the action protect critical facilities, infrastructure, or community assets?
- Does the action support multiple goals or address multiple hazards?

SHMT members also weighed the pros and cons of proposed actions based on their judgement, subject matter expertise, and experience with local hazards.

7.3 Funding Mitigation Activities

New Mexico uses a variety of sources to fund state and local mitigation activities. While much of the funding comes from the federal government, additional funding comes from state and local governments as well as private organizations. The state has instituted an effective and comprehensive all-hazard mitigation program. Through a variety of programs, and the wise use of available federal and state funds, the state has been successful in mitigating areas against the devastating effects of disasters. New Mexico remains committed to a comprehensive state hazard mitigation strategy, including the effective state management of all FEMA mitigation grant programs.

For more details on how the State has funded and will fund mitigation activities, see Section 4.5.

7.4 Mitigation Action Plan

Table 7-1 lists the specific mitigation projects and activities intended to meet the plan's goals, including both new and continuing mitigation actions. These projects detail specific actions for reducing future hazard-related losses across the State. The projects include details on the department and partners necessary to implement the project, estimated cost, potential funding sources, timeline, and their relative priority (high, medium, low). For actions carried over from the 2018 Plan, the table includes notes describing progress made since 2018.

Table 7-1 2023 State of New Mexico Mitigation Action Plan

#	Project Name & Description	Hazards Mitigated	Lead Agency	Estimated Cost	Potential Funding Sources	Timeline	Priority	2023 Update
1	**Develop Comprehensive Public Education/ Outreach Strategies** - A series of public service announcements, pamphlets, trainings, and demonstration activities on the hazards New Mexicans face.	Dam Failure, Drought, Earthquakes, Extreme Heat, Expansive Soils, Flood/Flash Floods, High Wind, Landslide, Land Subsidence, Severe Winter Storms, Thunderstorms, Tornados, Volcanoes, Wildfire	NMEMA, NMFMA, THE NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY, EDAC, DHSEM, State Forestry, NM Environment Department, NM Department of Agriculture, Office of the State Engineer, Department of Energy Minerals and Natural Resources, local hardware and home improvement stores, local media outlets, websites, etc.	Employee time, materials, estimated costs for first year $100,000	FEMA grants, NMEMA, NMFMA, THE New Mexico Institute of Mining and Technology, EDAC, DHSEM, State Forestry, NM Environment Department, NM Department of Agriculture, Office of the State Engineer, Department of Energy Minerals and Natural Resources, private contributions, local emergency management personnel time, legislative allotments	Immediate and ongoing	High	State Forestry has continued to host a variety of public education and outreach strategies to reduce wildland fire risk. The State Forestry Division participates yearly in Wildfire Awareness Week. Billboards with wildfire prevention messages have been used to reach out to the public along highways and interstates in numerous locations around the state. State Forestry maintains the online resource "After Wildfire: A Guide for New Mexico Communities," as well as associated print resources. DHSEM Mitigation Section's public education program has not been as active over the last 5 years due to staffing shortages and turnover; improving this is a priority for the coming years.
2	**Create a Centralized Repository of Hazard Mapping Accessible for Local Jurisdictions, Tribal Entities, and State Agencies** – This action focuses on creating the statewide repository and providing access to local and tribal entities. GIS capabilities vary between local jurisdictions and tribes. Local jurisdictions and tribal entities do not always have the capability for in-house GIS personnel and resources. EDAC is working to compile all of the public GIS information into one location (as described above). Some hazard types below include a separate action item to create a hazard map (earthquake hazard, land slide, land subsidence, soil hazard). There is not a single State-wide map that shows the risk for these hazard types.	Dam Failure, Drought, Earthquakes, Extreme Heat, Expansive Soils, Flood/Flash Floods, High Wind, Landslide, Land Subsidence, Severe Winter Storms, Thunderstorms, Tornados, Volcanoes, Wildfire	DoIT, EDAC	Computer equipment, software, GIS technicians/ contractors	FEMA, USACE, State budget	Ongoing	High	No update has occurred to MHRP. RGIS does have the acequia, landslide, and data from the 2020 State Forest Action Plan. The floodplain inundation mapping that USACE did of the Hermit's Peak/Calf Canyon wildfire burn area (10 HUC-10 watersheds) is also on RGIS. To support the Action, UNM Earth Data Analysis Center (EDAC) and EMNRD developed and launched the New Mexico Climate Risk Map web application at www.NMClimaterisk.org. The web application can be accessed by New Mexicans to establish their exposure to natural hazards exacerbated by climate change.
3	**Establish and Enhance GIS Capabilities Within DHSEM** – GIS capability allows DHSEM to identify specific hazard areas, critical facilities/key resources and to analyze the overlap of numerous hazard impacts. This information would provide data to prioritize mitigation and recovery efforts.	Dam Failure, Drought, Earthquake, Flood, Extreme Heat, Landslide, Land Subsidence,	NMEMA, NMFMA, NMT, EDAC, DHSEM State Floodplain Coordinator	Contract services, employee time, software, materials	DHSEM Budget, FEMA grants (CAPSSSE)	Ongoing	High	DHSEM continues to partner with EDAC, and has also been working to improve its in house GIS capability. An online story map created for the 2022 wildfire/flood season received excellent feedback.

#	Project Name & Description	Hazards Mitigated	Lead Agency	Estimated Cost	Potential Funding Sources	Timeline	Priority	2023 Update
		Expansive Soil, Thunderstorms, Tornadoes, Volcano, Wildfire, High Wind, and Winter Storms						
4	**Map State Facilities and Assets in Relation to Identified Hazard Areas** – Including State owned and managed facilities in a GIS database will aid with the process of identifying critical facilities and assets that are within State-agency control. Having this critical facility information in a database that can be spatially queried allows for greater understanding of asset value and the impact that natural disasters would have on them. This would allow the re-examination of mitigation priorities.	Dam Failure, Drought, Earthquakes, Extreme Heat, Expansive Soils, Flooding, High Wind, Landslide, Land Subsidence, Severe Winter Storms, Thunderstorms, Tornados, Volcanoes, Wildfire	DHSEM, GSD, DoIT, State Forestry, National Guard, local emergency management agencies, UNM EDAC, NMT, SIPI	Contract services, employee time, software, materials	DHSEM Budget, FEMA grants (BRIC, HMGP), UNM, NMT	Ongoing	Medium	NMDOT has a GIS database with all bridges and culverts on state routes. The culvert database is part of a statewide inventory expected to be complete by Sept 2023. These datasets will be combined with available floodplain and waterway information to identify potentially vulnerable drainage structures over the next two years. NMDOT has also started internal discussions about the feasibility of identifying critical roadways serving vulnerable communities and ensuring access to high priority / critical facilities. Our expectation is that we can combine this effort with our bridge and culvert structure databases with the intent of revising our overall structure rehab/replacement prioritization and capital investment processes. The Earth Data Analysis Center at the University of New Mexico—the New Mexico Cooperating Technical Partner—coordinated with DHSEM and the New Mexico General Services Department's Risk Management Division to conduct an analysis of state-owned structures in areas that are at risk of flooding, as defined by FEMA's Flood Insurance Rate Maps or Base Flood Level Engineering studies. The initial results of the analysis identified ninety-three state-owned structures at risk of flooding.
5	**Update Hazus and Train Emergency Management Personnel in Use** – FEMA, DHSEM and EDAC utilize the damage estimation software (Hazus) for preparedness and response planning. Hazus is a good tool for estimating damages to structures, utilities and roadways.	Earthquake, Flood, High Wind	DHSEM, EDAC, NMT, SIPI (Southwest Indian Polytechnic Institute)	Employee time, training materials for workshop; software and hardware costs	EMPG grant, FEMA grants, local emergency management, UNM EDAC, NMT, SIPI	60+ months	Low	Little progress has been made on in this area since 2018. DHSEM retains Hazus capabilities, but also relies on contractor support when necessary.
6	**Implement Actions to Improve Forest and Watershed Health** – This action was identified in the Drought Task Force Impact Assessment Committee Status Report from January 2013. Implement actions as	Drought, Flood, Wildfire	State Forestry, OSE, Environment Department, NM	$10 million per year for the New Mexico	Agency budgets, federal, state, and foundation grants	Continuous	High	State Forestry hosts quarterly statewide Forest and Watershed Health Coordination Group Meetings, which are typically well-attended. They

