

# Brackish and Saline Groundwater in New Mexico

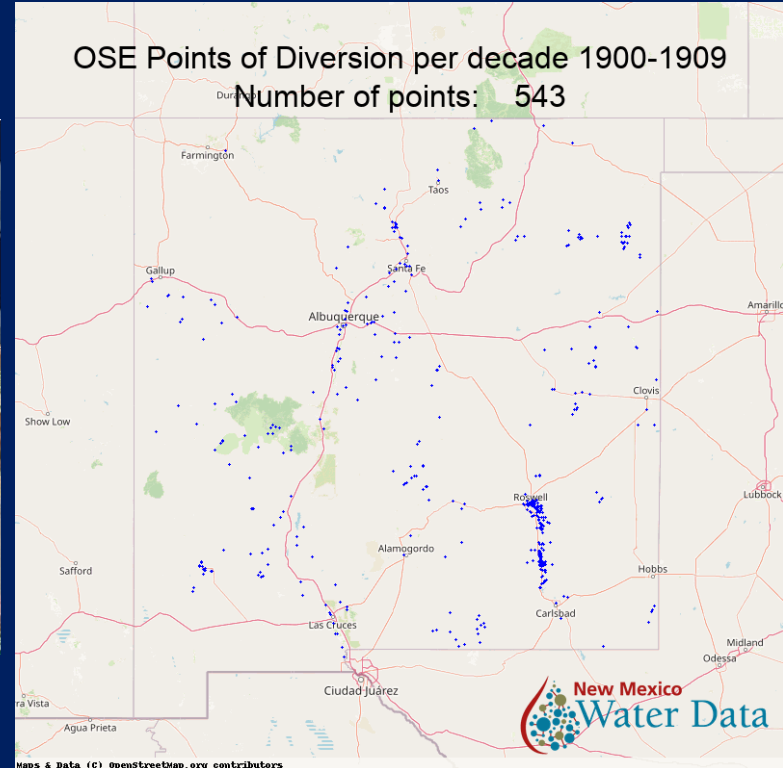
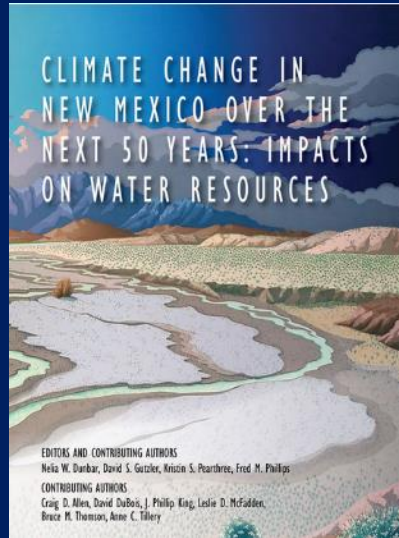
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Stacy Timmons  
NM Bureau of Geology and Mineral Resources



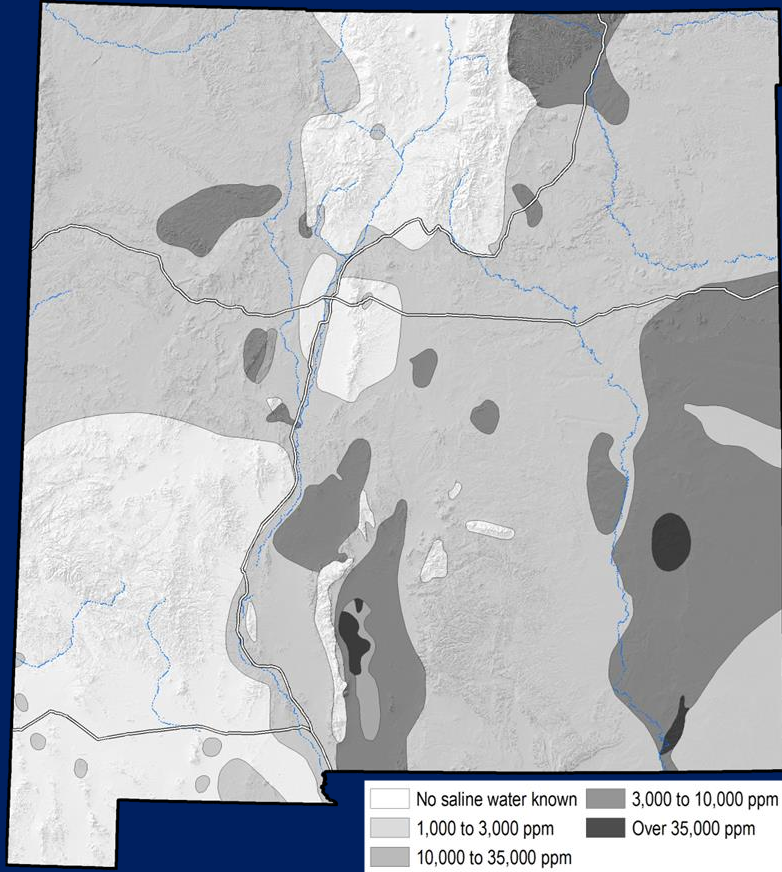
# New Mexico is facing numerous water challenges NOW

