NEW MEXICO 360
GROUNDWATER REPORT

NEW MEXICO 360 GROUNDWATER REPORT

January 2026

Co-Authored by New Mexico Groundwater Alliance Members:

Gretel Follingstad, PhD
Senior Manager, Climate Resilient Water Systems, Environmental Defense Fund

Maurice Hall, PhD
Senior Advisor, Climate Resilient Water Systems, Environmental Defense Fund

Phil King, PhD
Phil King Consulting

Adrian Oglesby, JD
Director, Utton Center

Ramón Lucero
Regional Field Manager, RCAC

Leslie Hine, MSW
Hine Consulting

Laura Ziemer, JD
Culp & Kelly

Jennifer Diffey, JD
Culp & Kelly

Ladona Clayton, PhD
Executive Director, Ogallala Land & Water Conservancy

Aron Balok
Superintendent, Pecos Valley Artesian Conservancy District

Reviewed by:

Stacy Timmons
Associate Director, NM Bureau Geology & Mineral Resources

Ronna Kelly
Environmental Defense Fund

Patrick McCarthy
Thornburg Foundation

This report was made possible by the generous support of the Thornburg Foundation.

TABLE OF CONTENTS

FIGURES AND TABLES

EXECUTIVE SUMMARY

New Mexico's long history of severe drought and surface water scarcity fueled the development of groundwater to meet water demands. The state's groundwater aquifers provide over half of the state's total water supply, making it critical to the health of communities and economies. The escalation of groundwater pumping has severely outpaced natural aquifer recharge and caused significant declines in groundwater levels in various areas, including Santa Fe County, the Lower Rio Grande, the Estancia Basin, and the Southern High Plains Basin. As climate change intensifies and temperatures continue to rise, increasing aridification is driving a projected 25% to 30% decrease in surface water availability for New Mexico by 2050. This will undeniably increase reliance on groundwater. Given these dependencies and impacts of climate change, New Mexico needs to more closely and sustainably manage groundwater to preserve this resource for future generations.

New Mexico's groundwater aquifers are naturally occurring infrastructure, formed through geologic events. Like surface water reservoirs, aquifers require careful management to sustain the viability and availability of groundwater resources. In addition to providing drinking and agricultural irrigation water, groundwater is used in oil and gas production and industrial and commercial uses. Groundwater also makes a significant contribution to the streamflow of rivers, streams, and springs across New Mexico.

New Mexico Groundwater By the Numbers

- **Over 50%** of the state's total water supply
- **78% of New Mexico's drinking water** comes from groundwater
- **19 of 23 federally recognized Tribes, Pueblos, & Nations** depend on groundwater
- **24 of 33 counties** depend on groundwater
- **81% of public water systems** depend on groundwater
- **Over 170,000 private wells**
- **78%** of total groundwater use is **for irrigated agriculture**

As an arid and water-limited state, New Mexico is home to centuries-old cultural traditions and practices for water management, learned from the state's 23 Sovereign Nations and 400-year-old acequia systems. These values, traditions, and knowledge about how to adapt to changing conditions, and use less water, are central to improving future groundwater resilience for the state. New Mexico has groundwater management success stories (Pecos Valley, the High Plains Aquifer, and Lower Rio Grande) that highlight the feasibility and benefits of localized groundwater management. These success stories and lessons from other western states provide a road map for the development of a statewide groundwater management framework informed by community needs, data, science, historic values, and cultural traditions.

This New Mexico 360 Groundwater Report provides an overview of the knowns and unknowns about New Mexico's groundwater resources, and recommendations for building longevity and groundwater resilience. The report highlights New Mexico's history of groundwater development; available groundwater data and data gaps; water uses by category; and the evolution of the laws, codes, and administrative tools that currently govern groundwater in New Mexico. As a launching point to elevate the urgency of groundwater declines across the state, this report is a call to action for proactive groundwater management to address New Mexico's diminishing groundwater resources.

Recommendations to proactively address groundwater challenges:

- **Treat Aquifers as Critical Infrastructure:** Manage, monitor, and maintain aquifers at the same level as conventional surface water infrastructure and conveyance systems such as dams, reservoirs, and canals. Recognize and fund New Mexico's aquifers as critical natural infrastructure for long-term water security.
- **Accelerate Aquifer Mapping, Monitoring, and Characterization:** As part of a multiyear effort, fund the New Mexico Bureau of Geology and Mineral Resources' (NMBGMR) budget requests for the Aquifer Mapping Program to develop descriptive models of groundwater flow in important aquifers around the state and develop a comprehensive, statewide groundwater monitoring network. These aquifer studies provide essential basin level information — such as quantity and quality of groundwater resources — for management of groundwater and targeted strategies to address groundwater declines (water reuse, conservation, and managed recharge). The request also supports a gap in funding for the Water Data Act, aimed to help state agencies share, integrate, and better manage water data using 21st century technologies.
- **Expand Statewide Groundwater Metering:** Execute metering of all groundwater diversions, starting with at-risk areas where water tables are dropping rapidly. Metering is essential to monitoring groundwater use, ensuring groundwater is not overused, and understanding the rate of aquifer declines. Metering data improves accounting and modeling to inform local management decisions. Metering has proven instrumental and essential for the Pecos Valley Artesian Conservation District (PVACD) to manage water allotments and avoid priority calls on their water, while facilitating a trading program to reach groundwater management goals.
- **Develop a Statewide Groundwater Management Framework to Guide Local Management:** Provide guidance and support for monitoring aquifer conditions and a proactive approach for reaching desired future groundwater conditions, based on local circumstances, needs, and goals. Provide technical assistance needed to establish local groundwater management authorities, adapted from successful examples of community-based groundwater management elsewhere in New Mexico, that includes sustainable financing for these authorities.
- **Enable Meaningful Engagement with Tribes, Pueblos, and Nations in Groundwater Policy and Management:** Work in partnership with the New Mexico Indian Affairs Department to develop guidance for consultation with the 23 Tribes, Pueblos, and Nations of New Mexico, in a manner that respects their sovereign rights to control access to their knowledge and data on groundwater, to grant or withhold permission to share that information, and to dictate terms of partnerships in the development of a statewide groundwater management framework.
- **Support Community-Driven Groundwater Planning and Conservation with Robust Data and Tools:** Support and create pathways for local involvement and representation of all interests in groundwater management and decision-making. Provide a

groundwater conservation toolkit for locally relevant incentive-based conservation that builds upon New Mexico-specific strategies. Tools for reducing groundwater pumping in regions with declining aquifer conditions should include: conjunctive management of groundwater and surface water, community-driven groundwater management based on aquifer conditions, water banks, rotational agricultural water conservation or voluntary fallowing, among others.

- **Ensure that Groundwater is Fully Understood and Addressed in Regional Water Planning and other Community-Based Conservation Initiatives:** Provide information to water managers, policy makers, and stakeholders about aquifer status and trends. Support the Water Security Planning Act implementation with informed engagement about groundwater conservation tools in community water planning efforts, Water Trust Fund proposals, Infrastructure Capital Improvement Plans, and Capital Outlay requests.

New Mexico is at the front lines of climate change impacts, which threatens water resource availability. Groundwater management is paramount to the resilience of water supplies, communities, and economies for generations to come.

Abstract

This New Mexico 360 Groundwater Report provides an overview of New Mexico's groundwater resources and recommendations for building longevity and groundwater resilience moving forward. This report builds off of Governor Lujan-Grisham's Water Policy & Infrastructure Task Force 2022 report and the 50-Year Water Action Plan, which warns that New Mexico will have 25-30% less water by 2050 and recommends improved groundwater science, data, monitoring, and management. Groundwater provides more than half the state's total water supply, with 81% of public water systems in New Mexico dependent on groundwater for drinking water for their communities.

By taking a deeper dive into New Mexico's groundwater history and current challenges this report elevates the increasing urgency of groundwater declines in various areas of New Mexico. The New Mexico 360 Groundwater Report highlights the state's history of groundwater development, data gaps, water uses by category, and the evolution of the laws, codes, and administrative tools that currently govern groundwater in New Mexico. This report also features successful groundwater management case studies within New Mexico, and highlights other western state strategies and tools for groundwater sustainability. Serving as a launching point, the New Mexico 360 Groundwater Report is intended to elevate and educate New Mexicans about the urgency of statewide groundwater declines and serve as a call to action for proactive management to avoid a looming groundwater crisis.

INTRODUCTION: THE IMPORTANCE OF GROUNDWATER FOR NEW MEXICO

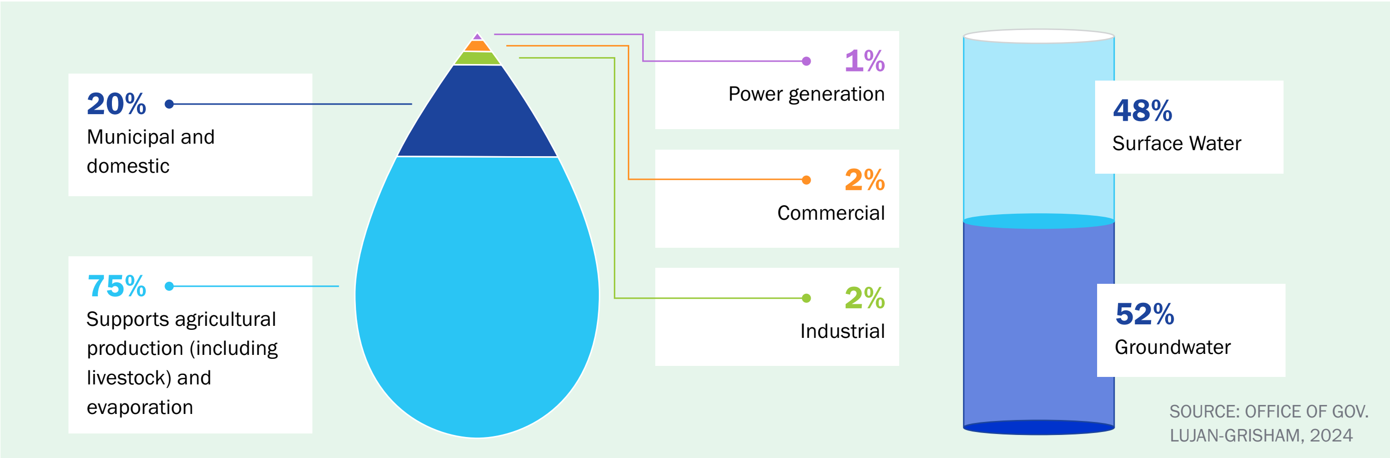
New Mexico, known as the Land of Enchantment, is a unique state composed of diverse and dynamic desert landscapes, high alpine mountains, revitalizing rivers, streams, spring fed wetlands, and majestic prairies and playas. New Mexico's precious water resources, both surface water and groundwater, have sustained the existence and continuity of life across the state for many millennia. Together these landscapes and resources form the foundation of the state's environmental and cultural history. As an arid state, New Mexico ranks fifth driest in the U.S, centering water as the keystone of the state's environmental, economic and cultural resilience. Receiving only 8-12 inches annual average precipitation, only 1.6% of the water from rain and snowmelt feeds rivers and streams, 78.9% is transpired from thirsty plants and 17.7% is consumed by evaporative demand of the arid climate. The remaining 1.8% of annual precipitation infiltrates into the ground reaching shallow, alluvial and deeper groundwater aquifers[1] (Dunbar et al., 2022).

This report describes New Mexico's groundwater, including the knowns and unknowns about aquifers (data gaps), water uses by category, and a history of the state's groundwater laws, codes, and administrative tools to govern groundwater. Advancing groundwater management strategies for New Mexico's unique hydrological, cultural, and institutional landscape, is not a one-size-fits-all approach and will require local knowledge and commitments to various groundwater challenges. The urgency for proactive groundwater management, including metering and monitoring is essential for creating longevity for this diminishing resource.

New Mexico's underground reservoirs, or groundwater aquifers, provide 52% of all the water used statewide for domestic, agricultural, industrial, and commercial uses (Office of the Governor Lujan-Grisham, 2024).

FIGURE 1:

2024 Percentages of Water Use in New Mexico



SOURCE: OFFICE OF GOV. LUJAN-GRISHAM, 2024

1 Aquifers are simply rock formations or sediment material that can contain or transmit water that is held within rock, the tiny open spaces between sand grains or gravel, within cracks, and sometimes in small caves dissolved out of the rock. While most rocks can store groundwater, water needs to be able to easily move through the rock or sediment to be a useful aquifer and the permeability is the ability of the rock material to move fluid through it. The best aquifers hold a lot of water and are highly permeable (NM Bureau of Geology & Mineral Resources, 2023).

Furthermore, New Mexico's rivers, streams, springs, and seeps are connected to groundwater basins, which increases the importance of groundwater in managing and sustaining surface flows. These unseen, underground reservoirs are vital water supplies that have been overused in many areas of the state. Increasing water demands due to drought conditions, growing populations, irrigated agriculture and industrial purposes are exacerbated by rising temperatures and climate change. For these reasons, the longevity and resilience of New Mexico's water supplies is at risk, requiring adaptation to management strategies to withstand these changing conditions. Thus, the necessity for comprehensive, statewide groundwater management has never been more important.

Native Nations, Tribes, and Pueblos Valuing Water

New Mexico's origins are built on adaptive water management practices, in response to periods of extreme water scarcity and drought. For time immemorial, New Mexico's 23 Native Nations, Tribes, and Pueblos have valued and recognized water as central to the existence, maintenance, and continuity of their cultural identity and the physical well-being (Tribal Water Work Group, 2022). These values are outlined by the Tribal Water Working Group's (TWWG) 2022 New Mexico Tribal Water Report, which elevates the inherent significance and importance of protecting water in all its hydrological forms, including in springs, aquifers, in-stream flows, reservoirs, rivers, and precipitation (Tribal Water Work Group, 2022). New Mexico's "Nations, Tribes and Pueblos have recognized water as the source of life for humans, animals, plants, and supernatural beings, which hold inherent sacredness deserving of perpetual respect" (Tribal Water Work Group, 2022). Climate change and water decision-making are impacting New Mexico's Tribal communities. The TWWG outlines important recommendations for State-Tribal coordination and collaboration to address these impacts. Importantly, the TWWG provides policy recommendations drawn from collective Tribal input, "to support continued government-to-government consultation, communication, and decision-making between the State, its agencies, and individual Nations, Tribes and Pueblos" (Tribal Water Work Group, 2022). Improving groundwater management in New Mexico will require partnership, collaboration and coordination with New Mexico's Nations, Tribes, and Pueblos to advance alternative, specific solutions as each Tribal Nation deems effective (Tribal Water Work Group, 2022).

> "Tribes developed resilient water strategies and technologies in response to unpredictable changes in the physical, social, and cultural environment. Many Tribes developed broad systems of water management engineering, specifically for subsistence agriculture and other regenerative uses. For example, water harvesting and conservation practices contributed to riparian ecologies by enhancing groundwater resources for the benefit of flora, fauna, and human life. We recommend that the State of New Mexico issue formal recognition of Indigenous Traditional Ecological Knowledge as contributing to the scientific, technical, social, and economic advancements of the State and to our collective understanding of our environment. We further recommend that the State work in partnership with the NM Indian Affairs Department to develop guidance for State agencies on consultation and application of ITEK. The State should engage with ITEK only through partnerships with Nations, Tribes and Pueblos, and in a manner that respects the rights of Nations, Tribes and Pueblos to control access to their knowledge and data, to grant or withhold permission, and to dictate terms of its application."
>
> *Source: New Mexico Tribal Water Report (Tribal Water Work Group, 2022).*

Historic Acequia Systems

Additionally, New Mexico has hundreds of historic acequia systems which have been a mainstay of successful adaptive water management. The early Spanish settlement in the 16th century established New Mexico's acequia systems[2] (Rosenberg et al., 2020). These community-based irrigation systems (ditches) deliver water for agriculture and are managed by a mayordomo who oversees the maintenance, distribution of water, and overall management of the acequia, ensuring equitable access to water and resolving disputes among users. New Mexico's acequia systems' have proven methods for water shortage sharing and have contributed to the long history of adapting to changing water availability. The centuries-old acequia systems and the water stewardship traditions of Tribes and Pueblos provide a deep historical foundation for New Mexico's agrarian culture and adaptive water management (Rosenberg et al., 2020). This history offers valuable insights for progressing groundwater management for the state.

Early Groundwater Development

The development of groundwater in New Mexico began in response to the 1885-1904 drought. The first wells were drilled in 1891 in the Roswell Artesian Basin, to supplement water supplies due to drought conditions (Bushnell, 2012). During this period, drought conditions led water users in the Gila River and Mimbres River to begin tapping groundwater to supplement limited surface water for irrigation and livestock production (Bushnell, 2012). In the early 20th century, with improved well drilling technology, groundwater development expanded outside the primary river corridors (Rio Grande, Pecos, Canadian, San Juan and Gila Rivers), to underpin irrigated agriculture in many areas where no other water sources are available.

Currently, most New Mexican communities depend on groundwater aquifers to supply municipal water needs, equating to 87% of public water supply for tribes, pueblos, small rural communities and thousands of domestic wells. New Mexico's aquifers deliver groundwater for roughly 1.12 million people, 53% of the total population (Valdez et al., 2024). Notably, groundwater is the solitary water source for 24 of 33 New Mexico counties. Many of these groundwater dependent communities are in rural areas with agricultural economies and have struggled with wells going dry and water quality issues. In addition to drinking water, New Mexico's aquifers support irrigated agriculture with 1,499,256 acre-feet (AF) of groundwater, which is 78% of the state's total groundwater use (Valdez et al., 2024).

Groundwater supplies support a wide range of sectors in addition to municipal and agricultural needs:

- Rangeland water use depends on 35,371 AF of groundwater (91.83% of total water use);
- Commercial water depends on 30,526 AF of groundwater (53.91% of total water use);
- Industrial activities depend upon 8,586 AF of groundwater (100% of total water use);
- Mining uses 56,385 AF of groundwater (99.35% of total water use);
- Power/energy depends upon 32,946 AF of groundwater (50.36% of total water use) (Valdez et al., 2024).

2 Acequias are technological systems that are designed, maintained, and operated to meet a variety of productive goals, social services, and health needs, with the practice of irrigated agriculture being of paramount importance. In preindustrial times, acequia systems have relied on the force of gravity for the collection, conduction, distribution, recollection, and discharge of each system's waters—with the only exception of systems fed by water captured from streams or the water table by means of implements operated by animal or human force (Rosenberg et al., 2020).

FIGURE 2:

NM Bureau of Geology & Mineral Resources Groundwater Regions & Sub-Regions

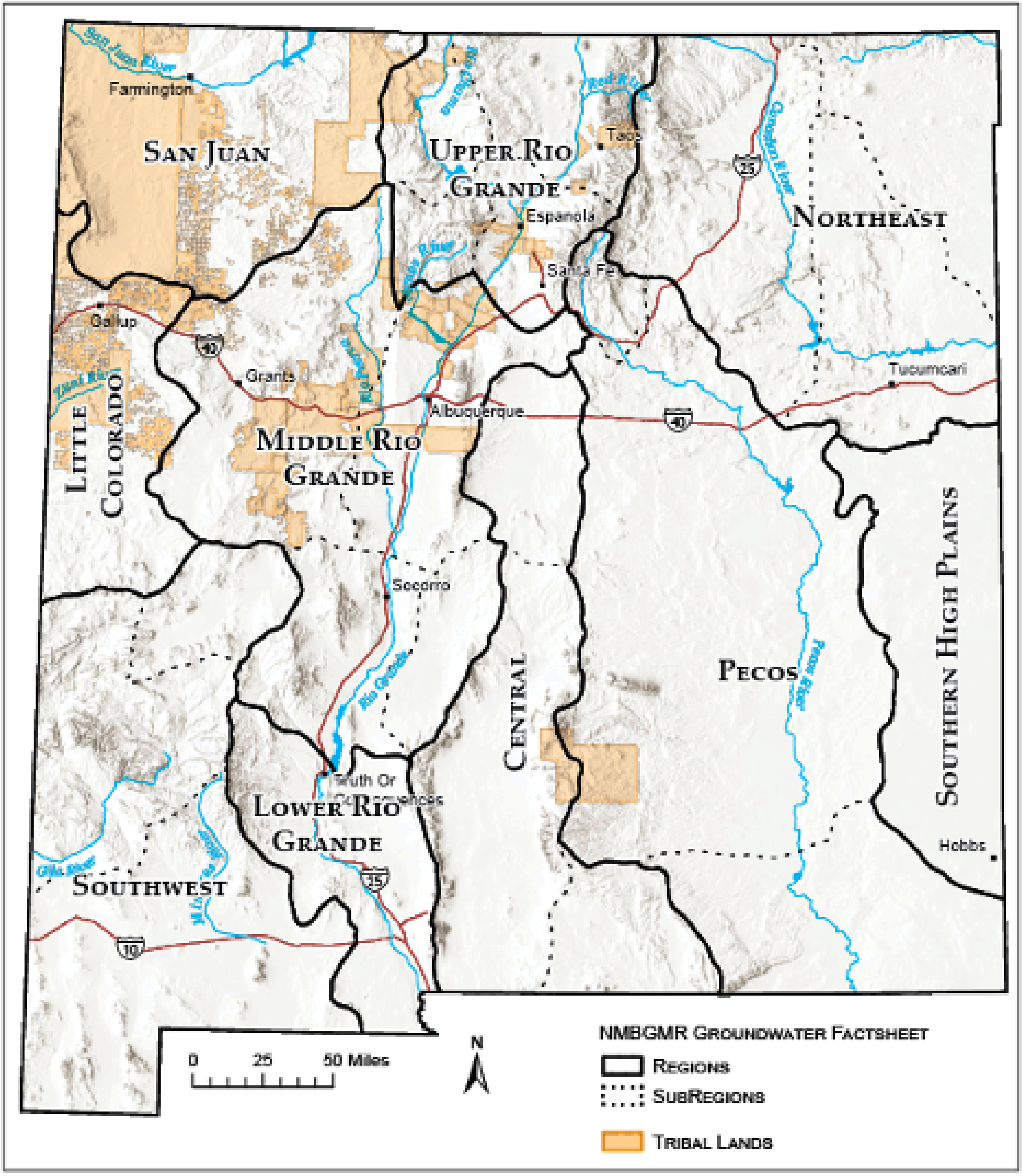


FIGURE 3:

New Mexico's Groundwater Uses by River Basins (Valdez et al., 2024)

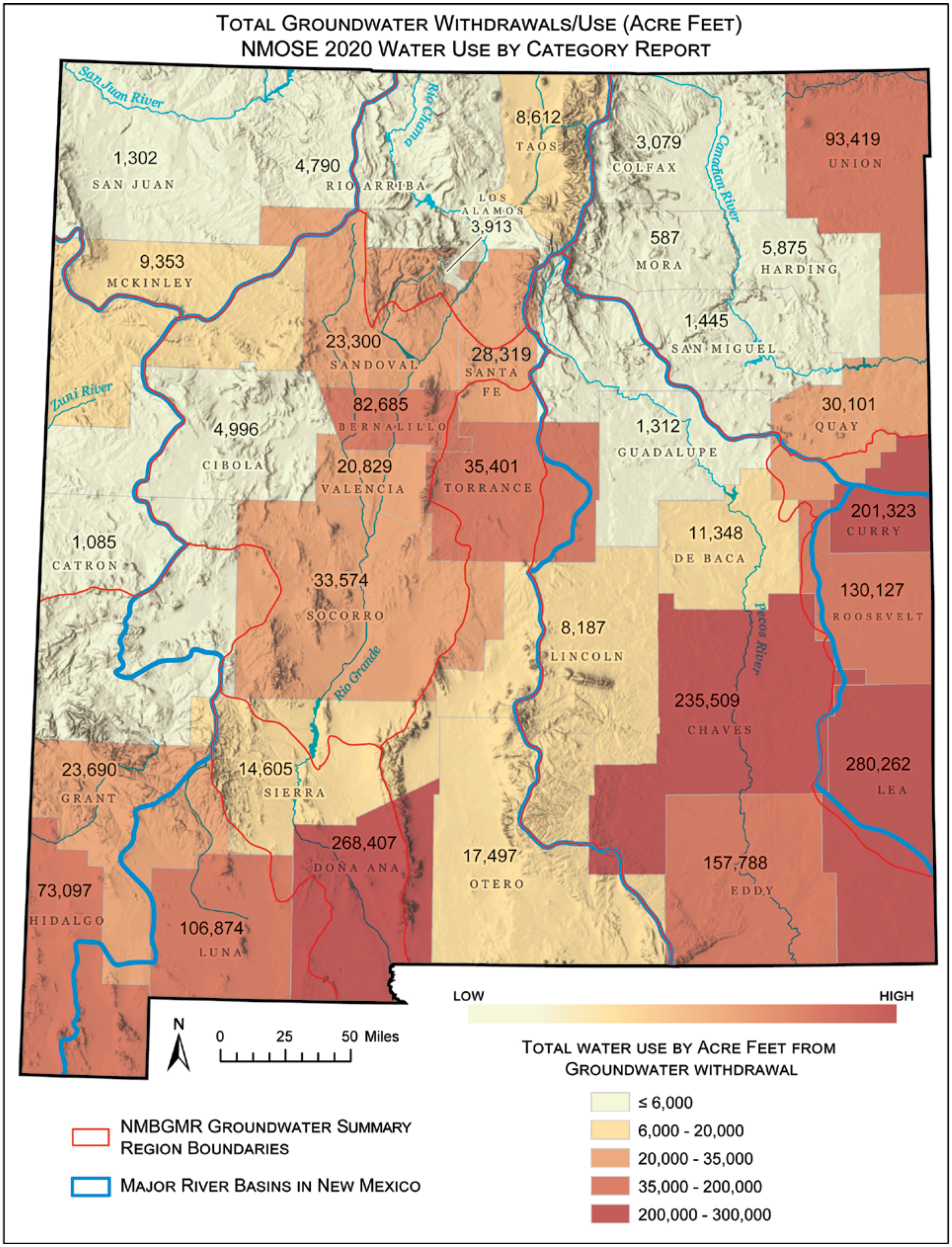


FIGURE 4:

New Mexico's Surface Water Uses by River Basins (Valdez et al., 2024)

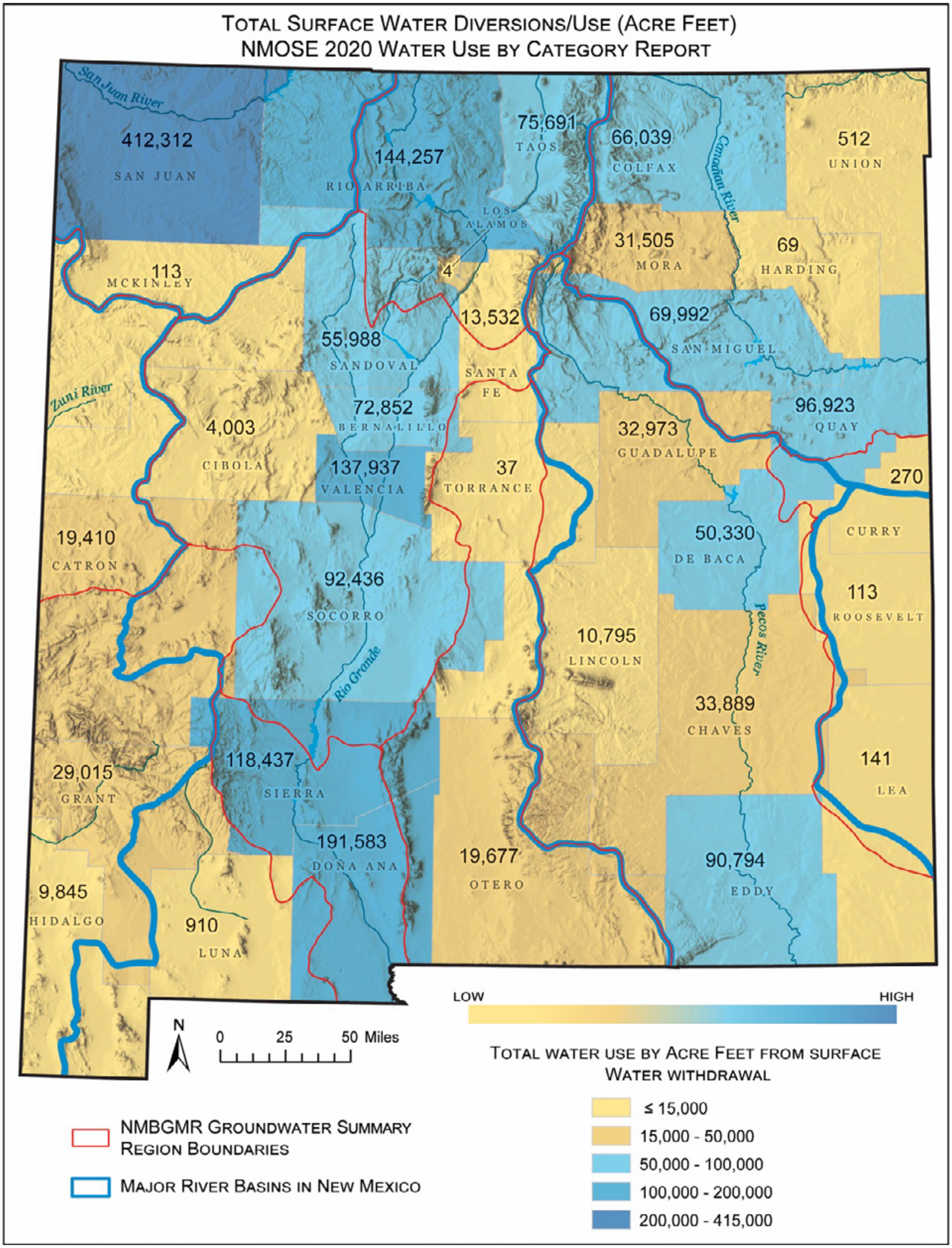


FIGURE 5:

New Mexico's Total (Groundwater & Surface) Water Uses (Valdez et al., 2024)