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	identified in the New Mexico Forest and Watershed Health Plan in addition to the New Mexico Forest Action Plan (formerly "New Mexico Statewide Natural Resources Assessment and Strategy and Response Plans."		Energy Minerals and Natural Resources, NM Department of Agriculture	Watershed Restoration Initiative. Other actions may be identified by State Forestry and the State Forest and Watershed Management Coordinating Group				published their New Mexico Forest Action Plan in 2020.
7	**Hire a Dam Safety Engineer** – The Office of the State Engineer (OSE) has oversight over non-federally owned dams in New Mexico. However, there is no one specifically assigned to assist dam owners with preparedness activities such as development of their Emergency Action Plans (EAPs). An additional Dam Safety Engineer could focus on the large number of existing dams that do not hold an EAP. Potential areas for mitigation activities include resources to evaluate and reduce uncertainties with dam data, preparation of EAPs for all high hazard dams, comprehensive facility evaluations to quantify risk, and rehabilitation of existing dams. These actions will contribute to dam failure risk reduction through emergency planning and increased warning for affected communities.	Dam Failure	DHSEM, OSE	Salary and benefits for this position could be shared between DHSEM and the OSE	EMPG, existing or future OSE budget	When funding is available	Medium	Little progress on this item due to economic constraints and the pandemic. OSE has an unfunded engineer position, and will analyze the budgetary obstacles for filling this position.
8	**Rehabilitate or Remove Unsafe Dams Starting with "High Hazard" Classification** – The OSE identified nearly 100 dams across the state as needing repair or rehabilitation to correct safety concerns. There are numerous public and private dam owners that do not have the financial capability to make the necessary repairs.	Dam Failure	OSE, Silver Jackets, dam owner groups, and NM OSE Dam Safety Bureau	Funding for engineering analysis and demolition when appropriate.	EMPG, special legislative funding, federal funding through NRCS programs and proposed National Dam Safety Program funds, owner cost share	60 months+	Low	Little progress on this item due to staffing limitations at OSE and other priorities driven by the pandemic. A new mitigation action (#57)
9	**Create Emergency Action Plans for "High" and "Significant Hazard" Class Dams** – Dam owners are required to have Emergency Action Plans (EAPs) but assistance for dam owners is needed to accomplish this goal. The OSE has created an EAP template for dams within New Mexico. The EAP provides steps for the owner to follow in a potential emergency that help to recognize problems and to make decisions in order to provide the best response to avert a dam failure if possible. Each EAP has an inundation map based on modeling of the potential dam failure under various operation conditions. An evacuation map is	Dam Failure	Dam owners, local emergency managers, DHSEM, OSE, Dam Safety Engineer, Silver Jackets	Engineering analysis and mapping and staff time	EMPG existing or future budgets, FEMA National Dam Safety Program Grant, future state funding	60 months	High	Little progress on this item due to staffing limitations at OSE and other priorities driven by the pandemic.

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	then prepared in consultation with local emergency management officials from the inundation map. Many owners report that the costs associated with preparation of the inundation maps are prohibitive and interaction with emergency professionals is needed for proper planning.							
10	**Mandate Xeriscaping with Drought Resistant Species at State Facilities and encourage Xeriscaping Statewide** – Xeriscaping refers to landscaping in ways that requires little to no supplemental irrigation. The end result is a reduction in water use at State owned facilities. Once implementation occurs, the State facilities could serve as field examples of xeriscaping methods and techniques.	Drought	New Mexico State Legislature, State agencies	Installation of plants and hardscape	Existing budgets	60 months	Medium	Individual departments have made some efforts to switch to xeriscaping. However there has not been a mandate or coordinated effort to do so at all state facilities.
11	**Require Grey Water Systems at State Owned Facilities and encourage Grey Water Use Statewid**e – This action requires installation of grey water systems for new State construction and retrofits of existing structures. Reusing water to irrigate landscaping would conserve potable water for uses such as human consumption, agriculture, and livestock.	Drought	New Mexico State Legislature, State agencies	Up to $50,000 depending on the facility	US EPA grants	60 months	Low	Little progress on this item due to staffing limitations and other priorities driven by the pandemic.
12	**Establish a Rebate Program** – Establish new rebate programs where they do not exist, for homeowners who convert to low flow toilets or purchase EnergyStar certified clothes and dish washers.	Drought	DHSEM, OSE, local emergency managers, water conservation and watershed health interest groups	$50,000-$1,000,000	US EPA grants	36 months	Low	The legislature authorized the Solar Market Development Income Tax Credit program in 2021. Additional research needs to be conducted to 1) clarify how the State's anti-donation clause would affect implementation, 2) identify successful rebate programs that have been implemented in the State and elsewhere, and 3) identify current opportunities related to the new programs to be created under IIJA or BIL.
13	**Incorporate Drought Mitigation Activities into Range Management Plans** – This was a new mitigation action for the 2013 State Plan. It was identified in the Drought Task Force Impact Assessment Committee Status Report from January 2013. NMDA provides technical assistance in the form of consultation in developing range management plans and sound agricultural practices. Cooperation between State, Federal and industry organizations must be part of developing and monitoring mitigation strategy implementation.	Drought	NMDA, industry organizations, ranch owners and managers	More detail is needed for specific action items	State budget	Continuous	High	Little progress on this item due to staffing limitations and other priorities driven by the pandemic.
14	**Develop New Useable Water Source**s – Additional water sources are a constant concern in New Mexico. Advances in technology have allowed continued extraction of water from sources previously thought to have been unusable. Identifying the location of new sources and determining the impact of new techniques is an ongoing process.	Drought	local water providers	water extraction and purification equipment	State budget	Continuous	Low	Little progress on this item due to staffing limitations and other priorities driven by the pandemic.