- Average temperatures warming 5-7°F over next 50 years
- Increasing aridity
- Increasing wildfire
- Increasing demand on groundwater



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

# Estimates have been made about saline aquifers in New Mexico



Approximately three-quarters of the groundwater in New Mexico is saline and requires some treatment prior to use.

-Reynolds, 1962

Modified from Hale et al., 1965 (OSE Technical Report 31)

# It relates back to the geology

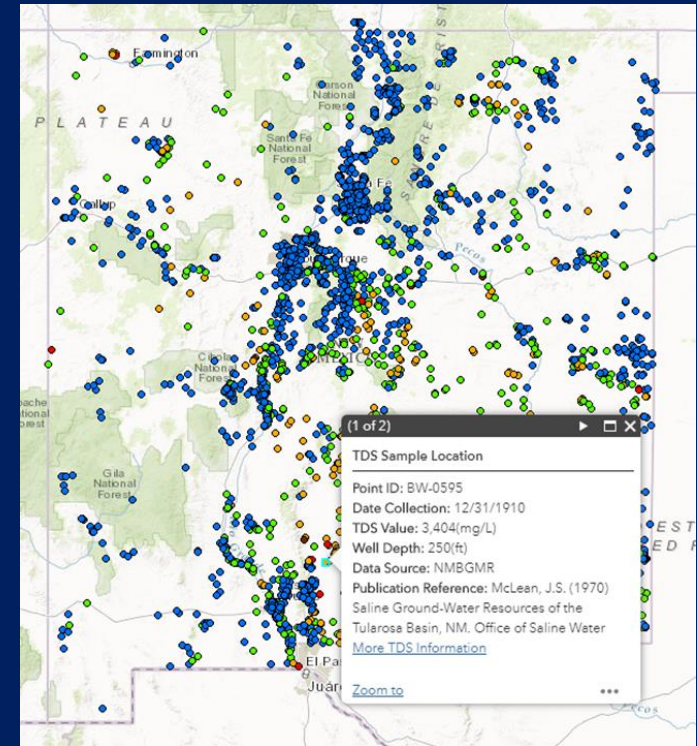
- Water quality distribution (spatially and vertically)
- Volume of water
- Productivity of the aquifer
- Connections between aquifers and/or surface water
- Suitability for different uses
- Waste disposal considerations





# Statewide Brackish Water Assessment (2016)

- 2013 Brackish Water Working Group driven interests
- Funding to NMBGMR from NMED – Drinking Water Bureau
- Digitized and compiled legacy water quality data – mostly drinking water wells from USGS, NMED and NMBGMR studies



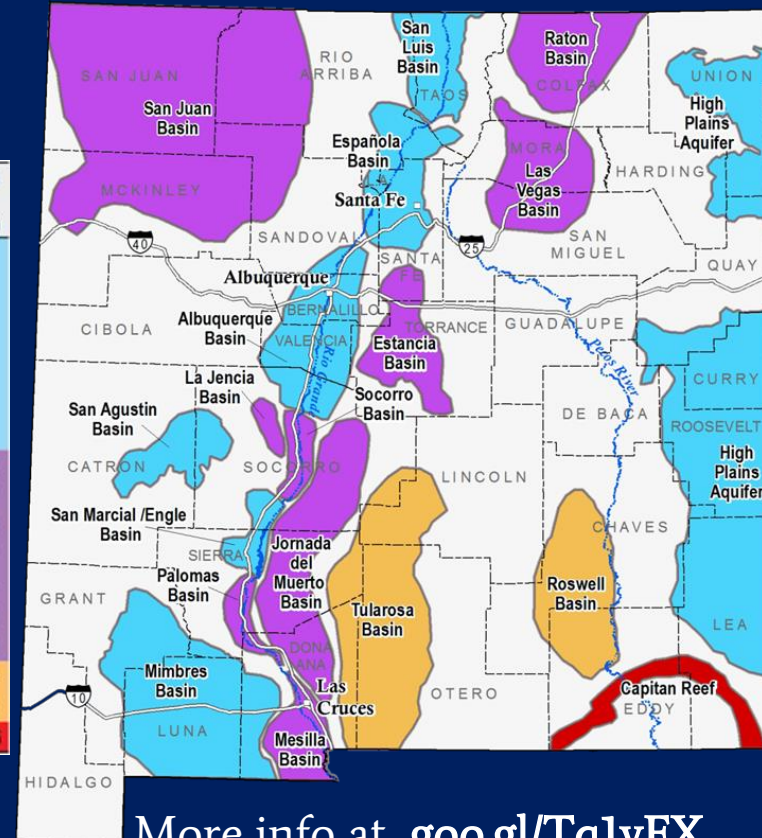
Well No.	COUNTY	Depth ft.	Temp. °C.	Calc. mg/l.	Magn. mg/l.	Sulfate mg/l.	Total mg/l.	Hardness mg/l.	Sodium mg/l.	Chloride mg/l.	Fluoride mg/l.	Nitrate mg/l.	Nitrite mg/l.	Ammonia mg/l.	Cobalt mg/l.	Protein mg/l.	Dissolved silica mg/l.	pH
Data from previous tables 88-Continued																		
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Interactive map: <https://maps.nmt.edu/>