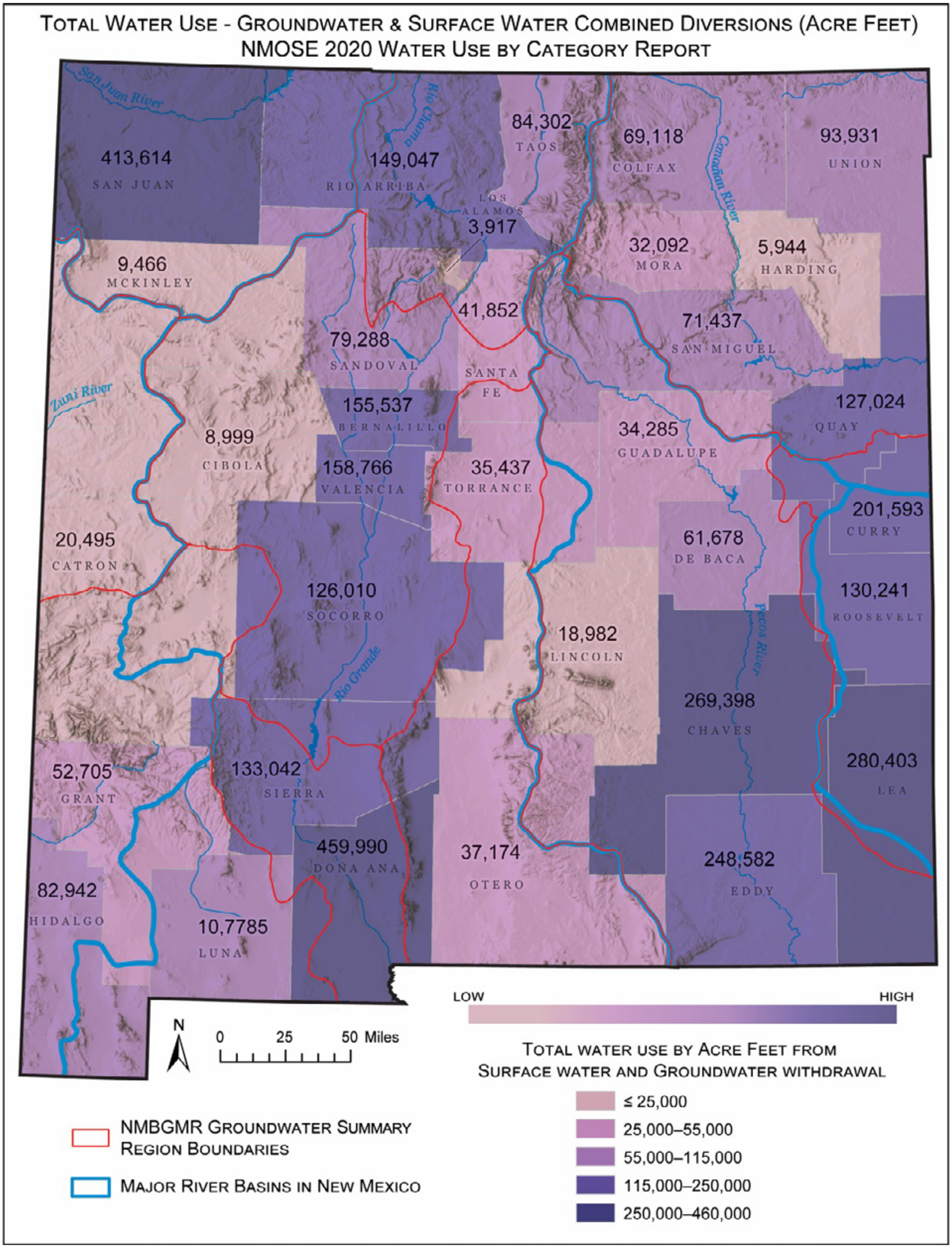


TABLE 1:

New Mexico's Total Groundwater & Surface Water Uses (Valdez et al., 2024)

		Withdrawls Surface Water (WSW)		Withdrawls Groundwater (WGW)		Total Withdrawls (TW)	
RIver Basin	2020 Population	acre-feet	% of basin total	acre-feet	% of basin total	acre-feet	% of state total
Arkansas-White-Red	31,507	238,400	64	135,949	36	374,349	10
Lower Colorado	65,537	57,381	44	73,319	56	130,700	3
Pecos	194,004	247,722	36	449,703	64	697,426	18
Rio Grande	1,564,141	925,266	57	685,558	43	1,610,825	42
Texas Gulf	133,455	208	0	576,171	100	576,379	15
Upper Colorado	128,878	413,408	100	1,990	0	415,398	11
State Totals	**2,117,522**	**1,822,385**	**49**	**1,922,692**	**51**	**3,805,077**	**100**

History of Drought

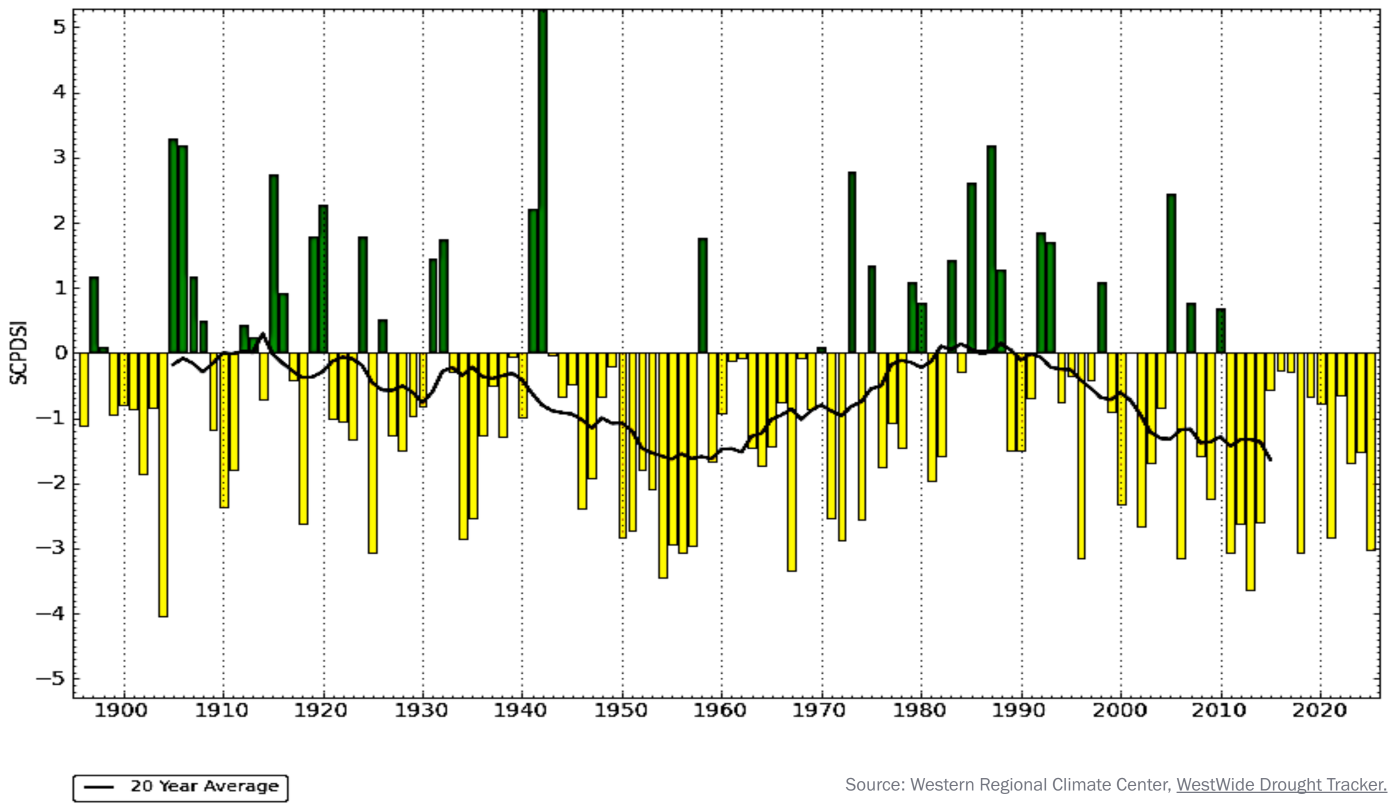
In addition to the rich and diverse landscapes, cultural history and heritage, New Mexico also has an extensive record of prolonged and severe drought. The first documented drought in New Mexico, the 'Great Drought' of the Pueblo Periods I-V: 750-1600 AD, led to the collapse and migration of the ancestral Anasazi Pueblo at Chaco Canyon (Benson et al., 2007). Notably, this drought preceded the development of groundwater use and the option of supplementation of insufficient surface water. Severe drought periods have continued to impact the state's water security ever since, with disproportionate impacts on rural communities and tribal lands. Importantly, these rural communities often lack the capacities and capabilities to respond in the same way larger municipalities and large economic sectors do.

The graph below depicts the steady increase in drought years (yellow bars) for New Mexico since 1895, which noticeably corresponds with the initiation and evolution of groundwater development in New Mexico. The key takeaway from this graph is the decreasing number of wet years (green bars) since the early 1950s, and a steady deepening and persistence of drought conditions since the 1990s. Importantly, worsening drought for New Mexico corresponds to continuously increasing average annual temperatures. These conditions are advancing aridification across the state and increased water demand and dependence on groundwater, with municipalities and irrigators turning to wells to supplement deficient surface water supplies.

FIGURE 6:

Self-Calibrated Palmer Drought Severity Index 1895-2025

Self-Calibrated Palmer Drought Severity Index (scPDSI) annual time series 1895-2025. Drought Severity scale -5 to +5. Values below -3 indicate severe to extreme drought; below -2 moderate drought; below -1 mild drought. scPDSI is locally calibrated by location, accounting for specific climate and water availability changes.

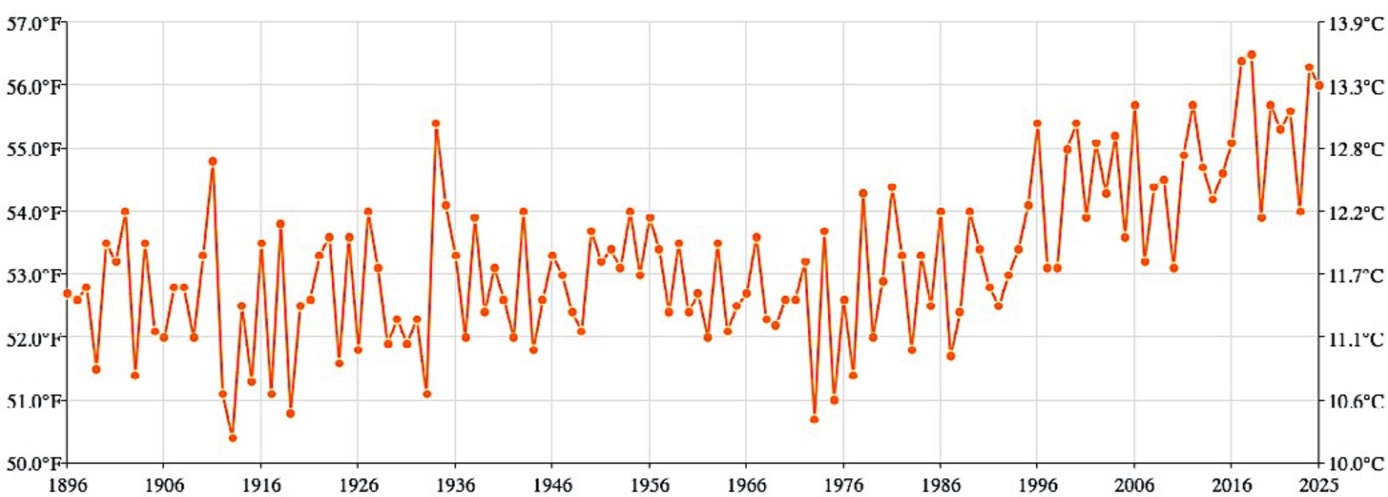


Source: Western Regional Climate Center, WestWide Drought Tracker.

FIGURE 7:

New Mexico Average Temperature 1896-2025

Average annual temperatures in New Mexico have increase by 1-3ºF since the 1980s.



NOAA National Centers for Environmental information, Climate at a Glance: State Time Series, retrieved on August 1, 2025, from https://www.ncdc.noaa.gov/cag.

Since the 1930s drought (Dust Bowl era), groundwater withdrawals have exceeded recharge rates in most basins in New Mexico. Recharge to groundwater (Figure 8) occurs in areas adjacent to mountains or highlands, where precipitation is concentrated. Within an aquifer, groundwater is a continuous, connected, slow-flowing volume. How that resource travels through the subsurface is determined by the geology of the aquifer. Geologic data and water level data from monitoring wells are together used to determine groundwater flow paths, from recharge areas to natural discharge areas and groundwater wells (New Mexico Bureau of Geology and Mineral Resources, 2023). Depending on local geologic and hydrologic conditions, time scales for aquifer recharge can vary widely. In aquifers closely connected with rivers and streams, significant recharge can happen over weeks or even days. In deeper or more isolated aquifers, recharge can take hundreds to thousands of years. When pumping groundwater outpaces the rate of aquifer recharge, the water produced from pumping is likely thousands of years old and considered a finite and non-renewable resource, with limited longevity (unsustainable). Extracting water from these deep aquifers has a limited time horizon due to the very slow recharge rate and the very large withdrawals. This means that the groundwater supplies in these aquifers will be depleted unless the aquifer is managed based on the rate of recharge, versus the under-managed and continuous withdrawals based on need.

The aquifer recharge map below depicts the areas of the state where recharge rates have been monitored. As noted above, most of New Mexico's aquifers recharge is less than 2% of the annual precipitation (8-12 inches).[3]

Over time, there have been notable surges in New Mexico's groundwater use and expanded development, which supplemented scarce surface supplies (e.g. The post-World War II era during the 1940s-50s drought). These expansions of groundwater development met growing water demands. However, depletions of aquifers have outpaced natural recharge rates in many aquifers around the state. As a result, various groundwater dependent areas of New Mexico have suffered groundwater availability challenges. Notable declining aquifer levels that impacted the livelihoods of communities, led to different administrative responses[4] (see Section 3 of this report). Areas where there are significant groundwater declines that are under NMOSE administrative action include:

- Over 120 feet of decline in production wells in the Albuquerque area between 1972-2012 (USGS, 2024)
- Greater than 80 feet of decline in Animas Basin for irrigated agriculture (southwest corner of New Mexico) between 1948-1981.
- 40-80 feet declines in the alluvial aquifer in the Roswell / Pecos Valley region between 1950 and 1975.
- 200 feet declines in the Gallup area between 1999 and 2009. Source: (Bushnell, 2012)

Agricultural Water Use

The major river corridors and watersheds in New Mexico are the most populous areas of the state, with the highest intensity of irrigated agriculture. Agricultural areas, including the Middle Rio Grande (MRG), the Lower Rio Grande (LRG), and the Lower Pecos River around

3 Groundwater begins in recharge zones which are distinct areas where the rate of rainfall, snowmelt, and runoff entering the aquifer exceeds the rate of removal by evaporation and plant activity (NM Bureau of Geology & Mineral Resources, 2023). Direct recharge is water percolation and infiltration into an underlying aquifer. Indirect or diffuse recharge occurs when water flows down a river channel and soaks into a downstream aquifer (NM Bureau of Geology & Mineral Resources, 2023).

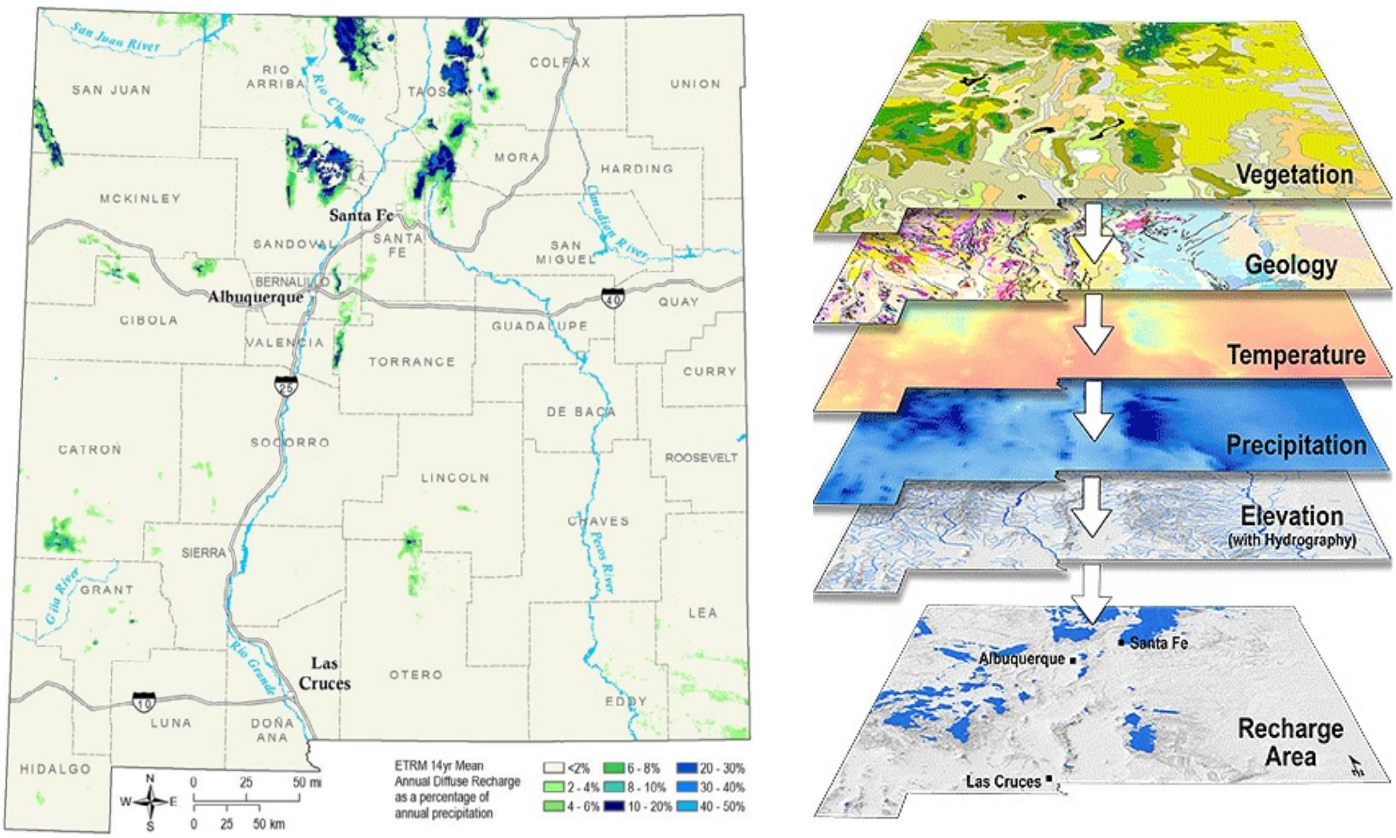
4 New Mexico's first Groundwater code was passed in 1931, which gave the State Engineer the authority to declare and administer groundwater basins.

Carlsbad, use both surface and groundwater and employ conjunctive management.[5] These river corridors should be thought of as two parts of one hydrologic system, that includes both groundwater and surface water, which interact with each other. Depending on conditions, surface water may be recharging groundwater or groundwater may be discharging to surface water. Surface water recharge of aquifers is an important source of infiltration of snowmelt and runoff from surrounding highlands. Areas of the state that use only surface water for irrigation include the San Juan River corridor, the Fort Sumner Irrigation District on the Pecos River, and the upper Pecos River north of Santa Rosa.

FIGURE 8:

Aquifer Recharge Model for New Mexico

Recharge as a percent of precipitation calculated by the Evapotranspiration and Recharge Model (ETRM)[6] (2000-2013). Highest recharge rates occur in the mountainous regions of the state (NM Bureau of Geology & Mineral Resources, 2017). Diffuse recharge is what lands on the surface and infiltrates into aquifers. This does not include focus recharge from areas such as arroyos and intermittent streams.



5 Conjunctive Use is the coordination of ground and surface water rights to measure the impact of groundwater pumping on surface flows. Conjunctive water management is the flexibility to alternate between the use of surface water and groundwater depending on availability of the supplies (NMOSE-ISC, 2018).

6 The ETRM uses existing spatial datasets that depict precipitation amounts, weather and climate conditions, and soil parameters throughout the state to model the daily soil water balance (NM Bureau of Geology & Mineral Resources, 2017).

Climate Change Impacts

Other significant facets for managing New Mexico's future water security include accounting for climate change impacts of projected average temperature increases of 5°F to 7°F over the next 45-50 years (Dunbar et al., 2022). Higher temperatures drive precipitation variabilities including reduced snowpack (rain versus snow at higher elevations) resulting in less runoff and streamflow, and increased water losses to evaporation and evapotranspiration. Only 1.6% of the precipitation that falls in New Mexico runs off into streams and rivers and only 1.8% infiltrates into the ground, recharging subsurface aquifers. Much larger proportions are transpired by plants (78.9%) or evaporated (17.7%). Climate change affects all these systems and reduces the state's water supply. The larger percentages of water lost to evaporation or transpiration, result in large changes to runoff and recharge. These coupled impacts lead to reduced soil moisture and influence precipitation patterns, collectively inducing drought conditions and intensifying aridification. This is the basis for the projected 25-30% reduction in New Mexico's water supplies by 2050 (Dunbar et al., 2022).

Furthermore, warmer temperatures and increasing aridification drive increased water demand. Historically, when surface water is scarce, water needs across New Mexico have relied upon supplemental groundwater pumping. The persistent drought conditions over the last several decades has led to significant water level declines in many of New Mexico's groundwater basins (New Mexico Bureau of Geology and Mineral Resources, 2025). Currently, the regions of the state with the largest amounts of groundwater declines include the High Plains (Ogallala) aquifer near Clovis and Portales, the Mimbres Basin near Deming, the Albuquerque Basin, the Estancia Basin, and Placitas and East Mountains in the Albuquerque area (New Mexico Bureau of Geology & Mineral Resources, 2023).

> "We're sitting in a teacup filled with water and sticking straws in and sucking it out. If climate change progresses, the basin won't receive enough snow or rainfall to recharge. That leaves two options, bring in water from somewhere else or leave. The problem isn't exclusive to Estancia — this is one measle in a case of measles all across the Southwest. This is everybody's problem out here."
>
> **Morrow Hall**
>
> *Former Estancia Mayor and Estancia Board of Trustees member*
>
> *Torrance County Region (Mencinger, 2025)*

FIGURE 9:

Map of the Estancia Basin

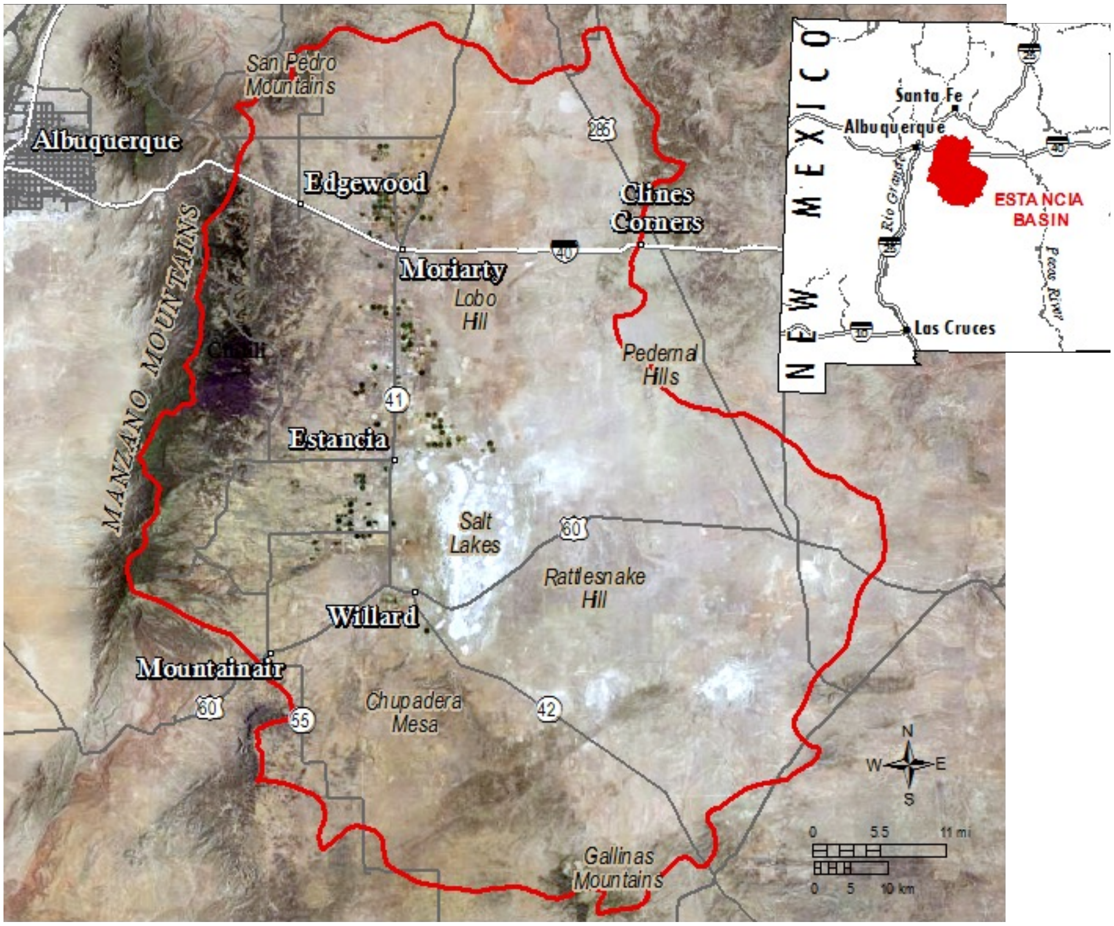
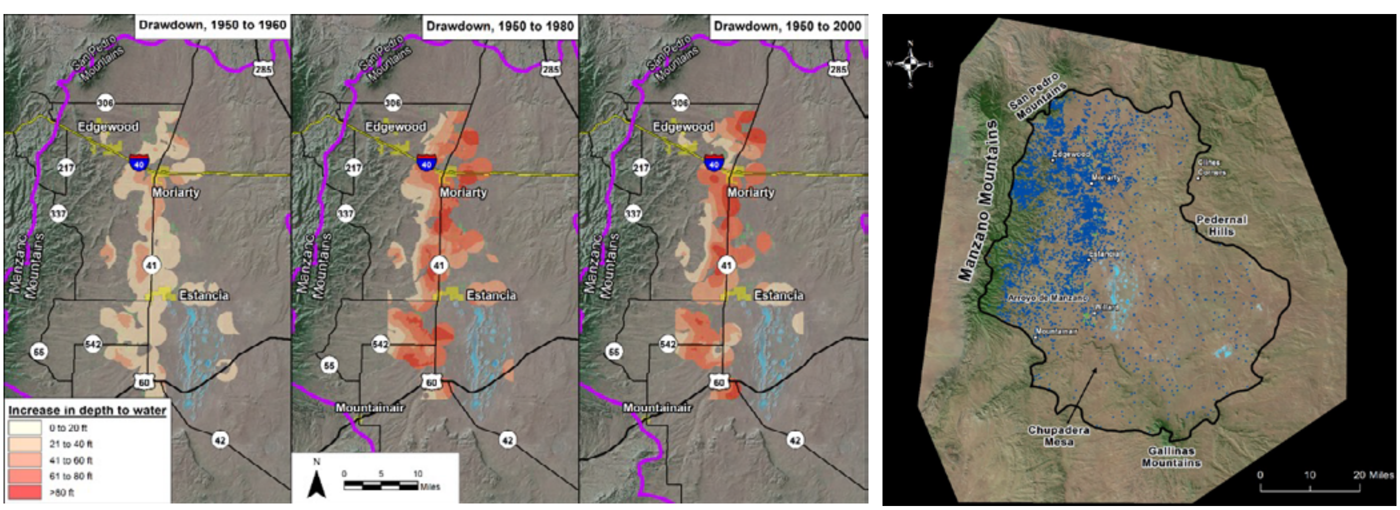


FIGURE 10:

Groundwater Declines in the Estancia Basin 1950-2000

Blue dot (cloud are individual wells across the Estancia Basin (New Mexico Bureau of Geology and Mineral Resources, 2023).



Water Quality Challenges

As aquifer levels drop the water quality can also degrade, and compounding water availability issues ensue. These groundwater quality problems, including naturally occurring arsenic, brackish conditions (saline), and PFAS-contaminated water infiltrating into aquifers, affect drinking water supplies. New Mexico's groundwater quantity and quality challenges, experienced across the state, are highlighted throughout this report to capture the diverse regional realities of community water managers, tribal leaders, irrigated agricultural producers, and mutual domestic board members.

FIGURE 11:

Common Insights and Shared Messages from Across New Mexico

Water Is Life — and It's at Risk
Whether spoken in spiritual, agricultural, or practical terms, every community emphasized water as a life-sustaining resource — one that is increasingly vulnerable due to drought, contamination, overuse, and climate change.

Groundwater is Invaluable — and Often Invisible
In many communities, groundwater is the only water. Yet it is often out of sight, poorly understood, and inconsistently governed - especially in rural areas and small systems.

Governance is Fragmented and Hard to Access
Community water managers, tribal leaders, and farmers alike described deep frustration with siloed agencies, regulatory confusion, and a lack of clear, consistent support from the state and federal levels.

Infrastructure and Capacity Gaps Limit Resilience
Small water systems and farming communities often lack the technical and financial capacity to maintain safe water access, implement conservation, or plan for the future.

Traditional Knowledge Holds Solutions
Acequia communities, tribal nations, and regenerative farmers shared knowledge systems and practices rooted in balance, sustainability, and mutual responsibility — offering vital models for adaptation and resilience.

We Must Work Together
Shared challenges call for shared solutions: stronger interconnections between systems, regional collaborations, and cross-cultural respect. Local leadership, when supported, is already showing the way.

