Groundwater in New Mexico and Water Data

Stacy Timmons
Associate Director for Hydrogeology Programs
NM Bureau of Geology and Mineral Resources

New Mexico Bureau of Geology and Mineral Resources
New Mexico Tech
Earth Science for the 21st Century

New Mexico Tech

AQUIFER MAPPING PROGRAM

Aquifer Mapping Program is water data and information

Research

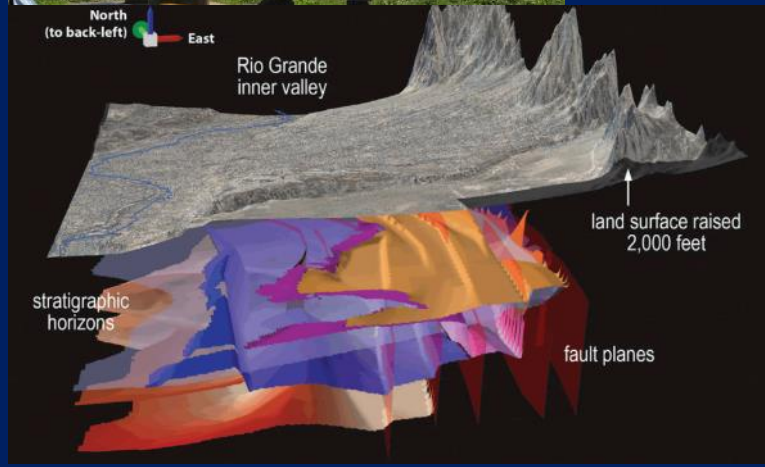
- Map and characterize New Mexico's aquifers
- Evaluate geologic influences, depth to water, flow directions, water quality, recharge, and water quantity estimation
- Compile existing data, collect new data
- Build GIS models, datasets and reports

Monitoring

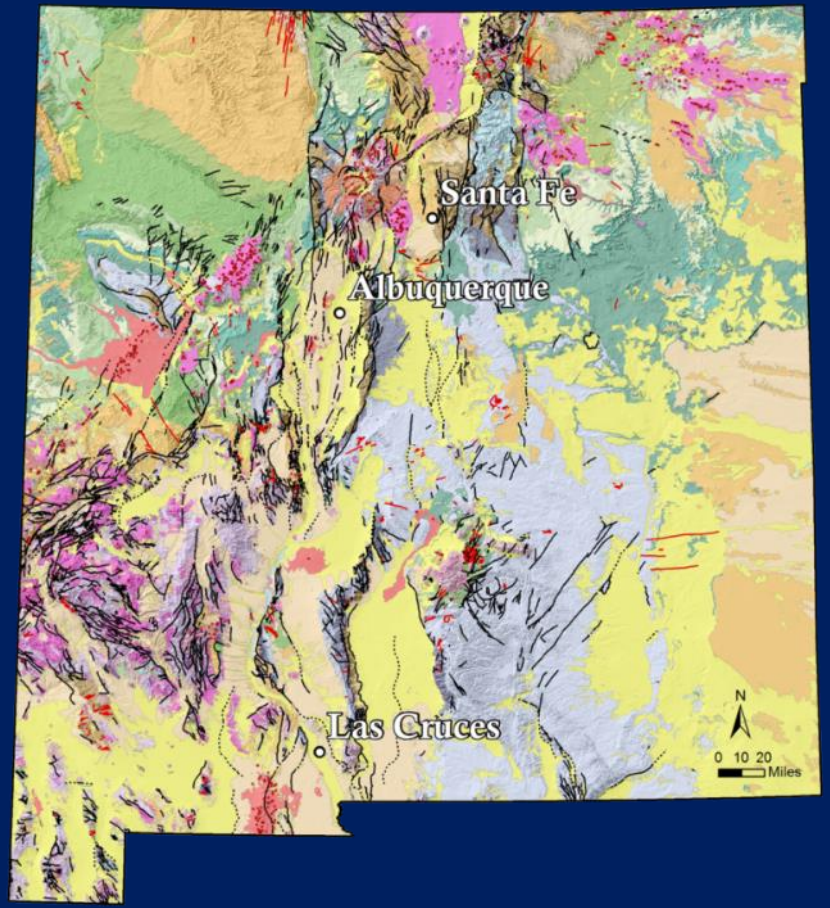
- Provide groundwater level data measurements
- Monitoring, tracking and evaluation of regional or local trends

