

Southeastern New Mexico Subsurface Mapping Project



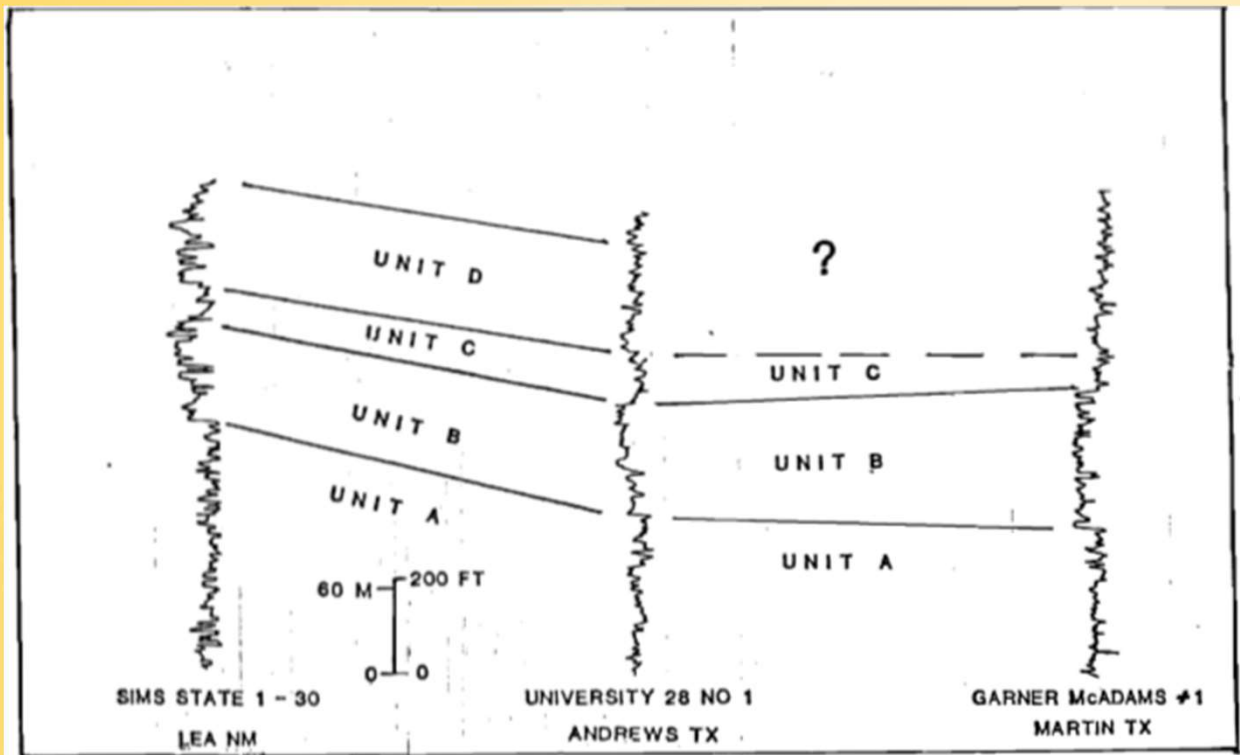
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Increasing Demand For Potable Water

- Demand for potable water continuously increasing.
- In the Permian Basin, only shallow aquifers contain potable water.
- Applications to appropriate potable water to meet demand are at an all time high in the area; Southern Lea County recently closed to new appropriations by OSE.
- Knowing the depth and thickness of shallow aquifers and aquitard formations is critical knowledge for well placement and groundwater flow modeling.



Stratigraphy of Interest



Pictured: Gamma log demarcations from Schiel's 1988 thesis showing the typical gamma signatures of the formations of interest to this project.

The Lower Tecovas Formation (Unit C)

- Primarily consists of shales, with thinly interbedded siltstones.

The Santa Rosa Formation (Unit B)

- Sandstone, with interbedded siltstone and cobblestone. Important regional aquifer.

The Dewey Lake Formation (Unit A)

- Characteristically red shale and siltstone, bounded below by the Rustler Formation.