The Future Depends on What We Do Now
There is an urgent call for action — not just from technical experts or policymakers, but from the people most directly connected to the land and water. Their voices echo the same truth: *Water can't wait.*

Groundwater challenges in New Mexico have been addressed by the NMOSE though various administrative developments. For example, the NMOSE created 40 designated groundwater basins to define aquifer boundaries. In some of those basins the agency has implemented metering and monitoring of groundwater levels. However, this has only occurred in basins facing quantity or quality challenges or to respond to interstate river compact settlement obligations. Legal tools, such as well drilling regulations, basin closure orders, and water rights administration, provide some fundamental tools for groundwater governance in New Mexico and have proven successful in the Pecos Valley Artesian Conservation District, and the Lower Rio Grande region. Communities such as Clovis, Portales, Roswell, Estancia, and Cañada de Los Alamos have proactively addressed groundwater challenges at the local level with innovative approaches, unique to their groundwater challenges. Recent efforts to comply with the New Mexico Water Data Act include the Bureau of Geology and Mineral Resources (NMBGMR) program to advance aquifer mapping and launch a statewide monitoring network, which was accelerated by legislative funding in 2025.

This report elevates the importance and awareness of the vital role groundwater plays in sustaining New Mexico's communities, ecosystems, and economies. Groundwater monitoring is critical to ensuring the longevity of this water source for generations to come. As the impacts of climate change unfold, building upon New Mexico's current administrative tools to advance a statewide framework for groundwater management is essential to building water resilience for the state's communities, economies, and cultural heritage. This document offers successful and relevant groundwater management methods from within New Mexico, and a review of other western states' frameworks for statewide, comprehensive groundwater management. This report invites a more resilient groundwater future for New Mexico by prioritizing the importance of groundwater management based in sound data, science and locally driven management.

II. UNDERSTANDING NEW MEXICO'S GROUNDWATER CONDITIONS

Geography of Groundwater in New Mexico

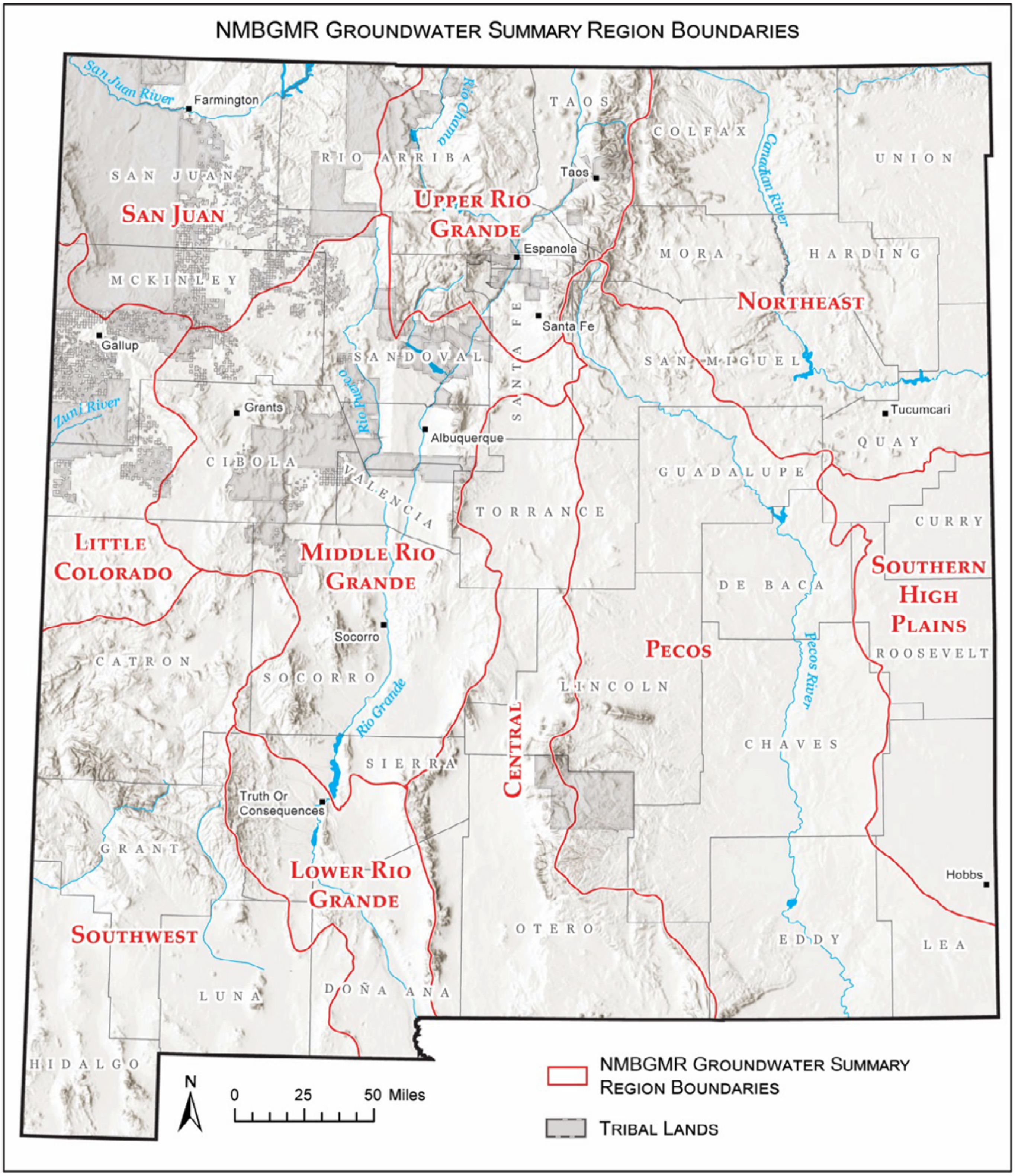
New Mexico's groundwater is highly diverse, due to the complex geologic history, changing hydrology and extensive groundwater use in recent decades. The development of geographic designations of groundwater use areas was derived from proactive research, administration, and consumption of groundwater. These geographic groundwater basins and groundwater use areas include:

1. **Forty (40) Underground Water Basins** declared by New Mexico Office of the State Engineer (NMOSE), based on hydrologic and administrative considerations.
2. **The surface water and groundwater withdrawal data, for the state's 33 counties,** divided into six major river basin areas **(NMOSE Water Use by Category Reports, 2020).**
3. **Nine Regional Planning Areas** (proposed) based on surface water and groundwater distribution (in consideration of administrative and political boundaries) administered by the New Mexico Interstate Stream Commission (NMISC) per the 2023 Water Security Planning Act.
4. **Groundwater Basin Summaries** of ten (10) Groundwater Regions conducted by the New Mexico Bureau of Geology and Mineral Resources (NMBGMR). These 10 Groundwater Regions are modified slightly from USGS Hydrologic Unit Code 6 (HUC) maps. HUC maps are four-color maps that present information on drainage, culture, hydrography, and hydrologic boundaries and codes of the 21 major water-resources regions and the 222 subregions designated by the U.S (USGS, 2013). HUC 6 areas reflect groundwater features[7].

7 USGS uses a nationwide system based on surface hydrologic features. This system divides the country into 21 regions (2-digit), 222 subregions (4-digit), 352 accounting units (6-digit), and 2,262 cataloguing units (8-digit) (USGS, 2013).

FIGURE 12:

NMBGMR 2025 Groundwater Regional Summary Boundaries



Historical and Current Groundwater Use in New Mexico

New Mexico's water was first used by Tribes, drawn from ephemeral and perennial streams, and groundwater-fed springs to irrigate and provide domestic water. New Mexico's historic acequia systems (community irrigation systems) were developed for subsistence agriculture. Both these culturally important irrigation systems were dependent on surface water, which inherently limited water use to what was hydrologically available. In 1907 New Mexico adopted the law of prior appropriation doctrine that governs water rights, granting priority use based on the chronological order of beneficial water use. This means the first user of a water source for a beneficial purpose has the senior water right, and in times of scarcity, the senior right holder gets their full allocation before junior right holders receive any water. This is often summarized as "first in time, first in right." Tribes and Pueblos have the most senior water rights, as they have been managing water in western states since time immemorial. Prior to the late 1800s, the focus was very much on the use of surface water, because the technology and capacity to economically extract and use large quantities of groundwater wasn't yet developed.

Larger scale irrigation was almost exclusively supplied by surface water until the late 1800s, when use of artesian groundwater expanded rapidly in the Roswell area. Groundwater drawn from simple wells provided small amounts of water for domestic use, livestock watering, and small gardens. Growing municipalities such as Albuquerque and Las Cruces also began developing groundwater supplies in the early 20th century with comparatively primitive drilling and pump technology. By the mid-1930s, Albuquerque had a population of about 34,000, and its "deep well pumping" produced 3,000 acre-feet per year (Bushnell, 2012).

The end of World War II ushered in a new era of groundwater development and management in New Mexico (and beyond). Drilling and pump technology advanced dramatically, providing high efficiency pumps and deep drilling methods that made the extraction of large volumes of groundwater easier and more economical. In the areas of the state where no major surface water features existed, agricultural irrigation from groundwater expanded rapidly. For example, the High Plains and Southwest regions of the state saw nearly all irrigated acreage develop in the mid-20th century. During the latter half of the 20th century in particular, rapid population growth in cities and towns also led to increased groundwater use for municipal needs.

The growing availability of affordable groundwater extraction also corresponded with the regional drought of the 1950s. Farmers who had been entirely dependent on the surface water of the Lower Rio Grande and Pecos rivers installed groundwater wells to supplement their drought-diminished surface water supply. Conover described the deleterious effect of groundwater extraction on surface water flow in 1954 (Conover, 1954) in the Lower Rio Grande (Conover, 1954). Despite this recognition, the ability to use groundwater to maintain agricultural production through drought periods was a saving grace for farmers, in the short term. However, supplemental groundwater use did not cease when surface water supplies recovered in the 1980s and 1990s. The water supply dependability offered by combined surface and groundwater supported crop diversification towards higher value crops such as pecans.

Currently, groundwater is a critical resource in New Mexico, supplementing surface water scarcity in an increasingly arid state. Municipalities, agricultural and industrial producers, and ecosystems rely on groundwater across diverse hydrogeological settings. The state's increasing temperatures, evapotranspiration, and growing population create significant dependence on groundwater resources (New Mexico Bureau of Geology & Mineral Resources, 2023).

Groundwater use in many parts of the state is difficult to quantify. The most accurate way of measuring groundwater use is with meters installed on wells that pump groundwater (and designated groundwater monitoring wells). Unfortunately, only a small fraction of New Mexico's wells are currently metered, inhibiting accurate groundwater use reporting and accounting.[8] Every five years, starting in 1990, the NMOSE has compiled statewide Water Use by Category (WUBC) reports. Due to the lack of groundwater metering across the state, comprehensive pumping is not measured. This has resulted in using estimates of water use by category in the WUBC, to calculate the percent of groundwater use that is not metered, based on best available data.

TABLE 2:

Estimated Groundwater Use, Percent of Total Groundwater Use, and Estimated Percent Metered by Category for 2020 (Valdez et al., 2024)

**Weighted average percent metered*

Use Category	Estimated Groundwater Use (acre-feet)	Percent of Total Groundwater Use	Percent Metered
Public Water Supply	229,470	12%	98%
Domestic	30,151	2%	0%
Irrigation	1,499,255	78%	35%
Livestock	35,370	2%	4%
Commercial	30,526	2%	95%
Industrial	8,586	0%	100%
Mining	56,385	3%	63%
Power	32,946	2%	100%
Total	**1,922,689**	**100%**	**45%***

Source: (Valdez et al., 2024).

TABLE 3:

Percentage of Water Use Categories Supplied by Groundwater (Valdez et al., 2024)

**Weighted average*

Use Category	Estimated Groundwater Use (acre-feet)	Percent of Supply from Groundwater
Public Water Supply	229,470	77%
Domestic	30,151	100%
Irrigation	1,499,255	51%
Livestock	35,370	92%
Commercial	30,526	54%
Industrial	8,586	100%
Mining	56,385	99%
Power	32,946	50%
Total/Weighted Average	**1,922,689**	**57%**

8 Please refer to the NMOSE Water Use by Categories Report for methods on water use accounting. (Valdez et al., 2024)

Table 2 shows the estimated groundwater use for each water use category in the 2020 WUBC report and the estimated amount of metered groundwater withdrawals. The total groundwater use is a weighted average of metered use, which reflects the very large degree of uncertainty in groundwater use across the state. Notably, only 35% of irrigated agriculture groundwater use is metered, of the estimated 78% of total irrigated agriculture groundwater use statewide. Examples of the areas where irrigation wells are metered include the Pecos Valley Artesian Water Conservation District, Fort Sumner Irrigational District and the Lower Rio Grande. These areas are both conjunctive use basins with delivery water obligations defined by interstate river compacts. While there are other areas of the state that have points of diversion with required metering (i.e. Rio Rancho) and some counties such as Santa Fe County, that require metering.

While less than half of the groundwater withdrawals are metered, groundwater is a large portion of the total available supply (surface water plus groundwater) for every water use category, as shown in Table 3. The NMOSE estimates that in 2020, New Mexico used nearly 2 million acre-feet of groundwater, which is more than half of the total water use in the state. More than three-fourths of the state's public water supply is from groundwater. While domestic use is a small annual volume of use, it is an irreplaceable resource for rural residents who lack access to a public supply system.

Groundwater use is not distributed uniformly over the state. For example, in the High Plains Region, with no reliable surface water sources, 100% of all uses is from groundwater. In the Southwest Region, Grant, Luna, Hidalgo, and Catron counties report 78% of the water use is groundwater. At the other end of the spectrum, the WUBC report shows that in 2020 the San Juan Region, (linked to the Upper Colorado River Basin) only about 1% of the region's water supply comes from groundwater, which is primarily for domestic wells. Both the Upper Rio Grande and San Juan regions have comparatively little groundwater use, and have historically relied solely on surface water. However, many community water systems are actively planning to develop groundwater capacity to cope with declining surface water supplies (Valdez et al., 2024). Importantly, in the Upper Rio Grande Region, Santa Fe has had a mix of surface water and groundwater for the last couple of decades, with the majority of supply coming from surface water.

General Hydrogeology

New Mexico's hydrogeology is very complex, with various types of aquifers across the state. Groundwater is found in underground aquifers, which are accessed by wells that pump the water to the surface. Aquifers are recharged by water that infiltrates down through overlying soils and rock from precipitation, river and stream systems, and wetlands. Groundwater is found in underground basins, called aquifers, which are accessed by wells that pump the water to the surface. The quantity and quality of groundwater varies between aquifer formations, geologic compositions and the depth of available water. An important part of proactive groundwater management is understanding the character of each aquifer or groundwater basin, which includes an understanding of the extent of the basin, the rates of recharge and the amount of water that is extracted. This information is necessary for managing the available water based on the basic concepts of hydrology (Inflow - Outflow = Change in Storage), which also applies for budgeting surface water reservoirs. Determining the hydrogeology, or the aquifer characterization, provides the necessary data to determine the 'Change in Storage', or the amount of water (volume), based on the difference between the 'Inflow' (recharge) minus the 'Outflow' (pumping, diversion or use of water). This allows for creating a basic water budget, to manage the groundwater within an aquifer (New Mexico Bureau of Geology & Mineral Resources, 2023)

Inflow − Outflow = Change in Storage

A common analogy for managing a volume of water, whether in an aquifer or a reservoir, is a bank account, where deposits are 'inflow' and withdrawals are outflow, and there should be an equal change in the balance, to avoid overdraft. Applying this analogy, a simplified aquifer the inflow (deposits) would correspond to the recharge from the land surface, whether precipitation or surface water systems (or in some cases subsurface inflow from adjacent groundwater). Outflow (withdrawals) would be pumping wells to withdraw water from aquifers for use. The change in storage is reflected by the aquifer level increasing or decreasing over time. In broad terms, this notion of hydrologic balance provides a structure for conceptualizing the effects of groundwater withdrawals. In simple terms, if groundwater levels are going down, the withdrawals and outflow are greater than the recharge. It is common to see a seasonal variation in water levels, but if groundwater levels continue to go down over multiple seasons, it means that the aquifer storage is declining due to the rate of outflow (withdrawals) exceeds the rate of recharge.

New Mexico's major river corridors and tributaries include the Rio Grande, Pecos River, Gila River, San Juan River, and the Canadian River, which coincide with where most of the state's population resides and where the most intensely irrigated agriculture is located. Along these river corridors, groundwater and surface water should be thought of as two parts of one hydrologic system that interact with each other. For any location within a river corridor, depending on conditions, surface water may be recharging groundwater or groundwater may be discharging to surface water (Newton et al., 2017). As indicated in the water budget concept above, surface water recharge of aquifers is an important source of groundwater, which comes from infiltration of precipitation (rain or snow) and runoff from highlands into streams and rivers. These groundwater systems receive significant recharge from surface water systems, however depletions of groundwater (over pumping), also results in losses to the surface water system. In a river-connected surface and groundwater system, recharge may seem plentiful, however, increased groundwater use reduces surface flows (Richter et al., 2025). When over pumping impacts surface flows, the availability of water in the river for fish and wildlife, downstream delivery obligations for surface water users, and interstate compact requirements are impacted. The Rio Grande, Pecos River, Canadian and Gila Rivers all have interstate compacts, which require New Mexico to deliver their equitable share of available surface water in those rivers, to downstream states. This places an institutional limit on groundwater use for river-connected aquifers, to ensure the surface water is not impaired by over pumping. Litigation over impairment of interstate surface water deliveries by groundwater pumping in New Mexico has occurred on the Rio Grande (NM Department of Justice, 2025) and Pecos River (Record, 2024), which dramatically affected how groundwater is managed in those areas.

In areas with little or no connection to river systems, such as the Southwest (Gila), High Plains, and Central groundwater regions, there are no institutional constraints for interstate water deliveries, to ensure limits on groundwater use. However, these areas also have dramatically less recharge (inflow) than in the river-connected groundwater systems. In these cases, the outflows (primarily groundwater withdrawals) can far exceed recharge from snowmelt and rainfall, which results in declining aquifer storage. As aquifer levels decline, groundwater use is physically constrained and the depths to water increases, which requires deeper wells and more energy-intensive pumping. This also causes reduced aquifer productivity (amount of water that can be pumped). Additionally, in the case of the High Plains Region, exhaustion of aquifer storage, referred to as 'mining the aquifer' is a real and imminent threat to viable water supplies for communities and agricultural economies.

> “I knew that our aquifer was in a state of decline, but you kinda put it out of sight, out of mind. People have a tendency to turn on the faucet and if we got water, we’re all good for that day. We lose 3.6% per year in aquifer decline.”
>
> **Mike Davidson**
>
> *Member, Portales Water Advisory Committee (The Rain We Keep, 2025)*

State of Knowledge on New Mexico Groundwater

Despite New Mexico’s substantial and critical dependence on groundwater, there are enormous gaps in the fundamental understanding of the state’s groundwater aquifers and systems. These data gaps include the extent of aquifers, interactions with other basins and surface systems, recharge processes, the properties and quality of the water, contaminants to groundwater from land uses, and infiltration of run-off. The science of groundwater hydrology includes well-developed analytical and mathematical models that provide predictions of aquifer behavior with accuracy. However, the accuracy of a groundwater model’s predictions is limited by the quality and quantity of data for input to the model, to best represent the groundwater system.

With projected declines of 25-30% available water resources in New Mexico by 2050 (Dunbar et al., 2022), the urgency for improved groundwater data from mapping and characterization is vital to better groundwater management. The larger urban areas of the state, including Albuquerque, Las Cruces, and Santa Fe, have well-characterized groundwater aquifers, but there are vast areas of the state where this data does not exist and is desperately needed. The New Mexico State Water Plan also acknowledges these data limitations as a primary constraint on effective statewide water management (New Mexico Office of the State Engineer, 2024).

The Aquifer Mapping Program at the NMBGMR, initiated in 2007, has attempted to systematically characterize these systems with “broad goals to map and characterize New Mexico’s aquifers, providing information on hydrogeology, depth to water, groundwater flow directions, recharge processes, water quality characteristics, as well as water quantity estimation” (New Mexico Bureau of Geology and Mineral Resources, 2025). This ongoing and important effort is necessary, and completing a comprehensive aquifer characterization is a monumental and costly task.

There are significant gaps in understanding aquifer connectivity, three-dimensional structure, and temporal behavior. In particular, the inflow for the hydrologic budget equation is the quantification of groundwater recharge, which represents a significant knowledge gap for most aquifers in New Mexico (Newton et al., 2017). There are various types of aquifer recharge including mountain-front recharge, diffuse recharge, and recharge through perennial and ephemeral channels. These metrics are difficult to measure (requiring multiple methods to develop a reliable estimate of recharge) and represent a large data gap and an important element of the hydrogeologic water balance equation.

Most of New Mexico’s groundwater withdrawals are not metered, and therefore the quantities of reported groundwater uses are based on estimates and assumptions, versus real metrics. Currently, only a few specific groundwater basins have metering orders, including the Lower Rio Grande and the Nambe Pojoaque Tesuque Water District and the PVACD, which are monitoring the amount of groundwater withdrawn for use. A metering order requires metering and reporting of groundwater withdrawals. This represents another key data gap in the groundwater balance of the hydrologic budget. There are some areas that require meters for new wells, but existing wells are exempted from the metering requirement, so there is no consistent accounting of how much water is being extracted.

Groundwater Monitoring

Groundwater monitoring generally refers to the regular assessment of basic aquifer conditions such as water level and water quality. Groundwater levels are measured by tracking the level of the water in a well. Dedicated monitoring wells are an important element for understanding aquifer behavior (water level declines and recharge) to inform groundwater management. Monitoring aquifers provides data on how the aquifer responds to pumping, quantifying changes in aquifer storage and variable recharge rates during wetter or drier weather. All this information is used for developing and calibrating groundwater models, and for water rights administration. Ideally, groundwater measurements are taken constantly to measure changes in the aquifer and gathered over the long-term, to gain a clear understanding of the aquifer and provide readily available data for decision-making. In addition, the wells dedicated to monitoring need to be properly constructed and located to meet a variety of monitoring goals.

New Mexico's groundwater monitoring infrastructure is highly variable. The U.S. Geological Survey (USGS) maintains discrete measurements of water levels in hundreds of wells in New Mexico at varying frequencies (monthly, quarterly, semi-annual, annual) and continuous measurement of water levels in more than 100 wells throughout the state (U.S. Geological Survey, 2024). The NMBGMR monitors over 200 wells across the state semiannually, annually and continuously, and collaborates closely with the USGS in monitoring activities. Many of these monitored wells are existing wells (domestic, irrigation or supply wells), which are reused but not dedicated for groundwater monitoring. Most monitoring wells, whether dedicated wells built for monitoring or repurposed production wells, lack long-term records necessary for trend analysis and drought impact assessment. Funding constraints and changing priorities have resulted in discontinued or sporadic monitoring at numerous sites, creating gaps in the historical record during critical periods. While long-term trends appear to exist, data gaps can span years or even decades. In addition, the spatial distribution of monitoring points is particularly inadequate in rural areas. Large portions of eastern and southwestern New Mexico lack sufficient monitoring well density to characterize regional trends or detect localized impacts. The spatial distribution of groundwater monitoring data is illustrated in Figure 13.

In addition to state and federal monitoring efforts, several water users around the state monitor groundwater level and water quality to regularly assess groundwater samples for pathogens and chemical contaminants. For example, Bernalillo County groundwater program work to provide cost-effective groundwater projects and initiative to determine groundwater availability and provide data for decision-making an policy formation, while keeping the public informed . However, there are significant challenges in integrating data from multiple monitoring programs and agencies. Groundwater level data, water quality measurements, pumping records, and geological information are collected by different organizations using varying protocols and stored in databases that are not well integrated. This fragmentation limits the ability to develop comprehensive understanding of aquifer system behavior and constrains integrated modeling efforts.

An ideal groundwater-level monitoring network of wells monitoring a particular region or aquifer has the following characteristics:

1. It is composed of ideal monitoring wells.

2. It is monitored for the long term, with funding and staff to support operation and maintenance of equipment and data collection.
3. The monitoring data are made rapidly and readily available to the public.

(Bernalillo County, 2025)

However, despite the large amount of groundwater data that have been produced over the years in New Mexico (and elsewhere), few of the wells or monitoring networks that have produced these data are close to ideal (Pine et al., 2023). The state has recently acknowledged the need for improved data access and groundwater monitoring with the Water Data Act[9] and in the 50-Year Water Action Plan (2024). The Water Data Act, and the agencies named within, are actively working to improve data integration and funding has been appropriated to several state agencies to modernize data sharing practices (2024 Plan: New Mexico Water Data Initiative).

Groundwater Modeling

Aquifer characterization, groundwater metering, and monitoring provide indispensable information that is used for analysis, administration, and management. This data is also used in computer-based numerical groundwater models. Groundwater models are mathematical and computational tools that simulate the movement and distribution of water in an aquifer, as well as the quality of water. These models are based on physical laws of groundwater flow (such as Darcy's law), to simulate water movements through subsurface geological formations, while accounting for factors such as formation permeability, porosity, hydraulic gradients, and boundary conditions. Models can range from simple analytical solutions for basic scenarios, to complex three-dimensional numerical models that incorporate detailed geological structures, multiple aquifer layers, and various hydrological processes.

Groundwater models are critical to water resource management, administration, and environmental protection. These models predict how aquifer systems will respond to different stresses such as over pumping, drought, or climate change, helping water managers make informed decisions about withdrawal rates and well placement. Models also play an essential role in contaminant transport studies, allowing scientists to track pollution plumes and design remediation strategies. Additionally, they support water supply planning by improving understanding about the impacts of proposed new developments on groundwater resources. Models also allow for evaluation of the effectiveness of artificial recharge projects and help resolve water rights disputes by providing quantitative analysis of aquifer behavior. Regulatory agencies, including the NMOSE, frequently require groundwater modeling in the permitting process for new wells. Other applications of groundwater models include assessing the environmental impacts of additional withdrawals and for groundwater management plans.

Importantly, the value of a groundwater model is limited by the quality of the data used for inputs. The substantial variability in availability and quality of groundwater data (geohydrologic, metering, and monitoring) in New Mexico, impacts the accuracy of the models in statewide groundwater administration. In 2008, NMOSE summarized 21 groundwater models that covered the major population regions, high groundwater use basins (Middle and Lower Rio Grande), and areas where groundwater wells are used to support a fish hatchery in Mora (Figure 14).

9 New Mexico Water Data Act (NMSA 1978, § 72-4B). 2019. Water Data Initiative (WDI) is a New Mexico Bureau of Geology and Mineral Resources (NMBGMR) project involving the Office of State Engineer (OSE), Interstate Stream Commission (ISC), Environment Department (NMED) and Energy, Minerals and Natural Resources Department (EMNRD), to coordinate, identify, share and integrate key water data.