# Statewide Brackish Water Assessment (2016)

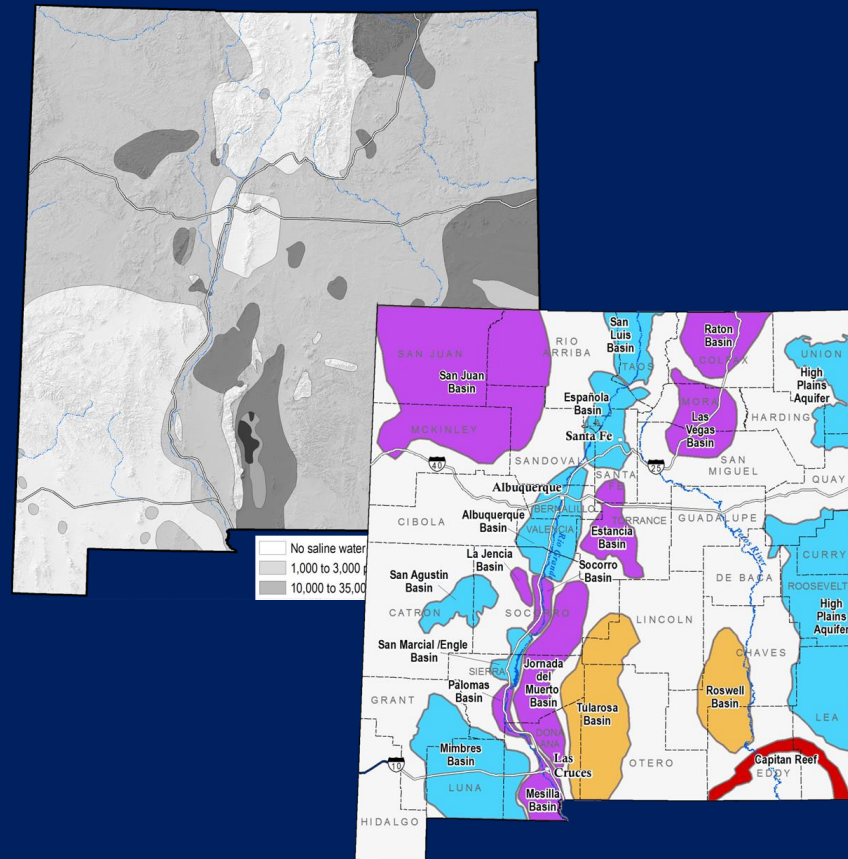
- Compiled data are useful for regional trends, but we lack data statewide to address detailed brackish water questions
- Region specific studies are needed with exploratory wells focused on characterizing geology, water quality and aquifer properties