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15	**Public Water Supply and Drought Vulnerability Assessments** – Better understanding of the vulnerability of public water supply will assist emergency, utility and land use managers to mitigate the impacts of reduced resource availability. Municipal water supply assessments are currently being conducted by NMED. Additional assessments could be done at a county, watershed (regional) and/or State-wide basis. The assessments would identify specific vulnerabilities and also recommend mitigation measures such as water supply monitoring, water conservation measures, utilization of multiple points of diversion, identification of additional sources of water, and/or developing Standard Operating Procedures specific to drinking water supply.	Drought	NMED, OSE, DHSEM	More detail needed for specific action items	State budget	36 months	High	NMED Drinking Water Bureau completed a study of "Past Fire Response In Areas With Impacted Drinking Water Intakes" to identify ways to improve the resilience of the State's drinking water.
16	**Develop the New Mexico Seismic Map or Series of Maps to Effectively Predict the Probability of Seismic Damage State-wide** – Although there are numerous studies and mapping projects that have been conducted Statewide, there is not one compilation map or series of maps that conveys earthquake hazard in an easily understandable format. The series of probability maps generated by the USGS and Al Sanford at NM Tech could be analyzed and represented in easier to understand graphics so that the lay person can understand the information	Earthquake	DHSEM, New Mexico Institute of Mining and Technology, DoIT	Cost for engineering studies, GIS mapping and production	State budget, DoIT, New Mexico Institute of Mining and Technology, FEMA Earthquake Hazards Reduction State Assistance Program, EMPG	60 months	High	Little progress on this item due to staffing limitations and other priorities driven by the pandemic.
17	**Complete Basic Vulnerability Assessments for State Owned Critical Facilities** – Most State owned facilities have not been engineered to withstand Earthquakes. Complete a seismic assessment of all critical facilities State-wide with the Belen to Taos corridor as a priority due to the seismic risk. A systematic study of these facilities would establish a susceptible structure prioritization. The loss of any of these facilities could lead to loss of life, injury, structural damage and delayed response time. The result of the seismic assessment would be a comprehensive attribute table (or database) linked directly to geospatial references. Mapping would visually communicate seismic risk to the public.	Earthquake	DHSEM, OSE, GSD, New Mexico Institute of Mining and Technology	Cost for engineering study at the identified critical facilities	State budget, EMPG	60 months	Medium	Little progress on this item due to staffing limitations and other priorities driven by the pandemic.
18	**Develop Region-Specific Earthquake Building Codes and Zone Map that Reflects Actual Risk** – This action was identified during 2013 SHMPT and Subject Matter Expert discussions. There are wind and snow load region-specific building codes for New Mexico, but no similar system exists for earthquake. The range of earthquake risk varies greatly State-wide and building codes should reflect the actual risk.	Earthquake	CID, GSD, DCA, local jurisdictions and tribal entities that implement building codes	Minimal staff time	Existing budgets, FEMA Hazard Mitigation Grant Program, EMPG	60 months	Low	Little progress on this item due to staffing limitations and other priorities driven by the pandemic.

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19	**Retrofit Most Hazard-Prone Critical and Public Facilities** – The result would be critical facilities that are retrofit to withstand earthquake risk that is regionally specific. Retrofitting these facilities will assure their operation during an earthquake event. It will allow for continuity of operations during and after an earthquake and will lead to fewer injuries.	Earthquake	Local jurisdictions, GSD, DCA	Design, engineering, construction material purchase and installation	State legislature, FEMA Mitigation grant programs, EMPG	60 months	Low	Little progress on this item due to staffing limitations and other priorities driven by the pandemic.
20	**Participate in ShakeOut! and Encourage Participation Statewide** – Shake-Out is the largest ever earthquake drill which encourages participants to 'drop, cover and hold on'. It is implemented internationally with 2013 being the first coordinated Western States Shake-Out. By participating in the exercise, individuals will be better prepared to survive and recover quickly from an actual earthquake event.	Earthquake	Local jurisdictions, State agencies, schools	Public Service Announcements, free registration on-line, DHSEM lead agency	DHSEM staff, New Mexico Bureau of Geology and Mineral Resources staff, individual communities and agencies as interest increases.	Annual October event	High	K-12 teachers are instructed on how to conduct ShakeOut! Drills as well as other earthquake safety topics during Rockin New Mexico (held annually every summer). Teachers are encouraged to register at the annual Rockin' Around New Mexico teacher education class hosted each summer by New Mexico Tech and supported by the DHSEM. In 2021, over 600 registered participants participated in the New Mexico ShakeOut. ShakeOut outreach conducted for the Cottonwood Valley Charter School (Socorro, NM).
21	**Map Location of the Various Types of Hazardous Soils** – This was a new mitigation action for the 2013 Plan and was suggested by the SHMPT and Subject Matter Experts during the data review for the Hazard Identification and Risk Assessment Section of the Plan. Expansive soil occurrence and damage data collection is needed. Research of existing soil data for corrosive and hydrocompactive soils should also be included. Once all available information is collected and mapped, analysis of Preparedness Area risk, frequency and probability can be evaluated. Then, more specific mitigation measures can be identified. Based on the results of research and data collection, it may be effective to have all hazard soils discussed as one subject in future updates of the Plan.	Expansive Soil, Land Subsidence	DoIT, DHSEM, DOT, New Mexico Institute of Mining and Technology	Current staff and resources	State budget, DOT, HMGP, BRIC	60 months	Medium	Hydrocompactive soil susceptibility was mapped in the Albuquerque area and the results are presented in this report: D.J. Koning, C.T. Cikoski, A.J. Rinehart, and A.P. Jochems, 2019, Mapping Suitability for Managed Aquifer Recharge in the Albuquerque Basin: New Mexico Bureau of Geology and Mineral Resources, Open-file Report 605.
22	**Acquire or Relocate and Educate regarding Repetitive Loss and Severe Repetitive Loss Properties** –Creating and implementing an outreach strategy for encouraging acquisition or relocation are tasks that could assist with implementing this action item.	Flood	DHSEM, State Floodplain Coordinator, Local Floodplain managers, local jurisdictions, property owners	Cost of structure acquisition or cost of retrofits and relocation	HMGP, FMA, SRL, BRIC, local/homeowner matching funds.	Unknown as based on voluntary participatio n of property owners	Medium	Little progress has been made on this item due to staffing limitations and other priorities driven by the pandemic. The number of RL properties in NM has increased from 38 in 2018 to 75 in 2023. DHSEM is in the process of hiring a new floodplain coordinator, who will pursue implementing this action.
23	**Add or Improve Flood Control Structures at Known Flood Impact Points** – Depending on the nature of the flooding, ponding (detention, retention or sediment), arroyo/river crossing (low water, culvert, bridge), energy dissipation, bank stabilization, erosion control elements	Flood	OT, land management agencies, local jurisdictions	Staff time, construction costs	DOT, HMGP, BRIC	60 months	Medium	NMDOT has started internal discussions about the feasibility of identifying critical roadways serving vulnerable communities and ensuring access to high priority / critical facilities. We are also looking