FIGURE 13:

USGS Groundwater Monitoring Data in the Southwest Groundwater Region

The graphs and map below show the decline reported by monitoring wells in the Southwest Region
(New Mexico Bureau of Geology and Mineral Resources, 2025; USGS, 2025)

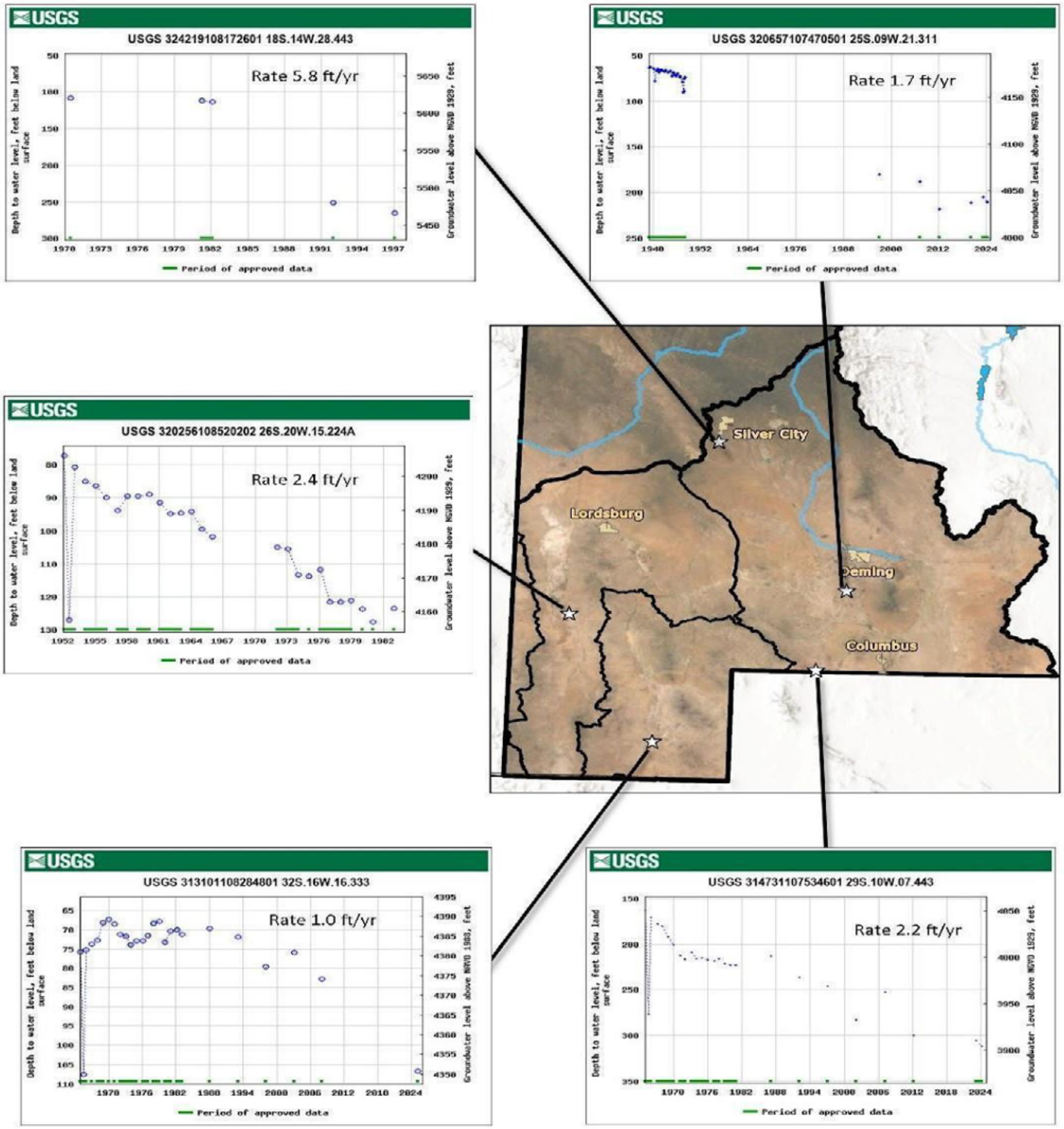
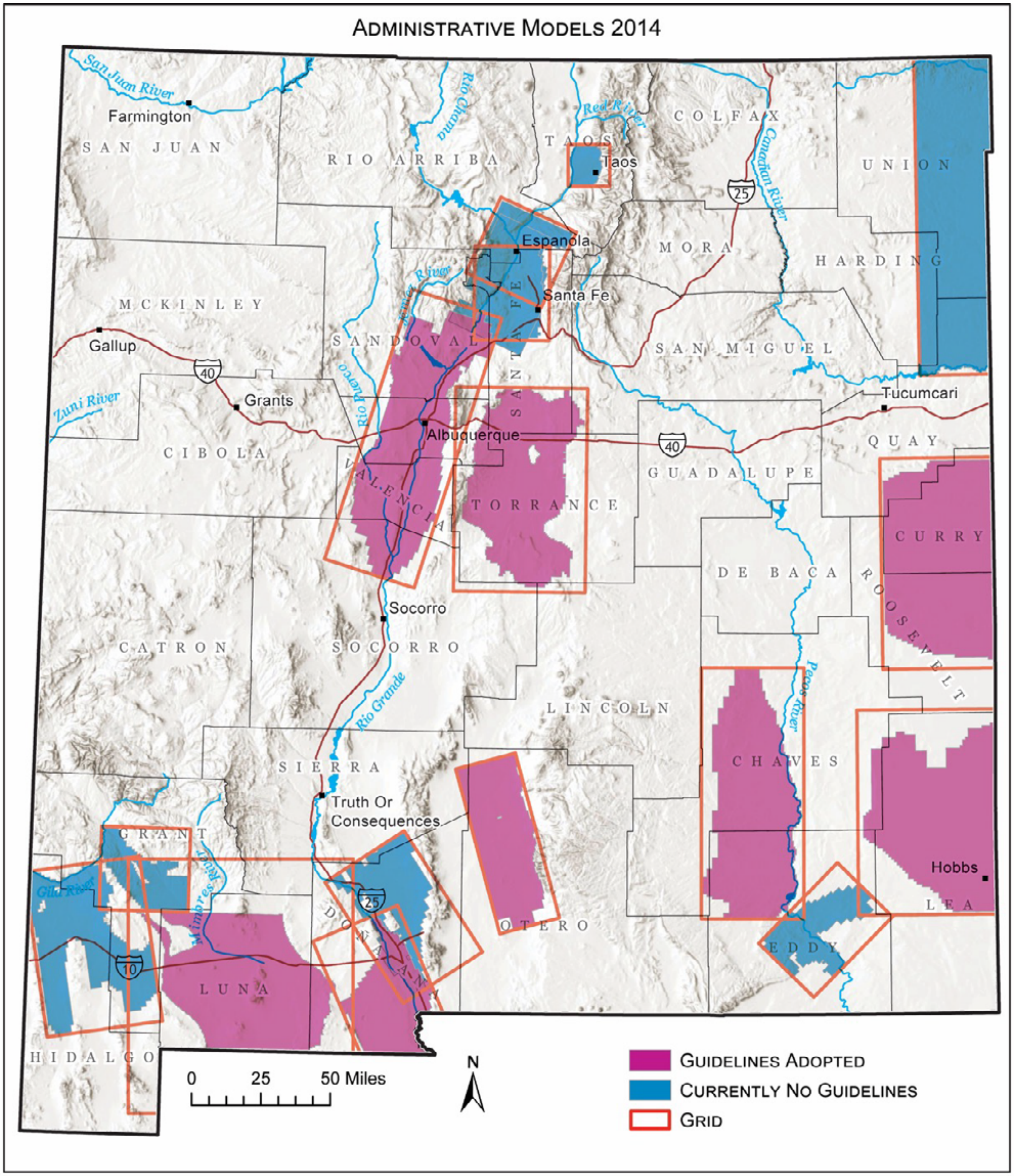


FIGURE 14:

NMOSE 2014 Administrative Models (Grids) for Groundwater Monitoring (NMOSE-ISC, 2006)



The maps below show the areas of the state that currently have administrative declarations, as it relates to the NMBGMR Groundwater Summary Regions and the NMISC Regional Planning boundaries. This helps groundwater managers better understand these administrative regulations across the state.

FIGURE 15:

Administrative Groundwater Models in New Mexico with the NMBGMR Groundwater Basins (NMOSE, 2008)

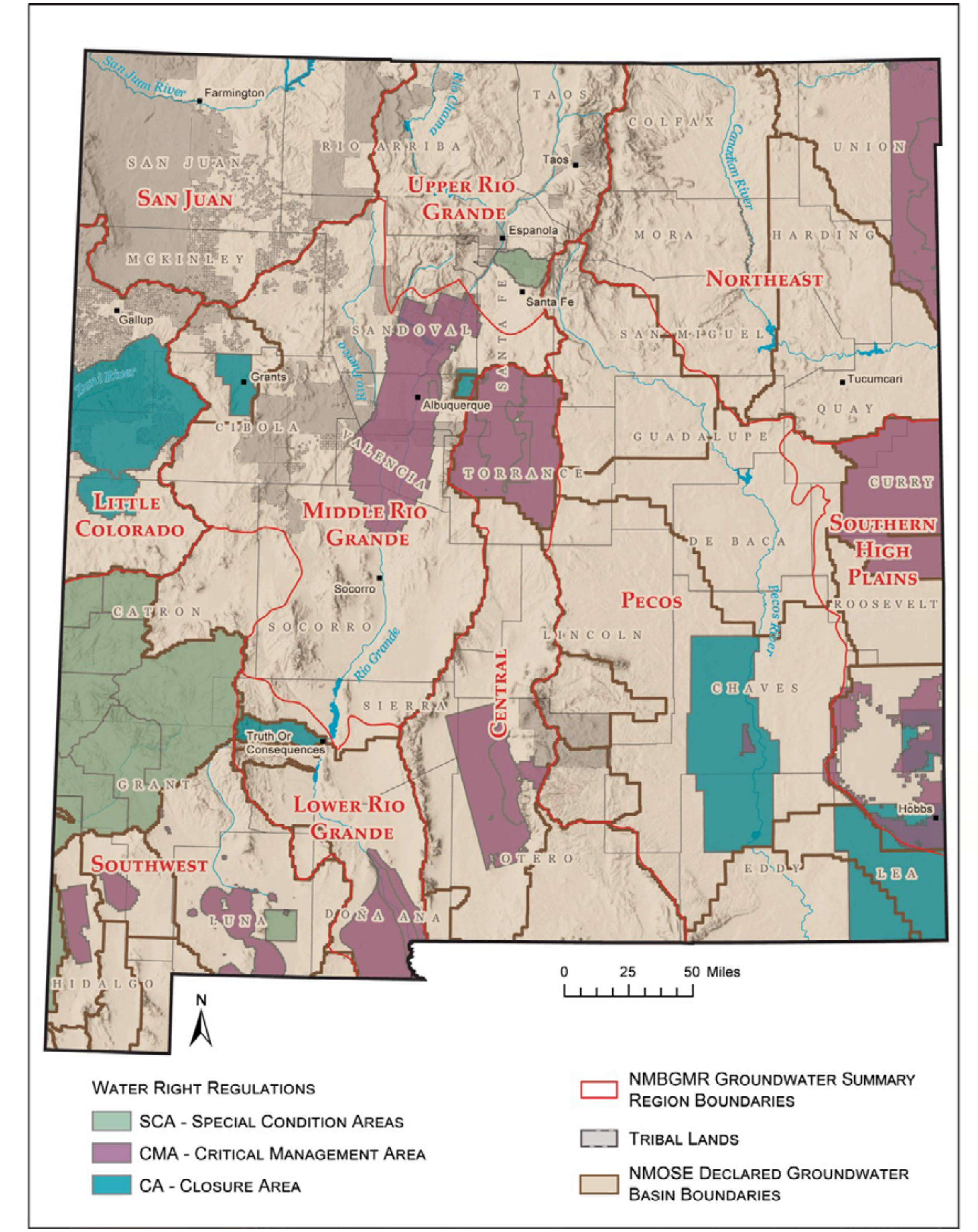
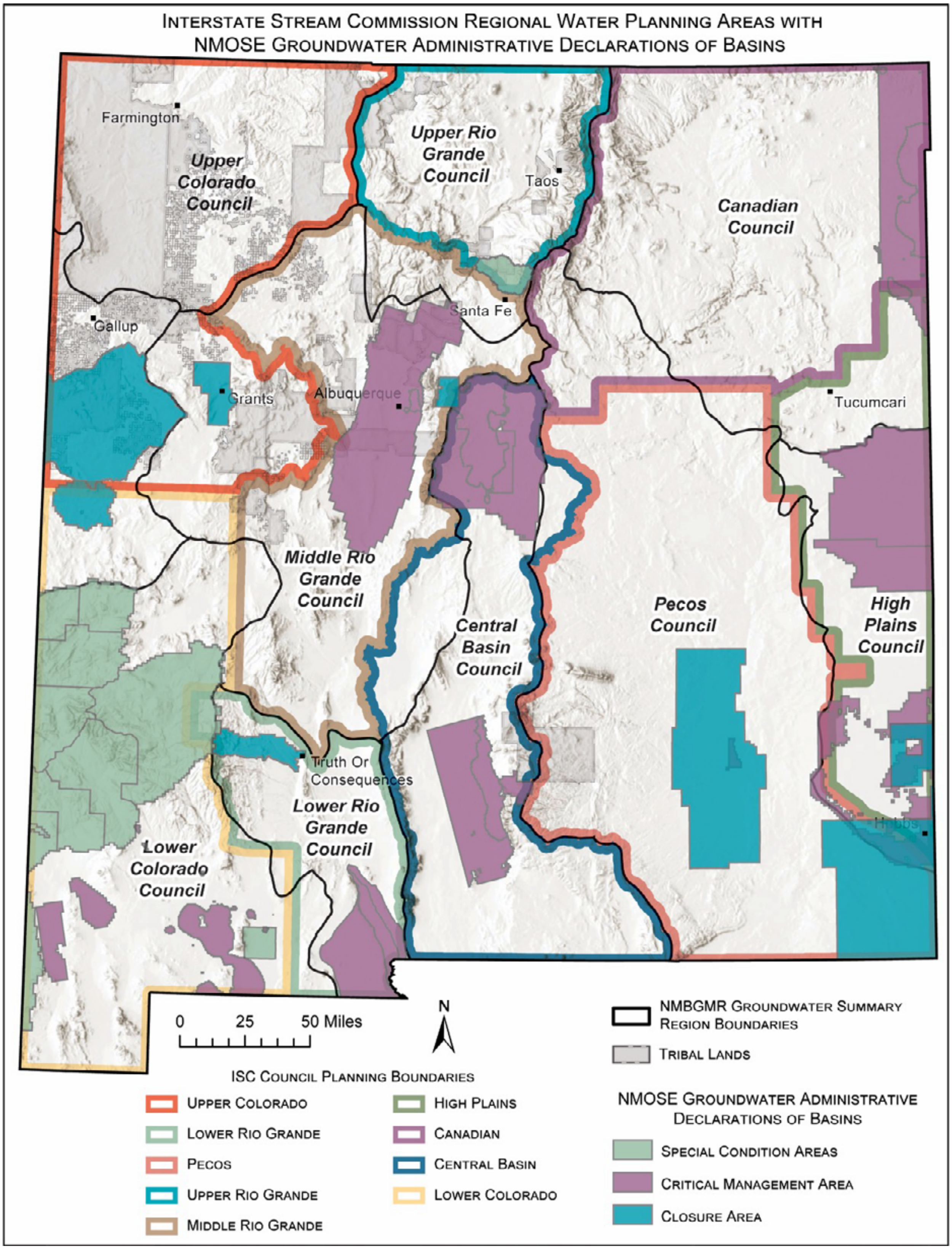


FIGURE 16:

Administrative Groundwater Models in New Mexico within the NM ISC Planning Boundaries



In addition, there are models in Curry-Portales, Estancia, and Animas-Lordsburg areas, which are used to administer groundwater use and estimate the longevity of aquifer life. Groundwater models that include impacts on river flows to best monitor groundwater use on surface water flow for interstate compacts compliance include the Rio Grande and Pecos corridors. Since the 2008 model summaries, several models have been updated or superseded and new models are being developed. It is important to increase data collection and availability for these modeling efforts. New Mexico needs substantial advancements in both data collection — aquifer mapping/characterization, metering, and monitoring — and modeling, to provide utility for water planning and analysis and optimize the longevity of groundwater resources.

> “
> Groundwater resilience for New Mexico includes tracking groundwater levels and well production rates with monitoring wells and metering production wells. This data allows us to see when groundwater levels are dropping and if there is reduced production, and informs proactive, community-based changes to prevent wells from going dry or impacts to municipal water service.”
>
> **Stacy Timmons**
>
> *Associate Director of Hydrogeology, Bureau of Geology and Mineral Resources*

Current Status of Groundwater Management in New Mexico

The status of groundwater management in New Mexico is highly inconsistent across the state and severely impeded in many areas by the lack of consistent data and information. As described in Sections IV and V, there are a few areas that have the data needed to assess the status of groundwater for decision-making and proactive management (Lower Rio Grande and the Pecos Valley Artesian Conservation District), yet the majority of the state lacks the necessary data to manage groundwater efficiently. New Mexico would benefit from a comprehensive groundwater management framework that includes aquifer condition monitoring (quantity and quality), metering of groundwater use and basin specific thresholds for water conservation efforts to improve the longevity of this finite and vital resource.

In the regions of the state where there is little connection to surface water, groundwater is generally in decline. The rate of recharge is not the same for all aquifers, and that must be considered when pumping water from a well. Pumping too much water too fast draws down the water in the aquifer and eventually causes a well to yield less and less water and eventually run dry, impacting the water availability of nearby wells pumping from the same aquifer. Groundwater systems in the High Plains and Southwestern and Central regions, among other areas, have declining water levels due to withdrawals far exceeding recharge rates.

For example, the High Plains Region of New Mexico relies on the Ogallala Formation, an aquifer that is declining rapidly, due to over pumping. This is an area where groundwater management is based on the aquifer’s useful life, or the amount of time until the aquifer is fully depleted. This is called groundwater mining, which is the steady loss of groundwater availability, and the need to drill deeper wells to access the finite water at depths that produce poorer quality water (salinity or brackish water). There are several mined-aquifer regions in New Mexico, where finite water declines and the limited longevity has been known for decades. The aquifers that are managed by the NMOSE, are assessed for the rate of drawdown based on a 40-year time horizon, and the administrative guidelines are set up

FIGURE 17:

New Mexico's Groundwater Basins and Levels

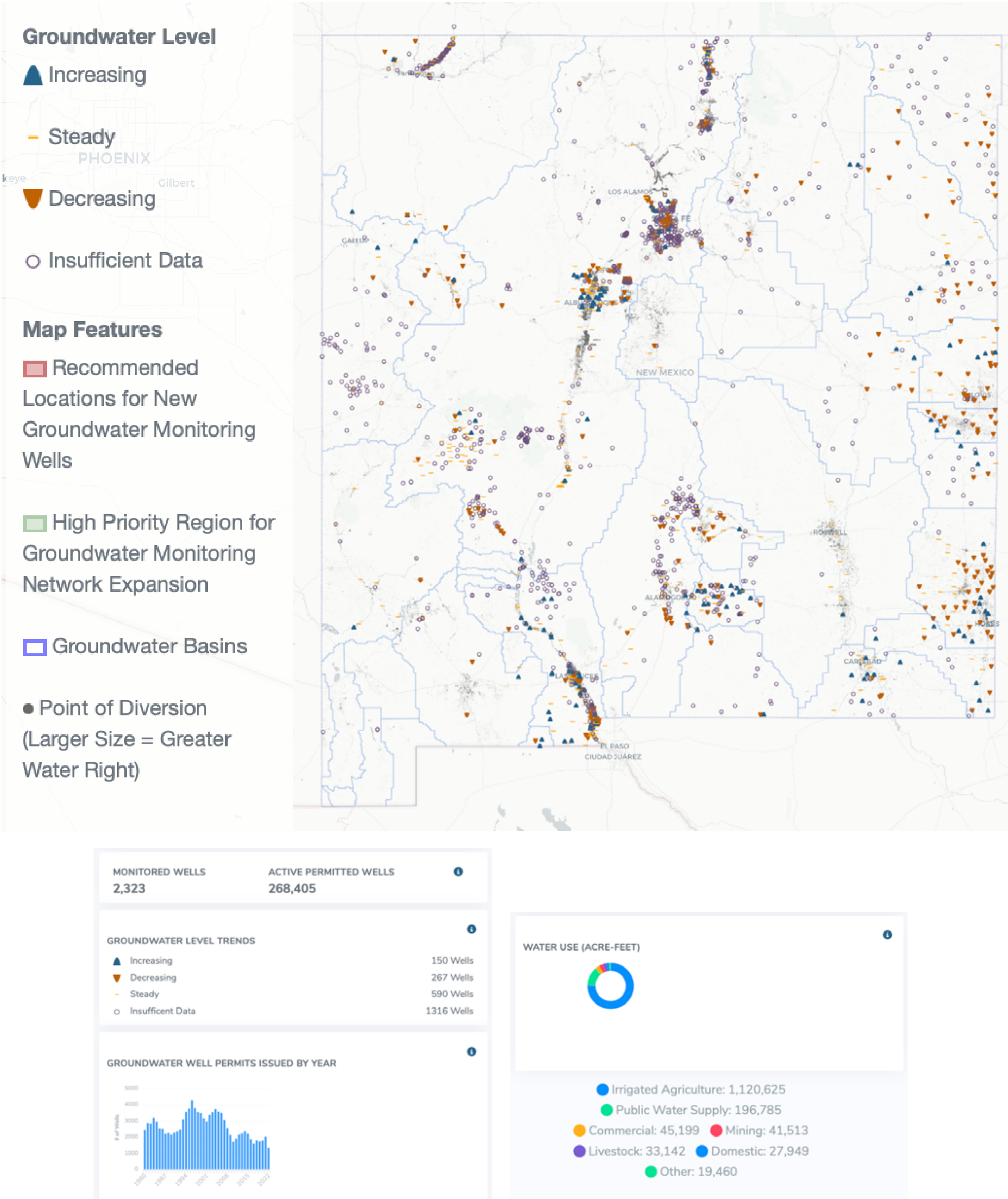
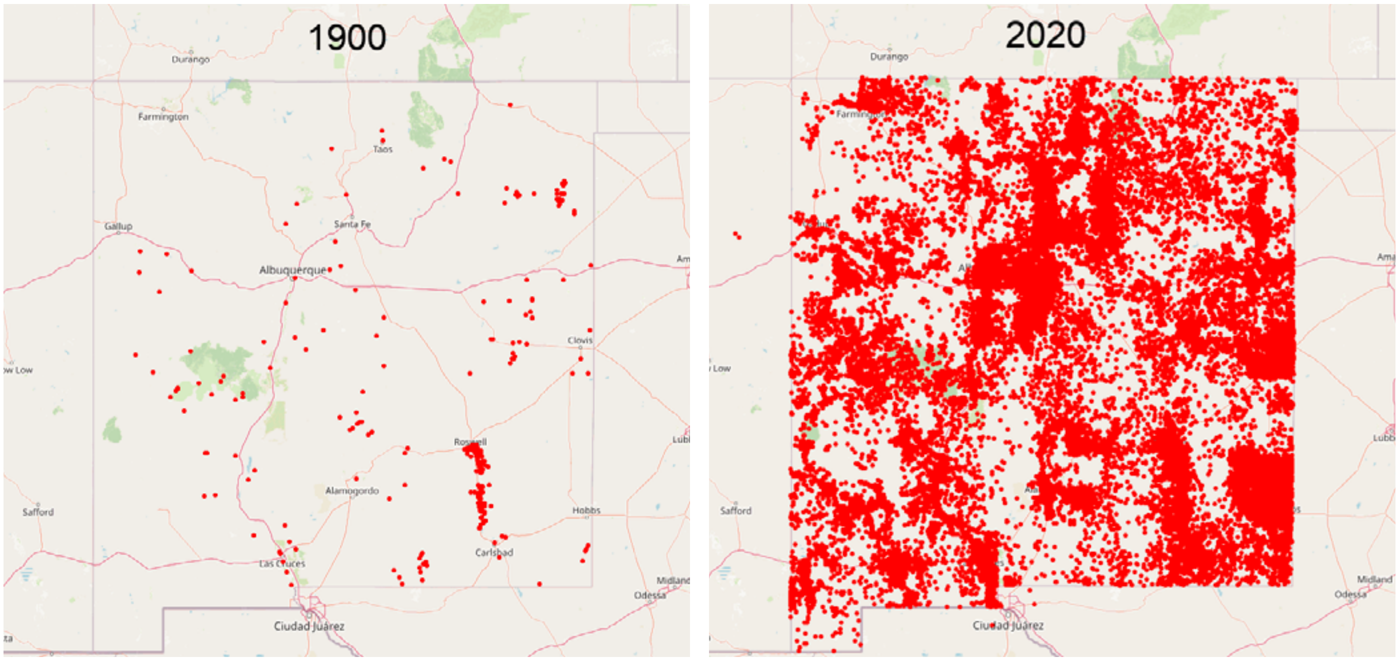


FIGURE 18:

New Mexico’s Groundwater Well Proliferation

These maps show the proliferation of wells across New Mexico from 1900 through 2020, with roughly 2,000 wells added a year since the late 1940’s due to advancements in well drilling technology. New Mexico is seeing significant challenges in areas with declining water levels due to ongoing use of groundwater and slow recharge from drought conditions (NM Interstate Stream Commission, 2023).



based on modeling to estimate water availability. The 40-year approach started during the tenure of state engineer Steve Reynolds (1955-1990) and has continued since. There is no clear justification for the 40-year timeline, and some areas that have been under the 40-year administrative guidelines, including the Clovis/Portales area, are currently facing a projection of only 5-10 more years of groundwater supply (NMOSE-ISC, 2006). This management framework has not created longevity or resilience.

Climate Change Impacts to New Mexico’s Groundwater

In addition to the unknowns about groundwater supplies and the unmanaged and in cases overuse of groundwater in New Mexico’s aquifers, other risks to this vital water resource are the impacts of climate change. The 2022 Leap Ahead report provides important assessments of the impacts of climate change for all of New Mexico’s water resources, surface and groundwater (Dunbar et al., 2022). Importantly, the permanent shifts in weather patterns due to climate change are advancing aridity across the Southwest, acutely so in New Mexico. Increasing temperatures, intensification and duration of drought, and vast variability in precipitation patterns are impacting water availability. Reduced surface water of 25-30% is expected by 2040, as average snowpack and spring runoff decline. Historically, drought has been cyclical, and wetter periods provide a recovery period for groundwater storage. However, increasing temperatures and climate shifts towards a more arid environment, are setting records that depart greatly from historical climate normal.

In the river corridor regions with a hydrologic connection between the river system and groundwater, surface water scarcity has profound effects on groundwater levels. Low snowpack and reduced spring runoff reduces regional aquifer recharge. Without appropriate groundwater management, New Mexico is at risk of violating its interstate surface water compact obligations, illustrating the strong interaction between surface water and groundwater in the river corridors. Should such violations occur with an interstate compact, court-directed compliance enforcement is likely to be draconian, costly, and highly disruptive to the state's water users. This effect is currently playing out in the Lower Rio Grande Region, which recently settled the Supreme Court case that litigated for more than a decade over downstream effects of groundwater withdrawals (NM Department of Justice, 2025). To avoid repeated litigation with Texas, metering, monitoring and management will be required in the Middle Rio Grande region.

Additionally, the impacts of higher temperatures, less precipitation and drought in areas that solely depend on isolated aquifers (mined groundwater basins), lead to increased water demand and continued aquifer declines. In relation to the hydrologic water budget, drought-reduced inflows (minimal recharge) and increased pumping demands (higher outflows) constitute a "double whammy" on aquifer storage. Reductions in groundwater use will be vital to maintain communities and economies that are fully dependent on groundwater to exist.

Water Quality

Groundwater quality is a critical component of managing this critical resource for municipal and agricultural uses. The quality of the water pumped from underground aquifers can vary based on the depth of the aquifer and how the aquifer was formed and what kind of infiltration occurs. Assessing the quality of this underground resource helps determine the extent of necessary water treatment prior to use, to assure water safety for communities. New Mexico faces various groundwater quality issues including natural contaminants like arsenic and uranium, as well as synthetic compounds like PFAS ('synthetic forever chemicals,' found in a wide variety of items, such as firefighting foams, non-stick cookware and fast-food packaging), that seep into aquifers from sources like military bases, industrial facilities, and urban areas (USGS, 2024). Other concerns include aging infrastructure causing water loss, pollution from industrial agriculture, and issues with private wells not being regulated or consistently tested. New Mexico also has deep fossil water that is saline, or brackish water, that is being considered for supplemental water supply (Land & Timmons, 2016).

Brackish Groundwater in New Mexico

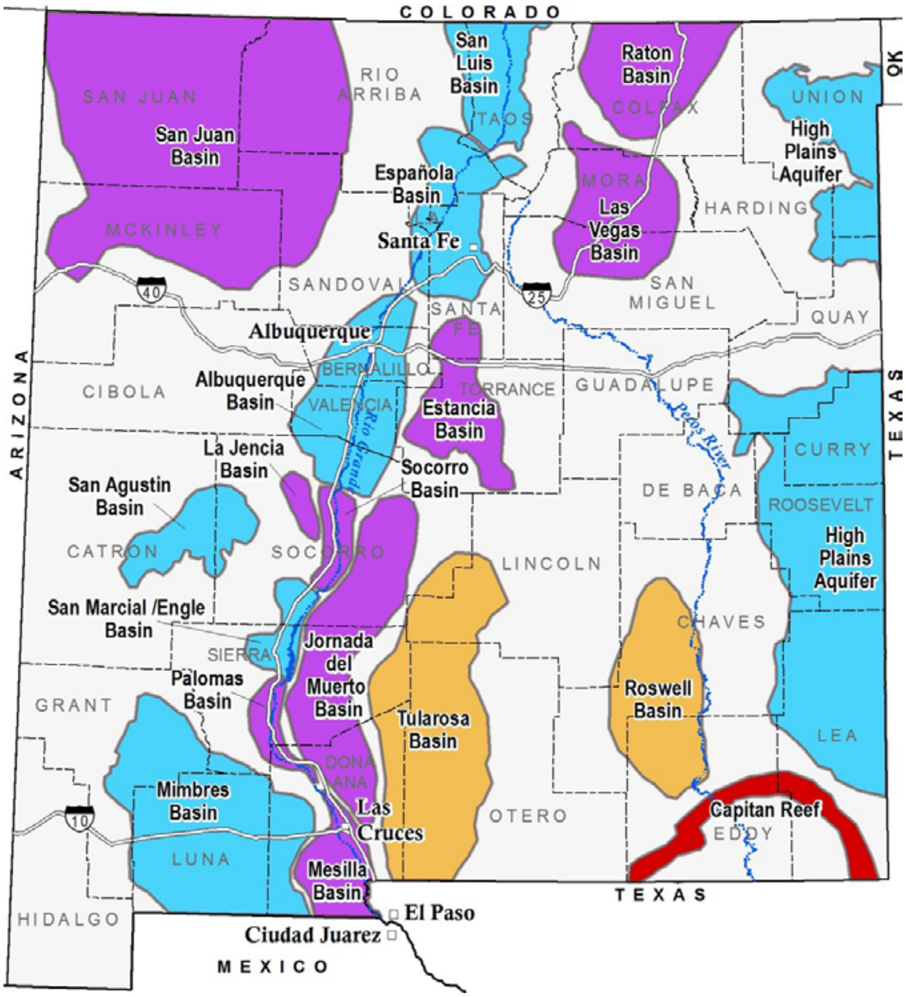
As water supplies diminish due to climate change and extended periods of drought, adequate water supply is becoming a critical issue for New Mexico. The state's limited freshwater resources can't withstand current demands for water from agriculture, industrial and municipal growth. This has led to increased interest in non-traditional water sources such as brackish water, which is water found in very deep confined aquifers that has higher salinity than typical groundwater. Brackish water has a concentration of 1,000–30,000 mg/L of Total Dissolved Solids (TDS). Water that has 10,000 mg/L TDS or above, is saline or brine. New Mexico is currently considering and evaluating the feasibility of using non-potable (over 1,000 mg/L TDS) brackish groundwater located in deep (below 2,500 feet) pre-historic aquifers in various groundwater basins across the state (Albuquerque, San Juan, Roswell, and Tularosa Basins). These brackish water resources require treatment before it can be used for domestic water supplies or for irrigation of most crops.

Figure 19 shows a preliminary map of the brackish water resources in New Mexico. However, very large regions of the state lack sufficient data to assess brackish water resources. The data compiled to create the map below was from USGS data, NMBGMR well monitoring data, and historic records from existing water supply wells. Therefore the map only represents a rough estimate of the brackish water in New Mexico and in general, the

FIGURE 19:

New Mexico's Brackish Aquifers (Land & Timmons, 2016)

Brackish water data compiled from USGS data, NMBGMR, and historic records from existing water wells. Colored regions are defined by average total dissolved solids (TDS). Blue areas have TDS below 1,000 mg/L (considered potable); Purple areas have between 1,000–3,000 mg/L TDS (slightly brackish); Orange areas have 3,000–10,000 mg/L TDS (brackish); Red have over 10,000 mg/L TDS (saline or brine). These are regional approximations and site-specific studies must be performed to confirm these results (Land & Timmons, 2016).



Basin/Region	Number of available records	Mean TDS (mg/L)
San Luis Basin	300	330
San Agustin Basin	185	341
Española Basin	612	390
Mimbres Basin	265	617
San Marcial and Engle Basins	32	704
Albuquerque Basin	987	881
High Plains Aquifer	560	996
Socorro and La Jencia Basins	379	1,002
Mesilla Basin	408	1,217
Estancia Basin	561	1,288
Palomas Basin	203	1,297
Jornada del Muerto Basin	173	1,354
Raton and Las Vegas Basins	80	2,336
San Juan Basin	1,011	2,373
Tularosa Basin	959	3,184
Roswell Artesian Basin	632	3,548
Capitan Reef Aquifer	13	54,046

shallowest parts of the aquifers where water wells are commonly completed (Land & Timmons, 2016). More accurate mapping of those reserves is necessary to know the actual retrievable volume of brackish water in these basins.