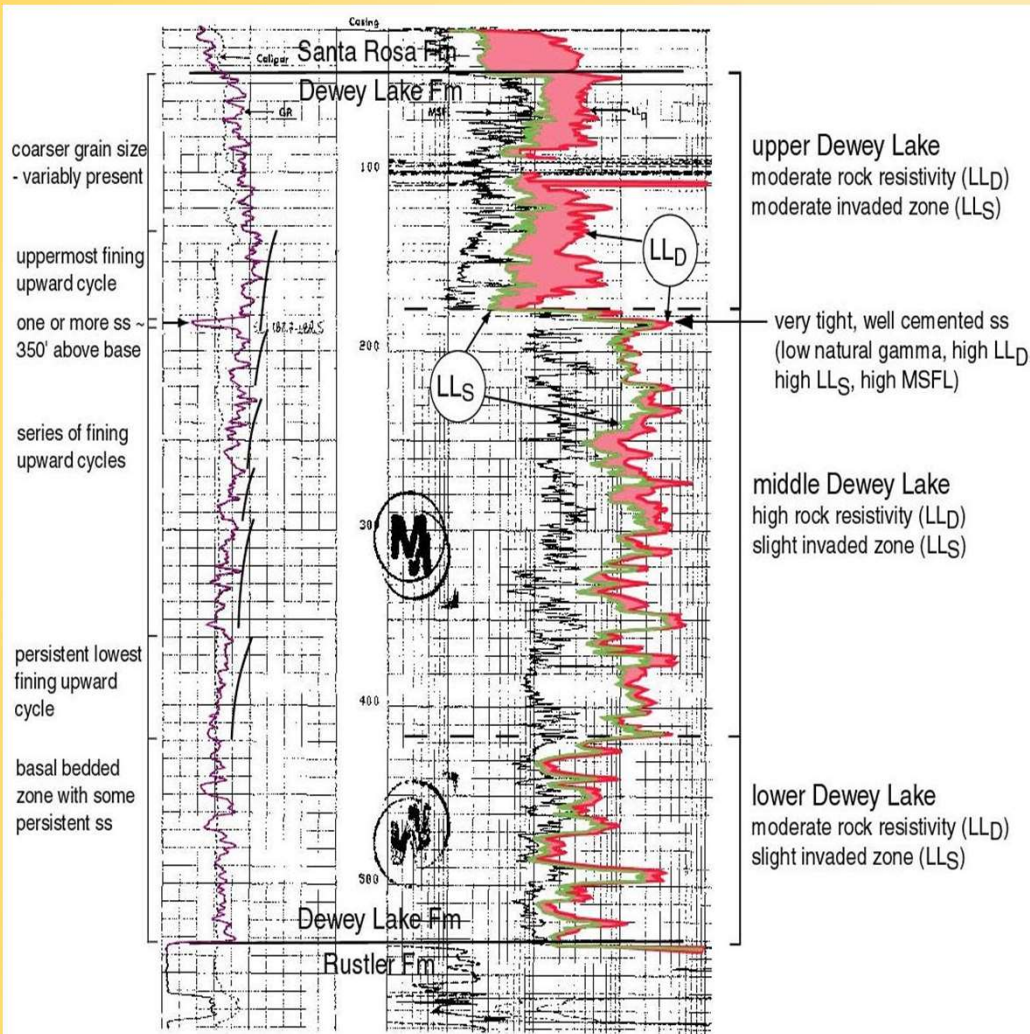
Understanding the Subsurface



Pictured: Some of the cuttings examined during this phase of the project

In 2019, to better locate these formations in the subsurface, the OSE and NMBGMR co-funded a joint subsurface mapping project.