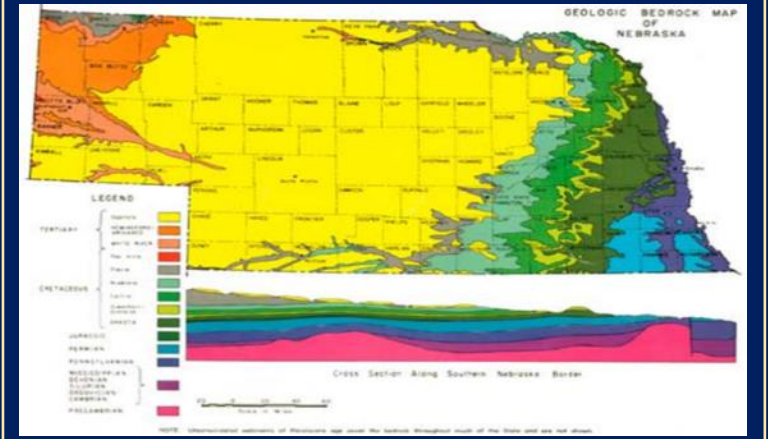
Service

- Address and respond to public inquiries
- Provide data and results



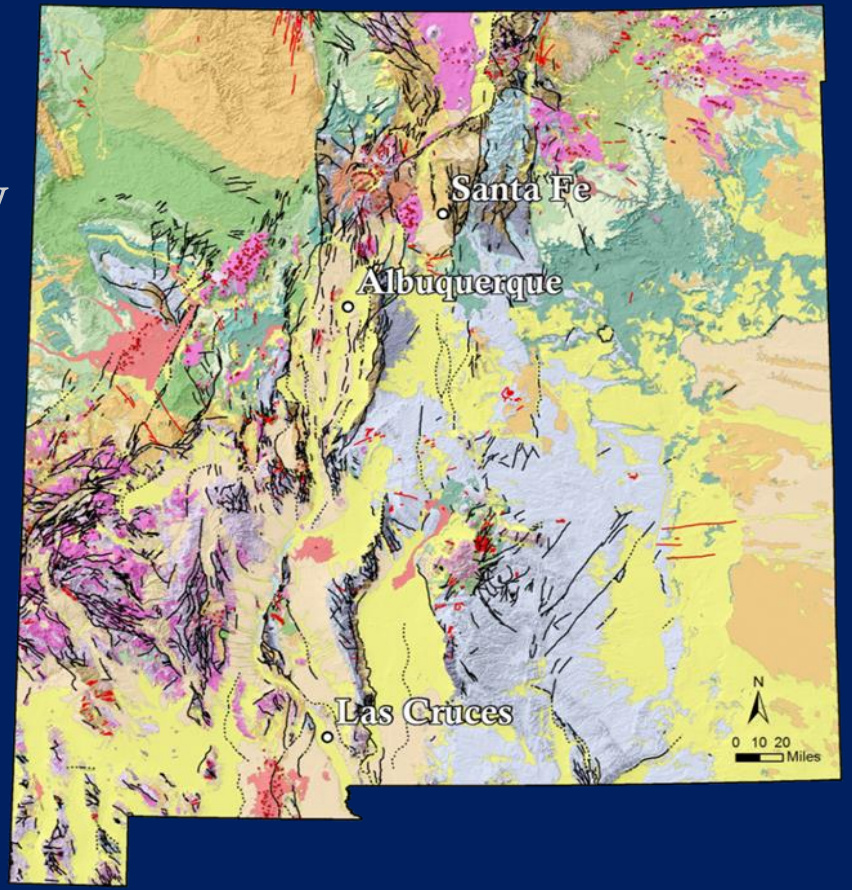
The geology of New Mexico is complex... and so are the aquifers



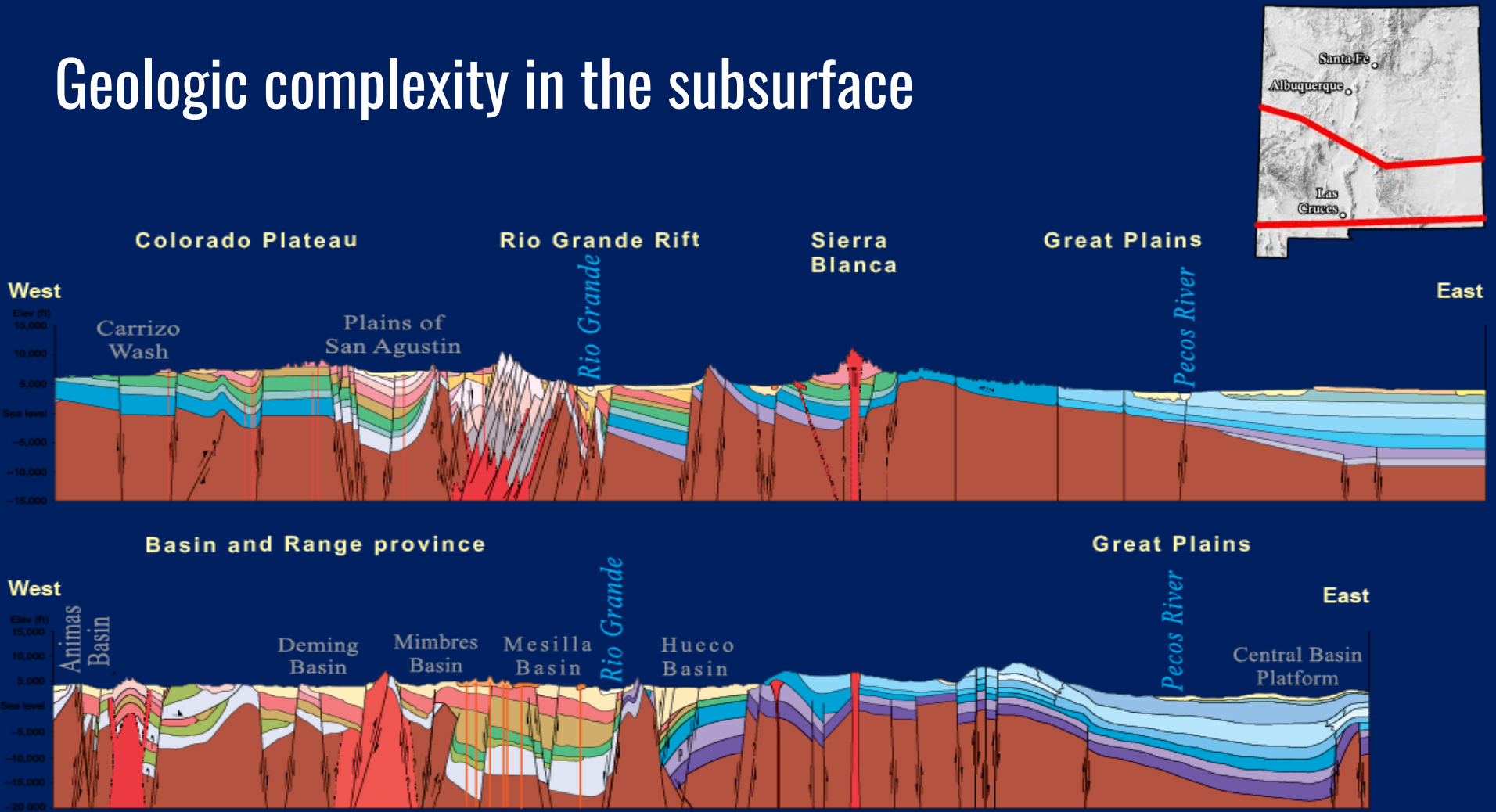


Groundwater – it all relates to the geology

- Volume of water
- Water quality distribution (spatially and vertically)
- Productivity of the aquifer
- Connections between aquifers and/or surface water
- Boundaries of aquifers