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	or other structural mitigation measures may be appropriate to lessen the impact of flooding. Allow installation/improvement of flood control structures (proactively or on an emergency basis) to protect downstream resources and assets from post-fire flood or debris flow.							for options that will provide more resilient structures. Our expectation is that we can combine this effort with our bridge and culvert structure databases to revise our overall structure rehab / replacement prioritization and capital investment processes.
24	**Study the Probability, Extent, Vulnerability and Impact of Post-Fire Flooding** – This is a new mitigation action for the 2013 Plan. USACE and USGS have generated flood frequency predictions and debris flow hazard assessments for areas impacted by recent wildfires. These studies have helped emergency and land managers plan for and mitigate some of the effects of post-fire flooding and debris flows. Public education and outreach, including targeted outreach to planners and decision-makers, should be part of the dissemination of the resulting maps and reports.	Flood	USACE, USGS, DHSEM, land management agencies, local jurisdictions, tribal entities	Staff time, production of reports and maps	USACE, USGS, State legislature, land management agencies	Ongoing	High	NMDOT has a current project specifically to design more resilient ("hardened") replacement culverts on wildfire impacted waterways.
25	**Study the Probability, Extent, Vulnerability and Impact of Alluvial Fans** – This is a new mitigation action for the 2013 Plan although it was discussed in the Hazard Identification and Risk Assessment Section of the 2010 Plan. The study could include: 1) identification and mapping of alluvial fan flood hazards, 2) definition of active and inactive areas of erosion and deposition, and 3) definition and characterization of the base flood within defined areas.	Flood	USACE, USGS, DHSEM, NMFMA, land management agencies, local jurisdictions, tribal entities	Staff time, production of reports and maps	USACE, USGS, State legislature, land management agencies	Ongoing	Low	The New Mexico CTP as part of the RiskMap program created a database of available digital alluvial data. The data were compiled from the New Mexico Bureau of Geology and Mineral Resources (NMBGMR) published detailed geologic surveys as well as the State-wide surficial geologic map at a scale of 1:500,000. The data are available for download from the Resource Geographic Information System and Clearinghouse (RGIS). As new geologic maps are published the data will need to be added to the database. Older, paper geologic maps need to be digitized to produce a more comprehensive alluvial fan database.
26	**Increase the Number of Communities Participating in the Community Rating System** – The Community Rating System (CRS) is a component of the National Flood Insurance Program. CRS reduces flood insurance rates in exchange for a community conducting certain flood hazard reduction activities that are beyond the minimum national standard for floodplain management.	Flood	DHSEM, State Floodplain Coordinator, local floodplain managers, local jurisdictions	Staff time, legal review, community outreach, raising political support	Existing budgets, US EPA watershed and water quality grant programs	60 months	Low	In the last 2 years, DHSEM has focused on helping existing CRS communities with recertification and improving their CRS class. DHSEM has identified communities that could benefit the most from joining CRS, and plans to begin outreach to them once a new floodplain coordinator has been hired.
27	**Provide Technical Assistance for the Development or Modification of Codes and Ordinances** – Local jurisdictions (especially those that have recently joined the NFIP or that have new floodplain administrators) may have difficulty in the creation of jurisdiction specific language that addresses floodplain management. If the communities are interested in implementing higher standards than the minimum Federal	Flood	DHSEM State Floodplain Coordinator, NMFMA	Staff time	CAPSEEE	Ongoing	Low	The State Floodplain Coordinator provides model ordinance examples to local communities and tribal entities upon request.

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	requirement, the model codes may not be easily understandable. The State Floodplain Coordinator and NMFMA could provide training or workshops on this topic.							
28	**Provide FEMA Introductory Floodplain Management Training in State Every Year** – Bring the following courses to New Mexico as demand increases; 1) G273 Managing Floodplain Development through the National Flood Insurance Program and 2) G278 National Flood Insurance Program/Community Rating System	Flood	DHSEM, NMFMA	Instructor time, training manuals, attendees time, travel expenses	Existing budgets	Two year cycle	Low	NMFMA & State Floodplain Coordinator have been offering the L-273 Managing Floodplain Development through the NFIP course. It was held February 10-13, 2020 in Albuquerque, and April 17 - 20, 2023 in San Juan County. Currently there are 2 NMFMA Board Members who are conducting the training.
29	**Map Landslide and Rock Fall Susceptibility Areas** – This was a new mitigation action for the 2013 Plan and was suggested by the SHMPT and Subject Matter Experts during the data review for the Hazard Identification and Risk Assessment Section of the Plan. The USGS produced landslide maps approximately 30 years ago based on aerial photographs of steep regions throughout the State. There are archive paper copies at 1:100,000 and mylars of a compilation at 1:500,000 scale. It would be helpful to produce Statewide landslide maps in digital format based on this mapping done 30 years ago. The Department of Transportation also has landslide information that is used for design and maintenance priorities. This information should also be included in a State-wide digital map to enhance the accuracy of the product. Recent landslides related to road building and irrigation ditch failures should also be included.	Landslide	DoIT, DHSEM, DOT, New Mexico Institute of Mining and Technology	Current staff and resources	State budget, DOT, HMGP, BRIC	60 months	Medium	Landslide mapping has been conducted in the lower Rio Chama gorge (2-15 miles upstream of Abiquiu Lake). The results are presented in the dissertation of Julian Chesntutt (North Carolina University, anticipated to be released in 2023). There are two on-going landslide mapping projects: 1) mapping landslides on the east flank of Black Mesa (Raja Das and Karl Wegmann) and 2) mapping of landslides on the east flank of the Chuska Mountains (K. Hobbs and J. Krupnick. Landslides are commonly mapped as part of 1:24,000 geologic mapping conducted by the NM Bureau of Geology (<<https://geoinfo.nmt.edu/publications/maps/geologic/home.cfml>>). Including recent landslides related to road building and irrigation ditch failures still remains to be done.
30	**Install Rock Nets or Other Protective Measures Along Roads** – Most of the landslide events in the state have been along roadways.	Landslide	DOT	Cost for study along roadways.	State budget, HMGP, BRIC	Online	Medium	DOT continues to install rock nets where needed as funding becomes available.
31	**Adopt Zoning which Restricts Development in Landslide Prone Areas** – Many areas in the State have no zoning restrictions at all, much less any specifically addressing landslide. Investigate if the New Mexico Building Code addresses this specific hazard. Research model ordinances that address this specific hazard. Adopt State-wide standard and encourage local communities and tribal entities to adopt codes that address their specific hazard.	Landslide	CID, DOT, DHSEM, New Mexico Institute of Mining and Technology	Staff time, legal review, community outreach, raising political support	State budget	60 months	Low	Little progress has been made on this item due to staffing limitations and other priorities driven by the pandemic.
32	**Map Known Land Subsidence Areas** – This is a new mitigation action for the 2013 Plan and was suggested by the SHMPT and Subject Matter Experts during the data review for the Hazard Identification and Risk Assessment Section of the Plan. Data needs to be collected and	Land Subsidence	DoIT, DHSEM, DOT, New Mexico Institute of Mining and Technology	Current staff and resources	State budget, DOT, HMGP, BRIC	60 months	Medium	Land subsidence investigated in the town of San Mateo, north of Grants. Results written up in the following report: L. Land and G. Veni, 2021, Electrical resistivity survey of a pseudokarst

