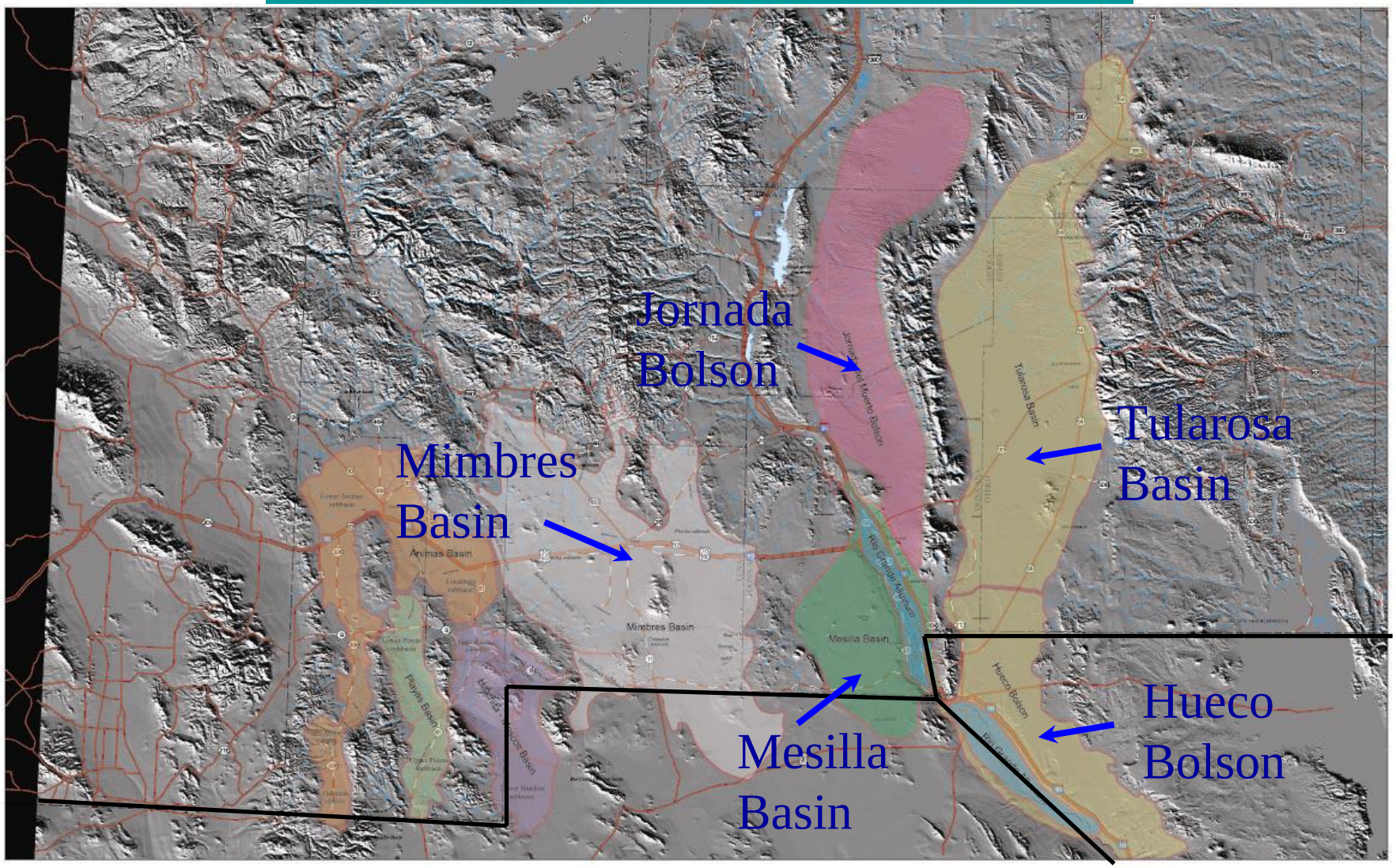
Groundwater Resources of the Las Cruces/Doña Ana County Region

Presentation to Lower Rio Grande Water Users Organization
Water Symposium
June 6, 2007
Las Cruces, NM

by

Bobby J. Creel, PhD
New Mexico Water Resources Research Institute

Water Resources in the Border Region



Selected Hydrogeology Investigations

King, W.E., J.W. Hawley, A.M. Taylor, and R.P. Wilson. 1971. *Geology and ground-water resources of central and western Doña Ana County, New Mexico*. New Mexico State Bureau of Mines and Mineral Resources Hydrologic Report 1, 64p.

Wilson C.A., R.R. White, B.R. Orr, and R.G. Roybal. 1981. *Water resources of the Rincon and Mesilla Valleys and adjacent areas, New Mexico.* New Mexico State Engineer Office Technical Report 43, 514p, 16 plates.

Seager, W. R., J.W. Hawley, F.E. Kottlowski, and S.A. Kelley. 1987. *Geology of the east half of Las Cruces and northeast El Paso 1x2 degree sheets, New Mexico,* New Mexico Bureau of Mines and Mineral Resources Geologic Map GM-57. scale 1:125,000.

Hawley, J.W., and R.P. Lozinsky. 1992. *Hydrogeologic framework of the Mesilla Basin in New Mexico and western Texas*. New Mexico Bureau of Mines and Mineral Resources Open- File Report 323.

Frenzel, P.F., and C.A. Kaehler. 1992. *Simulation of ground-water flow in the Mesilla Basin, Doña Ana County, New Mexico and El Paso County, Texas*. Supplement to Open-file Report 88-305. U.S. Geological Survey Water Resources Investigations Report 91-4155, 152p.

Frenzel, P.F. and C.A. Kaehler. 1992a. *Geohydrology and simulation of ground-water flow in the Mesilla Basin, Doña Ana County, New Mexico and El Paso County, Texas; with a section on water quality and geochemistry by S. K. Anderholm.* U.S. Geological Survey Professional Paper 1407-C. 105 p.

Selected Hydrogeology Investigations, continued.

Hamilton, S. L. and T. Maddock III, 1993, *Application Of A Ground-Water Flow Model To The Mesilla Basin, New Mexico And Texas*, Department Of Hydrology And Water Resources, The University Of Arizona, Tucson, AZ, 298 pp. + maps.

Seager, W. R. 1995. *Geologic map of the southwest part of Las Cruces and northwest part of El Paso 1x2 degree sheets, New Mexico.* New Mexico Bureau of Mines and Mineral Resources Geologic Map GM-60. scale 1:125,000

Shomaker, John W. And Steven T. Finch, Jr., 1996, *Multilayer groundwater Flow Model Of Southern Jornada Del Muerto Basin, Dona Ana County, New Mexico, And Predicted Effects Of Pumping Wells Lrg 430 S 29 And S 30*, City Of Las Cruces, New Mexico, 1996. 280 p.

Hibbs, B.J., R.N. Boghici, M.E. Hayes, J.B. Ashworth, A.T. Hanson, Z.A. Samani, J.F. Kennedy, and B.J. Creel, 1997, *Transboundary Aquifers of the El Paso/Ciudad Juárez/Las Cruces Region*, Texas Water Development Board and New Mexico Water Resources Research Institute, October 1997. 155 p.

Weeden, A.C. and T. Maddock, III, 1999, *Simulation of Groundwater Flow in the Rincon Valley Area and Mesilla Basin, New Mexico and Texas,* Department Of Hydrology and Water Resources, The University Of Arizona, Tucson, AZ, 187 pp.

Hawley J.W. and J.F. Kennedy, 2004. *Creation of a Digital Hydrogeologic Framework Model of the Mesilla Basin and Southern Jornada del Muerto Basin - New Mexico* Water Resources Research Institute Technical Report 332, New Mexico State University.

New Mexico Lower Rio Grande Regional Water Plan

Prepared For The:

Lower Rio Grande Water Users Organization

(For submittal to Interstate Stream Commission)

Prepared By:

Terracon

In association with:

Zia Engineering & Environmental Consultants, Inc.

Livingston Associates, P.C.

JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS

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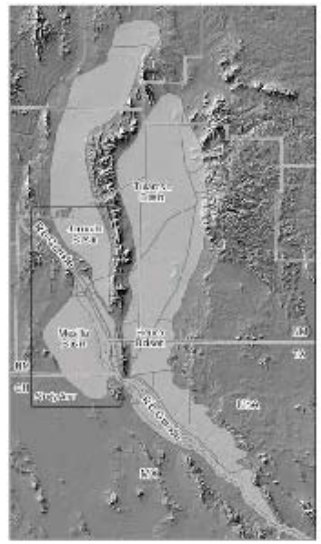
Chapter 6 – Water Resources Assessment for the Planning Region

JUNE 2004

CREATION OF A DIGITAL HYDROGEOLOGIC FRAMEWORK MODEL OF THE MESILLA BASIN AND SOUTHERN JORNADA DEL MUERTO BASIN

WRRI Technical Completion Report No. 332

John W. Hawley
John F. Kennedy



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Definitions

The terms “basin” and “bolson” are used as alternative designations for large intermontane-basin landforms and their sedimentary fill.

Some basins have no surface outlets and the lowest parts of their floors contain ephemeral-lake plains (playas).

Others contain axial drainageways that occasionally discharge to lower external areas.

Geohydrologists use the terms open and closed solely to describe basin topography and surface-flow systems; and undrained, partly drained, and drained refer only to groundwater flow.

Recharge to aquifers in desert basins is often considered to be the sum of several distinct processes occurring in different regions of the basin. These include mountain block, mountain front, ephemeral stream channel, interdrainage areas of the basin floor, and surface water bodies such as playas.

Mountainous regions are typically viewed as significant sources of recharge due to the larger precipitation input.