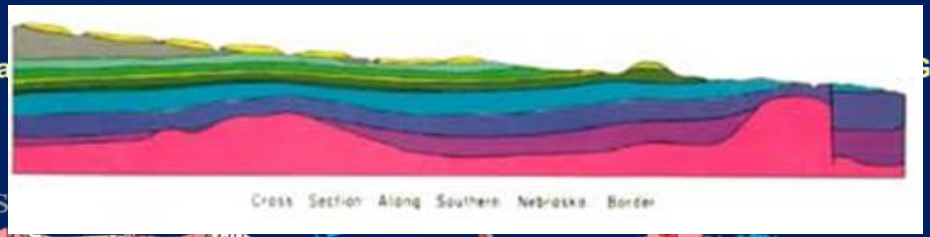


Geologic complexity in the subsurface



Geologic complexity in the subsurface

Nebraska



Colorado Platea

Great Plains

West

East

Carrizo Wash

Pecos River

Basin and Range province

Great Plains

West

East

Animas Basin

Deming Basin

Mimbres Basin

Mesilla Basin

Rio Grande

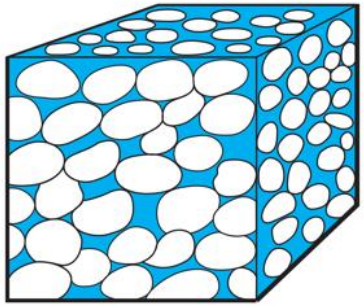
Hueco Basin

Pecos River

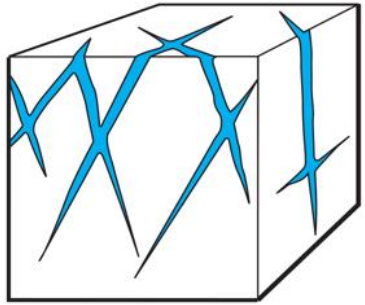
Central Basin Platform

What is an aquifer?

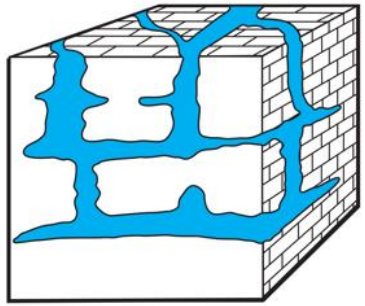
- An ***aquifer*** is simply a rock formation or sediment material that can contain or transmit water.
- While most rocks can store groundwater, water needs to be able to easily *move* through the rock or sediment in order to be a useful aquifer.
- The ***permeability*** is the ability of the rock material to move fluid through it. The best aquifers store a lot of water and are highly permeable.