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	compiled on past occurrence of the various types of land subsidence. For example, most of the land subsidence occurrences in the country have been due to sinkholes that are a sub-hazard of land subsidence. Once all available information is collected and mapped, analysis of Preparedness Area risk, frequency and probability can be evaluated. Then, more specific mitigation measures can be identified.							sinkhole hazard, Village of San Mateo, Cibola County, New Mexico: National Cave and Karst Research Institute, Report of Investigation 13.
33	**Install Snow Fences** – Blowing snow can pile up and create hazardous driving conditions.	Severe Winter Storm	NMDOT	Purchase and installation of equipment	WIPP budgets, highway maintenance budgets	30 months	Low	NMDOT continues to install and maintain snow fence at known wind drift areas.
34	**Require Use of Hail Resistant Materials in New State Funded Construction** – Hail causes damages to roofing, windows and siding materials	Thunderstorm	GSD, OSE, Legislature	Dependent on the specific structure	State Budget	60 months	Low	Little progress has been made on this item due to staffing limitations and other priorities driven by the pandemic.
35	**Encourage the Use and Installation of Storm Shelters in Tornado Prone Area**s – There are very few storm shelters in some areas of the State that are particularly vulnerable to tornado impacts. Certain communities are especially vulnerable. Identification of local vulnerability in local and tribal mitigation plans will help to identify those communities that would benefit from a storm shelter program. Enforcing existing building codes provides the greatest benefit for new construction to mitigate damages due to tornado events.	Tornado	State agencies, local jurisdictions, tribal entities	Dependent on the construction, size and specifications of each shelter location	HMGP, HUD, BRIC	60 months	Low	Little progress has been made on this item due to staffing limitations and other priorities driven by the pandemic.
36	**Create Additional Shelters Using Public Buildings and Retrofit Existing Public Shelters with Safe** – Rooms Few public shelters are rated to serve as safe rooms. Moreover, additional shelter locations are needed on the eastern side of the state to protect building occupants.	Tornado	Local jurisdictions, GSD, State agencies	Cost dependent on the construction, size and specifications of each shelter location	Existing budgets, HMGP, BRIC	60 months	Low	Little progress has been made on this item due to staffing limitations and other priorities driven by the pandemic.
37	**Conduct Mapping and Delineation of Areas Vulnerable to Volcano Eruption** – This is a new mitigation action for the 2013 Plan and was suggested by the Planning Team and Subject Matter Experts during the data review for the Hazard Identification and Risk Assessment Section of the Plan. Data needs to be collected and compiled on past occurrence of different types of volcanic activity. Currently the data base for volcanism in the State includes information on age and rock type (two factors useful in assessing risk). Improvement needs to be made for additional characteristics such as styles of eruption, longevity and scope of influence. Physical characteristics including structure and morphological development will contribute to making a mapping effort more useful for risk analysis. It may be beneficial to include volcanic activity outside the State that has the potential to impact New Mexico (ash clouds for example). Once all available information is collected and	Volcano	DoIT, DHSEM, DOT, New Mexico Institute of Mining and Technology, USGS	Minimal – primarily staff time	Existing budgets, HMGP, BRIC	60 months	Low	Several studies have been completed or are nearing completion that are related to understanding the regions of NM that are susceptible to future volcanic eruptions. Nearly 250 new high precision ages have been generated to understand the timing of young volcanism, eruption frequency, and vent migration patterns. A study related to the Valles caldera, a moderate threat based on recent USGS survey, was published in the Journal of Volcanology and Geothermal Research in 2022. The dataset is currently being used for a probabilistic assessment of future eruptions for Los Alamos National Laboratory, which is located on the flanks of Valles

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	mapped, analysis of Preparedness Area risk, frequency and probability can be evaluated. Then, more specific mitigation measures can be identified.							caldera. A similar study focused on small-volume, typically effusive mafic eruptions in NM is currently in review with the journal "Geosphere".. As part of these studies, some small areas have received reconnaissance-style maps or preexisting maps have been modified given the new datasets. A geologic map compilation of the southern Jemez Mountains volcanic field, which includes the Valles caldera will be completed by the end of 2023. However, modern, detailed maps of most volcanic fields in NM remain a large data gap. These maps would contain important information regarding eruption style. The status of investigations of volcanic fields outside of NM that could produce eruptions that impact the state is unknown.
38	**Provide Education About the Volcano Alert System and the Aviation Color Code Warning System** – This is a new mitigation action for the 2013 Plan and was suggested by the SHMPT and Subject Matter Experts during the data review for the Hazard Identification and Risk Assessment Section of the Plan. Because this is a hazard that is not experienced often, many citizens don't understand the severity of the potential impact of volcanic activity.	Volcano	DoIT, DHSEM, New Mexico Institute of Mining and Technology, USGS	Minimal – staff time	Department budgets	60 months	Low	No activities reported specifically about the Volcano Alert System or the Aviation Color Code warning. A New Mexico Bureau of Geology and Mineral Resources publication in NM Earth Matters titled "New Mexico's volcanic hazards: A Matter of Time" was published in winter 2021 that discusses the potential for future volcanic eruption and likely scenarios. The publication series is written for the general public. Outreach activities in National Parks that are focused on public awareness of future volcanism are conducted by researchers at the NM Bureau of Geology.
39	**Increase the Number of Fire Adapted Communities** – The Firewise program emphasizes community responsibility for maintaining a safe community. Fire Adapted Communities acknowledge their wildfire risk and take actions to protect residents, homes, neighborhoods, businesses, infrastructure, forests and open spaces. Mitigation options for wildland fire need to address not only the management of fuels, but also the potential for growing population in wildfire threat areas. The State Forestry Division has conducted a Statewide assessment on forest health and outlined mitigation efforts and priorities to reduce fuel loads and create more defensible space. More specific mitigation goals and actions are detailed in the New Mexico Forest Action Plan (formerly "Statewide Assessment, Strategy and Response Plans.")	Wildfire	NM Forestry, local fire departments, local emergency managers, FAC Learning Network	Volunteer and community efforts	Department budgets	60 months	High	Little progress has been made on this item due to staffing limitations and other priorities driven by the pandemic.