- Initially, cuttings from the NMBGMR's Petroleum Cuttings Library were examined and compared with Texas' Brackish Resources Aquifer Characterization System (BRACS) lithologic picks, and OCD gamma logs.
- Too Many Disadvantages
 - Missing intervals
 - Unclear/transitional contacts
 - Extremely time-consuming



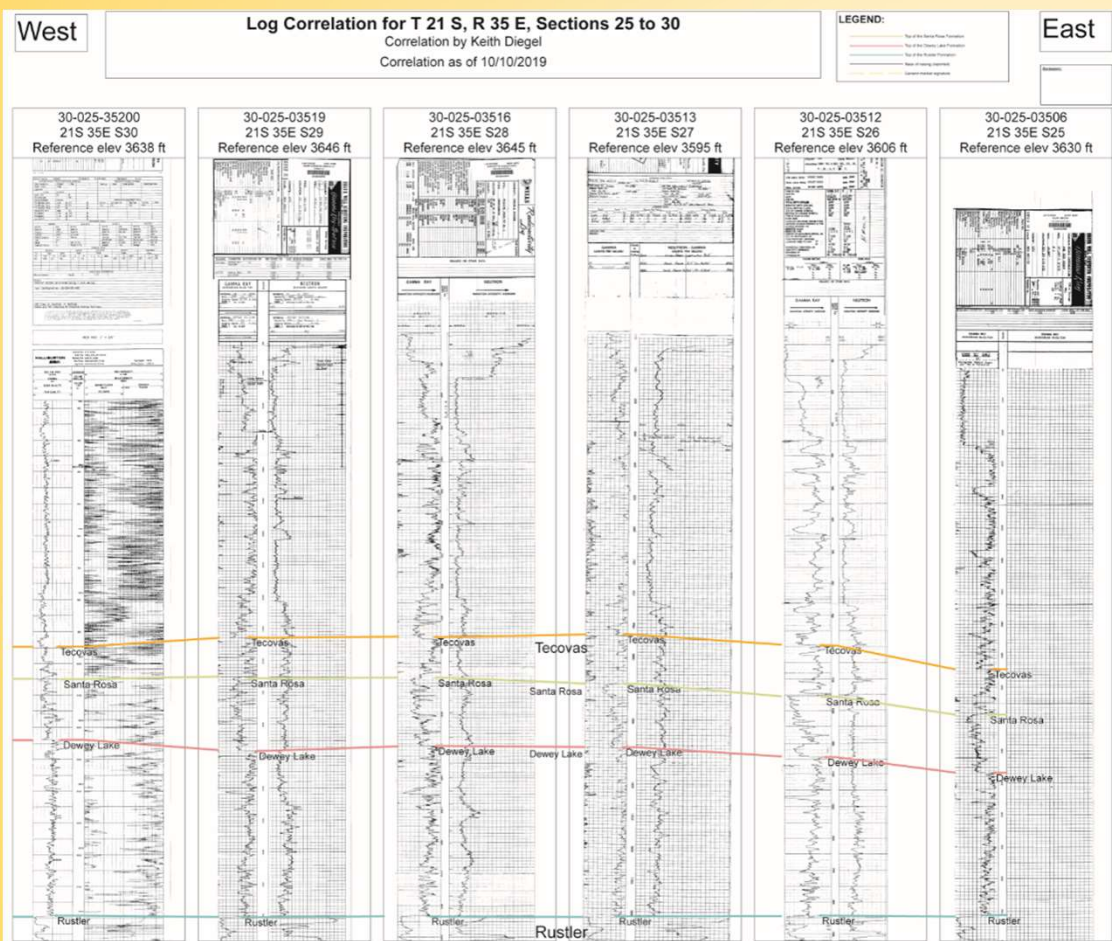
Pictured: Gamma log signatures for contacts between Santa Rosa & Dewey Lake, and Dewey Lake & the Rustler

Changing the Approach

We opted to examine well gamma logs directly, using patterns from Dennis Power's WIPP Site reports and Schiel's thesis as guides.