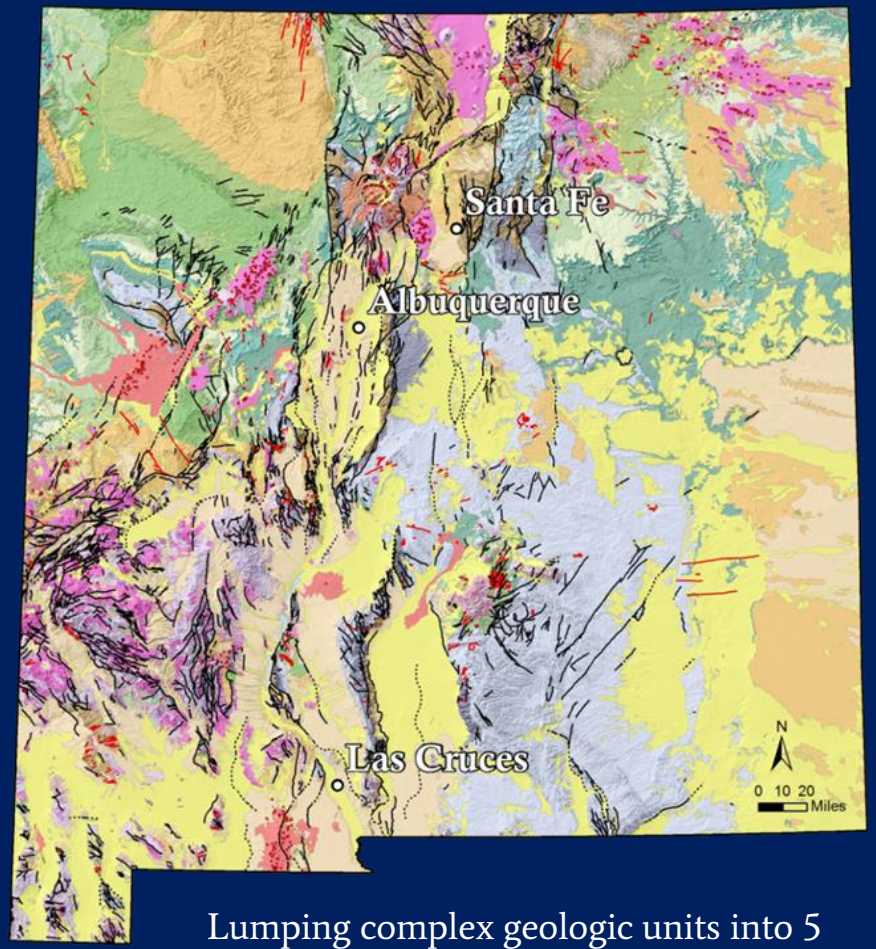
sediment aquifer



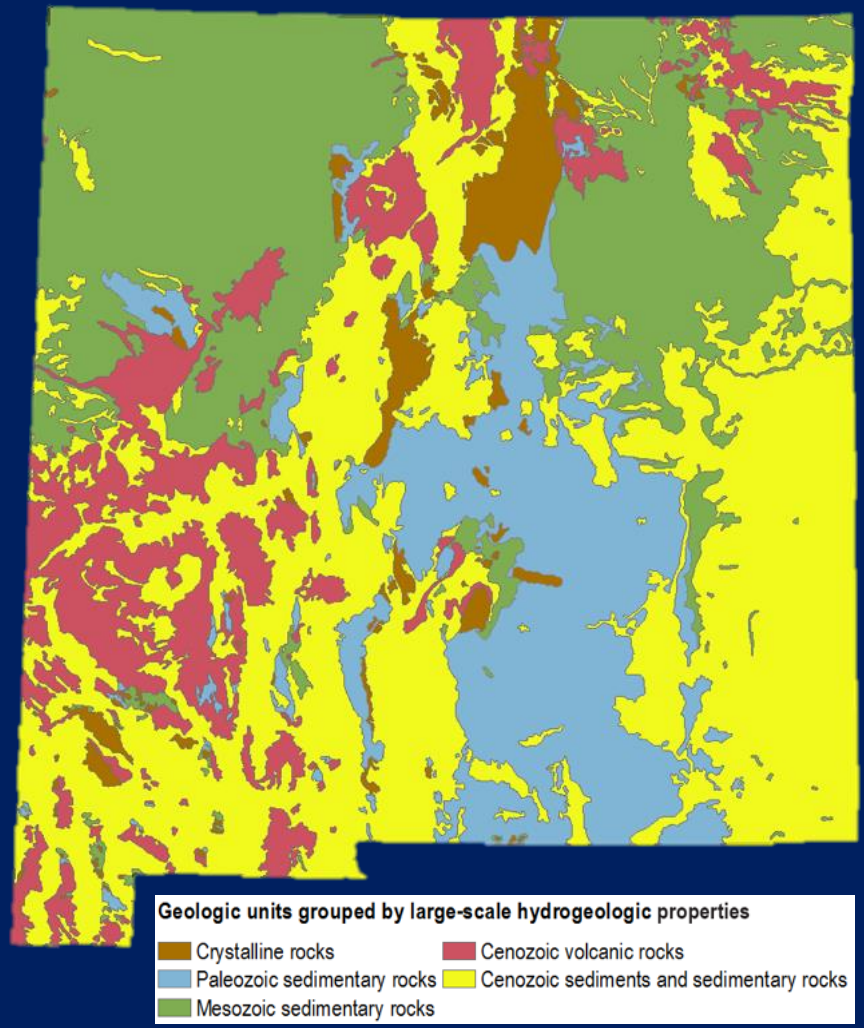
fractured rock aquifer



karst aquifer

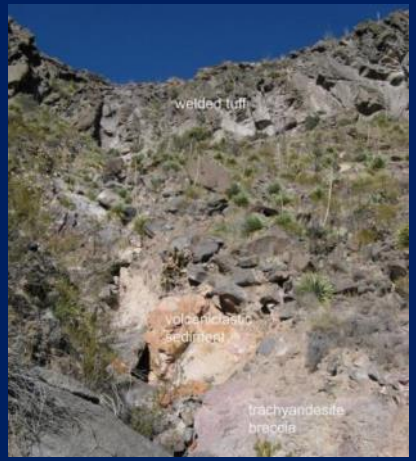


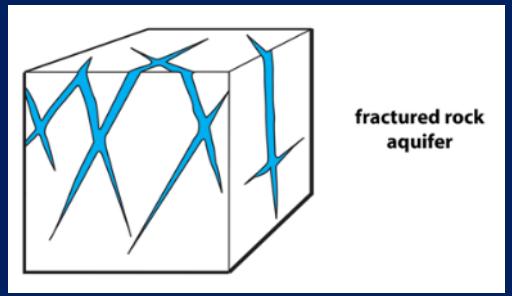
Lumping complex geologic units into 5 general hydrogeologic units →

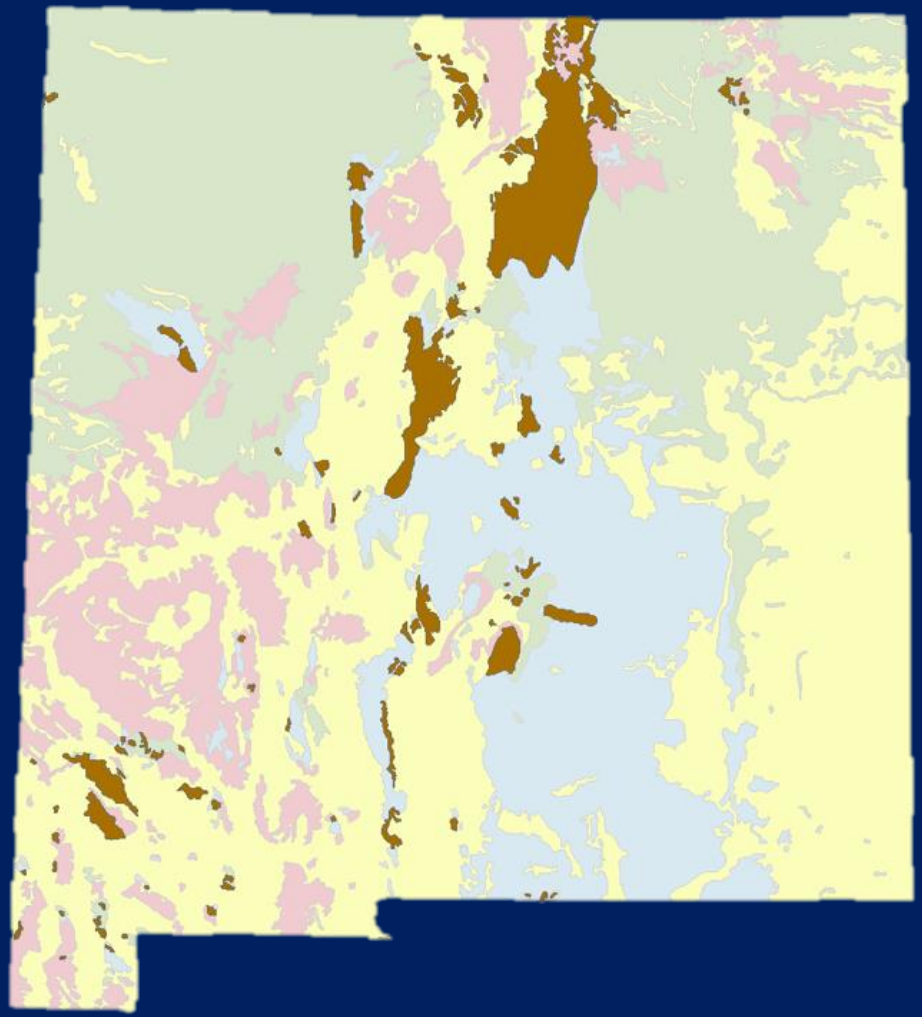


Crystalline rocks

- Old, hard rocks – not great for aquifers
- Generally mechanically strong and resist fracturing, and as a result, often behave as aquitards.
- Near fault zones, however, they may be well fractured and form local fractured rock aquifers.