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40	**Implement Defensible Space Around State Owned Facilities** – Defensible space around the structure will lessen the risk of structure damage.	Wildfire	DHSEM, NM Forestry	Brush/tree removal and maintenance of perimeter	Existing budgets, SFA-WUI	60 months	High	Little progress has been made on this item due to staffing limitations and other priorities driven by the pandemic.
41	**Increase Participation in Community Wildfire Protection Plans (CWPP)** – CWPP are community or county plans that address wildfire risk and mitigation for specific communities in New Mexico. The plan must have collaboration between land management agencies and the community, and it must prioritize fuel reduction areas and address the treatment of structural ignitability within the plan boundaries. Communities to target for participation are those with the highest risk.	Wildfire	Local jurisdictions, utilities providers, DHSEM, State Forestry, facility owners	Creation and updates of plan	Existing budgets, RFA, SFA-WUI, NM Assoc. of Counties Grants	60 months	High	In 2023, 5 New Mexico communities received over $11M from the first year of the Community Wildfire Defense Grant Program, some of which are using the funding to update their CWPPs. DHSEM and State Forestry will continue to leverage this and other funding sources to update CWPPs across the state.
42	**Reduce Combustible Fuels Around Critical Facilities in WUI Areas** – This action reduces the susceptibility to wildfires at critical facilities such as power stations, power lines, transformer sites, major transportation routes and critical watersheds. Critical facilities must be protected from wildfire on a priority basis. Transportation routes are critical for emergency traffic, residential ingress and egress. Some watershed areas can be vulnerable to other hazards (such increased sediment or pollutants) after wildfires.	Wildfire	Local jurisdictions, utilities providers, DOT, State Forestry, facility owners	Equipment and manpower	Existing budgets, BRIC, HMGP, RFA, SFA-WUI, RCA EAP	60 months	High	Little progress has been made on this item due to staffing limitations and other priorities driven by the pandemic.
43	**Rural Addressing for Emergencies** - This project would provide the counties funding to document rural addresses of the state into the emergency 911 system. Currently our rural areas do not have addresses in the system. This issue causes the emergency system to not be able to respond to the correct place when they receive an emergency call. This is a statewide issue that has been documented by every county in NM.	Fire, Flood, Health	County Managers	Est $700,000	FEMA	Unknown	High	New in 2023
44	**Mobile Emergency Support Units** - With the large number of natural disasters happening in the western region of the county. There is a need to increase the number of Mobile Emergency Response Support Units for this region.	Fire, Flood, Health	Local Jurisdictions, DHSEM	Unsure, est. $1,000,000	FEMA		High	New in 2023
45	**Radio Communication & Broadband Hardening and Upgrades -** for State and County EOCs, HHPD, Law Enforcement, Fire Departments, EMS to protect against Loss of Function.	All Hazards	Local Governments, State Digital trunked radio system management groups, DHSEM	Unknown	FEMA	Unknown	High	New in 2023
46	**Hazard Mitigation Plans and Emergency Action Plans -** Increase maintenance and active Hazard Mitigation Plans and Emergency Action Plans (EAP) for all NM regions and counties. Revisions to plans should include robust information on ESF 6, transitional housing, residential wind-hardening, residential fire-resistance, upgrade codes and	All hazards	Local Governments, DHSEM	Unknown	FEMA	Unknown	High	New in 2023

#	Project Name & Description	Hazards Mitigated	Lead Agency	Estimated Cost	Potential Funding Sources	Timeline	Priority	2023 Update
	standards, increase local BCEGS implementation. Create an SOP for Plan Maintenance, Mitigation Action Updates, State/County HM Plan updates due lessons learned, Best Practices, and loss Avoidance due to disasters that occur before the federal mandatory 5-year update.							
47	**Community Education Outreach Schedule** - Develop a schedule based on HMPs and EAPs for example: Wildfire Awareness, Extreme Heat, Flooding, NFIP Flood Risk communities/Dams, Earthquakes (Great ShakeOuts), and Severe High Winds. Hardened radio communications to share information on evacuation routes and transitional housing. Include Community Lifelines and Equity for vulnerable persons dealing with economic distress, language/communication barriers, disabled, senior citizens, isolated rural communities, social services agencies caring for youth, families, and senior citizens. *Example CEO: Prolonged exposure to Wildfire Smoke, Volcanic Vog, and extreme heat to shelter in place or to evacuate to identified disaster shelters, cooling centers.*	Fires, Wildfires, Flood, Extreme Heat, Earthquake, High winds	Local Governments, DHSEM	Unknown	FEMA	Unknown	High	New in 2023
48	**GIS Literacy by Community Education Outreach -** Promote and support the NM Citizens, County and State agencies in GIS Literacy by creating a Community Education Outreach of Geotagging Metadata for Critical Facilities, Invasive Species, Riverine Systems, repetitive flooding, local schools, and so on. Using 123 Survey mobile software (like the Great ShakeOut).	Flood, Fire, Utility Outage, Earthquake, Thunderstorm	Local Governments, DHSEM	Unknown	FEMA	Unknown	High	New in 2023
49	**Power Redundancy for Critical Facilities -** Protection for critical facilities for Water Utilities and including HHPDs. Reduce the loss of electrical power by adding electrical redundancy to critical facilities to 500-yr NFIP Flood Risk. Installation of Uninterrupted Battery Systems, SCADAs, updated backup generators with above codes and standards transfer switches, fuel tanks.	Flood, Utility Outages, Fires	Local governments, utility providers	Unknown	FEMA	Unknown	High	New in 2023
50	**County Road hardening** - to address Fire/Extreme Heat and debris filled flooding. Updated H&H per identified riverine and transportation are to correct culvert alignments and diameter, culvert type and amount. Installation of highly compacted course (lava type natural stone) material sub-base to disperse extreme heat. Harden road capacity to address vehicular load capacity.	Fire, Extreme heat, debris flows	Local governments	Unknown	FEMA	Unknown	Medium	New in 2023
51	**Road embankment and shoulder improvements** - Remove Invasive Species replace with native variegated mix seed adjacent ditches. Add bioswales, roundabouts, large vehicle turn-arounds, increase ditch volume capacity to create volumes of space to capture flows of floodwaters, heavy debris floodwaters or any high hazard flow to protect & prolong the use of roads exposure to natural disasters and to provide Life Safety and protect emergency response. Add signage on	Fire, Floods, Debris Flows	Local governments	Unknown	FEMA	Unknown	Medium	New in 2023