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



# Results of Land (2016) show that there is more work to do

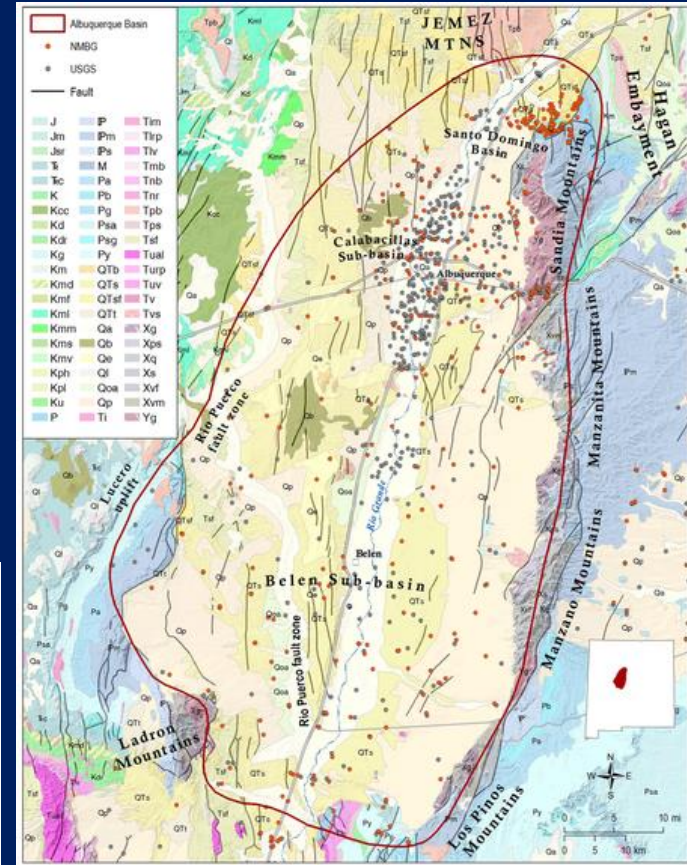
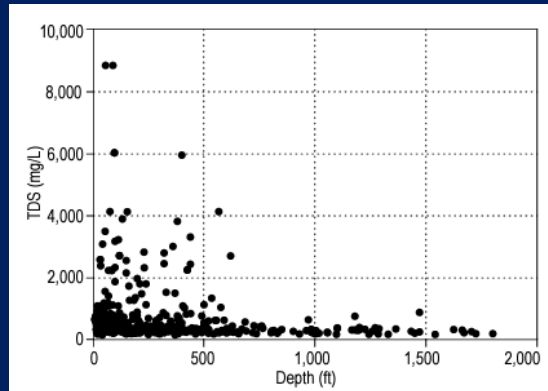
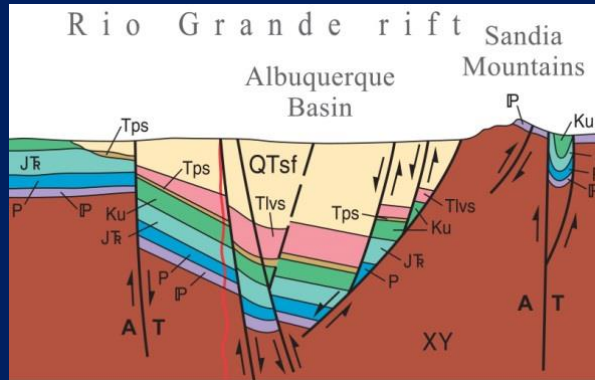
- (1) a detailed and quantitative understanding of those resources in individual basins is limited
- (2) chemistry data derived only from existing water supply wells is insufficient to provide a thorough understanding of the distribution of groundwater salinity





# Example: Albuquerque Basin

- Basin fill material; Permian bedrock
- Mostly fresh water, brackish west-south margin
- Depth and hydraulic conductivity issues
- Fresh water aquifer and streamflow impacts need further study





# Example: San Juan Basin

- Higher salinity at depth and central basin
- Aquifers are separated by aquitards
- $\text{Na-Ca-HCO}_3\text{-SO}_4\text{-Cl}$