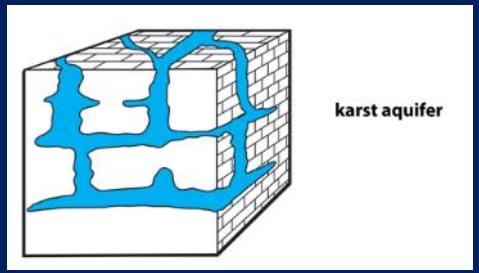


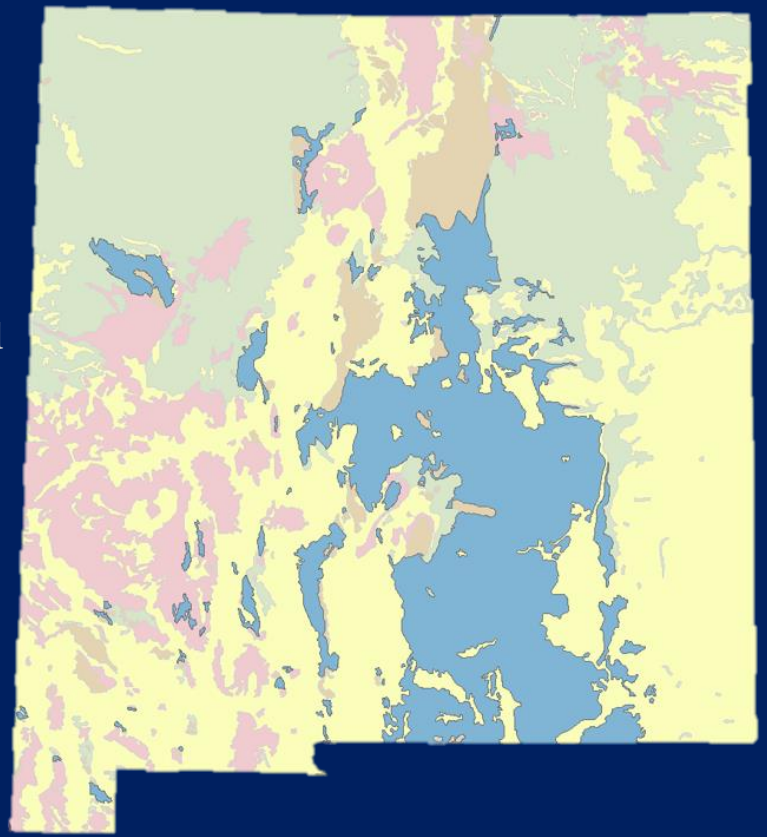




Sedimentary rocks (“Paleozoic” ~540-250 Million years old)

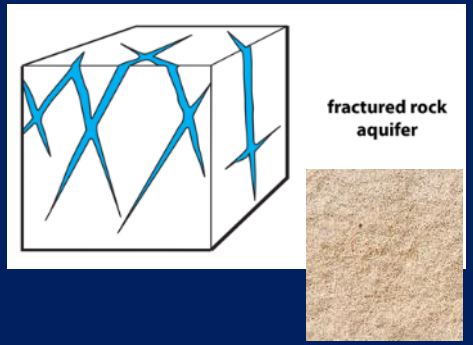
- Extensive limestones and sandstones that, where well-fractured, form productive, predictable aquifers.
- Some limestone units are particularly productive where dissolution of the rock has widened the fracture network, producing a karst aquifer.
- Interbedded mudstone and shale intervals and un-fractured rock sections act as aquitards that compartmentalize the aquifer system.

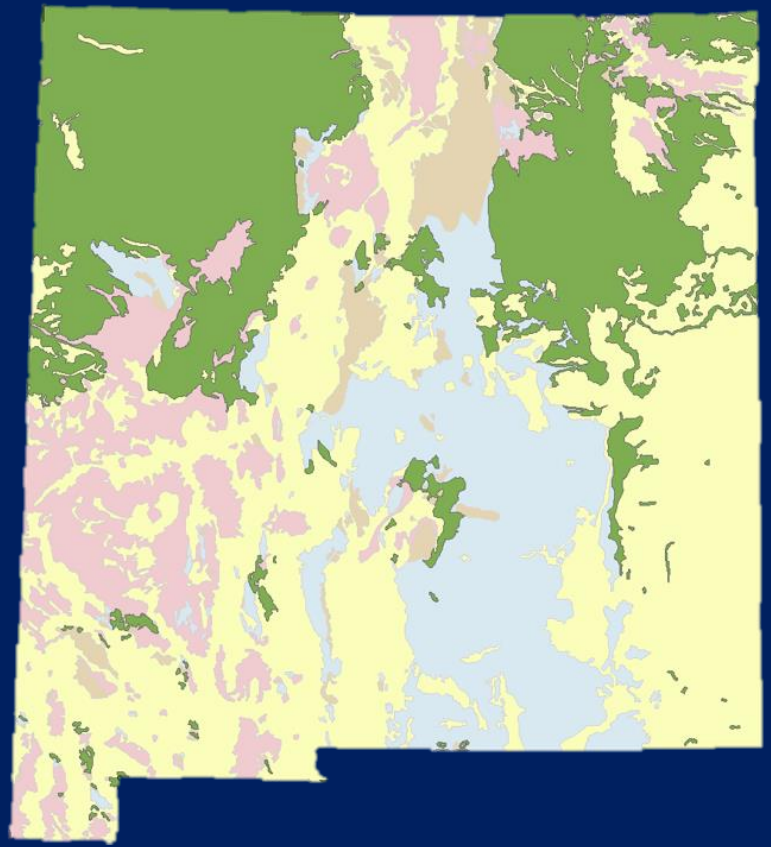




Sedimentary rocks (“Mesozoic” ~250-65 Million years old)