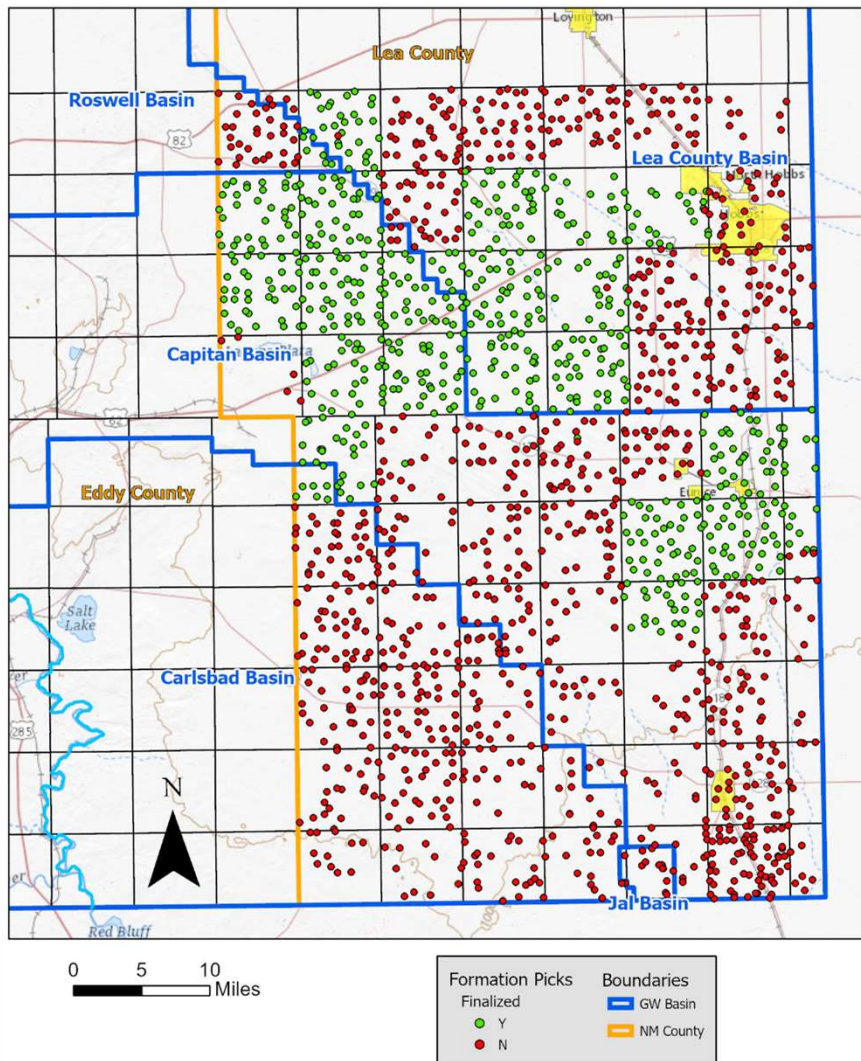
Others have used this approach, though not to the extent and resolution of this project.

Correlations to Assist Formation Picks



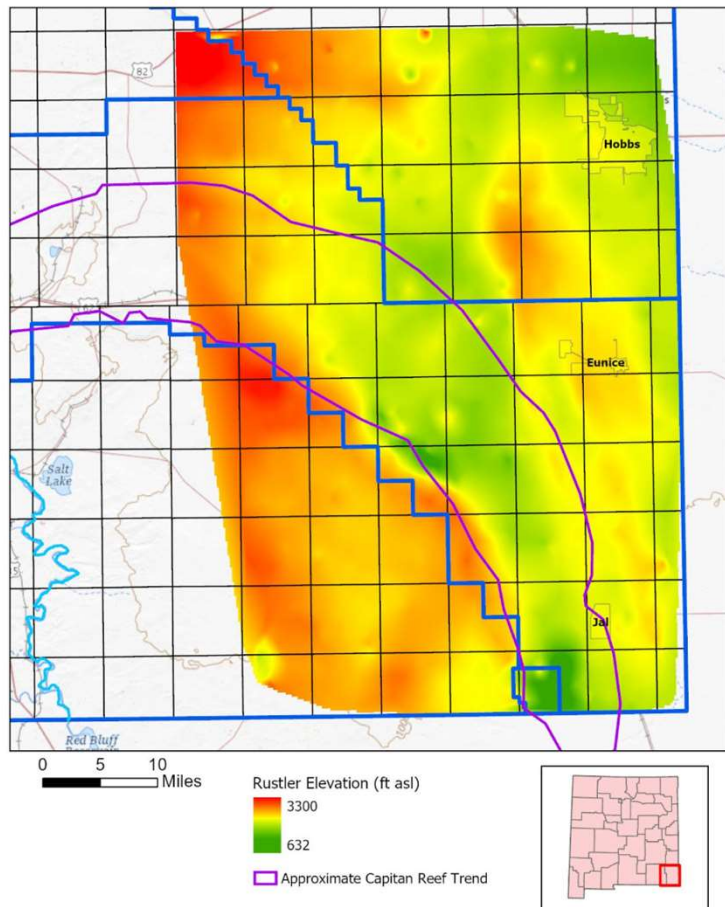
- Region defined as southern Lea County from T17S down.
- Gamma logs accessed via the OCD's well log repository.
- Target density of one log per section whenever possible.
- Some logs proved difficult to interpret individually; Correlating logs together aided in overcoming this problem