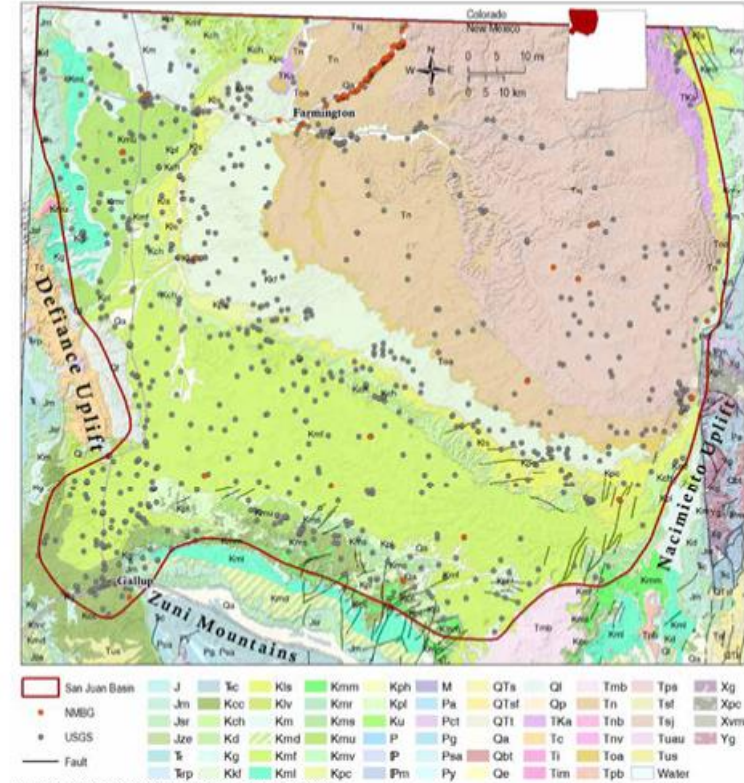
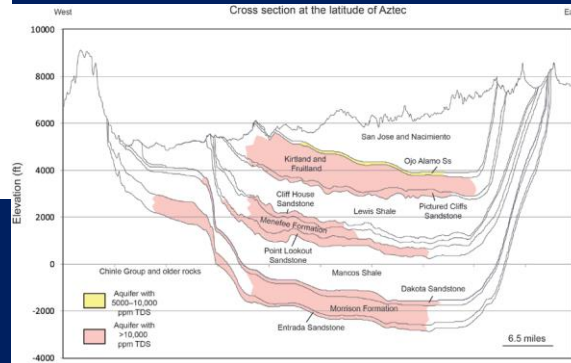
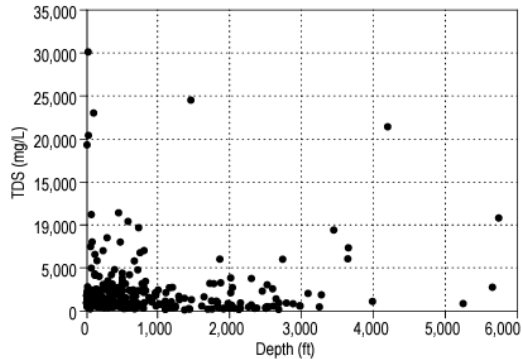
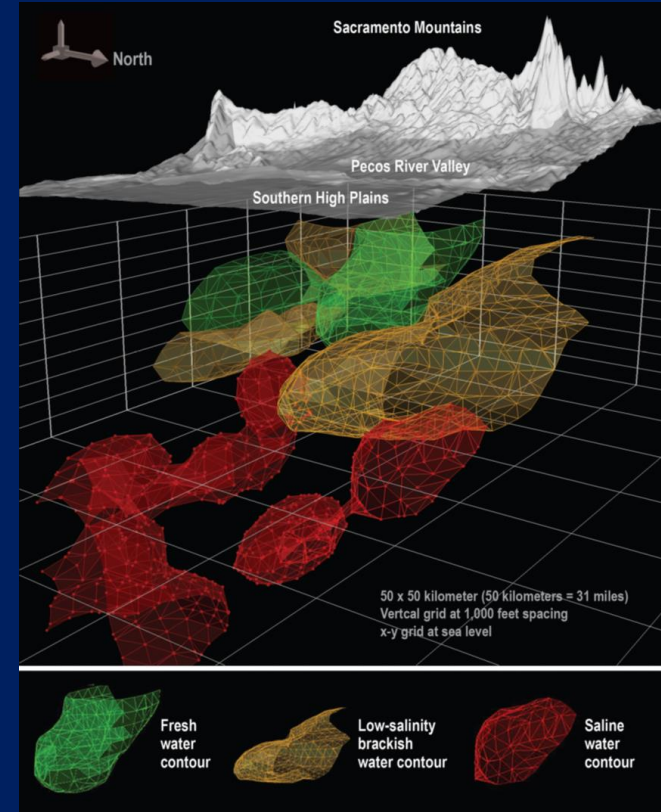


Figure 33. San Juan Basin, surface geology and data distribution.