#	Project Name & Description	Hazards Mitigated	Lead Agency	Estimated Cost	Potential Funding Sources	Timeline	Priority	2023 Update
	vehicle load capacity, Alluvial Fan High Hazards Warning, Low Water Crossing Warnings in high water flow.							
52	**Updates to Alluvial Flood Mapping / NFIP Flood Risk Maps** - Alluvial Flood Maps/NFIP Maps update effort to develop structure buyout zones based on flood risk.	Flood	DHSEM, Local governments	Est. $200,000	FEMA	60 months	High	New in 2023
53	**Property buyouts in Special High Hazard Risk Areas** - as identified in Alluvial Flood Maps/NFIP Maps Buy Outs. Buyout homes in significant Alluvial Fan high risk zones.	Flood	DHSEM, Local governments	Unknown	Unknown	Unknown	High	New in 2023
54	**Establish a Council of Governments for improved response** - Creating a centralized disaster response through the Councils of Government in each district in NM. This will reduce lag time for equipment deployment by prepositioning equipment around the state, as experienced during the 2022 fire and during a windstorm when it was challenging to deploy generators tree removal equipment. Using the Council of Governments will allow for improved regional planning and usage of equipment as well as to ensure that every community has an up-to-date Community Wildfire Protection Plan and Hazard Mitigation Plan on file. One idea is to pre-stage generators and other equipment at each council of government so that equipment can be quickly deployed for use by any district.	Wildfire, Wind, Flooding	Council of Government Offices (There are currently seven stationed around the state)	Est. $700,000	FEMA, Hazard Mitigation Grant Program, EMPG	60 months	High	New in 2023
55	**Digital Fire Surveillance** - Funding to provide each community of the state with digital security surveillance for fire mitigation. This project would provide each region of the state with funding to install digital surveillance in high fire risk areas.	Wildfire	Local governments	Est. $700,000	FEMA	60 months	High	New in 2023
56	**Senior Case Managers** - With NM slated to have the largest senior population within four years, there is a need to expand access to Senior Case Managers during a natural disaster, as experienced during the recent fires in Mora and Las Vegas, NM. During a natural disaster, senior case managers could be deployed to an area to assist the Senior population. These positions could also help with mitigation planning for seniors within the different regions.	Fires, Flooding, High Winds	Department of Senior and Aging Services	Est. $1,000,000	FEMA, State Appropriation	60 months	Medium	New in 2023
57	**HHPD Program Compliance** - The State does not currently meet all the requirements of the Rehabilitation of High Hazard Potential Dams (HHPD) Grant Program, making the state ineligible for funding under that program. This has been identified as an area for improvement.	Dam Failure	OSE- Dam Safety, DHSEM	Unknown at this time	Unknown at this time	12 months	High	New in 2023

8 PLAN IMPLEMENTATION AND MAINTENANCE

44 CFR Part 201.4
The plan must include: • *An established method and schedule for monitoring, evaluating, and updating the plan.* • *A system for monitoring implementation of mitigation measures and project closeouts.* • *A system for reviewing progress on achieving goals as well as activities and projects identified in the Mitigation Strategy.* • *The plan must be formally adopted by the State prior to submittal to us for final review and approval.* • *The plan must include assurances that the State will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, including 2 CFR parts 200 and 3002. The State will amend its plan whenever necessary to reflect changes in State or Federal statutes and regulations.* • *Plan must be reviewed and revised to reflect changes in development, progress in statewide mitigation efforts, and changes in priorities and resubmitted for approval to the appropriate Regional Administrator every 5 years.* • *[The State is encouraged to] review its plan in the post-disaster timeframe to reflect changing priorities.*

8.1 Plan Implementation

Hazard mitigation planning is a continuous and ongoing process. Effective implementation of mitigation activities paves the way for continued momentum in the planning process and gives direction for the future. New Mexico is committed to maintaining an ongoing effort to monitor and evaluate mitigation program implementation and to update the plan as progress, roadblocks, or changing circumstances are recognized. Policies and procedures established in this plan reflect the current emergency management and hazard mitigation philosophy at both the state and national level. Changes in hazards or vulnerabilities could necessitate modifications to this plan, as might changes in hazard mitigation programs and/or priorities, to include changes in legislation and available funding.

Agencies and organizations involved in the 2023 Plan Update will implement mitigation actions as resources become available. The SHMT can assist with prioritizing which action(s) to undertake first based on 1) the priority assigned to the actions in the planning process; and 2) funding availability. Low or no-cost projects most easily demonstrate progress toward successful plan implementation.

Implementation will be accomplished by adhering to the schedules identified for each action (see Section 7.4) and through constant, pervasive, and energetic efforts to network and highlight the multi-objective, win-win benefits of each project to the State. These efforts include the routine actions of monitoring agendas, attending meetings, and promoting a safe, sustainable community. The three main components of implementation are:

- Implement the action plan recommendations of this plan;
- Utilize existing rules, regulations, policies, and procedures already in existence; and
- Communicate the hazard information collected and analyzed through this planning process so that the community better understands what can happen where, and what they can do themselves to be better prepared. Also, publicize the "success stories" that are achieved through the HMPC's ongoing efforts.

8.1.1 Role of the State Hazard Mitigation Team

The New Mexico State Hazard Mitigation Team (SHMT) is the principal body responsible for coordinating the state's comprehensive hazard mitigation program, and for implementing the SHMP with facilitation provided by the SHMO or their designee. Going forward the SHMT will:

- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high priority, low/no-cost recommended actions;
- Keep the concept of mitigation in the forefront of community decision making by identifying plan recommendations when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters;
- Maintain a monitoring of multi-objective cost-share opportunities to help the community implement the plan's recommended actions for which no current funding exists;
- Monitor and assist in implementation and update of this plan;
- Report on plan progress and recommended changes to the Board of County Commissioners, municipal councils, and other partners;
- Inform and solicit input from the public;
- Review mitigation proposals, consider stakeholder concerns about hazard mitigation, pass concerns on to appropriate entities, and post relevant information on the appropriate websites.

With facilitation from the SHMO or their designee, the SHMT will also monitor funding opportunities that could be leveraged to implement mitigation activities. This will include creating and maintaining a bank of ideas on how to help local and tribal governments with local match or participation requirements. When funding does become available, the SHMT will be in a strong position to capitalize on the opportunity. Funding opportunities to be monitored include special pre- and post-disaster funds, special district budgeted funds, state and federal earmarked funds, and other grant programs, including those that can serve or support multi-objective applications.

8.2 Monitoring, Evaluating, and Updating the Plan

The New Mexico State HMP is a living document that may be adjusted or updated as conditions change, actions progress, or new information becomes available. This section describes the method and schedule the SHMT will follow for monitoring, evaluating, and updating the Plan over the next five years.

8.2.1 Monitoring

Monitoring refers to tracking the implementation of the plan over time. The SHMO will be responsible for reaching out to lead and supporting agencies identified in the mitigation actions table for status on those mitigation actions. The SHMO will coordinate with SHMT members at least annually to identify and track any significant changes in their agencies' mitigation efforts. More information about the annual meeting is below in Section 8.2.2.1. Additionally, the SHMO will use the following process to track progress, note changes in vulnerabilities, and consider changes in priorities as a result of project implementation:

- A representative from the responsible entity identified in each mitigation action will be responsible for tracking and reporting to the SHMT when project status changes. The representative will provide input on whether the project as implemented meets the defined goals and objectives and is likely to be successful in reducing vulnerabilities.
- Projects that were not ranked high priority but were identified as potential mitigation actions will be reviewed periodically to determine feasibility of future implementation.