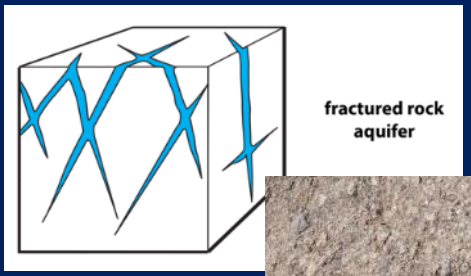
- These sedimentary rocks consist of thick sections of mudstone and shale aquitards surrounding fractured sandstone layers that are potential aquifers.
- Some sandstone sections are thick and continuous over many miles, forming predictable aquifers, but others are thin and pinch out laterally in the subsurface, and provide only limited water resources.

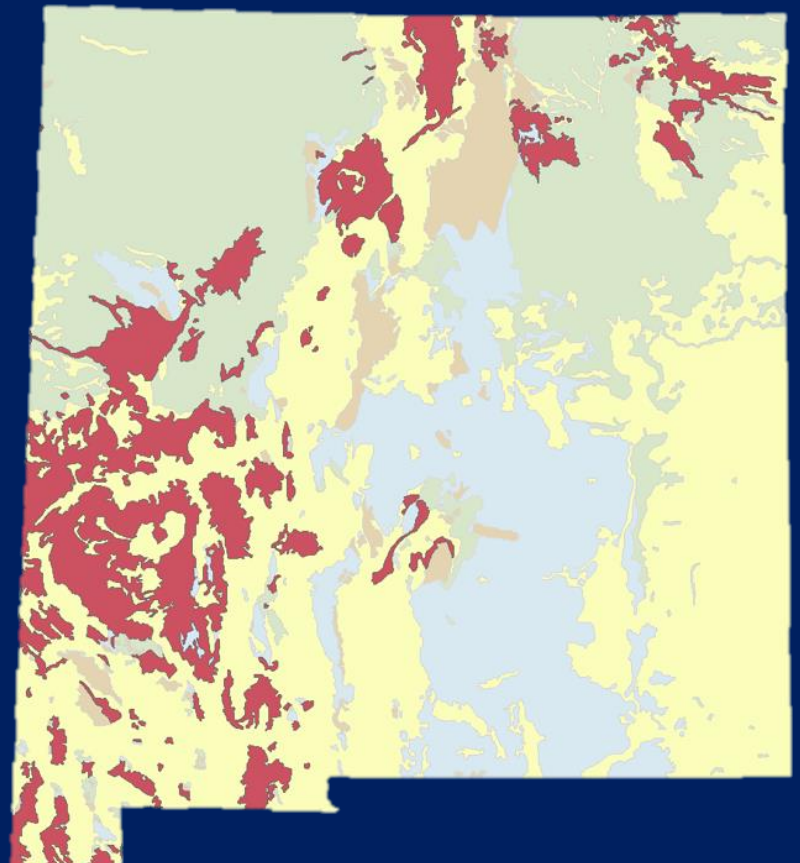




Volcanic rocks (“Cenozoic” ~65 Million years – Present)

- New Mexico’s other name – The Land of Volcanoes.
- These volcanic rocks and basalt flows are highly variable and consist of rock units that change thickness and degree of fracturing rapidly or end abruptly in the subsurface.
- Unpredictable aquifer characteristics.
- Fractured volcanic rocks that are well-connected to recharge areas can be very productive aquifers.

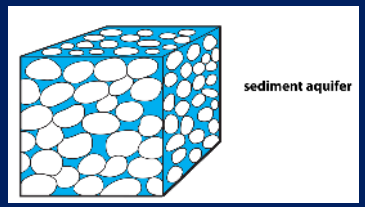


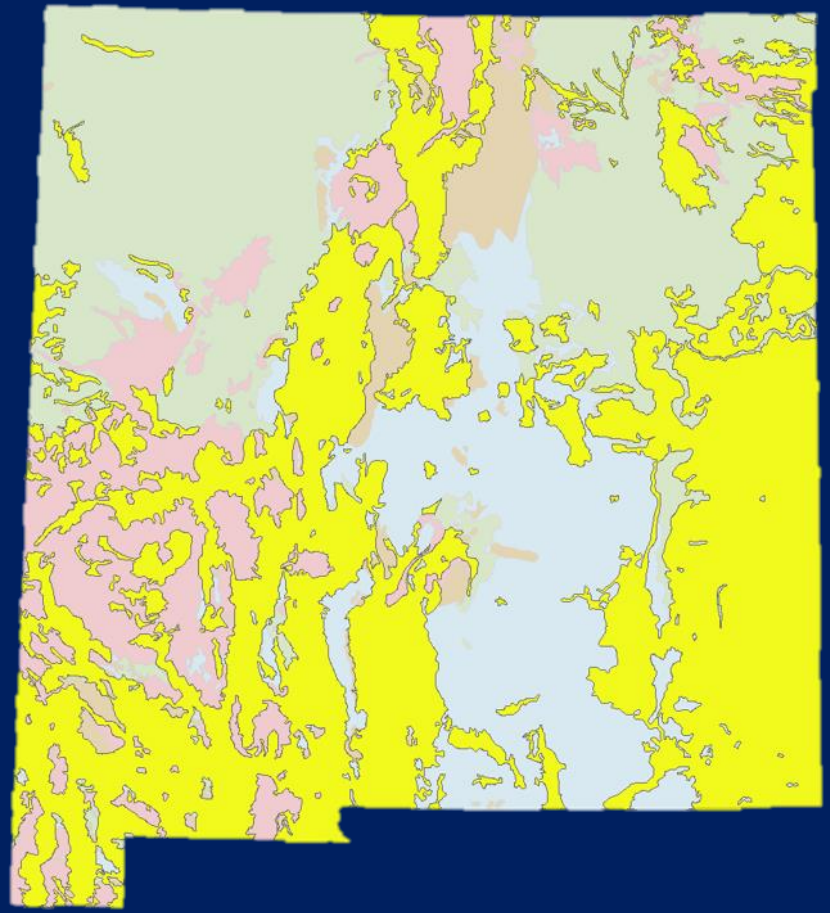


Alluvial aquifers (sediments) (65 Million years – Present)