In the basin floors the desert vegetation may effectively capture most of the potential recharge.

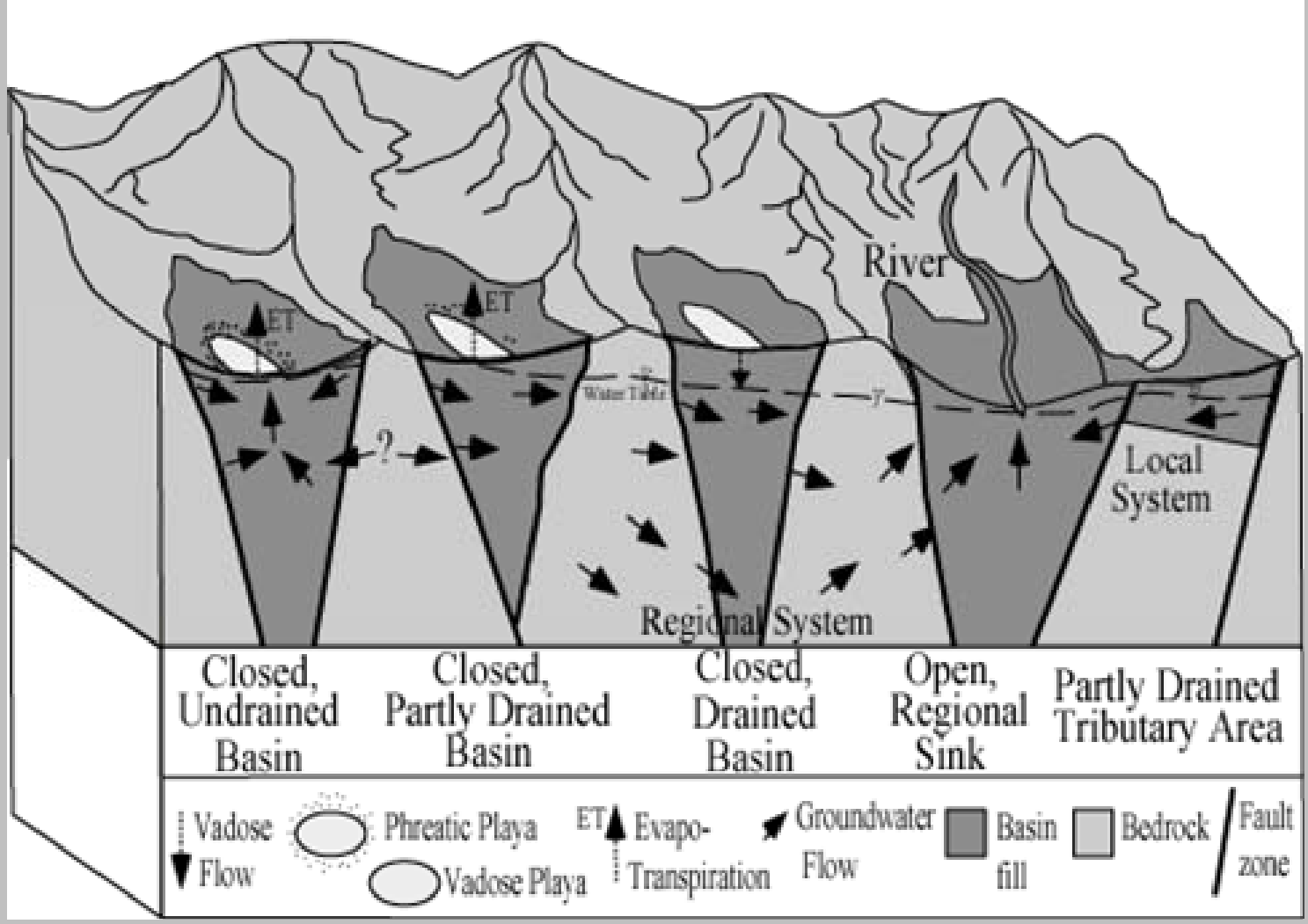
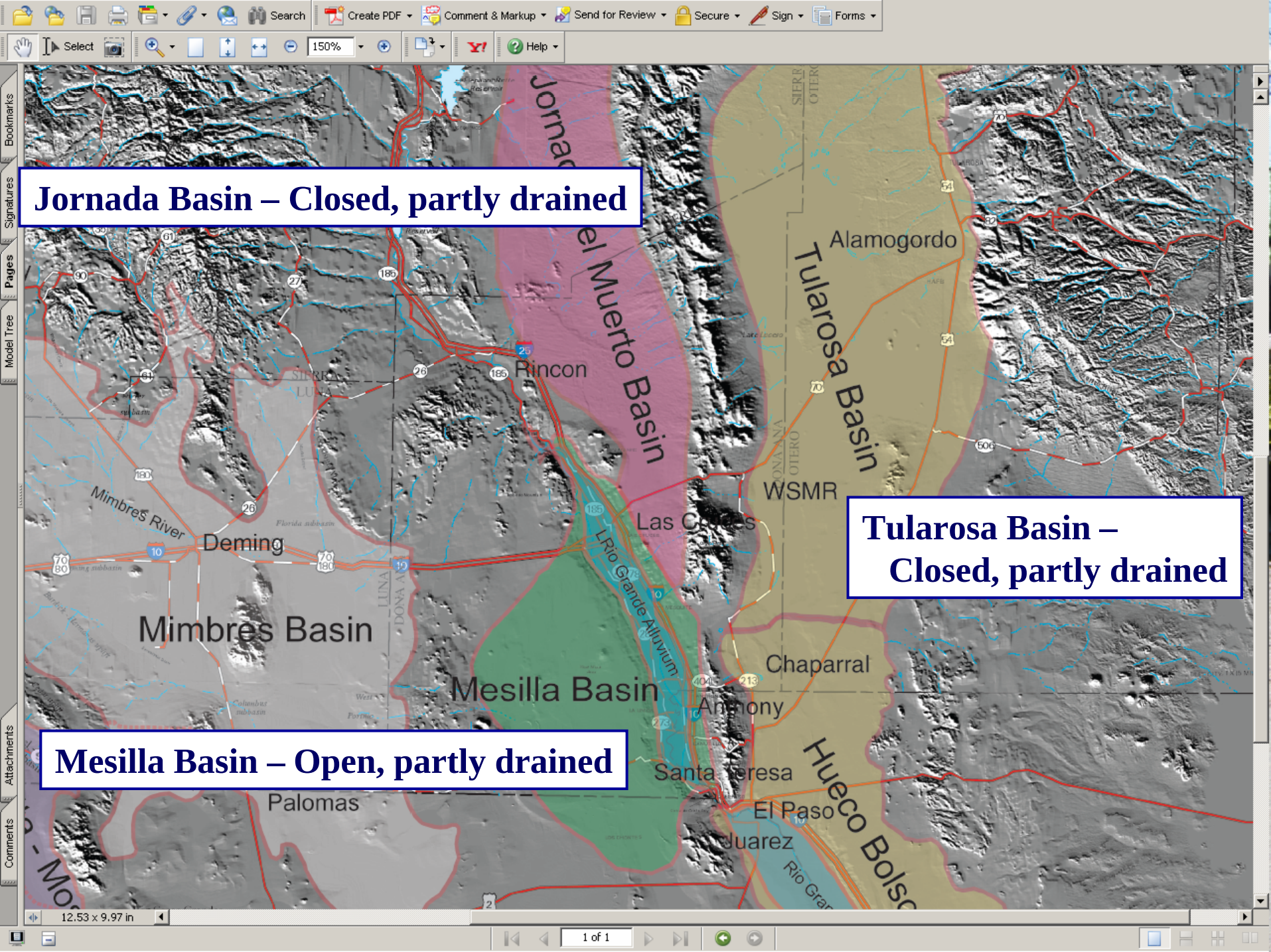
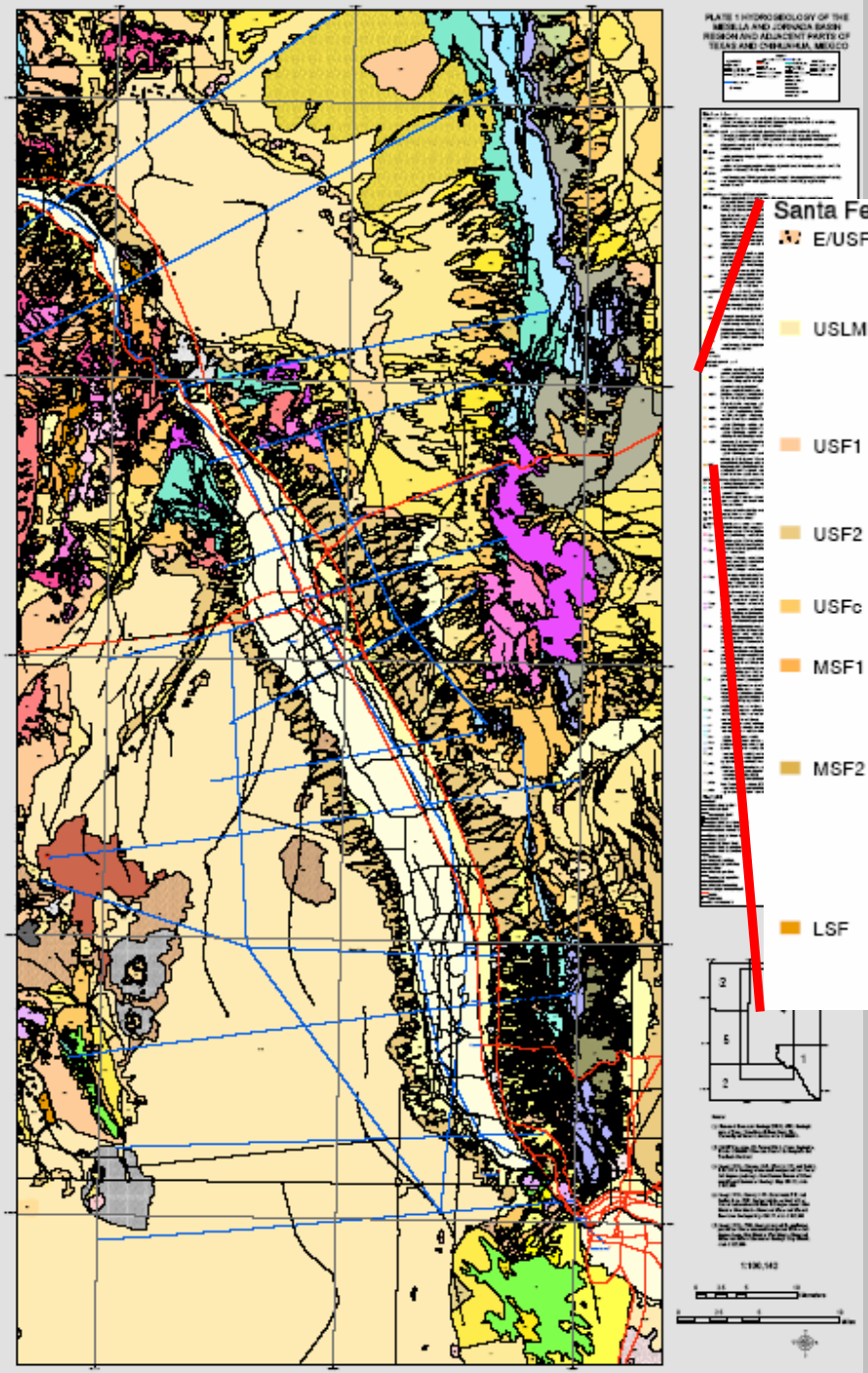