Pictured: Correlation across multiple logs



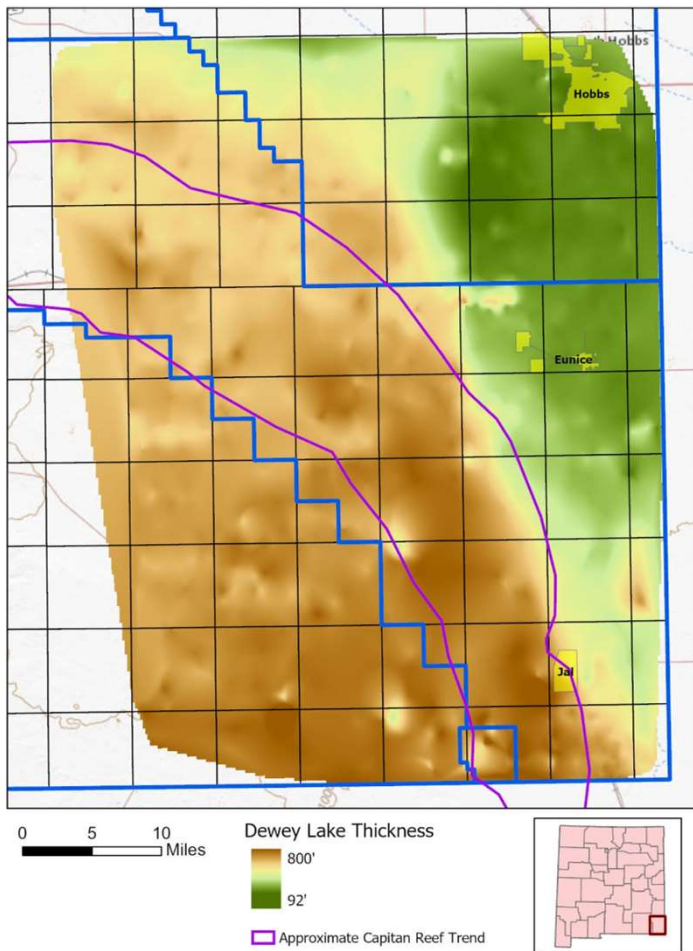
Well Locations

- 1,744 Well Logs.
- QC is ongoing. 645 data points finalized.
- Elevation of contacts determined from datum provided by logs with regard to Mean Sea Level
- Thickness of relevant formations calculated from elevation