- Alluvial / sedimentary aquifers are some of the most consistent aquifers in the state.
- Producing water through pore spaces, these aquifers have storage capacity and do not rely on fractures to carry water.
- Can be highly connected with surface water
- The largest cities in the state utilize alluvial aquifers

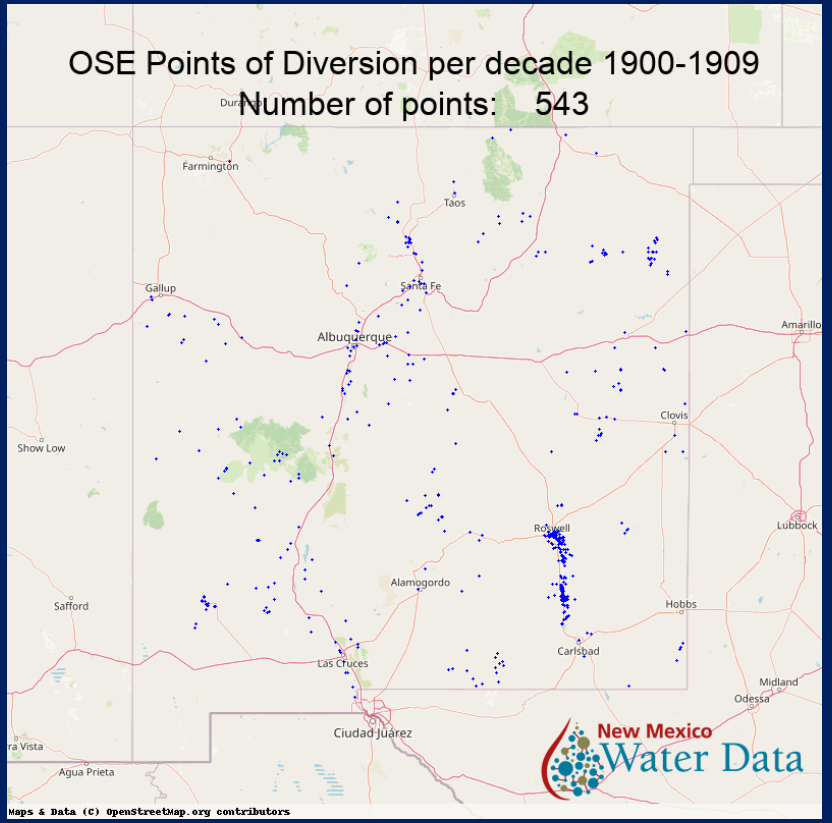

Alluvium (sand, gravel, clay)





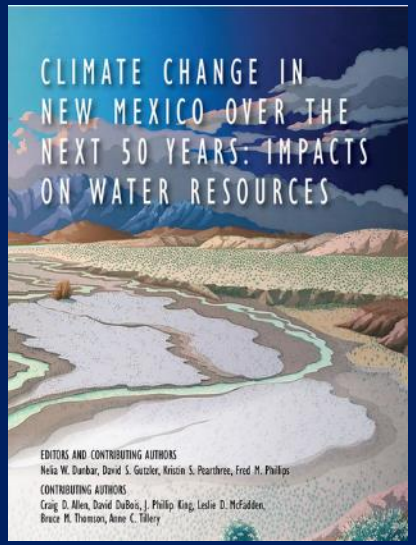
What is so hard about groundwater and aquifers?

- New Mexico has amazing, complex geology
- We are using limited well data to characterize what we cannot see beneath us.
  - Some areas have extremely sparse data (wells)
- Many surface water concepts are wrong when applied to groundwater.
  - Groundwater impacts can happen up-gradient
  - Groundwater impacts can cross hydrologic divides
- Impacts to groundwater may not be visible for long time scales



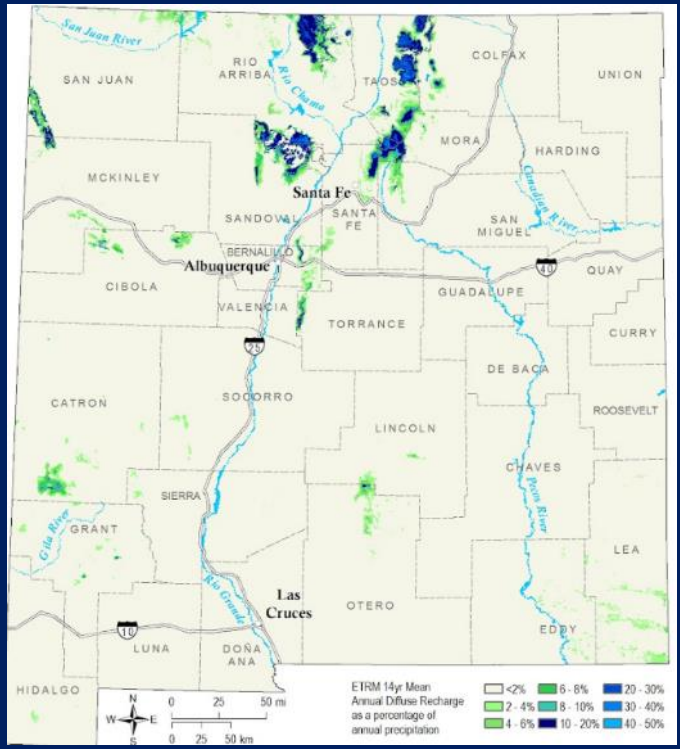
New Mexico is facing numerous water challenges

- Average temperatures warming 5-7°F over next 50 years
- Increasing aridity
- Decreasing water supply due to less snowpack, less runoff, and less recharge
- More variable and extreme precipitation
- Increasing wildfires
- Reduced surface water quality



https://geoinfo.nmt.edu/ClimatePanel/report/home.html

Diffuse groundwater recharge map



Hotter, drier times call for more water data

- How much water is left?
- How will our aquifers change?
- How will humans respond to change?
- How will New Mexico continue to thrive econmically?