Importantly, the retrievable volumes of brackish water are difficult to measure or estimate due to the complicated hydrogeology in some areas of New Mexico. In addition, drilling for brackish water can impose risks of contaminating adjacent or neighboring fresh water basins with brackish water. This complicates accurate measurement of brackish water volumes. Also, the depth to brackish water means higher energy needs and associated costs of pumping. Once brought to the surface, the brackish water requires additional treatment, beyond what is normally required for freshwater sources. This treatment yields a salt-biproduct, or brine, that requires disposal. These realities of using brackish water to supplement scarce freshwater, translates to a much more expensive water source. While brackish water may be available in some locations, that water may need to be conveyed to distant locations, which adds another cost to this water. These limitations and constraints are frequently overlooked in the dialogue about exploring this water source. In addition, it is important to highlight that brackish groundwater is almost always completely non-renewable, having been formed and/or trapped in previous geological periods. Any exploration and development of brackish water is considered aquifer mining.

Even with these considerable limitations, in some situations where freshwater sources are severely limited, withdrawal and treatment of brackish groundwater may be a reasonable option for meeting local water needs for a time. The desalination technologies to treat brackish water and exploit those resources have been used in many arid areas around the world. Some important takeaways on using brackish water sources include:

- **Location and availability of brackish groundwater is highly variable,** and quantities are uncertain. Therefore, it is important to consider if development of a brackish source can economically offset uses in another location.
- **Potential depletion of freshwater aquifers during brackish aquifer pumping.** When aquifers are pumped, the water pressure in the pumped aquifer decreases, and less pressure can induce flows from surrounding aquifers into the newly pumped aquifer and lower groundwater levels in surrounding aquifers. Repeatedly across the arid West, newly discovered aquifers have been touted as new, "untapped" water sources, only to learn that after those new aquifers are pumped, they are connected to surrounding aquifers, and the pumping of the new aquifer, after a period of time, begins to affect surrounding aquifers, eventually lowering pressures in, and depleting those surrounding aquifers.
- **Rigorous monitoring program must be in place** with any exploration and development of new brackish pumping, to track levels in the newly pumped, brackish aquifer and to assess potential impacts on overlying or adjacent freshwater aquifers.
- **Brine disposal must be planned to assure brine waste doesn't impact communities, natural environments and wildlife.** Treatment of brackish water of all levels creates two streams of water, the fresher water that is desired for use and a remaining saline water stream, or brine solution of higher salinity than the source water. Appropriate disposal of this brine in inland areas is an ongoing challenge and cost.
- **The non-renewable nature of brackish groundwater.** Highly saline water is an indicator it was confined in the geologic setting for a long time and is not being refreshed from precipitation or infiltration of surface water. Thus, most brackish water is a non-renewable source of water. As new sources of brackish water are developed, it is important that this finite condition is considered because this water source is generally not sustainable.

Other Groundwater Quality Issues in New Mexico

There are several naturally occurring chemicals and contaminants in New Mexico's groundwater that cause problems with drinking water quality. Additionally, the quality of the water can decline as water levels in aquifers drop. The concentrations of substances of concern can increase as the water level gets lower in the aquifer, which presents another constraint on usable groundwater availability. For example, there is an abundance of naturally occurring arsenic in organic-rich shale and volcanic rocks (particularly in light-colored, silica-rich volcanic rocks found in the Jemez Mountains). These formations can contain several hundred parts per million (ppm) of arsenic. Doña Ana County also has naturally high levels of arsenic and fluoride affecting groundwater quality from volcanic rock formations.

Other groundwater contaminants include naturally occurring and human-caused uranium, which have been recorded in wells in north and south-central counties, above the Environmental Protection Agency (EPA) Safe Drinking Water standards. Safe drinking water concentration for uranium is 30 parts per billion (ppb). Groundwater contamination from uranium mining was detected as early as 1961. However, prior to that, the federal government was aware that New Mexico's waterways were showing signs of radioactive contamination from the uranium extraction industry. For example, the Grants Mineral Belt has a history of uranium mining, leading to contamination of groundwater with radionuclides.[10] For nearly eight decades, water and soils contaminated with myriad hazardous chemicals and radioactive waste have resulted from activities at Los Alamos National Laboratory. The Laboratory area has concerns over legacy waste, including radionuclides and solvents that potentially contaminate groundwater and surface water. Local communities, including Native American reservations, face ongoing risks from these legacy pollutants. For example, an underground plume of toxic chromium has spread from Los Alamos National Laboratory to Pueblo de San Ildefonso land, marking the first time the plume has been detected within the pueblo boundaries. The plume's spread does not pose imminent threats to drinking water in the pueblo or in Los Alamos County, but long-term ingestion of hexavalent chromium can cause serious health problems or increase risk of certain cancers (Lohmann, 2025).

New Mexico also has some of the highest documented levels of per- and polyfluoroalkyl substances (PFAS),[11] which are in the vicinity of Lake Holloman, near the Holloman Air Force Base and White Sands National Park. The PFAS tests conducted by the Air Force showed levels of PFAS up to 1,294 ppb in water below Holloman, which is more than 27,000 times the advisory level. In addition, rural Curry County and the city of Clovis reported PFAS pollution from Cannon Air Force Base, which led to euthanizing 3,600 dairy cows that were poisoned from drinking the groundwater with high levels of PFAS. These forever chemicals have been detected in groundwater and surface water resources across the state of New Mexico. According to two recent studies by the U.S. Geological Survey in cooperation with the New Mexico Environment Department, 27 of the 117 groundwater sites evaluated had PFAS concentrations above the threshold detection level. The studies also found that urban areas are the most significant contributor of these substances (Prokop, 2023).

Finally, domestic wells in New Mexico make up about 10% of household water sources and use. Currently, there is no requirement for private domestic wells to be routinely tested for water quality, and most are not. Many households that rely on private wells also rely on a septic tank system for wastewater disposal. If these systems are not properly sited and managed, the effluent from the septic tank can reach the well, resulting in nitrate and pathogen contamination of the groundwater. Since testing is not routine, the scale and consequences of the water contamination are not well understood and highlights another important improvement to groundwater management for New Mexico.

Produced Water

In recent years, considerable interest has arisen in "produced water" as a new or alternative water supply for New Mexico. Produced water is industrial wastewater, coming from the residual water from fracking for oil and gas extraction. This waste product from oil and gas production is co-produced with the oil and gas for as long as the production well is operated. Produced water consists of a combination of fluid that returns to the surface from

10 Radionuclides (including Radon, Radium and Uranium). EPA.

11 PFAS are a group of manufactured chemicals that have been used in industry and consumer products since the 1940s. There are thousands of different PFAS, known as 'forever chemicals' that never disappear from the environment and build up in people, animals, and the environment over time.

the fracking process (flowback), chemicals routinely injected into production wells as part of ongoing maintenance that returns to the surface, and formation water that contains contaminants from the natural geologic environment of oil-production and surrounding geologic formation. The fracking fluids are often proprietary and may contain PFAS. It is widely accepted that the produced water must be treated before it can be used for other purposes. However, there are a large variety of unknowns about the contaminants from these varied sources. As such, the treatment process is still experimental and has not been determined safe by the EPA or New Mexico Environment Department (NMED) as of this writing. Thus, the appropriate uses for this treated wastewater and any long-term public and environmental health impacts of that possible use, have not been fully assessed. In addition, this treatment process is very extensive, energy intensive, and expensive. Furthermore, the administrative process for how to put this wastewater to beneficial use, or reuse, has not yet been developed for the state of New Mexico. These administrative processes would require close coordination between the NMED for determination of water quality standards and the New Mexico Office of the State Engineer (NMOSE) to determine appropriate uses and water rights associated with the treated water.

Overall, produced water would be very expensive and the costs of treatment and transportation for certain uses would need to be covered, whether by New Mexican taxpayers or the private sector. Furthermore, tracking the water uses for the treated wastewater would require an additional arm of regulation for the NMOSE, which already lacks capacities for statewide groundwater management. Notably, the estimated amount of produced water is not well understood, requiring close consideration of the costs and benefits of this alternative water supply, which should be closely compared to the costs and benefits of robust water conservation strategies for agriculture and municipalities. Finally, and importantly, produced water is generated primarily in the Permian Basin in the southeast part of the state, with much lesser amounts generated in the San Juan Basin in the northeast. Accordingly, even if adequate treatment could be assured, the treated produced water would only be available to a small portion of the state without extensive transportation costs.

III. NEW MEXICO'S LAWS, STATUTORY AND ADMINISTRATIVE TOOLS FOR GOVERNING GROUNDWATER

History of Groundwater Codes, Administrative Guidelines, and Management

As noted earlier, the development of groundwater in New Mexico expanded as municipalities, including Albuquerque and Las Cruces, grew in the early 20th century. As such, the first groundwater code was enacted in 1927 and by the mid-1930s large-scale groundwater use was a key component of municipal water supply (Bushnell, 2012). New Mexico was influential as the vanguard of groundwater law in the West. "New Mexico…was the first of the western state groundwater statutes to be put into active operation and has set the pattern for much of the subsequent legislation on that field in the West." (President's Water Resources Policy Commission, 1950).

TABLE 4:

Milestones for New Mexico's Groundwater Laws

1927	New Mexico enacts a groundwater code.
1930	New Mexico's nascent groundwater code is found to be unconstitutional, although the New Mexico Supreme Court finds it declaratory of existing law (Yeo v. Tweedy, 1930).
1931	New Mexico enacts the current groundwater code (Declaration of Beneficial Use; Verification; Recording, n.d.).
1949	New Mexico enacts a well drillers code, requiring drillers to have a license issued by the State Engineer and prohibiting drilling without a well permit from the State Engineer.
1951	The State Engineer explicitly recognizes the correlated nature of surface and groundwater in the Carlsbad Basin (Manual of Rules and Regulations Governing the Drilling of Wells and the Appropriation and Use of Underground Waters in Declared Basins of the State of New Mexico, 1951).
1953	State Engineer John Bliss states, in the District Court of Lea County, that a groundwa-ter basin is fully appropriated when there was enough water in storage to allow prior appropriators a reasonable amount of water for a reasonable length of time (Cooper v. John H. Bliss Engineer, n.d.).
1958	The New Mexico Supreme Court applies the doctrine of surface water connectivity with groundwater (Templeton v. Pecos Valley Artesian Conservancy, 1958).
1967	Public notice of well drilling is required.
1967	New Mexico enacts the first deep water statute to exempt oil and gas operations from involvement in Pecos River Compact operations.
1999	New Mexico enacts the Groundwater Storage and Recovery Act (Declaration of Beneficial Use; Verification; Recording, n.d.).
2006	All 40 groundwater basins in New Mexico are declared to be under the jurisdiction of the State Engineer (Utton Center, 2015).
2009	New Mexico enacts the Non-Potable Deep Aquifers Act, giving the State Engineer the authority to declare a groundwater basin below 2,500 foot depth beneath the surface and regulate non-potable deep water within it (Restrictions on Drilling of Supplemental Wells, 2024).
2022	The New Mexico Court of Appeals considered how to apply "the contrary to the conservation of water" standard in the context of groundwater application (Aquifer Science v. Verhines, 2022).
2025	New Mexico amends the Strategic Water Reserve Act, which allows for the Interstate Stream Commission to acquire water and use it for aquifer recharge.

Pursuant to the laws noted above, the New Mexico Office of the State Engineer (NMOSE) has adopted general groundwater regulations that address needed oversight of various circumstances, including:

- Water rights that were developed prior to the declaration of a basin;
- Permitting of new wells;
- Licensing of beneficial water uses;
- Well construction standards or regulations;
- Changes to location, place, or purpose of water use;
- Changes of ownership of water rights;
- Drilling of supplemental wells;
- Deepening of wells;
- Well repair;
- Plugging retired or unproductive wells;
- Termination or forfeiture of groundwater use;
- Metering orders and other reporting requirements;
- Groundwater transport and storage.

Impairment of Groundwater Rights in New Mexico

An important component of managing groundwater in New Mexico is understanding what constitutes impairment of a water right holder's access to water. New groundwater wells and water use can change the availability and quality of water accessed and used prior to the withdrawals from a new well. This circumstance causes impairment to another well owner/water user. The Courts in New Mexico consider impairment to be a "functional definition" of this kind of impact, but it is not a policy (Montgomery v. New Mexico State Engineer, 2005). Therefore, no laws are in place that specifically protect water users that are impacted by new wells which change the previous or historic availability of groundwater.

The determination of impairment of groundwater rights in New Mexico is determined by the courts on a case-by-case basis. The Courts consider the specific circumstances of the case, based on a variety of factors including groundwater level declines or water quality impairments. The analysis of impairment "must be tailored to each particular application to ensure that the conditions specific to the proposed water use, the existing water rights, and both local and regional hydrologic conditions are adequately considered"(Carangelo v. Albuquerque-Bernalillo County Water Utility Authority, 2013).

Notably, the lowering of the groundwater table in the aquifer does not necessarily constitute impairment of the rights of prior groundwater appropriators. However it is an important factor that should be considered in addition to the characteristics of the aquifer and the locations of other wells (Application of Brown, 1958). Currently in New Mexico, the decline or lowering of the water levels in wells is considered an inevitable result of groundwater use, for areas where there is more than one appropriator (Mathers v. Texaco, Inc., 1966). In addition, when there are economic losses, such as increased pumping costs and lower well yields, as a result of the approval of new groundwater rights and new wells, these on their own also do not constitute impairment (Montgomery v. New Mexico State Engineer, 2005). Furthermore, negligible impacts on water quality caused by declines in the groundwater table, also do not alone constitute impairment (City of Roswell v. Berry, 1969). For example, an acceleration of salt intrusion due to pumping may be an acceptable degradation of the groundwater quality based on the specific conditions of the case (Stokes v. Morgan, 1984).

One example of a ruling of impairment based on water quality degradations by the New Mexico Supreme Court, upheld the State Engineer's decision that a groundwater permit application in the Roswell Artesian Basin would, "not result in any measurable reduction in available water to existing water users; but the increased salt content of water from the Applicant's well due to increased pumping, in the event an application is granted, would impair existing rights" (Heine v. Reynolds, 1962).

In northern New Mexico, within the area of the Aamodt water rights adjudication, which includes the Pueblos of Nambé, Pojoaque, San Ildefonso, and Tesuque Water Rights Settlement, the State Engineer allowed the Water Master to determine impairment. The State Engineer issued a regulation which governs how the Water Master will determine impairment in the area, by determining if non-Pueblo groundwater rights are being impaired by other water wells and water uses. The Water Master utilizes a hydrologic model in considering the factual and technical basis of the projected impairment (Water Master Determination of Impairment to Groundwater Rights from Exercise of Pueblo Water Rights on Pueblo Lands, 2017). In addition, as part of the State's groundwater management program in the Aamodt Settlement area there is an established mitigation fund that can be utilized to pay for the cost to drill a replacement well or to obtain an alternative water supply (Mitigation Fund, 2017).

Fully Appropriated Groundwater Basins in New Mexico

The New Mexico Constitution declares that all unappropriated water within the state belongs to the public and is subject to appropriation based on putting the water to beneficial use (Appropriation of Water, n.d.). The Office of the State Engineer is responsible for determining new appropriations and ensuring that any new appropriation does not impair existing water rights or contravene public welfare and conservation principles (Water Appropriations; Preferences, n.d.). Additionally, the State Engineer must ensure that any new beneficial use of water, even if non-consumptive, does not impact the available water in fully appropriated groundwater basins (Carangelo v. Albuquerque-Bernalillo County Water Utility Authority, 2013).

In the Rio Grande Valley, groundwater and surface water are connected. Like other river basins, "in the western states, where the public waters are held subject to use by prior appropriators, it has always been the law that a prior appropriator from a stream may enjoin one from obstructing or taking waters from an underground source which would otherwise reach the stream and which are necessary to serve the stream appropriators' prior right" (City of Albuquerque v. Reynolds, 1962). The Middle Rio Grande Administrative Area is a fully appropriated basin and State Engineer's guidelines require that any new groundwater use be "offset", to avoid impairment of existing surface water rights and uses (Montgomery v. Lomos Althos, Inc., 2006). The State Engineer can condition a new groundwater permit by requiring "offsets" where pumping will cause unacceptable depletions of surface water resources. To meet an offset requirement, a proposed appropriator must acquire a senior surface water right and obtain a State Engineer permit to transfer change the place of use to the proposed groundwater diversion. The land on which the surface water was used no longer has an associated water right and is determined to be "retired." Requiring offsets protects the surface flows of the related stream by reducing surface water diversions from a river to accommodate depletion by pumping of the hydrologically connected groundwater.

Management of Mined Groundwater Basins

A mined groundwater basin refers to groundwater withdrawals from aquifers that do not recharge. This means the aquifer has a limited longevity of providing water supplies. he State Engineer has the authority to develop administrative guidelines for issuing permits for new appropriations and changes to existing water uses in mined groundwater basins. The goal of these administrative guidelines is to extend the aquifer's productive life by regulating the rate of dewatering the aquifer.

The State Engineer considers the development of administrative guidelines when a groundwater basin shows evidence of significant drawdown and/or water quality issues. Examples of problems that have led to administering these guidelines include:

- Domestic wells going dry and irrigation wells experiencing reduced production in the Curry County and the Portales Basin;
- Declining water levels and deteriorating water quality in the Estancia and Tularosa Basins;
- Groundwater depletion effects on senior users on the Rio Grande from Albuquerque's municipal pumping;
- Meeting Rio Grande Compact obligations to Texas in the Lower Rio Grande;
- Land subsidence issues in the Middle Rio Grande area due to over pumping.

The goal of administrative guidelines is to guide OSE staff on the regulation of groundwater use and management to:

1. assure the orderly development of the water resources within the basin;
2. meet the statutory obligations regarding protection of the senior users; and,
3. extend the life of these basins so that they have a minimum of forty years of productivity.

Metering

Metering is critical to managing groundwater use and justification of any increase or decreases in pumping. Metering is used to monitor well pumping and the amount of groundwater that is extracted. This is important data for understanding changes in aquifer levels, points of diversion (PODs) and points in time that groundwater is being used or over-used.

The NMOSE WATERS[12] database provides the potential platform for better monitoring and management of PODs. However, there are significant data gaps in WATERS, including the lack of meter modules for wells or surface diversions that have (or should have) meters. Additionally, the exact number of unabstracted water rights is not known and there is limited knowledge on the code that operates the platform. WATERS has information on over 235,000 PODs, 220,000 of which are for the purpose of pumping or diverting water (as opposed to monitor wells or other wells) referred to active PODs.[13] Only 30,800 PODs have the required meter module in WATERS, which is about 14% of the active PODs (Lewis, 2019). It is unknown how many active wells or surface diversions have yet to be included in WATERS. The 2018 state water plan recommends expanding the NMOSE WATERS[14] database to a centralized platform for managing measured or metered water diversions to store water right and water use information throughout the state and create a statewide water right owner interface for entering meter data (NMOSE-ISC, 2018). This is an essential component of groundwater management and updates to the WATERS database would help modernize the agency and improve groundwater management.

12 Water Administration Technical Engineering Resource System. WATERS is the in-house name of the database for water right information including meter data, and NMWRRS is the public name for the WATERS database.

13 Of the total "Active PODs", about 160,000 are 72-12-1 wells (domestic and stock) that may or may not require metering. (Some 72-12-1 wells do require meters, such as the nearly 3,000 72-12-1 wells in the Nambe-Pojoaque-Tesuque basin that require meters per a recent court order). Of the total PODs with meter readings, about 27,000 are non-72-12-1 wells or 35% of the non 72-12-1 wells.

14 Water Administration Technical Engineering Resource System. WATERS is the in-house name of the database for water right information including meter data, and NMWRRS is the public name for the WATERS database.

The NMOSE requires metering, monitoring, and reporting water usage in specific areas of the state that are under administrative orders from the State Engineer. Metering orders are aligned with the NMOSE's mission to protect and administer New Mexico's groundwater diversions and use. In areas where there are metering orders, well owners are required to obtain, install, maintain, and repair meters on their wells. In addition, well owners must report meter readings to the NMOSE on a biannual or quarterly basis (more frequently if necessary). Metering and reporting allow the State Engineer Water Masters to monitor for over-diversion (over-pumping) and provide the data needed to manage the condition of the aquifer. For example, maintaining groundwater levels to avoid water right impairments to senior water rights holders and to meeting commitments of interstate river compact obligations. Previously, metering was not required unless by a court order, however currently the State Engineer can issue a metering order without a court order.

New Mexico has issued groundwater metering orders for several areas, identifying the following basins for active water resource management: Lower Rio Grande, San Juan River, Upper Mimbres, Rio Gallinas, Nambe-Pojoaque-Tesuque, and Rio Chama. Additionally, specific orders have been issued for parts of the Lea County, Capitan, and Carlsbad underground water basins to temporarily close them to new appropriations and require metering in some cases.

Active Water Resource Management Basins

- Lower Rio Grande Basin
- San Juan River Basin
- Upper Mimbres Basin
- Rio Gallinas Basin
- Nambe-Pojoaque-Tesuque Basin
- Rio Chama Basin

Specific Metering and Closure Orders are in place in Lea County, Capitan, and Carlsbad Underground Water Basins. Portions of these basins were temporarily closed to new appropriations, and metering is required for some users in the drought-stricken eastern part of the state, as per a 2021 order (NM OSE-ISC, n.d.).

There are a variety of challenges with the current process for metering orders and enforcement. First, once a metering order is in place, the order is only enforced when well owners come into contact with the NMOSE for another purpose, such as when the owner requests a change in their diversion or well depth permit, which opens the standing well permit. In addition, NMOSE faces capacity challenges, particularly at district offices, which are charged with metering order enforcement. Other issues with the current administrative process for metering include the obligation that well owners pay for and install the meters, which can be a cost burden for some well owners. There are wells that are extracting water without permits across the state which impact groundwater levels, and when there was a metering order, those wells would not be captured in the execution of the order.

Overall, only 30% of the non-domestic wells across the state are metered, and only 10% of domestic wells are metered. This is partly due to wells losing production (going dry) or wells that are abandoned when property changes hands. Also, if a well is replaced the previous well should be properly plugged, which is the property owners' expense, and therefore is not consistently executed.

In addition, when municipalities submit a well permit application, they are required to present a 40-year water plan to show the projected needs and beneficial use over the project period. This means that the amount of water that the permit is for may not be used initially. This can impact the conditions for approval of other well permits or actions needed due to aquifer conditions, which requires that the well is metered.

There are areas of New Mexico with successful, fully metered groundwater pumping to manage aquifer conditions and water uses. These include the Pecos Valley Artesian Conservation District (PVACD), which has a very strict metering order that allows all the well owners to better understand the amount of water they are allocated and how much they are using (Record, 2024). This is also a successful example because irrigation districts have the power to enforce a metering order.

New Mexico's Interstate Compacts and Groundwater-Surface Water Connectivity

The Interstate Stream Commission (ISC) has the authority to protect New Mexico's right to the water agreed to in eight interstate compacts (Rio Grande, Pecos River, Canadian River, Colorado River, Upper Colorado River, La Plata, Animas-La Plata, and Costilla). Interstate compacts provide certainty for water users and ensure that each state meets its obligations to deliver water owed to its sister states. This is an important component of groundwater management because of the connectivity between groundwater and surface water explained in the previous section of this report. The ISC becomes involved in groundwater management in areas where pumping affects surface water flows and deliveries required under compacts. To support the ISC's responsibility to compact deliveries, the agency has developed groundwater models to assess the impacts of groundwater pumping on river flows. The Legislature authorized the ISC to purchase water rights or appropriate water on behalf of any region, to ensure its ability to manage compact compliance. A prime example of how ISC employs this authority are the water rights purchases and groundwater leases to supplement Pecos River flows to ensure New Mexico meets its obligations to Texas under the Pecos Compact.

Pueblo and Tribal Groundwater Rights

New Mexico's Tribes, Pueblos, and Sovereign Nations have held and stewarded the state's lands and waters since time immemorial. As such, tribal water rights are the most senior rights in the prior appropriation system and are not subject to curtailment. However, many Tribes across the west and in New Mexico have not fully developed their water rights. As a result, when Tribes develop and put their water rights to beneficial uses, this requires settlement of those water rights in some cases. New Mexico has entered into several Tribal water rights settlements which provide clear operating procedures for water users in the adjudication areas. An example of this is the Aamodt adjudication in northern New Mexico, where the 1985 opinion of the federal district court concluded that the Pueblos' water rights under Spanish and Mexican law still exist and can be satisfied from either surface water or hydrologically connected groundwater.

The development of a Tribal water code is an avenue for groundwater administration within Tribal boundaries. The Navajo Nation, for instance, asserts ownership of full equitable title to groundwater through the Navajo Nation Water Code. The Navajo Nation Water Code defines the waters of the Navajo Nation to include "all surface and groundwaters which are contained within hydrological systems located exclusively within the lands of the Navajo Tribe of Indians; and all groundwaters located beneath the surface of the lands held in trust by the United States of America for the Navajo Tribe of Indians." The Navajo Water Code sets forth provisions for the administration of water, the issuance of water permits, the determination of availability and need, transfers, and prohibited acts such as waste.

IV. EXAMPLES OF COUPLING SCIENCE, LEGAL AND ADMINISTRATIVE TOOLS FOR NEW MEXICO'S GROUNDWATER MANAGEMENT

Mimbres Basin

The Mimbres basin lies in the southwest New Mexico desert, west of Las Cruces and the Mesilla Basin. It is bordered on the north by the Gila Mountains and the Black Range and on the south by Mexico. In average water years, the Mimbres River flows perennially from the Gila Mountains down to near the Luna County line where it infiltrates into the ground and becomes a dry riverbed. The basin contains the municipalities of Silver City, Deming and Columbus which all rely on groundwater for their domestic supply. The area is part of the Basin and Range Province, which consists of high mountain ranges separated by deep basins filled with alluvium. The alluvium that contains the regional aquifer, is known as the Gila Group, which can be as much as 3,700 feet thick. Despite the thickness of the Gila Group, only the upper portion, which varies from around 300 feet to 1,000 feet, has good aquifer properties for water supply (Hawley et al., 2000). Some wells producing from the upper Gila Group have been able to pump over 1,000 gallons/minute.

The Mimbres is named for the Mimbres branch of the Mogollon people who thrived in Southwest New Mexico from 200 CE to 1450 (there are fourteen large Mimbres archaeological sites in the Mimbres Valley) (Pool, 2013). The Mimbres people cultivated irrigated agriculture including maize, beans, and squash, using specific water control features from the 10th through 12th centuries CE (Pool, 2013).

The Mimbres basin has been a center for agriculture for more than a century. A U.S. Department of Agriculture study found that the Rio Grande and Mimbres were the major centers of irrigation in New Mexico in 1886 (Clark, 1987). In 1901, plans were made to develop a reservoir and irrigation systems for 50,000 acres along the Mimbres. By 1911, the Rio Mimbres Irrigation Company had downscaled its plan to irrigate only 25,000 acres. The reservoir was never built, but by 1917 9,000 acres were being irrigated with groundwater wells (Clark, 1987). Pumping groundwater for irrigation began in the Mimbres Valley between 1908 and 1911. Beginning in 1912 there was a rapid expansion in groundwater development and by 1914 nearly 200 groundwater wells were installed or under construction, which covered a large area around and south of Deming (White, 1930). However, early operating costs exceeded crop returns, and the area was abandoned, leaving wells and farms behind. The decline in pumping activity occurred quickly, with only about twenty-five pumping plants left in operation by 1919. Around 1924 a revival in groundwater development began, and in 1930 there were 116 wells actively pumping (White, 1930). Between 1930 and 1960 irrigated acreage in the Mimbres increased from 7,600 acres to 35,000 acres (Clark, 1987).

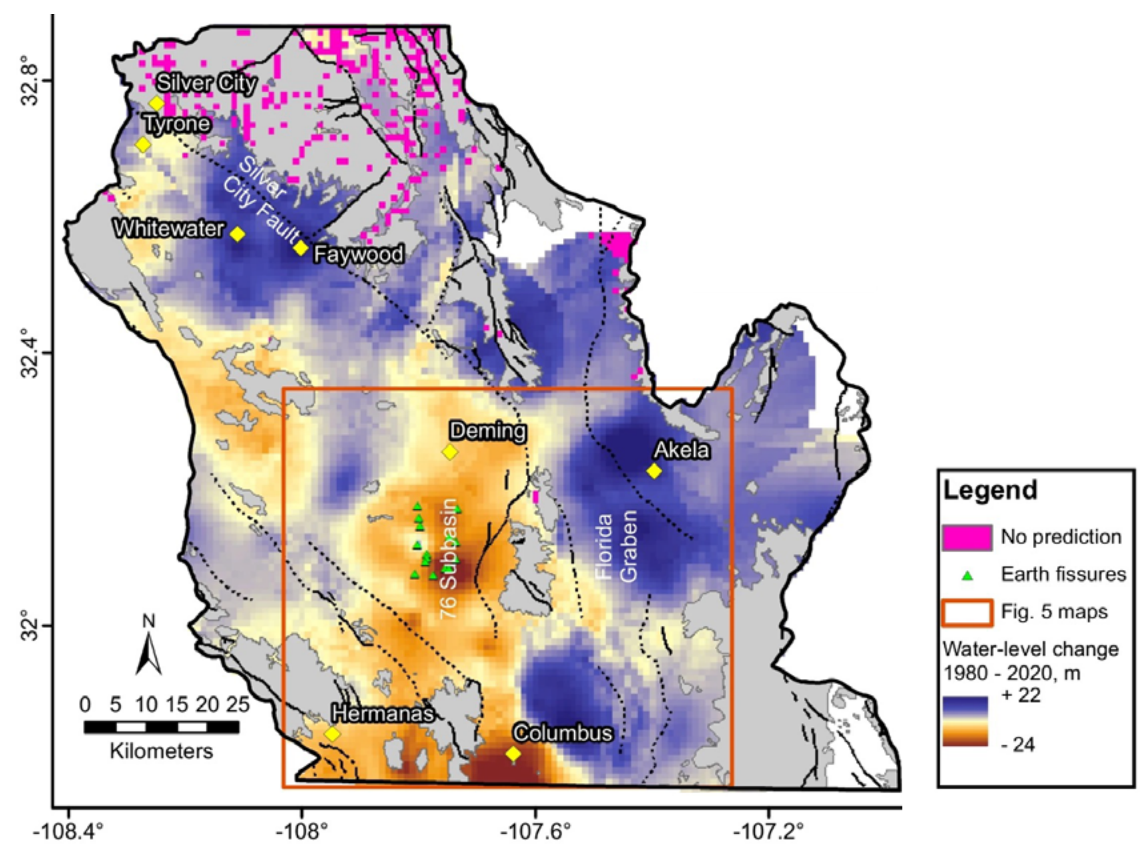
The estimated quantity of water stored in the Mimbres basin has been estimated by DBSA (2005) as approximately 45,000,000 acre-feet (Daniel B. Stephens and Assoc., 2005; INTERA, 2009). Yet, as much as much as 100,000 acre-feet of groundwater is pumped per year (ac-ft/yr) since 1980 (Daniel B. Stephens and Assoc., 2005). The annual recharge of this reservoir is relatively small compared to the use. Groundwater in the Mimbres is primarily recharged in the Gila Mountains and Black Range and from infiltration of surface water from the Mimbres River.[15] By 1930, after just the first 15 years of groundwater pumping in the basin, the water table declined 2 to 15 feet in different parts of the pumping districts, the average decline being about 6 feet (Finch & Melis, 2008; INTERA, 2009; Pool, 2013; Rawling, 2022). Today, the average rate of decline is around 1 foot per year with some wells declining over 2 feet per year.