Figure 3-1. Schematic diagram showing hydrogeologic framework and groundwater-flow system in interconnected group of closed and open; undrained, partly drained, and drained intermontane basins. Modified from Eakin and others (1976), Mifflin (1986), and Hibbs and others (1998).


Jornada Basin – Closed, partly drained
Tularosa Basin – Closed, partly drained
Mesilla Basin – Open, partly drained
Alamogordo
Rincon
Deming
Mimbres River
Mimbres Basin
Mesilla Basin
Tularosa Basin
WSMR
Las Cruces
Rio Grande Alluvium
Chaparral
Anthony
Santa Teresa
El Paso
Juarez
Palomas
Hueco Bolson

Geology



Santa Fe Group HSUs

E/USF1

USLM — *Middle Pleistocene to Pliocene, Upper Santa Fe HSUs, sandy, fluvial and eolian sediments (with partially indurated clacic paleosols) of the La Mesa geomorphic surface; up to 20 ft (6 m) thick and entirely in the vadose zone; up to 10 ft (3 m) of upper Quaternary eolian cover is locally present*

USF1 — *Early Pleistocene to Late Miocene, Upper Santa Fe HSUs, medial to distal piedmont facies, mostly facies 5 and 6; includes Camp Rice Formation; up to 10 ft (3 m) of upper Quaternary eolian cover is locally present*

USF2 — *Early to Late Miocene, Upper Santa Fe HSUs, basin- floor facies 1 to 4, undivided; includes Camp Rice Formation subdivisions; up to 10 ft (3 m) of upper Quaternary eolian cover is locally present*

USFc — *Pliocene to Late Miocene, Upper Santa Fe HSUs, mostly proximal piedmont facies 6 and 8; includes Camp Rice Formation subdivisions*

MSF1 — *Upper Tertiary, Middle Santa Fe HSUs, primarily conglomeratic piedmont facies 7 and 8; includes Fort Hancock and Rincon Valley Fm subdivisions*

MSF2 — *Upper Tertiary, Middle Santa Fe HSUs, basin-floor facies undivided, primarily weakly to moderately indurated pebbley sandstones, sandstones and mudstones of facies 3, 4, and 9 (mostly in the zone of saturation); includes Rincon Valley Fm subdivisions. Note that unit only occurs in the subsurface beneath the central basin areas*

LSF — *Upper Tertiary, Lower Santa Fe HSUs, undivided piedmont and basin-floor facies 4, 7, 8, 9, and 10; fanglomerate, conglomerate, conglomeratic sandstone, siltstone, and mudstone with thin, fresh-water limestone tongues; mostly derived from local volcanic rocks. Basalt fanglomerate correlates with Hayner Ranch Fm. Note that unit is mostly buried in central basin areas and is saturated*