# New work underway: Aquifer mapping in 3D

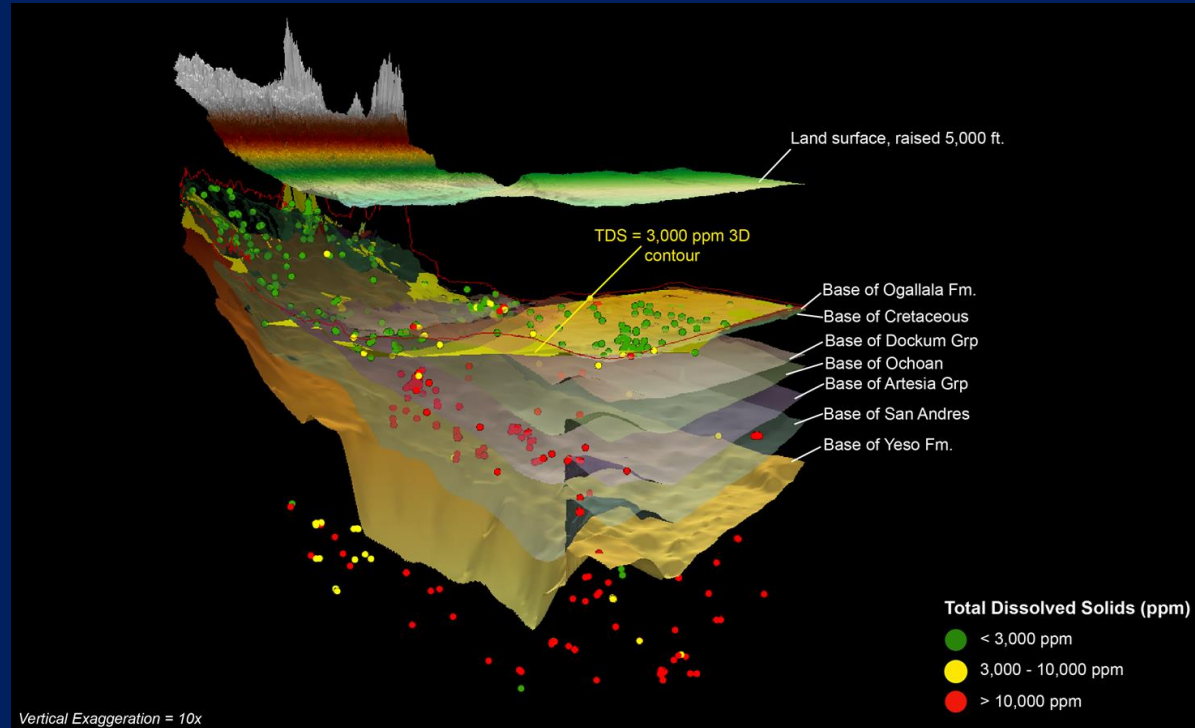
ArcGIS models of geologic surfaces and fresh / saline water interfaces are under development

- Pecos Slope and Estancia Basin are complete - GIS files are available at:  
<https://bit.ly/3Khmqat>
- Delaware Basin and Salt Basin are underway
- Collaborative funding from Healy Foundation, EMNRD and NMBGMR Aquifer Mapping program

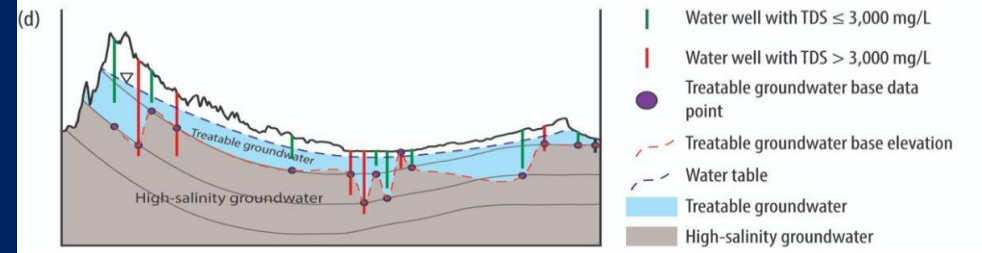
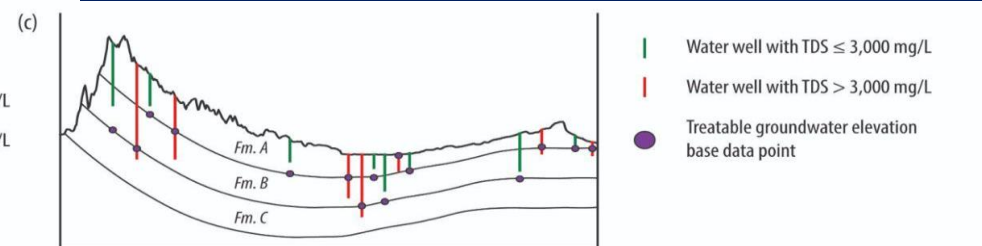
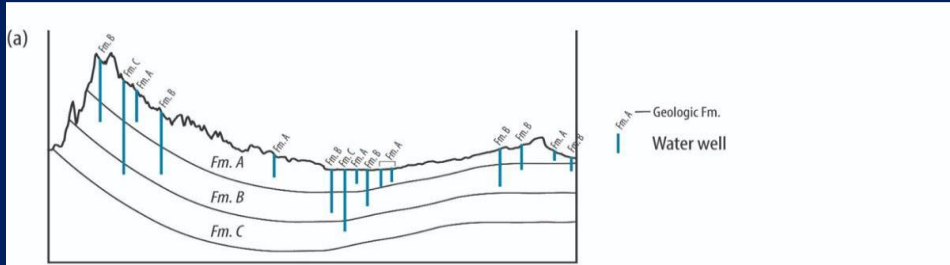