Shortly after the passage of the 1931 statewide groundwater code, the State Engineer issued the first groundwater basin declaration in the Mimbres Basin. As groundwater levels declined, the State Engineer began closing portions of the Mimbres basin by 1945. See the table below for a summary of all State Engineer Orders in the Mimbres. This coincided with the State Engineer commissioning the first groundwater study of the Mimbres basin at the request of the Deming Chamber of Commerce.

FIGURE 20:

Groundwater Level Trends in the Mimbres Basin, Southwest Region (Rawling, 2022)

Net water-level change from 1980–2020. Pink areas are regions of sparse data in steep terrain where the trend surface plus kriging model predicts water levels above the ground surface, and thus is not valid. Uplands and mountains of lithified Cenozoic sedimentary rocks and older sedimentary, igneous, and metamorphic rocks, undivided, shown as gray overlay (Rawling, 2022).



15 Climate-change predictions indicate decreasing snowpack and increasing evaporative loss of snowpack resulting in decreasing recharge (Dunbar et al., 2022). This means that the rate of groundwater declines will increase over time if withdrawals continue at today's rates and other factors remain constant.

> “
> The valley should be developed to the safe limit of the available supply. It is recognized that overdevelopment would be fatal to the best interests of the community and that future expansion in pumping activities should be guided by as adequate information as it is possible to obtain concerning the extent of this resource” *(White, 1930)*

There is a special provision in the State Engineer's declaration of authority over the Mimbres Basin, which is intended to protect the deep artesian aquifer in some areas. In the specially designated areas, drillers are restricted from drilling below 200 feet though the driller may request permission from the NMOSE to drill deeper under some circumstances.

The Mimbres Basin adjudication began in 1970 and was completed in 1993 (Mimbres Valley Irrigation District v. Salopek, 2006). The Final Adjudication Decree determined all the groundwater rights in the basin, except for livestock and domestic uses. In 1982, the State Engineer issued Administrative Criteria for the review of water right applications in the southern portion of the Mimbres basin, known as the Deming-Columbus Administrative Area. The intent was to limit the annual rate of decline in the basin to 2.5 feet over the period of 1975 through 1994 (D. Gray, personal communication, August 4, 1982).

In 2005, the State Engineer issued an Order establishing the Upper Mimbres Water Master District (State Engineer Order 171, 2005). The State Engineer had a Water Master in place prior to the 2005 Order, but a local irrigation company had challenged the Water Master's authority in court in 2004 (Mimbres Valley Irrigation District v. Salopek, 2006). The State Engineer delegated their authority to its local Water Master to appropriate, regulate and control both surface and groundwater. The Water Master is specifically charged with:

- Curtailing illegal diversions
- Measuring and reporting water usage
- Curtailing out-of-priority diversions that are determined by the State Engineer to cause injury to senior diverters
- Administering agreements between water users

The Water Masters salary and expenses are paid by the water users, based on the amount of water they use, through the Grant County Commission, unless otherwise funded by the State Legislature.

In 2006, the State Engineer issued an order providing guidance on priority administration in the Upper Mimbres Basin (State Engineer Order 177, 2006). During a priority administration all out of priority uses shall be limited to essential indoor uses (drinking, cooking, indoor cleaning, sanitary, and cooling). Out of priority livestock use shall be limited to "relatively small amounts of water required for essential livestock watering". Furthermore, the 2006 Order clarified that the State Engineer will approve alternative administration plans developed by water users, if those plans do not impair water users who are not participating in the plan. This Order also provides for objections to, review of, and appeal of Water Master decisions. Additionally in 2006, the State Engineer expanded the Upper Mimbres Water Master District to include the entire Mimbres Stream System (State Engineer Order 181, 2008).

In 2011, the State Engineer issued new Administrative Criteria for the Deming-Columbus Administrative Area (Guidelines for the Deming-Columbus Administrative Area for Review of Water Rights Applications, 2011), which utilizes a 40-year planning period through 2050. The allowable drawdown rate under this Criteria is 2.5 feet per year, for a total of 100 feet by

2050. Furthermore, the areas expected to exceed 2.5 feet of drawdown per year, were designated Critical Management Areas (CMA). New water usage in these Critical Management Areas may not increase drawdown by more than 0.1 feet per year (limiting the total allowable drawdown in the CMA to 2.6 feet per year).

Today, the area from Deming down to Columbus in Luna County contains a significant amount of irrigated agriculture, all reliant on groundwater. Crops include Chile, hay, pecans and wine. In the areas of the most abundant groundwater pumping for irrigation, from Deming to Columbus, water levels have declined up to 24 m and cones of depression have expanded greatly. In other areas, water levels have risen, presumably as a result of declining irrigation resulting in the flattening of cones of depression (Rawling, 2022). Water-level declines have occurred in concert with declining regional precipitation over the past 10 years near Whitewater and Faywood, both identified as areas of groundwater recharge in previous studies (Rawling, 2022). However, in the 2020 Water Use by Categories Report the State Engineer estimated that only 58,851 acre-feet of groundwater was diverted to irrigate 16,800 acres of farmland (Valdez et al., 2024). These discrepancies point to the need for improved monitoring and management of groundwater.

TABLE 5:

State Engineer Orders in the Mimbres Basin (Index of State Engineer Orders, 2023)

Order No.	Date	Basin	Purpose
1	7/29/1931	Mimbres	Establish Basin (1)
12	4/13/1942	Mimbres	Extends Basin (Red Mountain Extension)
11	4/7/1942	Mimbres	Extends Basin (Eastern Extension or Franklin Area)
14	4/20/1945	Mimbres	Closes Basin & 1942 Extensions - Rescinded by Order 192
27	4/26/1950	Mimbres	Reopens Red Mountain, Columbus, & Eastern Extension Areas - Order 192 rescinded 12/21/21
37	1/9/1953	Mimbres	Closes Columbus Area - Order 192 rescinded 12/21/21
46	8/9/1954	Mimbres	Restricted Drilling Depths in Eastern Extension (Franklin area) * Also Order from hearing 1951
53	1/4/1956	Mimbres	Closes Eastern Extension (Franklin area) Order 192 rescinded 12/21/21
54	1/4/1956	Mimbres	Closes Western Extension (Red Mountain Area) Order 192 rescinded 12/21/21
58	2/23/1956	Mimbres	Extends Basin & Closes Extension - Order 192 partially rescinded 12/21/21
78	7/31/1959	Mimbres	Reopens Franklin Area - rescinded by Order 192 12/21/21
80	6/3/1960	Mimbres	Extends Basin
107	2/24/1969	Mimbres	Extends Basin
110	2/3/1970	Mimbres	Extends Basin
116	6/16/1972	Mimbres	Extends Basin
171	12/16/2005	Upper Mimbres	Creation of the Upper Mimbres Water Master District and Appointment of the Water Master
177	7/25/2006	Mimbres	Domestic Well on the Upper Mimbres Watermaster
181	9/26/2008	Mimbres	Expansion of the Upper Mimbres Water Master District
184	6/12/2013	Mimbres	Metering Surface Water Diversions in the Mimbres Water Master
185	3/26/2014	Mimbres	Penalty Assessment order for Mimbres non-compliance with Order 184
192	12/21/2021	Mimbres	Rescinding Orders 14, 27, 37, 53, 54, 58, and 78 which closed areas to new 72-12-3 appropriations as these are replaced by the administrative guidelines

Albuquerque Subregion

The Albuquerque Subregion lies within the Middle Rio Grande Groundwater Region along the Rio Grande rift and includes the Albuquerque geologic basin. The subregion extends from the Sandia and Manzano mountains on the east to roughly Rio Puerco on the west, and from Cochiti Lake in the north to San Acacia to the south. The major surface water feature in the subregion is the Rio Grande River.

The subregion includes most of Bernalillo and Valencia counties, and portions of Sandoval, Santa Fe, Torrance, and Socorro counties. It is the most populous area of the state, and includes the municipalities of Albuquerque, Rio Rancho, Los Lunas, and Belen.

The largest water utility in the state, the Albuquerque Bernalillo County Water Utility Authority (ABCWUA) provides water to the greater Albuquerque metropolitan area, which includes about 650,000 water users (ABCWUA, 2023). ABCWUA was created and assumed management of the water system from the City of Albuquerque and Bernalillo County in the mid-2000s. Before that, the City and County used only groundwater, producing about 40,000 acre-feet in 1970, peaking around 125,000 acre-feet in the 1990s, and reduced through conservation programs in the early 2000s. Since the creation of ABCWUA, a surface water treatment plant was built and began operation in 2008, providing treated surface water imported from the San Juan River system to reduce the utility's reliance on groundwater. Surface water availability for ABCWUA is affected by conditions in the Colorado River basin, and shortages are made up with groundwater. In recent years, the Authority's groundwater diversion has ranged from 76,000 acre-feet in 2021 to 41,000 acre-feet in 2020 (ABCWUA, 2023) due in large part to variations in surface water supply. There are several smaller community systems in the subregion reliant on groundwater, and many unmetered individual domestic wells.

The Albuquerque Subregion also includes a large portion of the Middle Rio Grande Conservancy District (MRGCD), which provides flood control, drainage, and surface water for irrigation. While MRGCD manages primarily surface water, its conveyance, delivery and drainage of irrigation water are important hydrologic components in the groundwater budget of the region. Some irrigators within MRGCD use supplemental groundwater for irrigation, but metering and reporting of well diversions are not systematic.

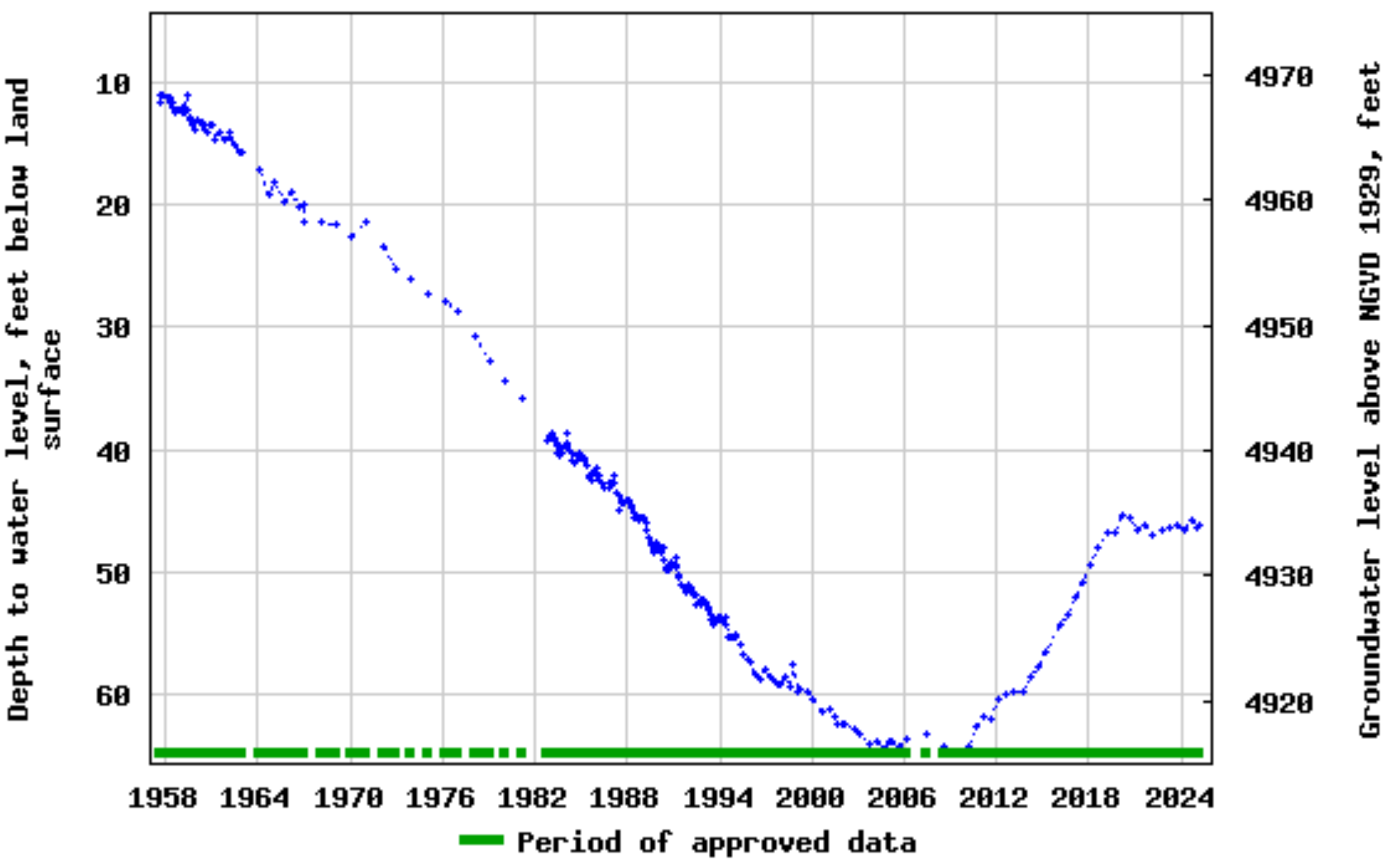
The Albuquerque Subregion lies within the Rio Grande rift valley, a zone of faults and basins stretching from Mexico north into Colorado. The Santa Fe Group aquifer system is the principal source of water supply in the Albuquerque Basin, and is made up of poorly-cemented sands and gravels of the Tertiary-Quaternary Santa Fe Group and overlying alluvial deposits associated with the Rio Grande and its tributaries (Thorn et al., 1993). Basin-fill deposits derived from mountain ranges, windblown sand, volcanic deposits, and river-borne sediment are collectively known as the Cenozoic Santa Fe Group, ranging from about 1,400 feet thick at the basin margins to approximately 14,000 feet thick in the deepest parts of the basin (Thorn et al., 1993). The Santa Fe Group aquifer system is divided into three parts: the upper (less than 1,000 to 1,500 feet thick), middle (250 to 9,000 feet thick), and lower (less than 1,000 to 3,500 feet thick). In places, the upper and/or middle parts have eroded away. Much of the lower part may have low permeability and poor water chemistry; therefore, groundwater is primarily withdrawn from the upper 2,000 feet of the aquifer. The most productive aquifer zones are channel deposits of the ancestral Rio Grande (Hilton, 2026). Several other aquifer systems provide an important supply for smaller systems and individuals, but by far most of the groundwater use is from the Santa Fe Group.

In the Albuquerque subregion, the main sources of aquifer recharge are mountain front recharge, river seepage, and canal seepage and on-farm deep percolation in the inner valley from the irrigation system operated by MRGCD (ABCWUA, 2023; Hilton, 2026; USGS, 1995). Subsurface drainage is used to control the water table, returning excess groundwater to the river. When groundwater levels decline, drain flows decrease, adversely affecting the downstream surface water flow.

For many years, Albuquerque was considered to have a virtually inexhaustible supply of groundwater, called an "underground Lake Superior." A 1993 report by the US Geological Survey, prepared in cooperation with the City of Albuquerque's Water Utility Division (Thorn et al., 1993), made clear that groundwater withdrawals were far exceeding recharge rates, resulting in rapid and widespread aquifer decline. This revelation served as motivation for water conservation measures for municipal groundwater users and the formation of ABCWUA, slowing the level of decline in the late 1990s and early 2000s. A period of recovery coincides with the start-up of ABCWUA's surface water treatment plant and subsequent reduction of reliance on groundwater for the Albuquerque area's water supply. Most monitoring wells show a leveling off of the recovery around 2020. The Figure below shows the steady decline of Albuquerque City Well #2, which has a relatively long period of record (USGS, 2025).

FIGURE 21:

Groundwater Level History at Albuquerque City Well #2 (USGS, 2025)



“

[Curry County continues to] see declines in our groundwater, even though the work we're doing is slowing down the mining of the aquifer.... I think it's essential that New Mexico as a whole state understands groundwater is finite. It is not a replenishing resource.”

Ladona Clayton
Executive Director, Ogallala Land & Water Conservancy

Southern High Plains Aquifer

The Southern High Plains Aquifer (SHPA) is part of the larger Ogallala Formation (Aquifer), which is the largest aquifer in the United States, covering portions of New Mexico, Colorado, Kansas, Nebraska, Oklahoma, South Dakota, Texas, and Wyoming. In New Mexico, SHPA provides groundwater for Lea, Roosevelt, Curry, and southern Quay counties (and adjoining areas in Texas). This region of New Mexico has no perennial surface water, which leaves these counties totally dependent on groundwater for agricultural irrigation, and municipal water supply for Clovis, Portales, Hobbs, Lovington, Eunice, and Cannon AFB.

The SHPA consists of fine to coarse grained sand, gravel, clay, and silt which readily produces reasonably good quality water pumped from wells. Starting In the 1940s and 1950s, intensive irrigated agriculture served by the SHPA, expanded in the Clovis/Portales areas and around Hobbs. However, the recharge in the SHPA is limited and groundwater pumping grossly exceeded recharge rates as early as the late 1940s. This has led to significant and unsustainable groundwater level declines in the Clovis/Portales areas, largely due the amount of groundwater diversion for irrigated agriculture. The Office of the State Engineer decided to “manage” the aquifer for a 40-year life, verses limiting the amount of groundwater production. The SHPA area wasn't closed to new groundwater appropriations until 2009.

In the early 1960s the Ute Reservoir on the Canadian River was constructed to diversify the water supply, due to the declines in the aquifer. The reservoir is located 64 miles north of Clovis and is intended to supply drinking water for the Clovis/Portales area. In 2001, the Eastern New Mexico Rural Water Authority (ENMRWA) was formed in response to the alarming declines in the SHPA. ENMRWA is responsible for the oversight of the funding and development of a system to deliver water from Ute Reservoir to Curry and Roosevelt counties, serving Clovis, Cannon AFB, Portales, Elida, and Texico. The project includes raw water intake, 130 miles of pipeline, pump stations, and a surface water treatment plant for 28 million gallons per day. The cost of the project was estimated at approximately $500 million (2001) but is likely to cost over $1 billion of state and federal funds (yet to be fully secured). None of this project water will be used for irrigated agriculture, so irrigation in the region will necessarily have to be dramatically reduced over time, likely requiring that much of the region return to dryland agricultural practices.

In 2009, the SHPA in Lea County was closed to new appropriations, due to steady water level declines since at least the 1950s. Similar to Clovis/Portales area, there is no surface water in Lea County and continued mining of the aquifer will inevitably lead to fully depleting the aquifer. As water levels decline, deeper groundwater sources within the Santa Rosa Formation, become the only alternative source for Lea County. However, deeper groundwater is much lower quality than the water within the SHPA and will likely require additional treatment to make it potable. In addition, these deeper aquifers do not produce water as readily as the SHPA.

“

Living in Eastern New Mexico, I have come to appreciate the vast open spaces, the quiet beauty of the land, and most importantly, the deep connection between our communities, our livelihoods, and our water. My family has been farming here since 1917 and over generations, we have watched the Ogallala Aquifer decline. When my grandfather started farming, no one worried about water running out. Today, we know better. Water is the lifeblood of our region. Without it, there is no agriculture, no cattle, and no future for our way of life. The Ogallala has been our main water source, but its levels continue to decline. We pump water from over 450 feet deep, and every year more wells dry up. The reality is clear: if we do not take steps to conserve and protect our water sources, we risk losing everything. That is why we made the difficult decision to participate in a conservation partnership, agreeing to convert our irrigated land to dryland to preserve water. It was not easy. Farmers are deeply connected to the land, and irrigation has always been an essential part of our operations. But we saw the reality — if we continued to pump at the same rate, the water would disappear, and our land would no longer sustain us. This decision ensures that we can continue to live and work here, that our cattle have enough water, and that future generations can carry on our way of life. For us, it was the right thing to do.”[16]

Ricky Lockmiller, Farmer, Curry County [17]

16 News, The Eastern New Mexico. “Letter to the Editor - Feb. 26.” The Eastern New Mexico News. Feb 26, 2025 Accessed.

17 Ricky Lockmiller, Curry County, New Mexico. Fourth-Generation Farmer and Conservation Participant, Lockmiller’s family has farmed the plains of Curry County since 1917 and he’s part of a new generation of agricultural leaders confronting the depletion of the Ogallala Aquifer. Faced with hard truths about pumping limits, Ricky made the choice to transition to dryland farming through a voluntary groundwater conservation partnership - ensuring that the next generation can stay rooted in place. His voice reflects both the gravity and hope of water stewardship on the High Plains.

V. LOCALIZED GROUNDWATER MANAGEMENT IN NEW MEXICO

As noted earlier in this report, New Mexico's vast geography includes a broad variation of aquifers and the groundwater supplies (quantities) and conditions (qualities) they produce. Some basins across the state have faced detrimental water level declines due to over pumping, which have led to proactive and effective responses to groundwater management. The overviews of localized groundwater management included below provide examples for a solely groundwater dependent area of the SHPA and Sangre de Cristo Foothills and for conjunctive management of surface and groundwater in the Pecos Valley and Lower Rio Grande. The overviews provided below were provided by local groundwater and land managers that were involved in innovating and developing solutions for localized groundwater deficits. While not an exhaustive list of localized groundwater management in the state, these examples demonstrate the important components of effective groundwater management that are considered to meet sustainability goals with effective measures.

A Community-Driven Model for Groundwater Conservation in the Southern High Plains

Written by: Ladona Clayton

Executive Director, The Ogallala Land & Water Conservancy (OLWC), Curry County, New Mexico

The Ogallala Land & Water Conservancy (OLWC), based in Clovis, Curry County, New Mexico, is spearheading one of the state's most urgent and innovative responses to the rapid depletion of the Ogallala Aquifer, a finite and sole-source supply. The mission of the OLWC is to conserve the agricultural land and groundwater of the Ogallala Aquifer paleochannels in Curry County by forever protecting, preserving, and stewarding these natural resources for vistas, recreation, wildlife, and non-irrigated agricultural use to enhance quality of life for Cannon Air Force Base, Curry County, and the City of Clovis. The OLWC was formed to respond to declines in groundwater levels in the town of Clovis resulting in wells drying up and projections that Clovis would be without water by 2030 if nothing was done. OLWC partners with agricultural producers to conserve groundwater, ensure long-term water security for Cannon Air Force Base (CAFB), and support the sustainability of rural communities.

Recognizing that irrigation farming uses 95% of the region's groundwater from this finite aquifer, OLWC developed a voluntary, incentive-based groundwater conservation model that addresses immediate threats while planning for long-term sustainability. Through voluntary participation, OLWC helps landowners retire irrigation wells and transition to dryland or regenerative land uses. Groundwater rights are placed under three-year Water Right Lease Agreements (WRLAs), followed by perpetual conservation easements. OLWC meters all wells, conducts rigorous crop budgets, and appraises groundwater based on actual production and financial loss from ceasing irrigation.

Core Strategies

Retirement of Irrigation Wells: OLWC works directly with agricultural producers to voluntarily retire irrigation wells drawing from the paleochannel, placing their water rights under renewable Water Right Lease Agreements (WRLAs) followed by permanent conservation easements.

Perpetual Conservation Easements: The conserved groundwater is held in place as a strategic reserve for CAFB and Curry County. Each easement secures 80% of the groundwater in place. The remaining 20% is retained by the landowner and may be sold to the local utility during extreme drought.

Appraised Water Value Using Actual Metering: OLWC meters water with ultrasonic wrap-around flow meters at each center pivot system. Appraised values are determined using a three-year crop budget, market-based income approach, and calculations of lost value from ceasing irrigation.

Land Use Transitions and Regenerative Agriculture: Participating landowners shift to dryland cropping, pastureland, or rotational grazing once their land is under easement. OLWC supports training and incentives for regenerative and multi-benefit land use practices.

Strategic Water Reserve for Cannon AFB and Community Resilience: Through its REPI partnership with the Department of Defense, OLWC ensures a regional water reserve that supports Cannon AFB through at least 2040, while also benefiting Curry County residents.

Results to Date

- 10,803.794 irrigated acres enrolled
- 12,846 acre-feet of groundwater conserved
- 7,964 gallons per minute (GPM) metered savings (4.19 billion gallons/year)
- 26,351 total acres in project area (irrigated and dryland)

Lessons Learned

- The OLWC model continues to evolve in response to legal, social, and hydrologic challenges. Its success depends not only on strategy and structure, but on humility, flexibility, and respect for the communities and producers who steward the land.
- Voluntary, incentive-based conservation works.
- Trust, respect, and fair compensation are foundational to landowner engagement.
- Include agricultural producers every step of the way. Their voices shape and sustain implementation. Cultivating long-term relationships with irrigation farmers is vital.
- Water Right Lease Agreements may fall through at the finish line.
- Legal or operational hurdles (e.g., unresolved estate issues) can prevent enrollment.
- Flexibility and support are essential.
- Be a risk-taker. Innovation requires courage.
- The OLWC model evolved through trial, error, and adaptation. Don't wait for perfect conditions — start and improve as you go.
- New Mexico's water law must evolve.
  - Existing statutes reward "beneficial use" through continued pumping—even in depleted areas. Meanwhile, drilling supplemental irrigation wells only accelerates decline.

- We need to remove water rights forfeiture from NM water law - stop penalizing farmers for not perfecting their water right
- We need to address the issue of dormant wells bordering protected aquifers, that see their well levels rise due to the sacrifice and work of neighbors to conserve groundwater, and who then turn the pump back on drawing down and erasing gains made. NM water law needs to be changed to prevent this from happening. Closing basins under current law does not address this problem.
- Current water laws make groundwater conservation difficult and overly complex - a "quagmire"

- Data and transparency build credibility.
- Metering and crop budgets create defensible appraisals and deepen trust with stakeholders.
- Multi-benefit land transitions sustain rural economies.
- Grazing, dryland cropping, and regenerative practices offer viable alternatives to irrigation.
- Inaction has a high price.
- Every year of continued irrigation in the paleochannel costs four years of future water availability.

The Pecos Valley Artesian Water Conservation District (Roswell-Artesian Basin), Chaves and Eddy Counties

Written by: Aron Balok

Superintendent, Pecos Valley Artesian Water Conservation District

The Pecos Valley, from Roswell to south of Artesia is home to the most dynamic, artesian, aquifer in the state. An artesian aquifer is under pressure, so when a well is drilled the water moves up toward the surface (without a pump). All artesian water is groundwater, but not all groundwater is artesian. The more the water rises up the well, the less energy is needed to lift (pump) the water to the surface. Porous, karst limestone allows water to move through the aquifer almost unrestricted and the surface connection allows the aquifer to benefit from rain events (recharge).

The artesian aquifer in the Pecos Valley was discovered in 1890, which forever changed the valley. High volume, free-flowing wells were drilled throughout the valley and by 1910, the aquifer began to decline as the artesian pressure subsided. Residents took action to protect the aquifer, and in 1912 the Roswell delegation lobbied the newly formed New Mexico legislature to pass a law forbidding waste, but it was inadequately enforced. In 1920, they returned to the Legislature, requesting $5,000 to be paid to the USGS for a hydrologic survey to better understand the system. Then in 1927, the Roswell delegation once again lobbied to pass legislation applying the prior appropriation doctrine to groundwater. The delegation argued that to manage the surface water, as the State Engineer is charged with doing, they must also manage the groundwater because the two are connected. In 1930, they re-wrote the legislation, and the concept of conjunctive management was born. That conjunctive management law applies the prior appropriation doctrine to groundwater, which was later copied by 13 of the 19 western states (west of the 98th meridian). That same year, the legislature passed a law granting the district court authority to create an artesian conservancy district. On September 8th, 1931, Judge Granville Richardson created the Pecos Valley Artesian Conservancy District (PVACD), whose mission was and still is, "to conserve the waters of the Pecos Valley".

The PVACD is run by a five-member, elected board of directors and operates as a political subdivision of the state of New Mexico. The Board is elected by those who reside within the boundaries of the district and pay the taxes that fund the district. The district offers low interest water conservation loans, plugs abandoned wells free of charge, and continues to ensure that wells with a water right are metered. The district is funded by an ad valorem tax and has taxing authority up to five mills.

In 1956, under threat of a lawsuit from the PVACD, the State Engineer began the water rights adjudication process. Ten years later, and a reduction of 12,000 acres of irrigated agriculture, the court issued its final partial decree and ordered the PVACD to install and maintain a meter at every point of diversion (well) that had a water right. The decree also ordered PVACD to pay the expenses of the water master who would be responsible for the accounting of water.