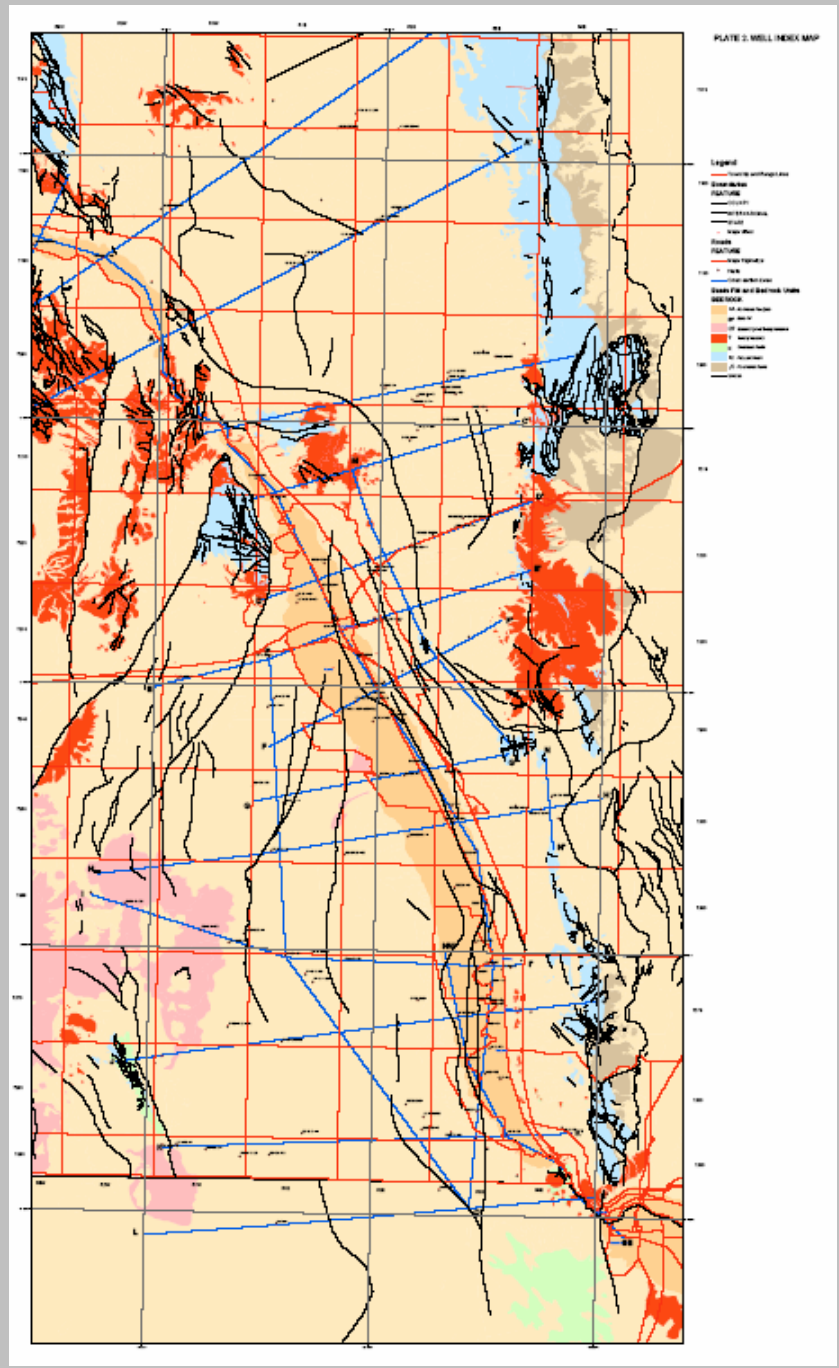
Cross-section Lines

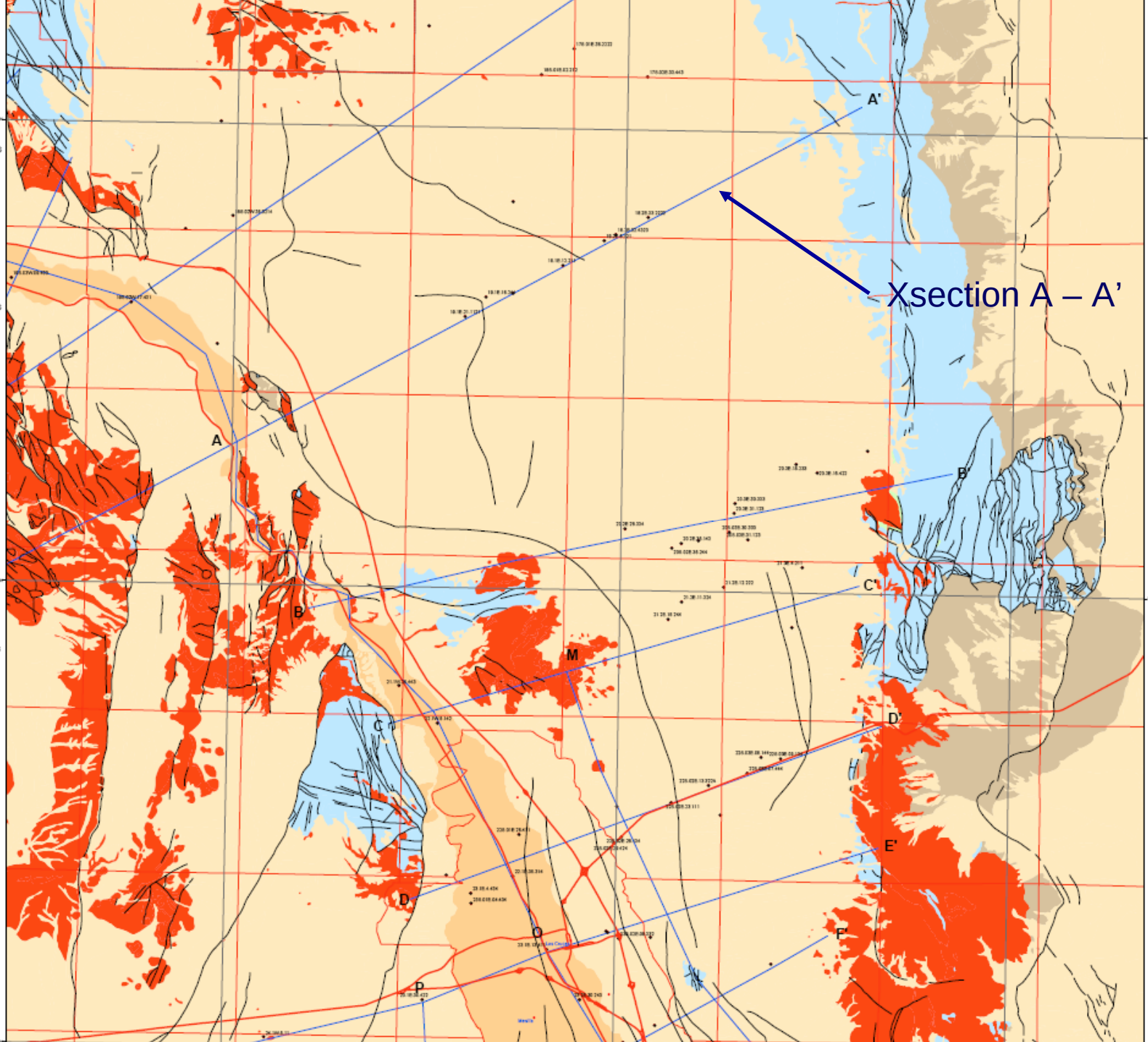
Basin Fill and Bedrock Units

BEDROCK

- RA *Rio Grande Floodplain*
- BF *Basin Fill*
- QT *Quaternary and Tertiary Volcanics*
- T *Tertiary Volcanics*
- K *Cretaceous Rocks*
- Pz *Paleozoic Rocks*
- pC *Precambrian Rocks*

faults arc

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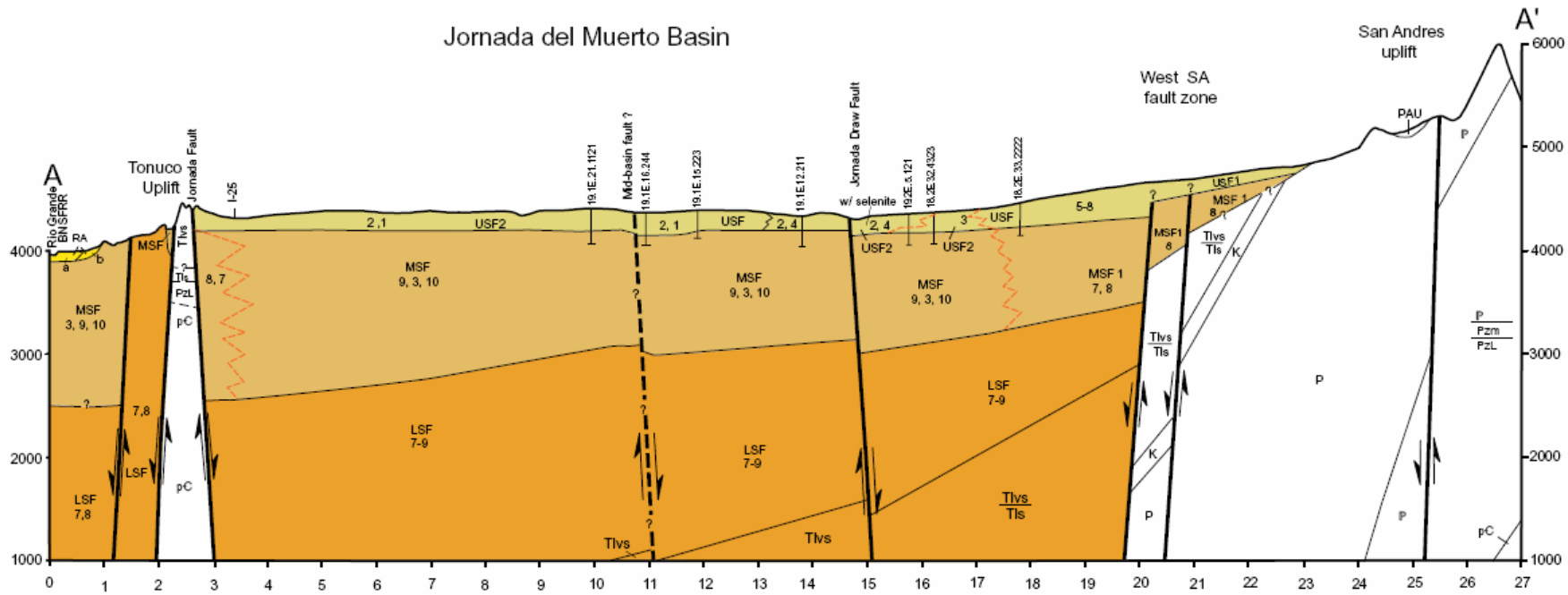
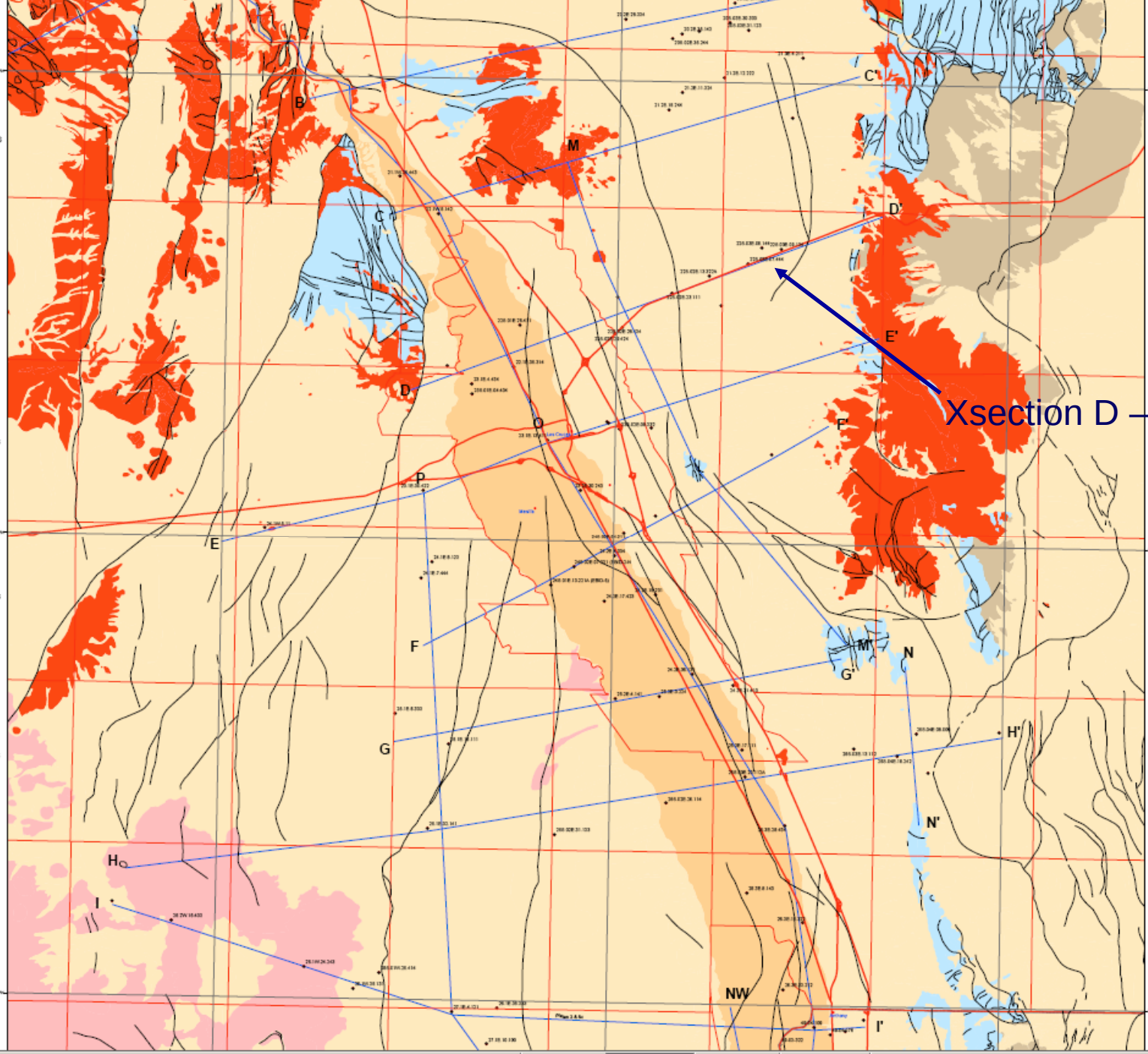


