

NEW MEXICO BUREAU OF GEOLOGY AND MINERAL RESOURCES

# Generalized Geology and Groundwater Surface of Union County and the Clayton Underground Water Basin, northeast New Mexico

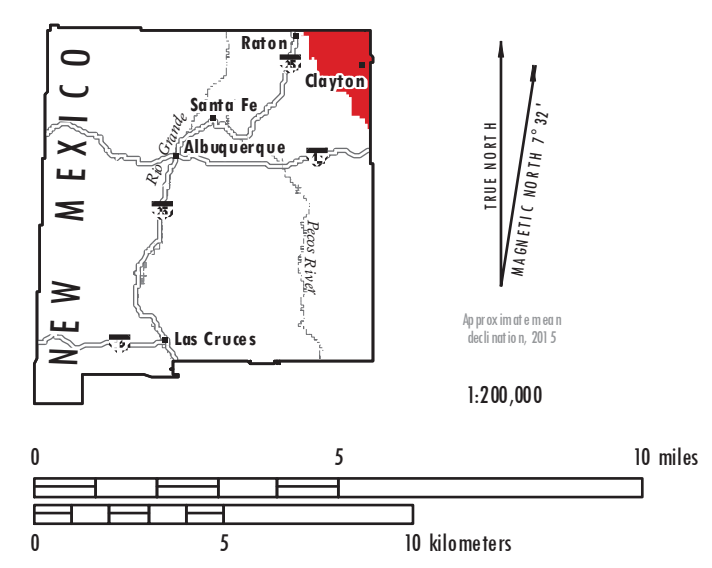
Open-file Report 570  
 Plate 1  
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### DESCRIPTION OF MAP UNITS

- Quaternary landslide deposits**  
 Unlithified deposits composed of a poorly sorted mix of sand, silt and clay, with abundant cobbles and boulders of sandstone and basalt. Only present in abundance along the flanks of Johnson Mesa and along steep slopes in the upper reaches of the Dry Cimarron River Canyon.
- Quaternary alluvium and aeolian deposits, and Tertiary Ogallala Formation**  
 The Ogallala Formation is a vertically and laterally complex rock unit composed of conglomerate, sandstone, and siltstone. Coarser-grained materials are generally present in paleo-channels scoured into the underlying bedrock, while finer-grained sediments are present on paleo-pland surfaces (Gustavson and Winkler, 1988). A thick, indurated caliche soil horizon (the "caprock" or "caliche") is present at the top of the formation. The Ogallala is usually covered with a mantle of unlithified aeolian sand occurring in sheets and small dunes. Drainages are floored with unlithified sandy alluvium. These units are the most widespread rocks south of the Dry Cimarron valley.
- Quaternary and Tertiary volcanic rocks**  
 Basalt flows and volcanoes that are coeval and younger than the Ogallala Formation. The widespread flows are abundantly fractured and often covered with a mantle of windblown silt. The shield volcanoes (e.g., Sierra Grande) and cones (e.g., Rabbit Ears Mountain) are composed of mixed basalt flows and loosely consolidated volcanic tephra.
- Cretaceous shale and minor limestone**  
 Unit includes all shale-dominated Cretaceous rocks above the Dakota Formation, and subordinate limestone beds. Included are the Graneros Shale, Greenhorn Formation, Carlile Shale, Niobrara Formation, and Pierre Shale. Exposures of these rocks are scattered across the northern two-thirds of the study area.
- Cretaceous sandstones**  
 Cretaceous sandstones, mostly the Dakota Formation, with minor exposures of the Vermejo and Trinidad Sandstones around Johnson Mesa. The latter two units are stratigraphically above the Cretaceous shale map unit. Included in this map unit are small exposures of unlithified Cretaceous rocks, which are assumed to be largely the Dakota Formation. The Dakota Formation contains minor shaly beds and coal but is dominated by sandstone beds. Includes the mixed sandstone and shale of the Cretaceous Gencam Formation and Lyle Sandstone below the Dakota Formation (together equivalent to the Purgatone formation, Kues and Lucas, 1987).
- Jurassic sandstone, shale, and mudstone**  
 Map unit consists of the Morrison and Entrada Formations. The Morrison is composed of mudstone and shale with locally abundant sandstone beds, whereas the underlying Entrada is a widespread clean aeolian sandstone that forms a prominent cliff in the Dry Cimarron Valley. Both units appear to be present throughout the study area, with exposures abundant in the Dry Cimarron valley and the upper reaches of Trampers Creek.
- Triassic shale and sandstone**  
 Exposures of sandstone and shale of the Chinle group that are abundant along the floor of the Dry Cimarron valley. There is an isolated exposure of Chinle in the southeast panhandle of the county.

- NMBGMR / NESWCD wells**
- Ogallala Fm/Upland deposits/Basalt
- Ogallala Fm
- Dakota Fm
- Lower Cretaceous Sandstone
- Morrison Fm or Entrada Fm
- Entrada Fm
- Triassic undiv
- OSE NMWRRS wells**
- Ogallala Fm/Upland deposits/Basalt
- Ogallala Fm
- Cretaceous Shale above Dakota Fm
- Dakota Fm
- Lower Cretaceous Sandstone
- Morrison Fm or Entrada Fm
- Entrada Fm
- Triassic undiv

- Well Information**
- Well ID
- Water level elevation
- Date of measurement
- Water Level Contours**
- Contour
- approximate
- Hydrology**
- Spring with elevation
- Perennial stream reaches
- Other drainages
- Study area
- Hydrograph regions
- County boundary



**Comments to Map Users**  
 The purpose of this map is to illustrate important aspects of regional groundwater conditions. Groundwater elevation data depicted herein were derived primarily from depth-to-water measurements taken between December 2012 and March 2013 by the New Mexico Bureau of Geology and Mineral Resources (NMGR) at New Mexico Tech, the Northern Salt and Water Conservation District, and the US Geological Survey. In locations where these recent data were not available, static water levels were used from selected well records in the older New Mexico Office of the State Engineer. Land surface elevations used to derive groundwater elevation values originated from a 10m digital elevation model (DEM). Groundwater levels in the vicinity of wells may fluctuate significantly with pumping. The user should be aware that the groundwater elevation surface depicted here is based on conditions as of 2012-2013. Current groundwater conditions may differ from those shown. Site- and time-specific conditions should be verified by the user. All additional information contained on this map, other than groundwater elevation data, not available static water levels were used from selected well records in the older New Mexico Office of the State Engineer. Land surface elevations used to derive groundwater elevation