- New mitigation projects identified will require an individual assigned to be responsible for defining the project scope, implementing the project, and monitoring the success of the project.
- Mitigation activities not identified as actions in this plan will also be tracked to ensure a comprehensive hazard mitigation program, and to assist with future updates.
- The State follows project closeout procedures as outlined in the State Hazard Mitigation Administrative Plan described in Section 4.2.1.2. These procedures require the sub-grantee to request closeout of the project by letter addressed to the SHMO. The SHMO coordinates via letters to and from FEMA for preparation of final notice that the project was completed in accordance with FEMA approvals. Project closeout procedures are detailed in the Administrative Plan.

The process described above focuses primarily on FEMA-funded mitigation projects; however, the same principles apply to all mitigation activities, the progress of which will be monitored in a similar manner.

As part of this coordination, the SHMO or their designee will also monitor repetitive losses; evaluate changes in hazards, vulnerabilities, or the distribution of risk across the State; and seek to identify new and ongoing mitigation opportunities.

8.2.2 Evaluation

Evaluating refers to assessing the effectiveness of the plan at achieving its stated purpose and goals. Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan, such as:

- Decreased vulnerability because of implementing recommended actions;
- Increased vulnerability because of failed or ineffective mitigation actions; and/or
- Increased vulnerability because of new development (and/or annexation).

The primary method of evaluation for the SHMP are the real-world incidents that occur within the state and disaster exercises as well as lessons learned by other states. After-Action Reports from real events and exercises can help identify Plan content and processes that may require revision or follow-up corrective actions. The recommended revisions/follow-up corrective actions will be provided to the SHMT, through the SHMO, for their review at their next scheduled meeting and for their consideration for inclusion in this Plan's next revision.

The SHMO will coordinate with other State agencies and stakeholders to facilitate an effective maintenance and implementation process.

8.2.2.1 Annual Review

The SHMT will meet annually to review and evaluate the status of the SHMP and the mitigation program overall, to include:

- Mitigation goals & objectives
- Progress of state, local, or tribal mitigation activities from inception through closeout.
- Significant hazard incidents during past year
- Any needed updates to the HIRA
- Any outdated information
- Any identified gaps in the mitigation strategy
- Changes in state, federal, local, or tribal capabilities
- Standard and enhanced plan compliance
- Status of local and tribal mitigation plan adoption

- Results of the most recent FEMA consultation visit

Similarly, major changes in federal mitigation programs or legislation could necessitate a special meeting of the SHMT.

8.1.1.1 *Post-Disaster Review*

The SHMT will meet following every declared disaster, although this meeting may be deferred until their next regular meeting at the SHMT's discretion. This post-disaster review will focus on identifying any changes to the State's risk assessment and identifying opportunities for mitigation projects and mitigation funding. An additional purpose of this post-event meeting is to determine if any mitigation projects were impacted by the disaster, and whether or not it is possible to evaluate the effectiveness of those projects in reducing losses or damage.

In addition to updating this plan, following every declared disaster the State Hazard Mitigation Officer (SHMO) will coordinate an update of the state's HMGP Administrative Plan if one is needed.

8.2.3 Updating

The Year 3 annual SHMT meeting will be used to lay out a road map for the next Plan update process. The SHMT will review the process used during the previous update process and decide on any changes that should be made to that process for the next update. If appropriate, DHSEM will pursue a planning grant.

In year four of the five-year cycle, the SHMO will initiate the update process. The SHMT and SMEs will be invited to a Kick-off Meeting 20 months prior to the expiration of the Plan. Updates to each section of the Plan will occur during that time. At a minimum, the update will address the following:

- Should the same planning process be followed as in the 2018 update?
- Does the SHMT and Subject Matter Expert list reflect the full range of interests State-wide?
- Are the State-wide mitigation goals still appropriate?
- What progress has been made on state, local, or tribal mitigation activities, and what challenges and opportunities have been identified?
- Has the pattern or type of natural disasters changed sufficiently that the Plan should have a different focus?
- What policies or regulations have been modified at the State or Federal level that may impact the Plan update?
- Information errors or omissions have been identified.
- New issues, requirements, or supplementary material have been identified which are not adequately addressed.
- Changes in information, data, or assumptions from those on which the Plan was based.
- The nature or magnitude of identified risks and/or hazards have changed.
- Implementation problems, such as technical, political, legal or coordination issues.
- Legislative changes affecting organizational structure of local or state agencies.
- Incorporation of new state or federal guidelines or directives.
- Exercises and/or real-world events reveal deficiencies or shortfalls.

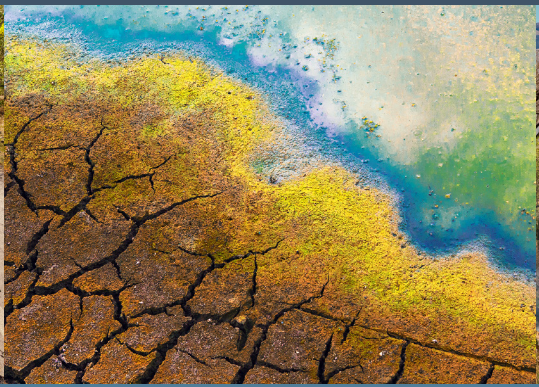
In addition to the mandatory 5-year update, the SHMT may amend the 2023 SHMP at any time it feels necessary, as determined during the annual or post-disaster reviews. The SHMT plans to update this Plan as frequently as practical to incorporate lessons learned, ensure compliance with applicable laws and guidance, reflect best practices, allow for community input and provide for effective coordination with other applicable plans. The SHMT can recommend changes and modifications to this Plan for approval by the

DHSEM Cabinet Secretary. No proposed change should contradict or override authorities or other plans contained in statute or regulation. Any state department or state or local agency may propose a change to this Plan and are encouraged to do so. All requests for changes will be submitted to the SHMO for consideration. As deemed appropriate, the SHMO will coordinate with the SHMP for review and next steps.

8.3 Integrating the SHMP Into Other Plans

Properly implemented, the SHMP should serve as the foundational document of the state's emergency management program. The Hazard Identification and Risk Assessment (HIRA) Section in particular helps establish the scope of the emergency management program since everything emergency management does should relate back in one way or another to the hazards the jurisdiction faces.

Over the next five years, SHMT members will use the updated SHMP to inform and improve other state plans, procedures, and programs, focusing on those described in Section 4.2.2.



DEPARTMENT OF HOMELAND SECURITY AND EMERGENCY MANAGEMENT
NEW MEXICO