Plate 3a. Section A-A' - Jornada (del Muerto) Basin: Rincon Valley and Tonuco Uplift to San Andres Mountains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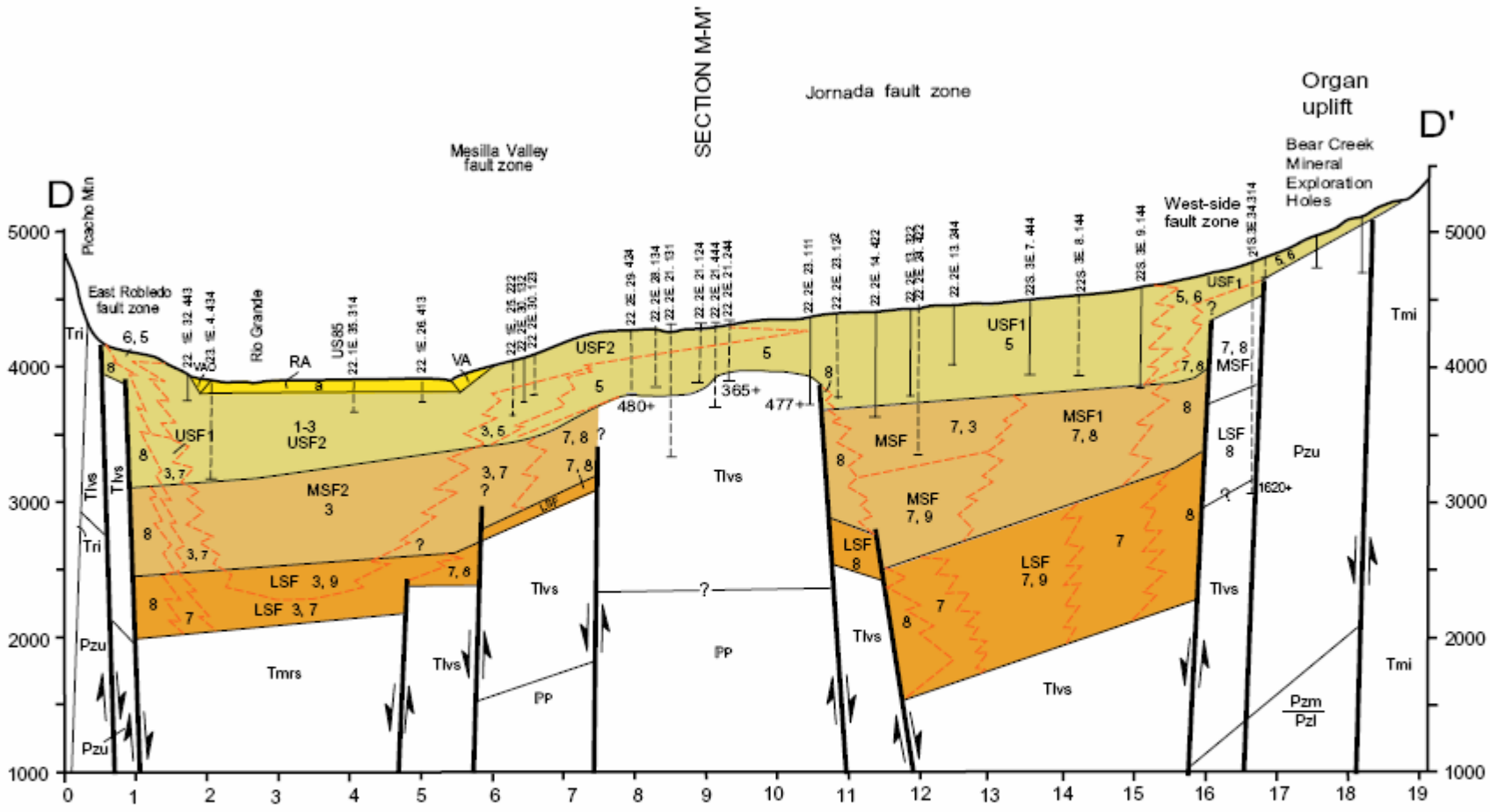
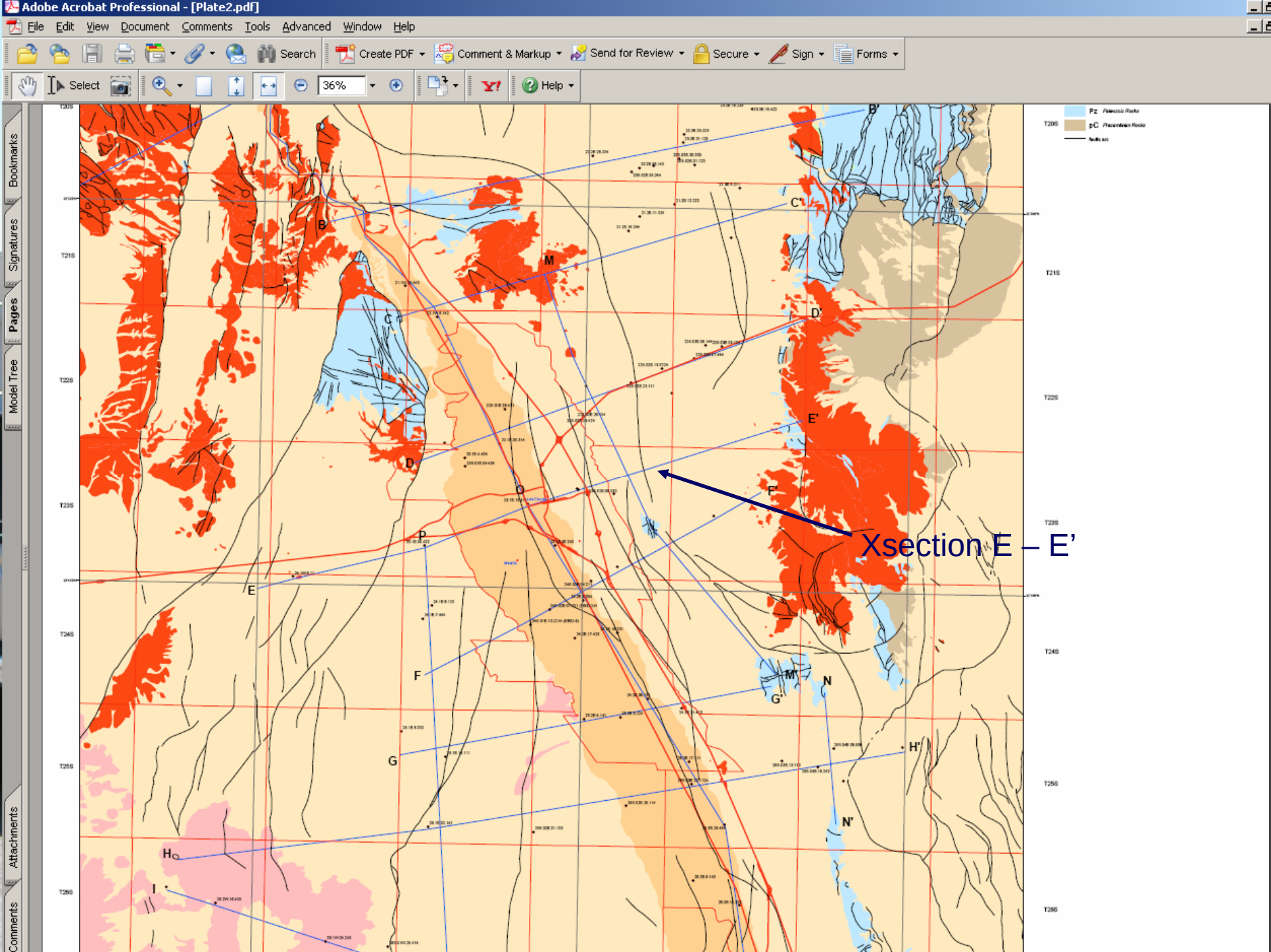


3d. Section D-D' - Mesilla Valley and U.S. 70 corridor at southern end of Jornada Basin: Picacho Mountain to San Agustin Pass through Northern Organ Uplift.