# The challenges of modeling water quality in 3D

- Every data point must have water quality data and well records (depth/geology)
- Wells with bad water quality are often poorly documented
- Collecting new regional samples is costly



# Conceptual model of salinity surface development

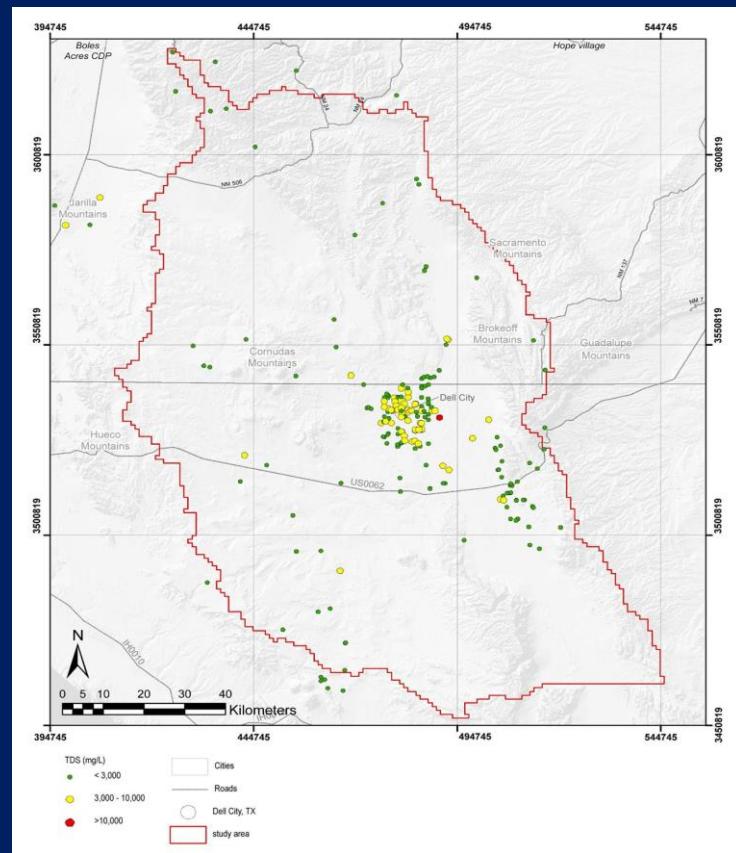
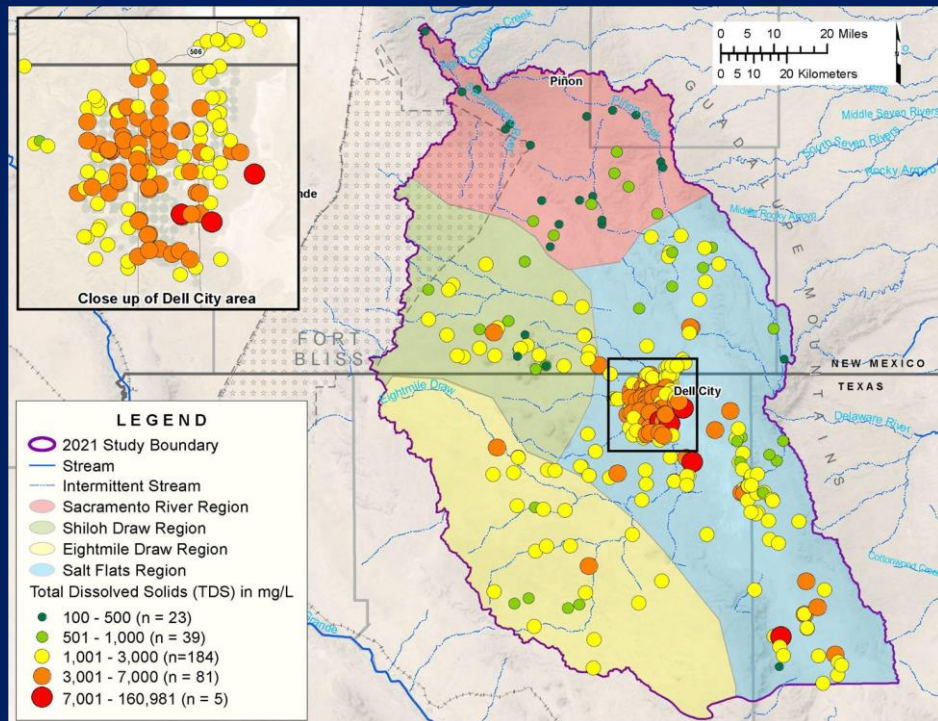