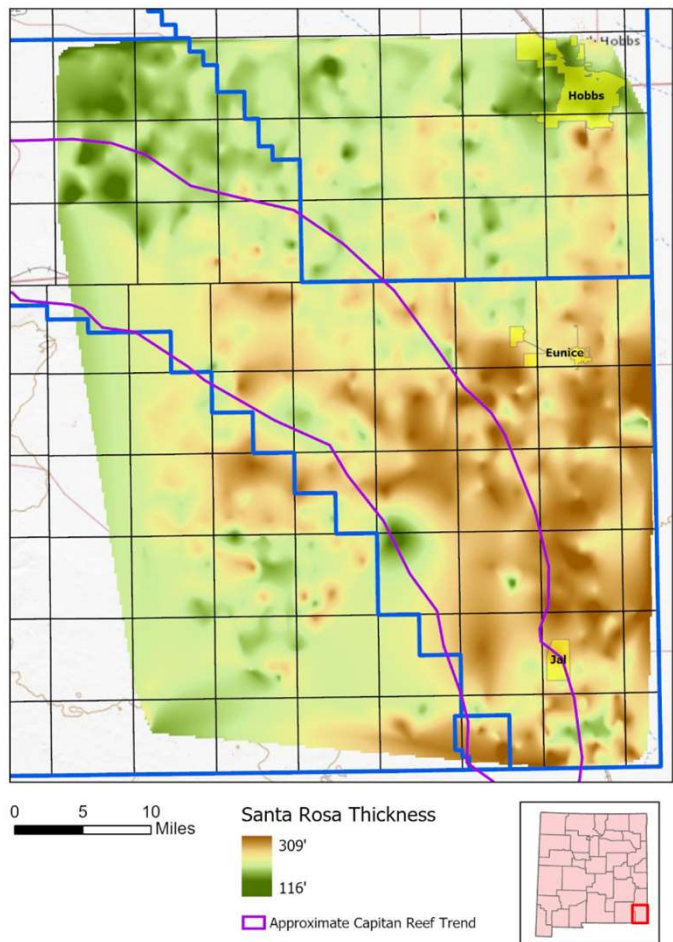
Top of the Rustler Formation

- Rustler elevation varies over 2,600'
- Monument Draw Trough is clearly visible, a vertical displacement resulting from dissolution of Castile Formation evaporites.
- Alluvial-filled trough is a significant shallow aquifer and is under great pressure to supply water.



Dewey Lake Formation Thickness

- Dramatic change in formation thickness in eastern portion of the region
- Transition boundary closely follows the outer Capitan Reef boundary



Santa Rosa Formation Thickness

- Thickens towards the southeast
- Less variable than the Dewey Lake
- Doesn't appear to be impacted by reef complex

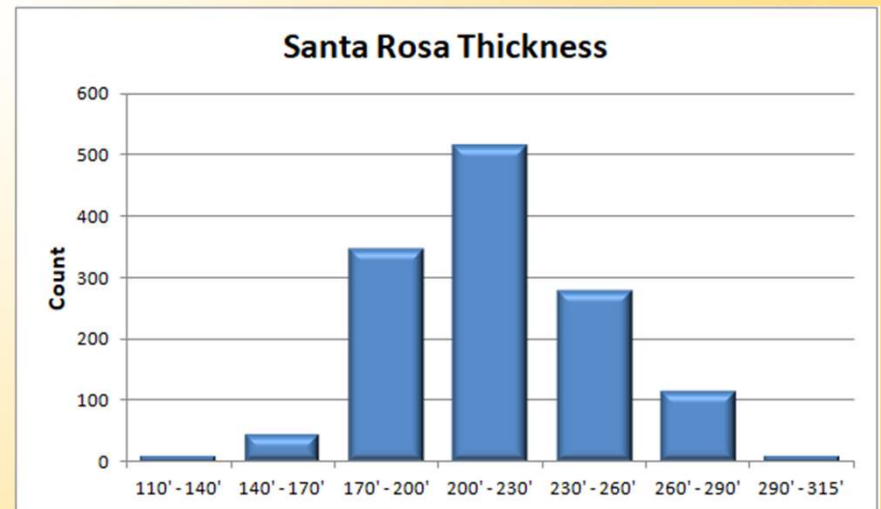
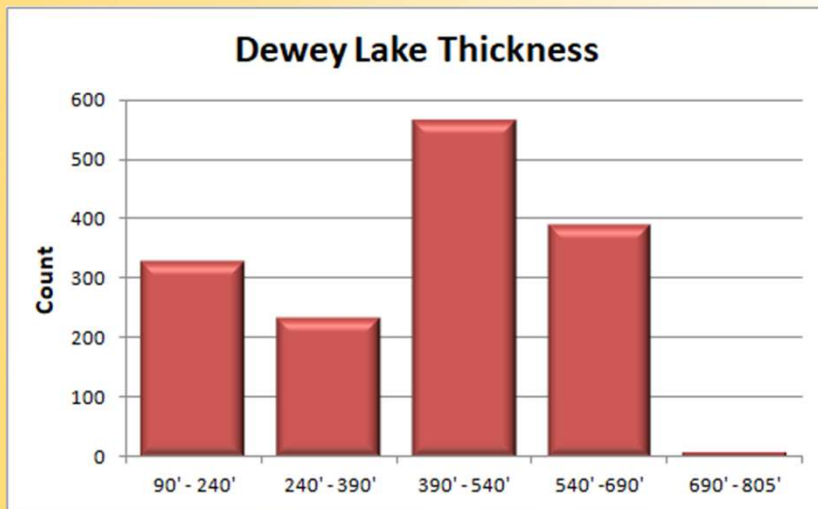
Statistics