Mesilla Basin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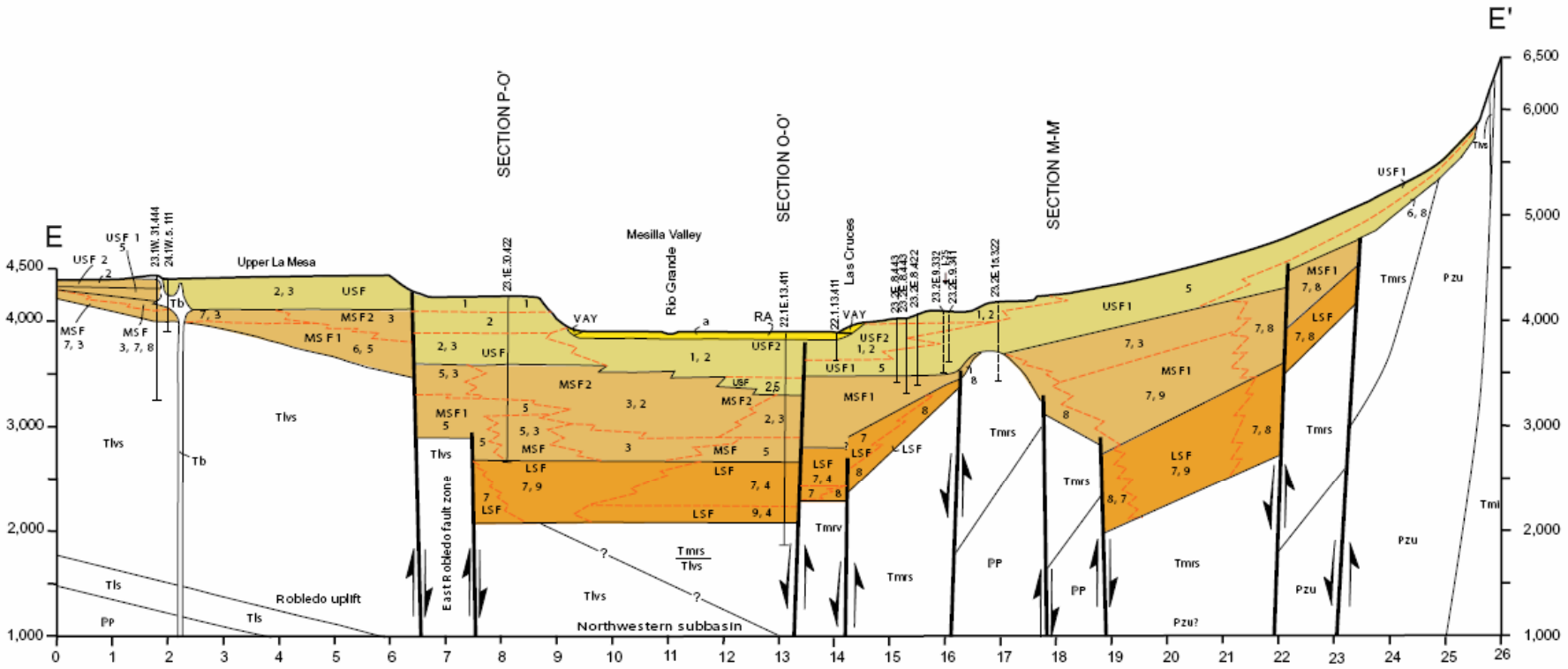
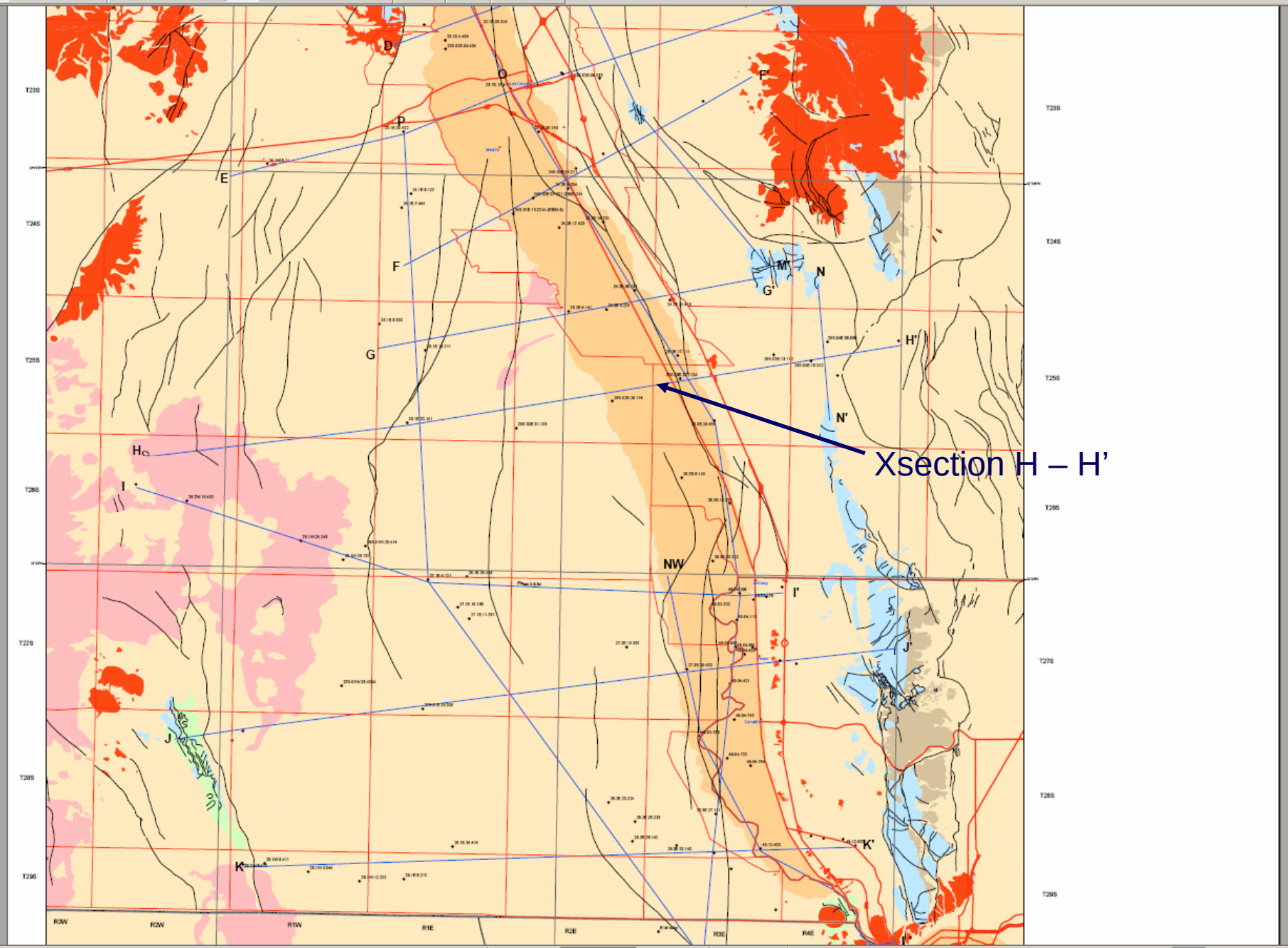


3e. Section E-E' - Mesilla Valley and Northern Mesilla Basin: Las Cruces airport to Organ Mountains.

Plate 3. Transverse Hydrogeologic Sections across the "Lower" Jornada del M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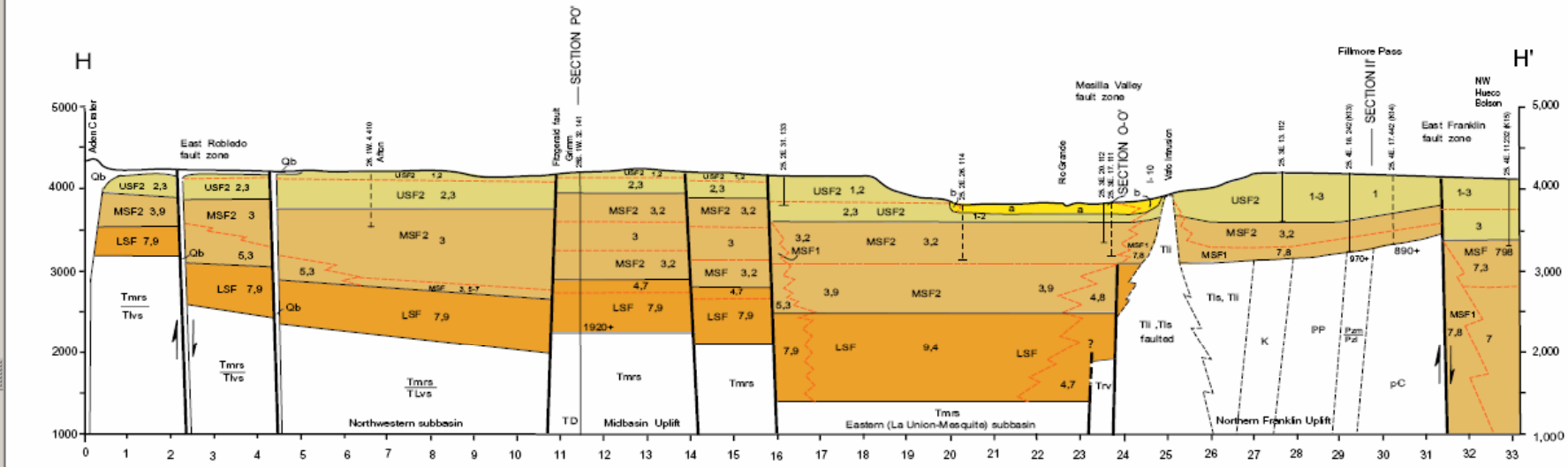
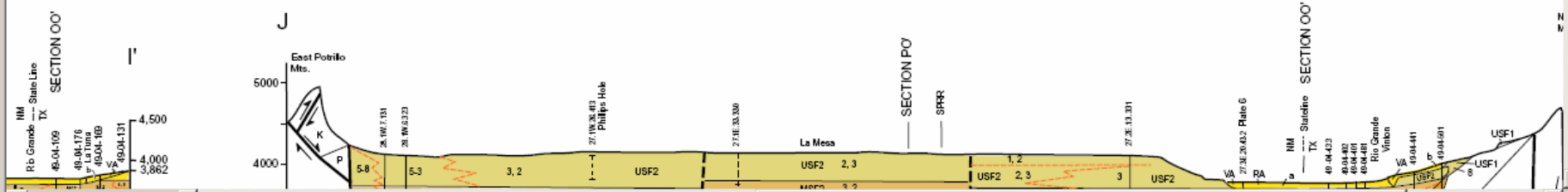
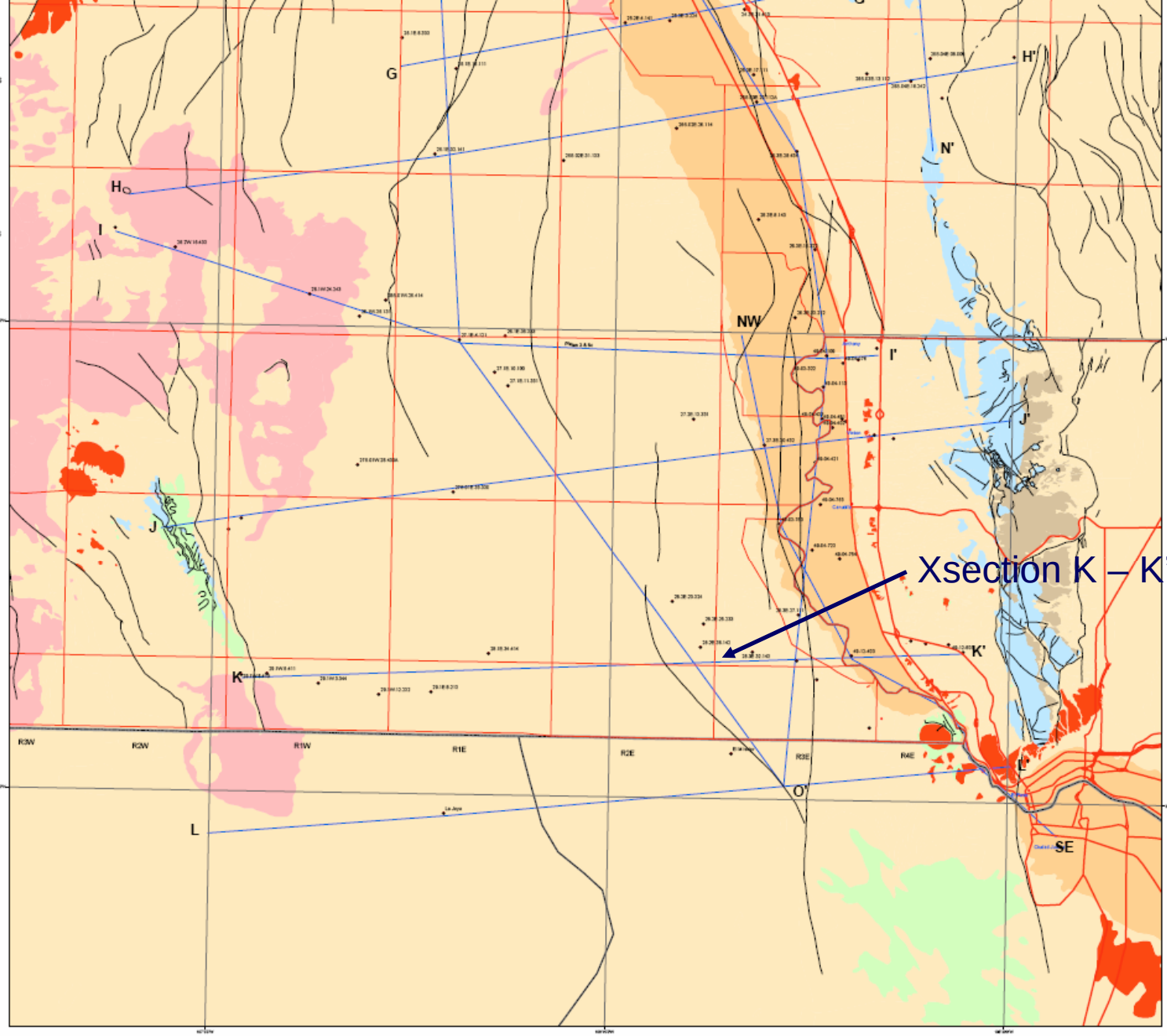