The next chapter for groundwater management in Pecos Valley stemmed from the 1988 Supreme Court ruling in favor of Texas, who sued New Mexico for violating the Pecos River Compact. The Court ordered New Mexico to pay $14 million and never again under-deliver on the Pecos River compact obligations to Texas. In 2003, PVACD signed the settlement agreement which created the roadmap to prevent under-delivery. PVACD has loaned over $20 million for water conservation projects and has spent nearly that amount to fund a water conservation program. A key component of the water conservation program included removing lands from agricultural production from Roswell to Carlsbad. Through its careful management, PVACD has helped reduce the chances of a priority call (senior water rights holders calling for priority water from junior water rights holders) from the Carlsbad Irrigation District (CID) downstream or from the state of Texas.

Lessons Learned

- The PVACD being established by the court gives the district legitimacy.
- The structure and oversight the PVACD provides creates the accountability necessary for people to choose to be more regulated and accept more restrictions on their water use, because they are confident that everyone will have to play by the same new rules.
- Creating the PVACD allowed for local level governance of groundwater and the funding mechanism to support the work to manage water conservation in the Pecos Valley. This is the #1 reason that the district (PVACD) works.
- The district is funded locally and is not dependent on the State or Federal government for funding.
- Groundwater Districts could be formed under existing New Mexico water law. The greatest challenge is getting residents to accept that change is coming (less water will be used) and they have a voice in how these changes happen. Not everyone loves the idea that their well will have a meter and that they are limited to how much water they can divert (pump).
- The Pecos Valley artesian aquifer is so unique that its value was recognized early. Other areas have taken their groundwater resource for granted and believed that they could not change the timeline of their aquifer, but diligent management of water use can change the longevity of the aquifer.

Lower Rio Grande Groundwater Conservation Program

Written by: Phil King

Principal Engineer, King Engineering & Associates, Inc.

The Lower Rio Grande (LRG) Groundwater Conservation Program (GCP) was prompted by the lawsuit between Texas, New Mexico and Colorado in the US Supreme Court, surrounding Rio Grande water delivery obligations under the 1939 Rio Grande Compact. The original case, No.141 Texas v. New Mexico and Colorado, began in 2013 when the state of Texas alleged groundwater pumping within New Mexico, depleted Rio Grande surface water, that was entitled to Texas (Texas v. New Mexico and Colorado, No. 141 Original, 2014). The issue had been brewing for decades. The United States intervened as a plaintiff due to impairment of the surface water supply within the federal Rio Grande Project (RGP) by groundwater pumping in New Mexico between Caballo Dam and the Texas state line.

New Mexico recognized the groundwater overuse problem in the LRG, and the GCP was developed to address the need to reduce groundwater consumption by temporarily and permanently retiring groundwater rights (NMOSE-ISC, 2025). About 80 percent of the groundwater use in the LRG is for irrigated agriculture. Acknowledging that farmers tend to have more flexibility in water use than municipalities providing drinking water, the primary goal of the GCP is to reduce groundwater depletions. The GCP implements a voluntary grant program designed to financially compensate farmers in the LRG to suspend the use of groundwater for irrigation for a one- to three-year period (NMOSE-ISC, 2025). For the LRG, this generally means the land enrolled in the program is fallowed.

The New Mexico Interstate Stream Commission (NMISC) began with a pilot program that ran from 2020 to 2023, which involved more than 70 grants, equating to 5,660 acres. Building on the pilot program's success, the GCP grew to 120 participants covering 6,191 acres in 2024-2025, and 2026-2028 will have about 8,350 acres in the program. Each participating farmer receives $750 per acre per year for one year enrollment, and up to $800 per acre per year for three-year enrollment (NMOSE-ISC, 2025).

During the implementation of the GCP, the Texas v. New Mexico supreme court trial and settlement talks were proceeding. The settlement agreement between parties was agreed to in 2025 and is pending approval by the Supreme Court. Key components of the settlement include:

- An index defining the annual delivery obligation to Texas based on the annual surface water release from Caballo Reservoir;
- The Upper Valley Diversion Ratio, which places a threshold on available Rio Grande Project surface water, is based on releases from Caballo Dam;
- A groundwater storage stability requirement, when the average release from Caballo Dam is above 400,000 acre-feet;
- The settlement requires New Mexico to reduce groundwater depletions in the LRG by 18,200 acre-feet within 10 years.

Assuming the Supreme Court accepts the settlement, New Mexico will be required to meet these new and specific obligations. This will necessitate the state to actively manage groundwater in the LRG far more aggressively that is has in the past. Fortunately, the LRG is a groundwater data-rich environment, as compared to many other basins in New Mexico.

The shallow groundwater levels in the Rincon and Mesilla valleys have been extensively and continuously monitored by the US Bureau of Reclamation (Bureau) and the Elephant Butte Irrigation District since the late 1940s (Conover, 1954). The NMOSE implemented a metering order in the LRG in the late 2000s, providing reliable groundwater withdrawal data for all major uses (NM OSE-ISC, n.d.). The LRG is also one of the most intensively modeled basins in the state (Hawley et al., 2000; Hawley & Kennedy, 2004; New Mexico Bureau of Geology & Mineral Resources, 2023), due in large part to its long history of water disputes. Still, in order to enter into and comply with the proposed 2025 Rio Grande settlement, New Mexico needs specific management strategies to control and reduce groundwater depletions in the LRG.

Both the immediate and mandatory effect of the LRG pilot program and the GCP is the reduction in groundwater depletions for the region, which also provide longer term benefits. The program has resulted in the development of institutional knowledge on how to organize and implement proactive reductions in groundwater depletions, provided hard data on costs, and increased awareness of and comfort with managed agricultural fallowing among the farming community. The GCP has been and continues to be foundational in achieving and implementing the Rio Grande settlement and resolving the current litigation.

Lessons Learned:

- The existing GCP provides a mechanism to manage temporary and permanent fallowing, which will be a valuable management tool in the future. Under the proposed settlement, New Mexico will also permanently retire groundwater rights for irrigation. The GCP provides a proven basis for accomplishing that requirement.
- The irrigated acreage coming out of production to achieve the depletion reduction requirement is significant, equating to about 10 percent of EBID's authorized acreage. The settlement requires that this be accomplished while maintaining the viability of irrigated agriculture in the LRG.
- A partnership was developed with the NM Department of Agriculture (NMDA) and NM State University (NMSU) to assist grantees in the program with additional funding and technical support for selecting and planting cover crops to protect soil health and prevent noxious weeds on fallowed land. This will be crucial as more irrigated land is fallowed to reduce groundwater depletion and prevent unwanted landscape outcomes.
- NMISC is working to address challenges in quantifying groundwater conservation as depletion reductions to achieve the specific settlement target and also to inform modeling and management to comply with ongoing state line Index[18], Upper Valley Diversion Ratio, and groundwater stability requirements.
- While fallowing-based groundwater conservation programs are not always politically or culturally popular, it remains an important tool in managing groundwater use in areas with significant irrigated agriculture.
- The GCP is tailored for the specific conditions and requirements of the LRG. However, it provides valuable lessons for groundwater management elsewhere in New Mexico.

18 Index Delivery is the sum of: (a) the annual flow at the El Paso Gage, after subtracting delivery to Mexico and Excess Flow, as defined in Exhibit A; and (b) the estimated Depletion of Project Supply, as defined in Exhibit A, caused by groundwater and surface water use in the Texas Mesilla, as determined using the methodology in Exhibit A (OPERATIONS SETTLEMENT AGREEMENT (Rio Grande Project Operations and Related Issues), 2025).

Cañada de Los Alamos Mutual Domestic Water Association (MDWA): Towards Water Security and Resiliency, Santa Fe County

Written by: Ramon Lucero

Regional Field Manager, RCAC

Cañada de Los Alamos is a small historic village in Santa Fe County, with a population of 487 people. The Cañada de Los Alamos Mutual Domestic Water Consumers and Mutual Sewage Works Association (MDWCA) was incorporated in 1957 under the 1949 New Mexico Sanitary Projects Act. MDWCA is one of approximately 650 public water systems in New Mexico, 88% of which serve populations under 500. MDWCA provides water to 68 people through 25 service connections. The village is in a hydrological area where wells are very susceptible to drought, water quality issues include high uranium, iron, and manganese levels, and low water productivity is an ongoing challenge. For decades, the MDWCA system has faced tremendous challenges including water quality issues and aging infrastructure.

Embedded in the southwestern U. S, which is suffering from an extended dry period, drought conditions pose an unprecedented threat to the community. Cañada de Los Alamos has tried to mitigate its drought vulnerability for years. In 1996, it secured funding to design and upgrade its delivery system and to install water meters. The association secured funding in 2003 to complete a geohydrology report and to design and construct a larger water storage tank and two water supply wells. The wells were installed to supplement water from an infiltration gallery, which was dug in 1959 and eventually went dry in July 2020. Unfortunately, the two deep wells have not solved the drought or single-source vulnerabilities. One of the new wells has uranium levels over safe drinking water standards and the second has issues with iron and has since been shut down due to contamination and malfunction. Furthermore, no other wells in the village produce enough water to serve more than one or two homes.

The MCWCA Board has been diligent and active in educating its members on its water crisis, proactive planning, and seeking funding for another local well and a future connection to Santa Fe County water. Yet, despite increased water rates to promote water conservation and adopting excellent conservation practices, it simply was not enough to ensure that the community had enough water to meet its drinking and sanitation needs. Over a 10-month period in 2021, Cañada de Los Alamos spent its entire financial reserves of $44,713 to purchase and haul water from Santa Fe County. The 25 member households were unable to sustain the $186 monthly cost to purchase and haul water from Santa Fe County or the $14,000 in annual operating expense. Unable to sustain this high cost, members went into arrears reaching an all-time high of over $8,500. Beyond the financial distress, the community's health, safety, and welfare was at stake, with the potential to be without water for drinking, hygiene, or cooking. Other efforts to find funding to address their water needs included a community adopted drought declaration which was submitted to Santa Fe County, Office of Emergency Management, the Department of Homeland Security-Office of Emergency Management, and the New Mexico Environment Department-Drinking Water Bureau in search of assistance. Unfortunately, all three agencies did not have the financial resources to address this environmental emergency.

Through the assistance from the Rural Community Assistance Corporation (RCAC), the MCWCA secured approximately $335,000 from the New Mexico Board of Finance to purchase and haul water from Santa Fe County. To mitigate their short-term water needs, the MDWCA secured $566,000 in emergency funding from USDA-Rural Development under their Emergency Community Water Assistance Grant to design and construct a supplemental shallow well. The well came online in 2025, running 24 hours a day, seven days a week at one (1) gallon per minute. Approximately $65,000 was secured from the New Mexico Department of Finance Administration to refurbish the original Infiltration Gallery, which has been dredged, tested, and has a new pump, to once again supplement their water needs. Although production is low in both wells, together they are meeting the community's immediate needs. To address their long-term needs, the MDWCA secured approximately $1,950,000 in funding from Capital Outlay Appropriations and the Water Trust Board for the design of a transmission line from Santa Fe County to Cañada de Los Alamos. Design is scheduled for completion in December 2025. Currently, the MDWCA is seeking funding for the construction of the transmission line.

Lessons Learned:

- Importance of establishing a secondary water source through a supplemental water supply well or emergency interconnection with a neighboring public water system.
- Collect and compile static water levels on a regular basis (monitoring) with the goal of understanding the aquifer characteristics through wet periods and drought cycles.
- Develop, maintain, and update a five-year revenue analysis including emergency reserves to ensure financial capacity to deal with infrastructure or environmental emergencies

> In June 2020, the small community water system well for Cañada de Los Alamos went dry. Nestled in the Sangre de Cristo foothills, this community's water is 100% dependent on the aquifer below. This wasn't the first drought-driven well failure that led to hauling water to address this emergency situation. For nearly a year, Cañada de Los Alamo relied on temporary funding to pay for this costly fix to provide safe drinking to all 25 households. Groundwater remains the only option for this community small water system and their experience underscores the vulnerability of small, rural groundwater-reliant systems across New Mexico.
>
> **Chita Gillis**[19]
>
> *Cañada de Los Alamos Mutual Domestic Water Consumers Association*
>
> *Secretary / Treasurer - Santa Fe Region*

19 Chita Gillis is a longtime community leader and volunteer water manager in the historic village of Cañada de Los Alamos, steering her small water system through drought-driven well failures, emergency water hauling, and complex funding negotiations to restore and secure drinking water for 24 households. Chita brings deep local insight and a steady voice of resilience from one of New Mexico's many rural communities.

VI. SHARED GROUNDWATER CHALLENGES AND MANAGEMENT APPROACHES ACROSS WESTERN STATES

New Mexico's aquifers and hydrogeology are unique and diverse, which make the groundwater challenges specific to the hydrologic, geologic, environmental, and cultural complexities of the state. However, many other western states also face groundwater scarcity and water quality challenges with similar trends of increasing aridification, aquifer depletion, fractured and outdated water governance structures, and communities struggling with capacity issues. From these commonalities, informative approaches have emerged across the West. It's important to highlight that no state has ideal groundwater management everywhere. In fact, significant areas of groundwater depletion and notable resulting water quantity and quality challenges continue to occur in practically every state across the western U.S. Yet, the tools and lessons referenced here have helped to address urgent challenges, and in many situations helped turn general depletion trends to balance. While each state has different geology, history, legal frameworks, and cultural nuances, many of the basic drivers and contributing factors related to groundwater depletion — and the accompanying remedy options — are similar. While there is no silver bullet, each management approach offers valuable insights that could be used to advance New Mexico's existing groundwater management tools into a more comprehensive statewide framework.

In this section, we summarize lessons learned from other western states and based on these lessons, identify five elements of proactive groundwater management. This framework is grounded in hydrologic systems thinking, field tested governance tools, and the lived experiences of communities.

The Five Pillars for Statewide Groundwater Management include:

1. **Science, Data, and Modeling -** to better understand conditions, enable informed decisions, build trust, and support planning.
2. **Governance & Investment -** to support locally-driven solutions with state alignment and support.
3. **Holistic Basin Management Goals -** to move beyond crisis response toward proactive management by defining desired future hydrologic conditions considering community, economic, and environmental values.
4. **Conjunctive, Integrated Management -** to reflect the reality of surface-groundwater connections and interconnected values across New Mexico's basins.
5. **Flexible, Adaptable Management Tools -** to support transitions in water use and adapt to declining supplies.

Each element is directly relevant to the groundwater challenges New Mexico faces and can be shaped to reflect the distinct landscapes, legal systems, and community values of the state. Accordingly, thoughtful consideration of where appropriate tools and lessons from other states might be adapted and deployed for New Mexico's unique legal, cultural, and physical setting is an important consideration to facilitate the rapid progress that New Mexico's groundwater challenge deserves.

The summary of tools below is condensed from a more thorough treatment of lessons from other states available at www.nmgroundwateralliance.org/otherregions.

FIGURE 22:

Five Pillars for Statewide Groundwater Management

1	2	3	4	5
Science, Data & Modeling	**Governance & Investment**	**Holistic Basin Management Goals**	**Toward Conjunctive, Integrated Management**	**Flexible, Adaptable Management Tools**
Building a foundation for decision-making	Supporting locally driven, state-supported management	Defining desired future hydrologic conditions considering community, economic, environmental values	Integrating surface and groundwater systems, and recognizing interconnected values	Incentives, markets, and enforcement mechanisms

1 Science, Data, and Modeling - Building a Foundation for Decision-Making

As discussed above, less than half of New Mexico has adequate monitoring to assess groundwater trends, and most groundwater withdrawals remain unmetered. Without robust data, decision-makers are left flying blind. As New Mexico expands metering orders and modeling tools, consistent investment in science must accompany policy advances - especially to address the "double whammy" of drought and climate-driven recharge losses. To manage water effectively, managers need accurate, timely, and comprehensive data.

Sustainable groundwater management begins with a shared understanding of hydrologic conditions, aquifer behavior, and the implications of current and future pumping. Across the West, states vary in the strength, scale, and integration of their data and modeling systems. Technical uncertainty, especially around groundwater-surface water interaction, can limit the enforceability of plans, slow permitting decisions, and reduce trust among stakeholders. By contrast, well-supported science and data systems offer a foundation for more transparent, durable, and adaptive decision-making.

- **Texas:** Provides one of the most comprehensive examples of state-supported groundwater modeling through its Groundwater Availability Models (GAMs), developed and maintained by the Texas Water Development Board (TWDB) (Puig-Williams & Rubenstein, 2023; TWDB, Groundwater Models Overview). These models include aquifer-specific information on recharge, geology, pumping, aquifer properties, and hydrologic features like rivers and springs. They are calibrated to historical groundwater levels and flows and made available to the state's Groundwater Conservation Districts (GCDs) and Groundwater Management Areas (GMAs) to support regional planning and permitting. TWDB's modeling capacity allows GMAs to explore management options and develop Desired Future Conditions (DFCs) and set long-term targets for aquifer levels or availability.

Takeaway for New Mexico: Texas's GAMs offer a compelling model for state-supported science and data that can be used by localized groundwater managers. In New Mexico, the aquifer mapping and efforts for metering that fall under the Water Data Act, can help shape localized water management in Critical Management Areas, by reducing the burden on local entities to administer these data needs and improving transparency.

- **Montana:** Requires well permit applicants to perform individualized hydrogeologic assessments in closed basins where surface water is over-appropriated and groundwater pumping may affect stream flows (Mont. Code Ann. §§ 85-2-360 to 362). Applicants in closed basins must analyze whether their proposed use will cause a "net depletion" to surface water, and if so, develop a mitigation plan. This effectively treats groundwater and surface water as one hydrologic system, with permitting tied directly to potential impacts on senior rights (Ziemer et al., 2006; Ziemer et al., 2010). Montana's decentralized approach places significant burdens on individual applicants. The state does not maintain baseline aquifer models or provide standardized tools to support these assessments, resulting in inconsistent methodologies, high transaction costs, and limited replicability. Moreover, enforcement capacity remains limited, and data collected for permitting often stays siloed within project files. This approach was formalized after litigation in the Smith River Basin, where the Montana Supreme Court halted groundwater permitting due to evidence of flow depletion and noncompliance with state law (Montana Trout Unlimited et al. v. DNRC, 2006 MT 72).

  Takeaway for New Mexico: Montana's net-depletion permitting approach shows the power of linking science to legal thresholds for new groundwater rights and illustrates the impact of switching the burden of proof for new groundwater pumping to show that proposed pumping would not harm surface flows. In New Mexico the burden is generally on an objector to proposed groundwater pumping, to demonstrate that their water rights would be impaired. In basins like the Mimbres or Upper Rio Grande, where surface water shortages and groundwater withdrawals are tightly linked, such permitting reforms could help protect senior rights and compact compliance.

- **California:** The Department of Water Resources (DWR) supports Groundwater Sustainability Agencies (GSAs) under the Sustainable Groundwater Management Act (SGMA) by providing model data packages, monitoring protocols, and technical assistance. While GSAs retain autonomy in crafting Groundwater Sustainability Plans (GSPs), DWR's centralized tools offer consistency and reduce barriers for smaller or under-resourced agencies (CA DWR Groundwater Models, 2024).

- **Oregon:** Groundwater management relies on regional designations (e.g., Groundwater Limited Areas, Critical Groundwater Areas), with the Oregon Water Resources Department (OWRD) conducting long-term monitoring and targeted studies to support basin planning. In the Harney Basin, enhanced monitoring and scenario modeling are used to guide locally led planning under state oversight (OWRD Admin Areas; Harney Basin Collaborative, 2020).

  Takeaway for New Mexico: Strong modeling and monitoring programs help bridge the gap between legal frameworks and on-the-ground implementation. Whether centralized

(Texas, California), permit-driven (Montana), or hybrid (Oregon), successful approaches invest in transparent data systems, baseline aquifer models, and institutional support for translating science into policy.

2 Governance and Investment – Supporting Locally Driven, State-Supported Management

New Mexico's experience with the PVACD, ABCWUA, and OLWC demonstrates that locally organized governance structures with dedicated funding and legal authority can achieve long-term groundwater conservation. However, many rural areas still lack technical or financial capacity and legal authority to create or sustain such institutions, especially in regions without adjudicated rights or clear state support. Groundwater governance in arid states increasingly reflects the need to balance local knowledge and authority with statewide consistency, legal accountability, and technical support. Many successful frameworks empower basin-scale planning and authority for management by local entities, while establishing clear pathways for the state to intervene when necessary. Long-term effectiveness depends not only on legal structure but on whether local institutions are sufficiently resourced to implement plans, adapt to change, and enforce regulations.

- **Nevada:** Using a tiered governance model that begins with local planning that is guided by a state-imposed backstop based on perennial yield thresholds, allows for a statewide framework with local control. The Nevada State Engineer may designate basins as Critical Management Areas (CMAs) when groundwater pumping exceeds the perennial yield. Once designated, local stakeholders have ten years to develop and adopt a Groundwater Management Plan (GMP). If they fail, the State Engineer is authorized to impose curtailments based on water rights priorities (Nev. Rev. Stat. § 534.110; Order No. 1302). This governance approach is designed to foster collaboration while ensuring enforceable outcomes. Diamond Valley's shares-based water allocation plan, which was created through local planning, was upheld by the Nevada Supreme Court in 2022. This ruling affirmed that innovative local solutions can satisfy legal standards when backed by a transparent process and state oversight (Diamond Nat. Res. Prot. & Conservation Ass'n v. Diamond Valley Ranch, LLC, 138 Nev., Adv. Op. 43 (2022)).

  Takeaway for New Mexico: Nevada's CMA model illustrates how state statutes can empower local stakeholders to craft plans - backed by state enforcement if local efforts fail. For example, this approach might potentially help formalize or scale efforts like OLWC's work in the Ogallala region or support community-driven planning in places like the Estancia or Tularosa basins.

- **Oregon:** The Oregon Water Resources Department designates areas as Groundwater Limited Areas, Withdrawn Areas, or Critical Groundwater Areas depending on data availability, aquifer status, and resource risk (OWRD, Admin Areas Overview). This groundwater governance system assigns different levels of regulatory oversight to basins based on the designated hydrologic conditions and resource stress. In addition to statewide classifications, Oregon also supports place-based planning, particularly in overdrawn basins like the Harney Basin, where groundwater levels have declined significantly. In the Harney Basin, a collaborative planning process involving landowners, conservation groups, and state agencies is exploring groundwater retirement, land use transitions, and monitoring improvements — demonstrating how state-local partnerships can shape adaptive basin-specific responses (Harney Basin Collaborative, 2020).

  Takeaway for New Mexico: This dual structure allows the state to deploy restrictions where necessary while enabling community-driven efforts that are responsive to regional priorities and socioeconomic realities.

- **California:** The 2014 Sustainable Groundwater Management Act (SGMA) created a framework for local control with built-in state enforcement, demonstrating the value of combining local responsibility with centralized technical assistance. Under SGMA, locally defined Groundwater Sustainability Agencies (GSAs) are responsible for developing and implementing Groundwater Sustainability Plans (GSPs) for each medium- and high-priority basin (Cal. Water Code §§ 10720–10738). GSAs were required to form by 2017 and submit GSPs by 2020 or 2022 depending on basin status. The Department of Water Resources provides technical support and evaluates GSPs, while the State Water Resources Control Board serves as the enforcement agency if plans are not developed, are deemed inadequate, or fail to be implemented. SGMA's structure incentivizes local planning and innovation while maintaining clear statutory timelines and consequences. The 25-year implementation window has slowed near-term results and allowed for some unintended consequences of continued groundwater development and aquifer drawdown, this governance model provides the autonomy and accountability for localized management of critical aquifers over time (Leahy, 9 Golden Gate U. Envtl. L.J. 5 (2015–16)).

  Takeaway for New Mexico: In New Mexico, a similar tiered approach where declared basins are required to develop sustainability strategies with OSE and ISC support could potentially create durable management frameworks rooted in local realities.

- **Texas:** Groundwater Conservation Districts (GCDs) are local political subdivisions created by the legislature or local petition. GCDs are authorized to regulate well spacing, permitting, and pumping volumes within their jurisdiction. They also participate in regional planning through Groundwater Management Areas (GMAs) and develop Desired Future Conditions for aquifers in coordination with other districts (Texas Water Code §§ 36.001 et seq.). While GCDs are empowered with rulemaking and enforcement authority, their capacity to manage effectively varies widely. Most have limited staff, rely on voter-approved property taxes for revenue, and operate with modest technical resources. Larger or wealthier districts may invest in detailed local models and monitoring, while smaller or rural GCDs may struggle to maintain compliance and long-term planning. Funding disparities have been identified as a core challenge in implementing aquifer-specific sustainability goals across the state (Puig-Williams & Rubenstein, 2023). The Texas model reflects strong local authority, but highlights how the absence of predictable, adequate funding can undermine policy implementation — even when statutory tools are available.

  Takeaway for New Mexico: Across different governance models, successful groundwater management hinges on clear roles, enforceable responsibilities, and sustained investment in local capacity. Flexible frameworks that empower regional solutions when paired with strong state oversight and support are more likely to achieve long-term sustainability. As in Texas, under-resourced communities, especially in New Mexico's vast rural spaces and in Indian Country, may need financial and technical support to meet policy and implementation goals.

3 Holistic Basin Management Goals - Defining Desired Future Hydrologic Conditions

Many basins in New Mexico are managed to slow the rate of decline, because the current demands on the aquifer outpace the rate of recharge. Without agreed-upon aquifer condition and management goals, decisions are often reactive and fragmented. A foundation step in active groundwater management is the articulation of basin-specific goals that reflect the physical limits of the resource, coupled with the values and priorities of local communities. These goals can take the form of thresholds for drawdown, aquifer storage, spring flow, or "safe yield," and should account for economic, environmental, and cultural uses of water. Setting these targets transparently — and aligning management actions accordingly — can help clarify regulatory intent, help communities make informed tradeoffs, guide investments, and build shared accountability

- **California:** Sustainable Groundwater Management Act (SGMA) (2014) mandates that all medium- and high-priority groundwater basins achieve sustainability by 2040 or 2042. The Groundwater Sustainability Plans that Groundwater Sustainability Agencies develop must define measurable objectives and avoid "undesirable results" across six categories:

  1. Chronic lowering of groundwater levels.
  2. Reduction in groundwater storage.
  3. Seawater intrusion.
  4. Degraded water quality.
  5. Land subsidence.
  6. Depletions of interconnected surface water.

  These goals must be tailored to local conditions, based on monitoring and stakeholder engagement, and submitted for review by the Department of Water Resources. Plans that fail to meet requirements may trigger state intervention by the State Water Resources Control Board (Cal. Water Code §§ 10720–10732).

  This structure creates a legally enforceable planning framework while giving GSAs the flexibility to choose which undesirable results are most relevant and how to manage them.

  Takeaway for New Mexico: SGMA's sustainability indicators provide a useful reference for New Mexico, especially in basins with risks of subsidence or facing challenges of interconnected surface water and groundwater use like the Middle and Lower Rio Grande. However, it is important to set sustainability indicators in any basin with groundwater overproduction concerns, including areas where brackish water intrusion is a potential concern, such as in the Estancia Basin or the Tularosa Basin. Tailoring sustainability goals around groundwater storage, stream depletion, or water quality thresholds could support more strategic basin-wide planning and investment.

- **Texas:** Groundwater planning in Texas is conducted through Groundwater Management Areas (GMAs), which are collections of Groundwater Conservation Districts (GCDs) organized by aquifer boundaries. Every five years, GMAs are required to adopt Desired Future Conditions (DFCs) for each aquifer in their area. Desired Future Conditions (DFCs) illustrate how legally mandated aquifer-level goals, even in a decentralized framework, can orient water planning toward specific, measurable targets. DFCs may include target water levels, allowable drawdown, or modeled availability over a specific time horizon. Texas law requires GMAs to consider a statutory list of nine factors when developing DFCs, including hydrologic conditions, existing water use, landowner rights, environmental impacts, and socioeconomic considerations (Texas Water Code § 36.108(d)). Once adopted, DFCs guide permitting and management decisions by individual GCDs, and the Texas Water Development Board (TWDB) translates them into Modeled Available Groundwater volumes for regulatory use. GCDs are also required to develop GCD-level management plans, which statutorily must address the following management goals, as applicable within a particular district (Texas Water Code § 36.1071):

  1. Providing the most efficient use of groundwater.
  2. Controlling and preventing waste of groundwater.
  3. Controlling and preventing subsidence.

4. Addressing conjunctive surface water management issues.
5. Addressing natural resource issues.
6. Addressing drought conditions.
7. Addressing conservation, recharge enhancement, rainwater harvesting, precipitation enhancement, or brush control, where appropriate and cost-effective.
8. Addressing the desired future conditions adopted by the district under Section 36.108.

Takeaway for New Mexico: This approach allows for regionally and locally tailored targets that reflect groundwater availability, recharge potential, and local priorities. For New Mexico, this type of structure could inform evolving the state's use of 40-year planning horizons for mined aquifers into enforceable management benchmarks - with metering, modeling, and stakeholder input.

- **Arizona:** Arizona established Active Management Areas (AMAs) under the 1980 Groundwater Management Act. Each AMA have their own long-term management goal, shaped by local hydrology and water demand trends. For example, the Phoenix AMA has a goal of safe yield by 2025 — balancing withdrawals with recharge over the long term. The Douglas AMA, added in 2022, allows continued reliance on groundwater under a managed depletion strategy, recognizing the limited recharge capacity of the region (Ariz. Rev. Stat. §§ 45-562(A), 45-531(12); ADWR AMA profiles). While these basin goals are legally defined and incorporated into management plans, enforcement has been uneven, and some AMAs have struggled to achieve meaningful reductions in pumping. Data quality and the limited regulatory reach of the Arizona Department of Water Resources have also posed barriers to effective implementation (EDF, 2018 Groundwater Case Study: Arizona).

4 Surface Water–Groundwater Integration and Flow-Based Management

The Rio Grande, Pecos, and Gila basins all function as single hydrologic systems. Yet legal separation of groundwater and surface water has led to overuse, litigation, and compact compliance risks. As seen in the Lower Rio Grande, drought drives increased groundwater use just when recharge is least available. Integrated management frameworks can ensure both systems are considered together.

In other arid regions where hydrologic connectivity drives ecological function and water supply reliability, some states have adopted regulatory frameworks that explicitly integrate surface and groundwater management. These models demonstrate how legal triggers, flow protections, and mitigation requirements can structure more responsive and enforceable systems — particularly in basins where pumping affects surface water rights, ecosystem flows, or compact obligations.