Dewey Lake Thickness

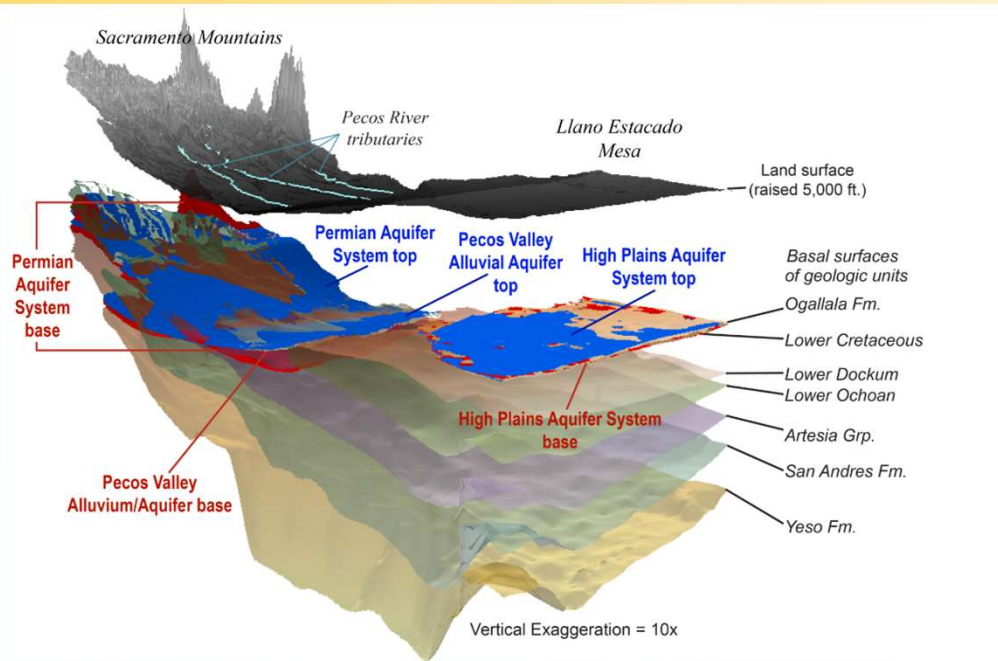
Mean	415
StdDev	162
Skewness	-0.478
Range	737
Minimum	90
Maximum	805

Santa Rosa Thickness

Mean	213
StdDev	30
Skewness	0
Range	205
Minimum	110
Maximum	315



Additional Work



Pictured: Aquifer Mapping Project's Pecos Slope 3D model, NMBGMR

- Complete QC
- Integrate Santa Rosa thickness into OSE southeast NM groundwater flow model, used to evaluate water rights applications
- Integrate final results into the Bureau of Geology's 3D model
- Extend range and include Chinle Formation and alluvial aquifers

References

BRACS Geophysical Well Logs Innovative Water Technologies - BRACS | Texas Water Development Board, <http://www.twdb.texas.gov/innovativewater/bracs/WellLogs.asp> (accessed March 2020).

Holt, R.M., and Powers, D.W., 1990, GEOLOGIC MAPPING OF THE AIR INTAKE SHAFT AT THE WASTE ISOLATION PILOT PLANT : Westinghouse Electric Corporation, Waste Isolation Division

Powers, D.W., and Richardson, R.G., 2003, Basic Data Report For Drillhole SNL-2 (C-2948) (Waste Isolation Pilot Plant): Office of Scientific and Technical Information.

Schiel, K.A., 1988, The Dewey Lake Formation: End Stage Deposit of a Peripheral Foreland Basin. University of Texas at El Paso.