4b. Section H-H' - Central Mesilla Basin and Valley: Aden volcanic center to La Mesa-Vado area and Fillmore Pass.

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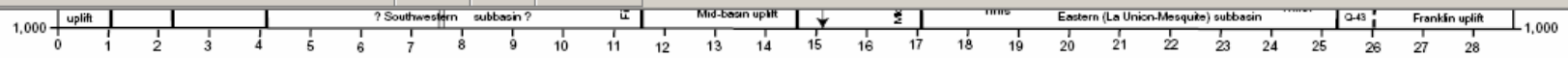
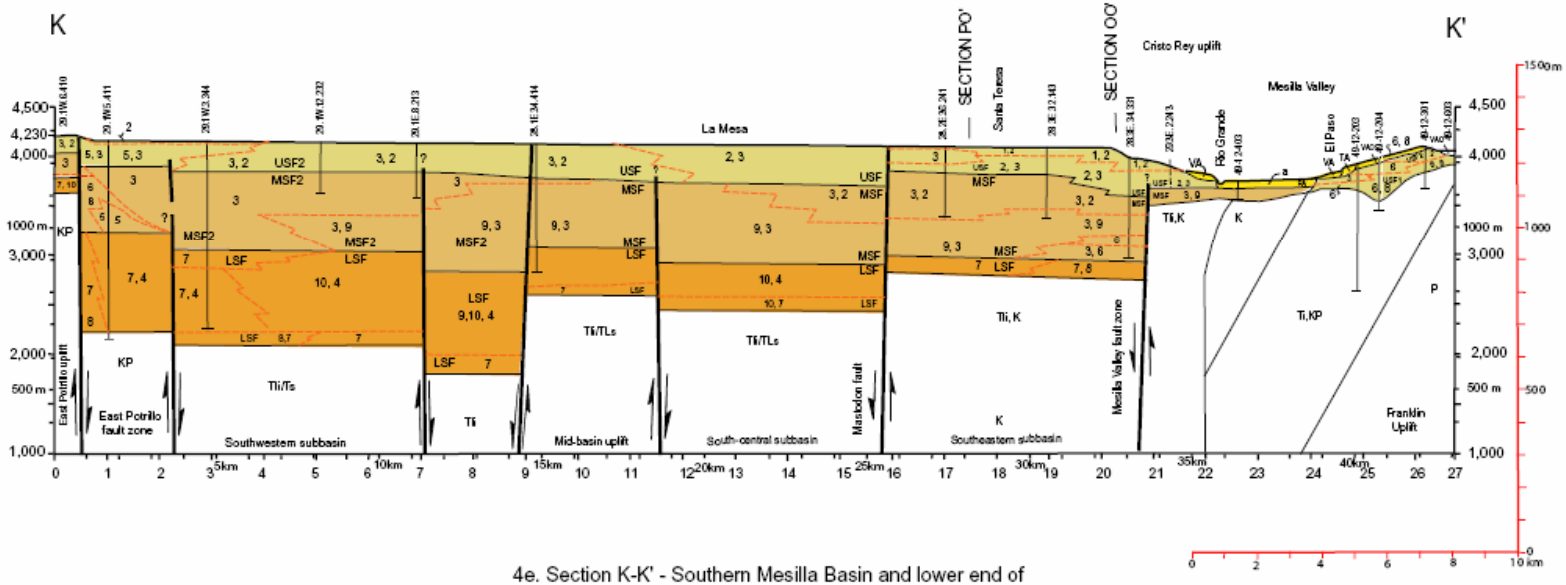
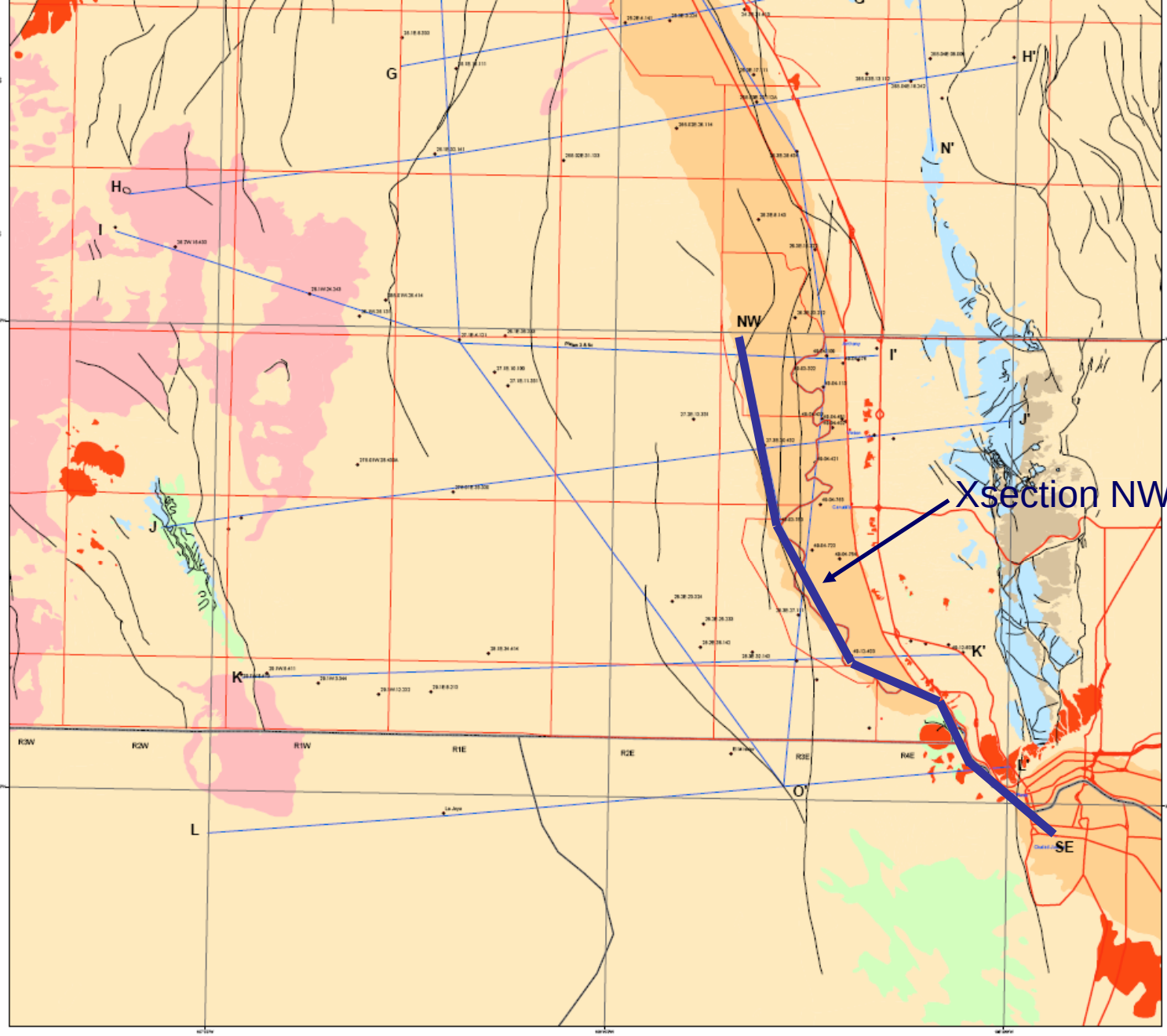


4c. Section I-I' - Central Mesilla Basin and Valley: East Potrillo Uplift and Afton volcanic field to Gadsden-Anthony area and Franklin Mountains.