- **Montana:** offers a clear example of statutory linkage between groundwater permits and surface water impacts in closed basins. Following a period of drought and litigation over stream depletions in the Smith River, the Montana Supreme Court halted new groundwater permits in 2006. The legislature responded with House Bill 831 (2007), which created a permitting process requiring hydrogeologic assessments and mitigation plans in closed basins. Under this framework, new groundwater appropriations that cause "net depletions" to surface flows must be offset through measures such as retiring senior surface rights or implementing aquifer recharge projects (Mont. Code Ann. §§ 85-2-360 to 362; Montana Trout Unlimited v. DNRC, 2006 MT 72) (see also Ziemer et al., 27 Pub. Land & Res. L. Rev. 75 (2006)). In New Mexico's declared and fully appropriated basins, a similar approach could potentially be used to ensure new uses do not impair existing surface flows.

- **Nevada:** The State Engineer adopted flow-based triggers that link streamflow levels to curtailment actions in the Walker River Basin. When minimum flows at designated points in the river fall below target thresholds, groundwater pumping is curtailed based on priority, beginning with supplemental wells used to augment surface irrigation supplies. This system, upheld in litigation by the Nevada Supreme Court (Walker River Irr. Dist. v. State Eng'r, 473 P.3d 402 (Nev. 2020)), emphasizes protection of senior rights and environmental flows. The approach is supported by phased monitoring and adjustment, using hydrologic data to adapt curtailment schedules over time (Nev. State Engineer, 2018 Curtailment Order; Nev. Rev. Stat. § 533.370).

  Takeaway for New Mexico: Where the ISC already develops groundwater models to inform compact management, adopting similar flow-based curtailment systems could potentially add clarity and enforceability.

- **California:** An integrated model emerging from the Mojave River Adjudication (1996) (rather than statute) established a basin-wide watermaster framework that governs both surface and groundwater use. It incorporates phased reductions in groundwater use, mitigation requirements for flow and habitat impacts, and a production allowance system enabling water trading among users. These measures are backed by monitoring, imported water recharge, and coordination with wildlife agencies to manage the Mojave River as a connected system (Mojave Water Agency; Mojave River Adjudication Decree, Case No. 208568).

  Takeaway for New Mexico: These case studies illustrate regulatory approaches that center hydrologic connectivity in permitting and enforcement. In New Mexico basins where streamflow impacts from pumping are increasingly visible - such as the Upper Rio Grande, Gila, or Mimbres - similar tools may help structure more adaptive and accountable groundwater governance.

5 Flexible, Adaptable Management Tools - Incentives, Markets, and Enforcement Mechanisms

Many of New Mexico's most depleted basins - like the Ogallala in the High Plains or the Mimbres and Animas basins in the southwest - have little to no recharge and require proactive reductions in pumping. However, the current system incentivizes continued use, penalizes conservation, and lacks transitional tools for landowners. Flexibility mechanisms like voluntary retirement, well metering with adaptive caps, and incentive-based land-use transitions could potentially support communities facing unavoidable tradeoffs. Groundwater sustainability in other arid regions often depends not just on clear rules, but on the availability of tools that help users adapt to new limits. Flexibility is especially important in overdrawn basins where steep reductions in pumping may be needed to prevent aquifer collapse, legal non-compliance, or ecosystem harm. States have deployed a mix of incentives, market mechanisms, and enforceable curtailments to support transitions in groundwater use while maintaining economic viability and protecting senior rights.

- **California:** The Mojave Basin Adjudication (1996) established a production allowance system, allocating each user a "Base Annual Production" based on historical use, with phased reductions to align pumping with sustainable levels (Mojave River Adjudication Decree, Case No. 208568). Mojave Basin offers a leading example of a flexible management system that emerged from a court-supervised adjudication. Users can buy, sell, or lease unused production allowances, creating a water market that enables efficient redistribution of pumping rights as the basin transitions from agricultural to urban and environmental uses. The system is supported by recharge projects using imported water from the State Water Project, and overseen by a court-appointed Watermaster, the Mojave Water Agency (Mojave Water Agency, Watermaster History).

Takeaway for New Mexico: This integrated structure allows for flexibility while ensuring that total withdrawals remain within a defined cap. While unique in its legal origin, the Mojave Basin demonstrates how market-based tools, combined with strong oversight and investment in recharge, can facilitate long-term aquifer stabilization.

- **Nevada:** Nevada launched a Voluntary Water Rights Retirement Program, funded by $15 million in federal American Rescue Plan Act dollars. The program offers compensation — up to $800 per acre-foot — for landowners who permanently retire groundwater rights (Brocato, 2023; Solis, 2024). The program has been widely utilized in Diamond Valley, a Critical Management Area facing significant overuse issues. Another flexible tool utilized in Diamond Valley is a shares-based plan for reducing use combined with state-imposed backstops, which allows the community to retain local decision-making while ensuring enforceability.

  Takeaway for New Mexico: Deploying multiple strategies that pair voluntary incentives with mandatory enforcement in overdrawn basins. These models offer a relevant example for eastern New Mexico's mined basins in Curry and Roosevelt counties, where the OLWC is piloting a conservation easement and leasing approach — yet current water law remains a barrier.

- **Oregon:** State and federal partners have deployed a Drought Conservation Reserve Enhancement Program (Drought-CREP), a federal Farm Bill program deployed in partnership with states. Drought-CREP compensates landowners who retire irrigation and convert land to conservation uses for 15 years. Oregon negotiated enhancements to federal payment rates and its program allows conversion to non-irrigated pasture, giving producers flexibility while reducing pumping. Though not a permanent solution, CREP has become a key "bridge" element of the region's broader planning and water retirement strategy (OWRD CREP Handout, 2022; Harney Basin Collaborative, 2020). The program was used in the Harney Basin, and provides an example of incentive-driven land transition tied to aquifer protection.

  Takeaway for New Mexico: Similar approach to the PVACD's historic land retirement efforts in the Pecos Valley, without the looping curtailment call from downstream senior water rights holders.

- **Colorado:** The Colorado State Engineer imposed mandatory curtailments of post-1975 junior wells in the Republican River Basin, in response to noncompliance with the interstate Republican River Compact (Colo. Div. of Water Res., 2020 Curtailment Order). To soften the economic impact, the Republican River Water Conservation District has offered voluntary well retirement programs, and the state constructed a pipeline augmentation project to deliver offset flows to Kansas.

  Takeaway for New Mexico: While these tools have not fully eliminated compliance risk, they reflect an approach that combines hard legal obligations with mitigation investments. Colorado's use of priority-based shutoffs, paired with compensation mechanisms, underscores the importance of clear enforcement structures backed by technical modeling and legal authority.

Across these states, flexibility in groundwater management is achieved not through deregulation, but through the strategic use of tools that support adaptation and compliance. Incentive programs (like CREP or ARPA-funded buybacks), trading systems, recharge infrastructure, and phased curtailments allow water users to navigate economic transitions while meeting legal obligations and sustainability goals.

VI. RECOMMENDATIONS FOR ADVANCING PROACTIVE STATEWIDE GROUNDWATER MANAGEMENT IN NEW MEXICO

New Mexico has long faced complex water challenges with resilience, innovation, and adaptation — all proficiencies that can be applied to advancing comprehensive statewide groundwater management. This report elevates the fundamental importance of groundwater to sustain the state's diverse cultural heritage, tribal lands, and expanse of majestic landscapes and natural environments. Eighty-seven percent (87%) of New Mexico's public water supply (domestic uses) and 50% of irrigated agriculture rely on groundwater. This precious, unseen, and finite resource, with limited replenishment, underpins New Mexico's urban, rural, and unincorporated areas; critical infrastructure; and key economies. This report provides a multidisciplinary compilation of what is known and unknown about New Mexico's groundwater resources and a depiction of groundwater use and conditions of monitored aquifers. In addition, this document provides a history of groundwater management tools that have been developed over time to address pressing groundwater circumstances or challenges — some legislative, some regulatory, and some community led or basin-specific. Many of these tools have been effective in the locations they are implemented. However, there are areas of the state that are currently facing persistent aquifer declines, resulting in hard choices about how to support life, community, and the economy with less water. Examples and stories embedded throughout this report illuminate the inequities and variability in the capacity to respond to these sometimes severe, water scarcity challenges

New Mexico has addressed groundwater concerns in a variety of ways that have proven effective for isolated areas or basins. Proactive efforts such as aquifer mapping, implementing metering requirements, and monitoring with specific objectives (in some cases to avoid interstate river compact violations), have provided a solid foundation for advancing statewide groundwater management. These activities highlight significant gaps and inconsistencies in reliable groundwater data, underscore the urgent need for broader metering and monitoring, and where data is available, reveal serious concern in multiple critical basins. Given the compounding effects of rising temperatures, persistent drought, and growing water demands, near-term, collaborative action is essential to develop a cohesive, statewide groundwater management framework — one capable of preventing severe impacts and potential crises in groundwater-dependent areas.

This section offers a portfolio of key takeaways as a starting point for co-creating a statewide groundwater management framework for New Mexico. The findings in this report highlight the need for groundwater management that includes well-defined objectives, reliable groundwater data (including aquifer conditions, metering, and monitoring) and flexibility to tailor management to the distinct needs of local basins and communities. These foundational components — when combined with strategic use of legal and regulatory tools, both existing in New Mexico and drawn from applicable examples across the West — can help address current gaps in data, law, regulation, funding, and institutional capacity. This report is an open invitation to build upon these findings and advance the urgently needed work of integrating groundwater management into the foundation of New Mexico's long-term water resilience.

Recommendations to Address New Mexico's Groundwater Challenges and Create Future Resilience:

- **Treat Aquifers as Critical Infrastructure:** Manage, monitor, and maintain aquifers with same diligence as surface water infrastructure — supported with State resources, including education to raise awareness about the importance of groundwater to New Mexico's water security.
- **Accelerate Aquifer Mapping, Monitoring, and Characterization:** As part of a multiyear effort, fund the New Mexico Bureau of Geology and Mineral Resources' (NMBGMR) budget requests for the Aquifer Mapping Program to develop descriptive models of groundwater flow in important aquifers around the state and develop a comprehensive, statewide groundwater monitoring network. These aquifer studies provide essential basin level information — such as quantity and quality of groundwater resources — for management of groundwater and targeted strategies to address groundwater declines (water reuse, conservation, and managed recharge). The request also supports a gap in funding for the Water Data Act, aimed to help state agencies share, integrate, and better manage water data using 21st century technologies.
- **Expand Statewide Groundwater Metering:** Execute metering of all groundwater diversions, starting with at-risk areas where water tables are dropping rapidly. Metering is essential to monitoring groundwater use, ensuring groundwater is not overused and understanding the rate of aquifer declines. Metering data improves accounting and modeling to inform local management decisions. Metering has proven instrumental and essential to manage water allotments and avoid priority calls on stream-connected basins, while facilitating a trading program to reach groundwater management goals.
- **Develop a Statewide Groundwater Management Framework to Guide Local Management:** Provide guidance and support for monitoring aquifer conditions and a proactive approach for reaching desired future groundwater conditions, based on local circumstances, needs, and goals. Provide a low barrier pathway and necessary technical assistance to establish local groundwater management authorities, adapted from successful examples of community-based groundwater management elsewhere in New Mexico, that includes sustainable financing for these authorities.
- **Enable Meaningful Engagement with Tribes, Pueblos, and Nations in Groundwater Policy and Management:** Work in partnership with the New Mexico Indian Affairs Department to develop guidance for consultation with the 23 Tribes, Pueblos, and Nations of New Mexico, in a manner that respects their sovereign rights to control access to their knowledge and data on groundwater, to grant or withhold permission to share that information, and to dictate terms of partnerships in the development of a statewide groundwater management framework.
- **Support Community-Driven Groundwater Planning and Conservation with Robust Data and Tools:** Support and create pathways for local involvement and representation of all interests in groundwater management and decision-making. Provide a groundwater conservation toolkit for locally relevant incentive-based conservation that builds upon New Mexico-specific strategies. Tools for reducing groundwater pumping in regions with declining aquifer conditions should include: conjunctive management of groundwater and surface water, community-driven groundwater management based on aquifer conditions, water banks, rotational agricultural water conservation or voluntary fallowing, among others.

- **Ensure that Groundwater is Fully Understood and Addressed in Regional Water Planning and other Community-Based Conservation Initiatives:** Provide information to water managers, policy makers, and stakeholders about aquifer status and trends. Support the Water Security Planning Act implementation with informed engagement about groundwater conservation tools in community water planning efforts, Water Trust Fund proposals, Infrastructure Capital Improvement Plans, and Capital Outlay requests.
- **Transparent Community Engagement and Education to Address Groundwater Concerns:** Support for public outreach and education about groundwater conditions and forums to ensure local involvement and representation of all interests in groundwater management and decision-making. Support locally derived groundwater management objectives, implement monitoring programs, or take other actions under unique circumstances. This is a key element of a statewide groundwater management framework that promotes the possibility of local management across the state's groundwater basins. Proactive community engagement helps create opportunities for partnerships and ensure accountability for achieving water security goals.
- **Expand Use of Evapotranspiration (ET) Data:** Evapotranspiration is the movement of water from the land and vegetated surfaces to the atmosphere via evaporation and plant transpiration, which is the consumptive use of vegetation. This data provides place-based values of approximate historical and current consumptive use by different land cover types and irrigated crops. OpenET platform provides easily accessible, transparently documented, and consistent source of ET from satellite data to inform groundwater management of water use, and recharge to strengthens groundwater modeling and water budgeting tools.
- **Control/Limit New Groundwater Permits and Pumping:** As an immediate measure, the NMOSE/ISC can implement priority region declarations to slow aquifer declines in priority areas. Additionally, until aquifer conditions are better understood from the NMBGMR mapping and monitoring programs, limit new groundwater pumping (including domestic wells) by requiring permittee to substantiate (prove) water rights and longevity and viability of the aquifer to withstand the new proposed use (example: Aquifer conditions withstand 200 years of use) without impact or injury to other existing water users before approval. These approaches will pause groundwater demands and share the burden of the NM Office of the State Engineer, with the applicant to prove viability of water source, before new uses are approved. Additionally, all newly approved permits should require meters and groundwater use reporting as part of an expanded aquifer condition network.
- **Provide Guidance for Conjunctive Management:** For aquifers that are interconnected with rivers, conjunctive management and thorough basin categorization can help establish tailored management objectives that align with surface water compacts and obligations on in connected basins. This can include permitting reforms to better protect surface flows and senior rights.
- **Support and Expand Water Quality Monitoring:** Groundwater quality limits the usability of groundwater resources and there are significant gaps in water quality knowledge, both within the aquifers and of possible contaminant sources that may infiltrate into shallow aquifers. Whether brackish or fresh, naturally occurring or human-introduced contaminants, more understanding of an aquifer's water quality is necessary to assess the viability of the source water for different uses and to determine investments in treatments such as desalination. Continued support for the New Mexico Environment Department's monitoring of water quality and support for communities to meet water quality standards for municipal supplies is essential and may require legislation and rulemaking to meet water quality standards.

REFERENCES

1. ABCWUA. (2023). Annual Comprehensive Financial Report for the Fiscal years Ended June 30 2023 and 2022. Albuquerque Bernalillo County Water Utility Authority. https://www.abcwua.org/wp-content/uploads/2023/12/FY23-ACFR_Final.pdf
2. Application of Brown, 65 N.M. 74 (New Mexico Supreme Court 1958).
3. Appropriation of Water, Article XVI N.M. Const. § Art. XVI, §2.
4. Aquifer Science v. Verhines, 527 P.3d 667 (New Mexico Court of Appeals 2022).
5. Benson, L., Petersen, K., & Stein, J. (2007). Anasazi (Pre-Columbian Native-American) Migrations During The Middle-12Th and Late-13th Centuries – Were they Drought Induced? Climatic Change, 83(1–2), 187–213. https://doi.org/10.1007/s10584-006-9065-y
6. Bushnell, D. (2012). Groundwater in New Mexico [Digital Repository]. Utton Tranboudary Resources Center. https://digitalrepository.unm.edu/utton_pubs/5
7. Carangelo v. Albuquerque-Bernalillo County Water Utility Authority, 320 P.3d 492 (New Mexico Supreme Court 2013).
8. City of Albuquerque v. Reynolds, 71 N.M. 482 (New Mexico Supreme Court 1962).
9. City of Roswell v. Berry, 80 N.M. 110 (New Mexico Supreme Court 1969).
10. Clark, I. G. (1987). Water in New Mexico: A History of Its Management and Use. UNM Press.
11. Conover, C., CS. (1954). Ground-Water Conditions in the Rincon and Mesilla Valleys and Adjacent Areas in New Mexico. Geologic Survey Water-Supply Paper 1230 (No. 1230; Geologic Survey Water-Supply Paper). USGS.
12. Cooper v. John H. Bliss Engineer, No. 9565 (Lea County Court).
13. Daniel B. Stephens and Assoc. (2005). Southwest New Mexico Regional Water Plan.
14. Declaration of Beneficial Use; Verification; Recording, Chapter 72, Article 12 NMSA §§ 72-5-12-1 et seq.
15. Dunbar, N. W., Gutzler, D. S., Pearthree, K. S., Phillips, F. M., Bauer, P. W., Allen, C. D., DuBois, D., Harvey, M. D., King, J. P., McFadden, L. D., Thomson, B. M., & Tillery, A. C. (2022). Climate Change in New Mexico Over the Next 50 Years: Impacts on Water Resources. New Mexico Bureau of Geology and Mineral Resources. https://doi.org/10.58799/B-164
16. Finch, A., & Melis, E. (2008). Geologic controls on ground-water flow in the Mimbres Basin, southwestern New Mexico. Geology of the Gila Wilderness-Silver City Area, 189–198. https://doi.org/10.56577/FFC-59.189
17. Gray, D. (1982, August 4). Memorandum discussing Mimbres Basin, New Mexico, Administrative Criteria [Memorandum].
18. Guidelines for the Deming-Columbus Administrative Area for Review of Water Rights Applications. (2011). [Guidelines]. New Mexico Office of the State Engineer.
19. Hawley, J., Hibbs, B., Kennedy, J., Creel, B., Remmenga, M., Johnson, M., Lee, M., & Dinterman, P. (2000). Trans-international boundary aquifers in southwestern New Mexico. NM Water Resources Research Institute, NM State Univ., Cal. State Univ. https://nmwrri.nmsu.edu/publications/pub-documents/trans-international-boundary-aquifers-in-southwest-new-mexico/title.pdf
20. Hawley, J., & Kennedy, J. (2004). Creation of a Digital Hydrogeologic Framework Model of the Mesilla Basin and Southern Jornada del Muerto Basin. WRRI. https://nmwrri.nmsu.edu/publications/technical-reports/tr-reports/tr-332.html#:~:text=The%20study's%20purpose%20was%20to%20create%20a,(polygons)%20*%20Line%20features%20such%20as%20fault%2Dzones
21. Heine v. Reynolds, 69 N.M. 398 (New Mexico Supreme Court 1962).
22. Hilton, J. (2026). Middle Rio Grande Groundwater Summary. New Mexico Bureau of Geology and Mineral Resources.
23. Index of State Engineer Orders. (2023). [Index]. New Mexico Office of the State Engineer.
24. INTERA. (2009). Technical Memorandum Gila Planning Project, Work Order GR-09-1. https://www.gilaconservation.org/wp/wp-content/uploads/2012/07/INTERA-Mimbres-Supply-Technical-Memorandum-Final.pdf
25. Land, L., & Timmons, S. (2016). Overview of Fresh and Brackish Water Quality in New Mexico (Open-File Report No. 583). New Mexico Bureau of Geology & Mineral Resources. https://geoinfo.nmt.edu/publications/openfile/downloads/500-599/583/OFR-583_NM_BrackishLR.pdf
26. Lewis, A. (2019). Status of Tracking Meter Readings In the WATERS Database. Interstate Stream Commission.
27. Lohmann, P. (2025, November 17). LANL chromium plume spreads onto San Ildefonso Pueblo land, NMED says. https://sourcenm.com/briefs/lanl-chromium-plume-spreads-onto-san-ildefonso-pueblo-land-nmed-says/
28. Manual of Rules and Regulations Governing the Drilling of Wells and the Appropriation and Use of Underground Waters in Declared Basins of the State of New Mexico, § IX, §F (1951).
29. Mathers v. Texaco, Inc., 77 N.M. 239 (New Mexico Supreme Court 1966).
30. Mencinger, A. (2025, May 1). Estancia Residents Urged to Conserve Water as Concerns Raised over Declining Aquifer. Santa Fe New Mexican. https://www.santafenewmexican.com/news/local_news/estancia-residents-urged-to-conserve-water-as-concerns-raised-over-declining-aquifer/article_50faf6bf-76a1-485f-9caf-07a659723bdb.html
31. Mimbres Valley Irrigation District v. Salopek, 140 N.M. 168 (New Mexico Court of Appeals 2006).
32. Mitigation Fund, Title 19, Chapter 25, Part 20 NMAC § 19.25.20.118 (2017).
33. Montgomery v. Lomos Althos, Inc., 141 N.M. 21 (New Mexico Supreme Court 2006).
34. Montgomery v. New Mexico State Engineer, 137 N.M. 659 (New Mexico Supreme Court 2005).

35. New Mexico Bureau of Geology & Mineral Resources. (2023). Groundwater in New Mexico [StoryMap]. Groundwater in New Mexico. https://nmt.maps.arcgis.com/apps/Cascade/index.html?appid=6be697576378473593115c22795593f0

36. New Mexico Bureau of Geology and Mineral Resources. (2023). Estancia Basin Geology and Groundwater [StoryMap]. NMBGMR Aquifer Mapping Program. https://storymaps.arcgis.com/stories/6e890924a26b4bebbfbe551e01fdf613

37. New Mexico Bureau of Geology and Mineral Resources. (2025). Aquifer Mapping Program [Bi-Annual]. New Mexico Bureau of Geology & Mineral Resources New Mexico Institute of Mining & Technology. https://geoinfo.nmt.edu/resources/water/amp/home.html

38. Newton, T., Phillips, F. M., & Ketchum, D. (2017). High-Resolution Estimation of Groundwater Recharge for the Entire State of New Mexico using a Soil Water Balance Model. New Mexico Bureau of Geology and Mineral Resources.

39. NM Department of Justice. (2025, August). New Mexico, Texas reach settlement agreements in decade-long Rio Grande water dispute. https://nmdoj.gov/press-release/new-mexico-texas-reach-settlement-agreements-in-decade-long-rio-grande-water-dispute/#:~:text=All%20Press%20Releases-,New%20Mexico%2C%20Texas%20reach%20settlement%20agreements%20in%20decade%2Dlong%20Rio,Grande%20can%20continue%20to%20thrive.

40. NM Interstate Stream Commission. (2023). Mainstream New Mexico. https://mainstreamnm.org/article-understanding-groundwater/

41. NM OSE-ISC. (n.d.). Active Water Resource Management (AWRM) [Govt]. NM Office of the State Engineer. https://www.ose.nm.gov/AWRM/PriorityBasins.php#:~:text=The%20State%20Engineer%20has%20identified%20the%20following,Interstate%20Stream%20Commission%20Basin%20&%20Compacts%20page.

42. NMOSE-ISC. (2006). ARTICLE 7 DECLARED UNDERGROUND WATER BASINS (RULES AND REGULATIONS GOVERNING THE APPROPRIATION AND USE OF GROUND WATER IN NEW MEXICO). New Mexico Office of the State Engineer. https://www.ose.nm.gov/RulesRegs/ground-water-regs/GroundWaterRegs-Article7.pdf

43. NMOSE-ISC. (2018). 2018 New Mexico State Water Plan. NM Office of the State Engineer/Interstate Stream Commission. https://www.ose.state.nm.us/Planning/swp.php

44. NMOSE-ISC. (2025). Lower Rio Grande (LRG) Groundwater Conservation Program [Govt]. Interstate Stream Commission. https://www.ose.nm.gov/LRGGWCP/index.php

45. Office of the Governor Lujan-Grisham. (2024). 50-Year Water Action Plan [Plan]. NM Office of the Governor. https://www.nm.gov/wp-content/uploads/2024/01/New-Mexico-50-Year-WaterAction-Plan.pdf

46. OPERATIONS SETTLEMENT AGREEMENT (Rio Grande Project Operations and Related Issues), No. 24-141 (Supreme Court August 29, 2025). https://nmdoj.gov/wp-content/uploads/Operations-settlement-agreement.pdf

47. Pine, R., Timmons, S., Chudnoff, S., Rawling, G. C., & Newton, B. T. (2023). Background and Considerations for a Statewide Groundwater-Level Monitoring Network in New Mexico (No. 624). New Mexico Bureau of Geology & Mineral Resources. https://geoinfo.nmt.edu/publications/openfile/downloads/600-699/624/OFR_624.pdf

48. Pool, M. (2013). Michael D. Pool. Mimbres Mogollon Farming: Estimating Prehistoric Agricultural Production during the Mimbres Classic Period. In Soils, Climate, & Society: Archaeological Investigations in Ancient America. (Edited by John Wingard and Sue Ellen Hayes) pp. 85-108. Boulder: University Press of Colorado. (pp. 85–108). https://doi.org/10.13140/RG.2.1.3301.1289

49. President's Water Resources Policy Commission. (1950). The Report of the President's Water Resources Policy Commission, Volume 3: Water Resources Law (p. 746).

50. Prokop, D. (2023, May 5). Feds announce $12.6 million to remove PFAS at southern NM desalination research plant. Source New Mexico. https://sourcenm.com/2023/05/05/feds-announce-12-6-million-to-remove-pfas-at-southern-nm-desalination-research-plant/

51. Rawling, G. C. (2022). Evaluation of water-level trends in the Mimbres Basin, southwest New Mexico (USA), using spatiotemporal kriging. Hydrogeology Journal, 30(8), 2479–2494. https://doi.org/10.1007/s10040-022-02549-7

52. Record, J. H. R. D. (2024, March 31). PVACD: Watching the water. Roswell Daily Record. https://www.rdrnews.com/pvacd-watching-the-water/article_528597a6-d740-11ee-ac6a-a7ed0e5a50ef.html

53. Restrictions on Drilling of Supplemental Wells, Chapter 72, Article 12 NMSA §§ 72-12-25 (2024).

54. Richter, B. D., Abdelmohsen, K., Dhakal, S., Famiglietti, J. S., Fowler, K. F., Green, H., Marston, L., Mekonnen, M. M., Prunes, E., Rohde, M. M., Ruddell, B. L., Rushforth, R. R., Shahbol, N., Sjöstedt, E. C., & Sandoval-Solis, S. (2025). Overconsumption gravely threatens water security in the binational Rio Grande-Bravo basin. Discover Water, 5(1), 104. https://doi.org/10.1007/s43832-025-00301-2

55. Rosenberg, A., Guldan, S., Fernald, S., & Rivera, J. (2020). Acequias of the Southwestern United States: Elements of Resilience in a Coupled Natural and Human System (Research No. 796). NM State University. https://pubs.nmsu.edu/acequias/docs/RR796_ada.pdf

56. State Engineer Order 171, No. 171 (New Mexico Office of the State Engineer December 16, 2005).

57. State Engineer Order 177, No. 177 (New Mexico Office of the State Engineer July 25, 2006).

58. State Engineer Order 181, No. 181 (New Mexico Office of the State Engineer September 26, 2008).

59. Stokes v. Morgan, 101 N.M. 195 (New Mexico Supreme Court 1984).

60. Templeton v. Pecos Valley Artesian Conservancy, 65 N.M. 59 (New Mexico Supreme Court 1958).

61. Texas v. New Mexico and Colorado, No. 141 Original (Supreme Court of the United States 2014). https://www.scotusblog.com/wp-content/uploads/2017/06/22o141-us-motion-to-intervene.pdf

62. The Rain We Keep. (2025, April 20). [Video recording]. https://www.pbs.org/video/farming-is-generational-ygll6i/

63. Thorn, C. R., McAda, D. P., & Kernodle, J. M. (1993). Geohydrologic Framework and Hydrologic Conditions in the Albuquerque Basin, Central New Mexico (Water Resources Investigations Report Nos. 93–4149). US Geological Survey Water Resources. https://pubs.usgs.gov/wri/1993/4149/report.pdf

64. Tribal Water Work Group. (2022). New Mexico Tribal Water Report. NM Indian Affairs Department. https://mainstreamnm.org/wp-content/uploads/2024/01/Tribal-Water-Report.pdf

65. USGS. (1995). Programs in New Mexico: Ground-Water Depletion and Contamination in the Albuquerque Basin (No. Fact Sheet FS-031-95). USGS. https://pubs.usgs.gov/fs/1995/0031/report.pdf
66. USGS. (2013). USGS Hydrologic Units Codes (HUCs) Explained [Government]. USGS. https://nas.er.usgs.gov/hucs.aspx
67. USGS. (2024). Scientific Investigations Report (Scientific Investigations Report) [Scientific Investigations Report]. USGS.
68. USGS. (2025). Groundwater levels for the Nation [Groundwater Monitoring Data]. URL: https://nwis.waterdata.usgs.gov/nwis/gwlevels
69. Utton Center. (2015). Groundwater [Water Matters!]. https://uttoncenter.unm.edu/assets/docs/publications/water-matters-2015/06_Groundwater.pdf
70. Valdez, J., Harms, P., Nelson, M., & Gagnon, A. (2024). New Mexico Water Use by Categories 2020 (Technical Report No. 56). New Mexico Office of the State Engineer. https://www.ose.nm.gov/WUC/wuc_waterUseData.php
71. Water Appropriations; Preferences, Chapter 72, Article 5 NMSA §§ 72-5-5.
72. Water Master Determination of Impairment to Groundwater Rights from Exercise of Pueblo Water Rights on Pueblo Lands, Title 19, Chapter 25, Part 20 NMAC § 19.25.20.116 (2017). https://www.law.cornell.edu/regulations/new-mexico/title-19/chapter-25/part-20
73. White, W. (1930). Preliminary Report on the Ground-Water Supply of Mimbres Valley, New Mexico [Contributions to Hydrology of the United States]. U.S. Geological Survey.
74. Yeo v. Tweedy, Nos. 3408, 3420 (Supreme Court of New Mexico 1930). https://www.casemine.com/judgement/us/5914cd57add7b04934811bd4