2019 Water Data Act – NMSA 1978, §72-4B

New Mexico Water Data

State agencies will collaborate with regional and national efforts to SHARE, INTEGRATE, and MANAGE water data.

- *Convener:* Bureau of Geology and Mineral Resources
- Office of State Engineer
- Interstate Stream Commission
- Environment Department
- Energy, Minerals and Natural Resources Department

newmexicowaterdata.org

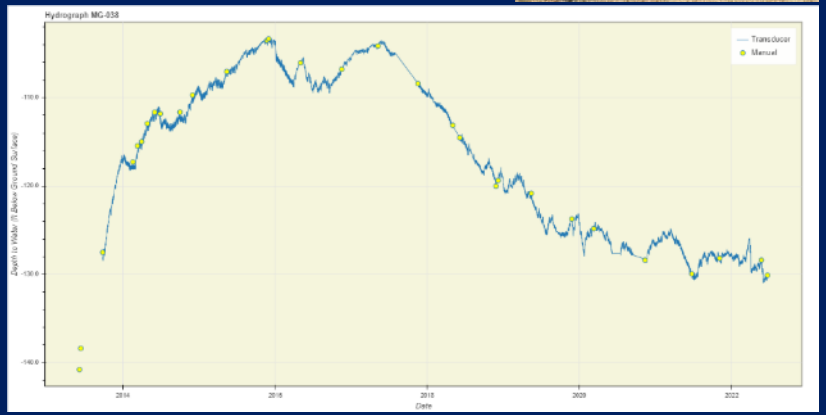
- ✓ Structured governance and work groups
- ✓ Built initial data catalog to illuminate data and engagement
- ✓ Designed and deployed website for further communications
- ✓ Developed data infrastructure plan for data integration
- ✓ Developing tools and applications to utilize water data
- ✓ Annual reports completed every September, with budget needs identified
- ✓ Initiated regional pilot projects
- ✓ Increased funding

Good water management requires good data!

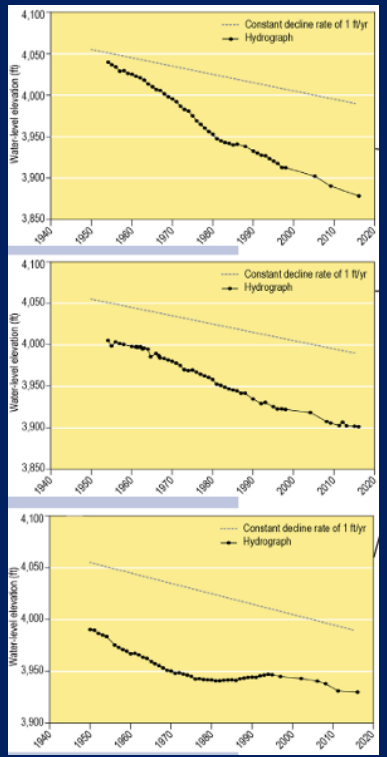
Magdalena, NM

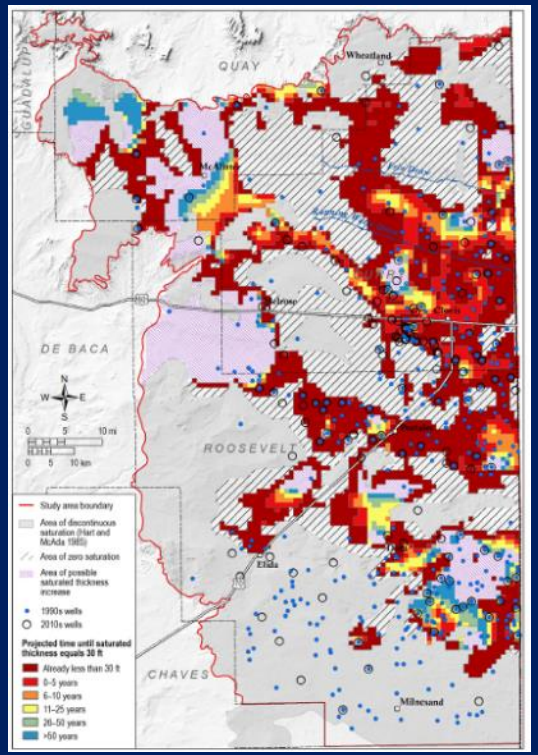
2013 water outage

2022 new well



Ogallala Aquifer Lifetime projections (Clovis, NM)





Major work ahead for New Mexico

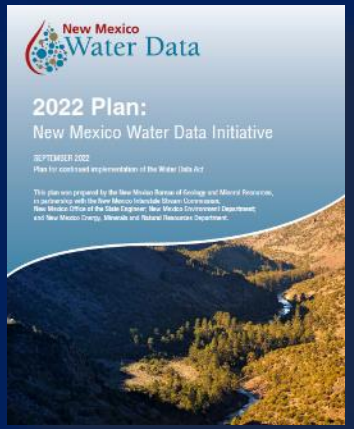
Build staff capacity at agencies charged with monitoring, managing or evaluating our water resources.

Improve monitoring efforts to measure water quantity and quality changes, and track water use better.

Enable state agencies to fully engage in the Water Data Act

Total Annual Recurring Funding Goal $2.65M

Total Non-Recurring Funding Goal $6.5M



newmexicowaterdata.org/resources/

Water Data Initiative - Groundwater Monitoring Gap Assessment

Thornburg Foundation has funded a project to evaluate data gaps and build a plan to improve coverage of groundwater monitoring.