- a) Wells are plotted in 3D (with depth)
- b) Assign water quality values to the wells

- c) Compare well depths to formation depths
- d) Create water quality surface

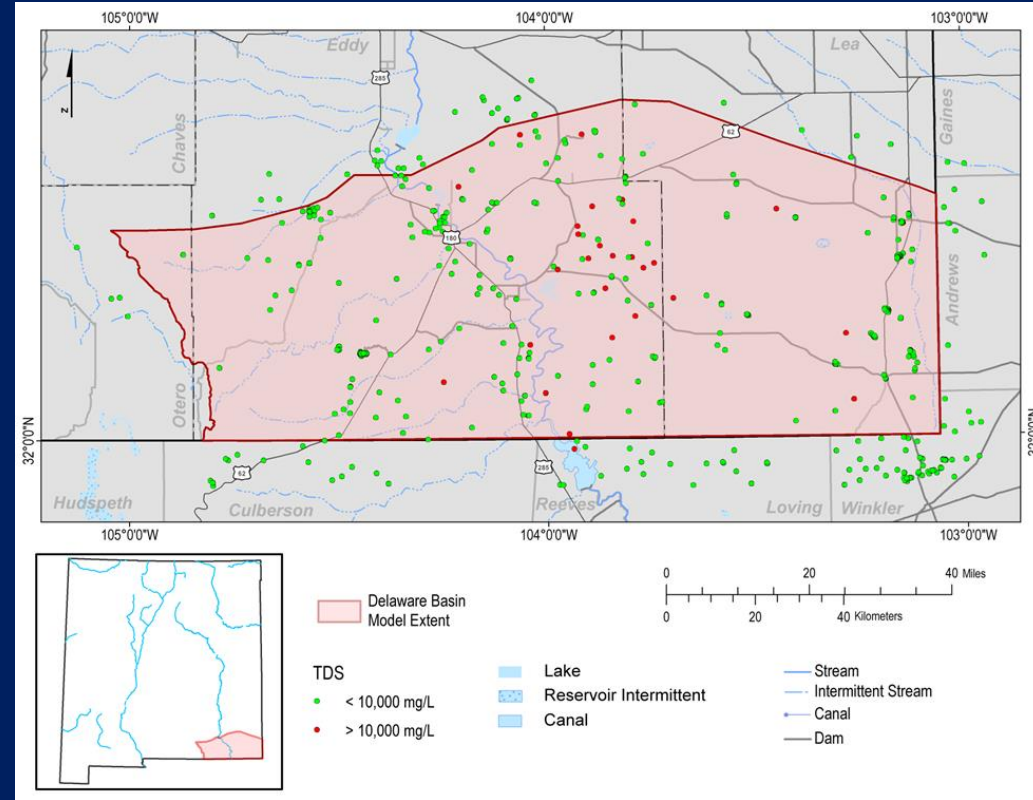


# Some historic data lack important details – example Salt Basin



# 3D Aquifer Mapping in the Delaware Basin

- Developing a hydrogeologic model of the Delaware Basin
- Focusing on the shallow, fresh water found in the top 2,500' of the subsurface (Capitan Reef and above)
- Geologic model draft complete (see Open File Geologic Map 303)
- Hydrologic model will be released in Spring 2023.
- Funding from EMNRD – OCD and USGS Statemap program



# Real investment is needed to move ahead on brackish water

Full aquifer characterization is needed, with immediate and long term funding

- Exploratory wells in priority regions
- Geophysical characterization
- Water chemistry analyses
- Environmental tracers to evaluate residence time, recharge rates, and connection with surface water
- Subsurface geologic and hydrologic mapping
- Hydraulic testing for aquifer properties (short and long tests)
- Commitment to long-term monitoring
- Open and fully accessible data (alignment with Water Data Act)

# Brackish water = overdraft account

- In many areas, brackish water is not actively recharged (GROUNDWATER MINING)
- EXPENSIVE challenges with inland desalination
  - Water quality/treatment is different from sea water (high silica)
  - Waste disposal
  - Energy cost for pumping and treatment
- Potential impacts to fresh water or surface water



Diffuse groundwater recharge map



**As we work to build resiliency and funding for next steps...**



- Conserve the limited freshwater resources
- Prepare for *supplementing* with brackish water - we *WILL* face harder droughts ahead
- Continue to improve regional characterizations of our aquifers (fresh and brackish waters)

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