4e. Section K-K' - Southern Mesilla Basin and lower end of Mesilla Valley: East Potrillo uplift to Santa Teresa-NW El Paso area.

Plate 4. Transverse Hydrogeologic Sections across the "Lower" M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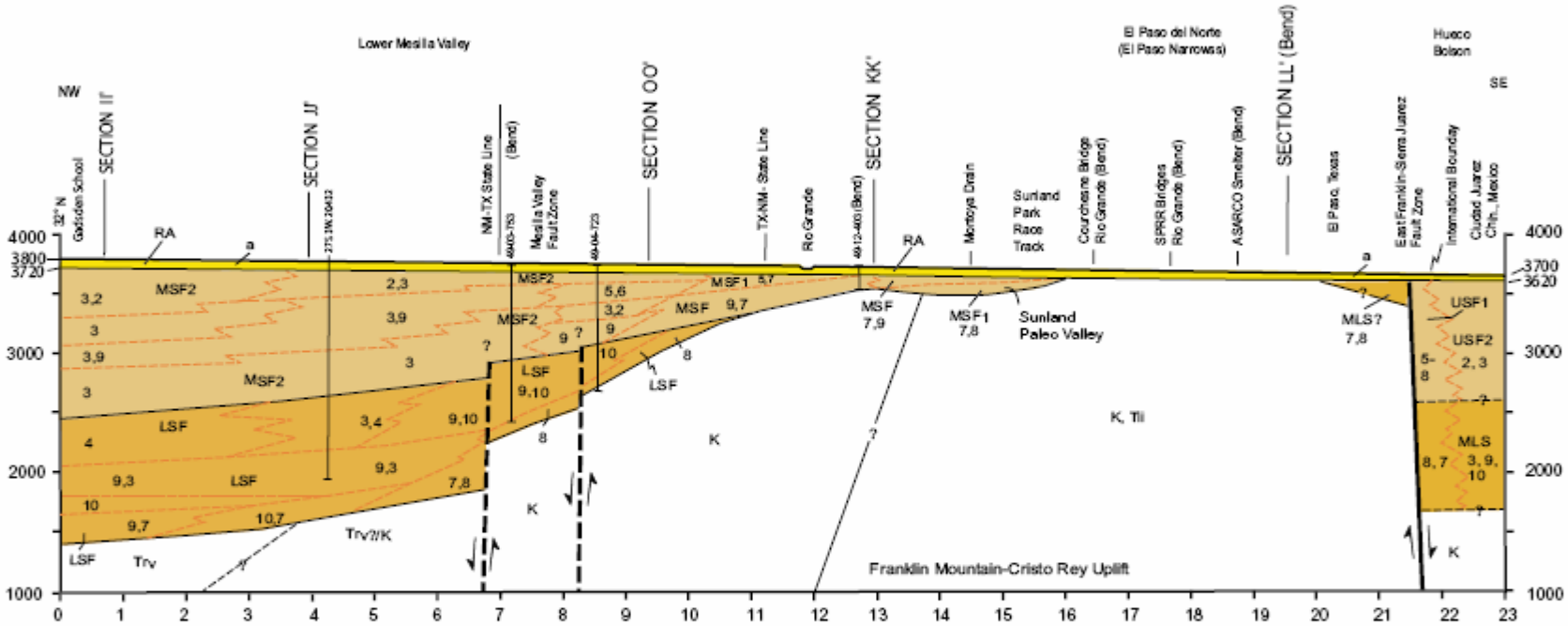

Plate 6. Hydrogeologic section of Lower Mesilla Valley and Paso del Norte reach of the Rio Grande Valley Floor, from Anthony-Gadsden area, NM to central El Paso, Texas and Ciudad Juarez, Chihuahua.

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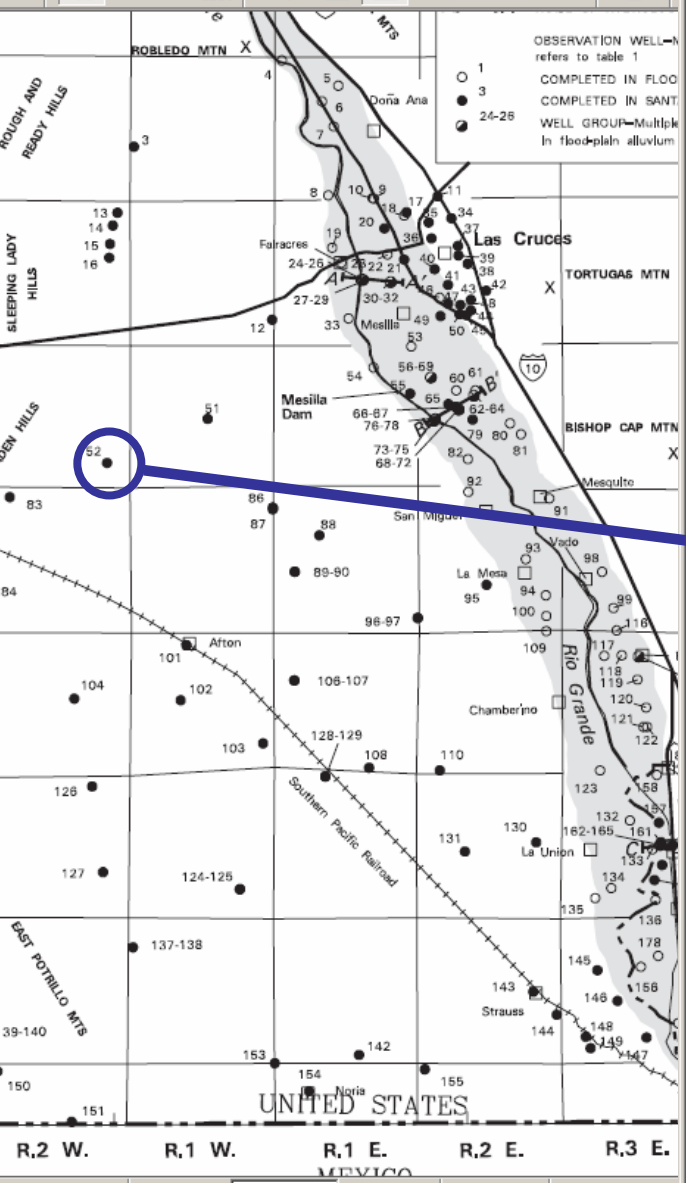

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Available data for this site | Ground-water: Field measurements | GO

Dona Ana County, New Mexico
Hydrologic Unit Code 13030102
Latitude 32°11'02", Longitude 107°00'18" NAD27
Land-surface elevation 4,322 feet above sea level NGVD29
This well is completed in the SANTA FE FORMATION (112SNTF) local aquifer.

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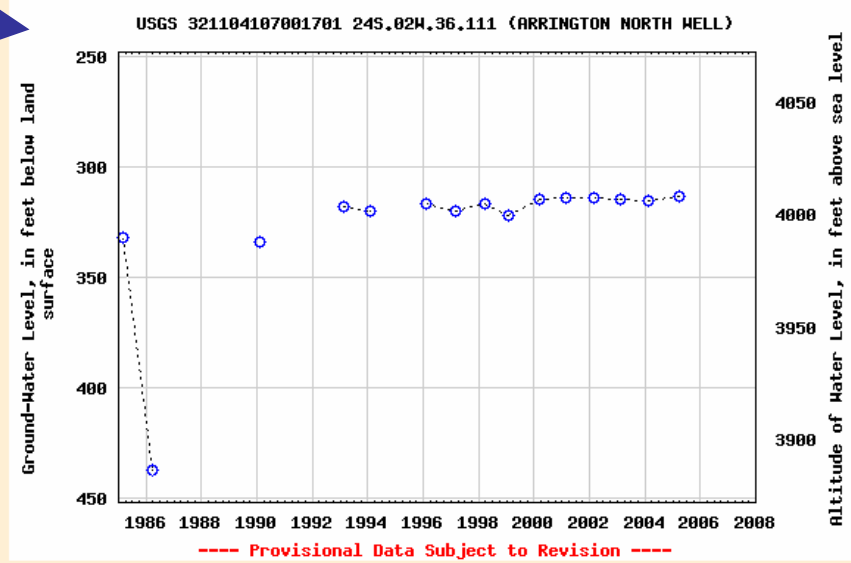

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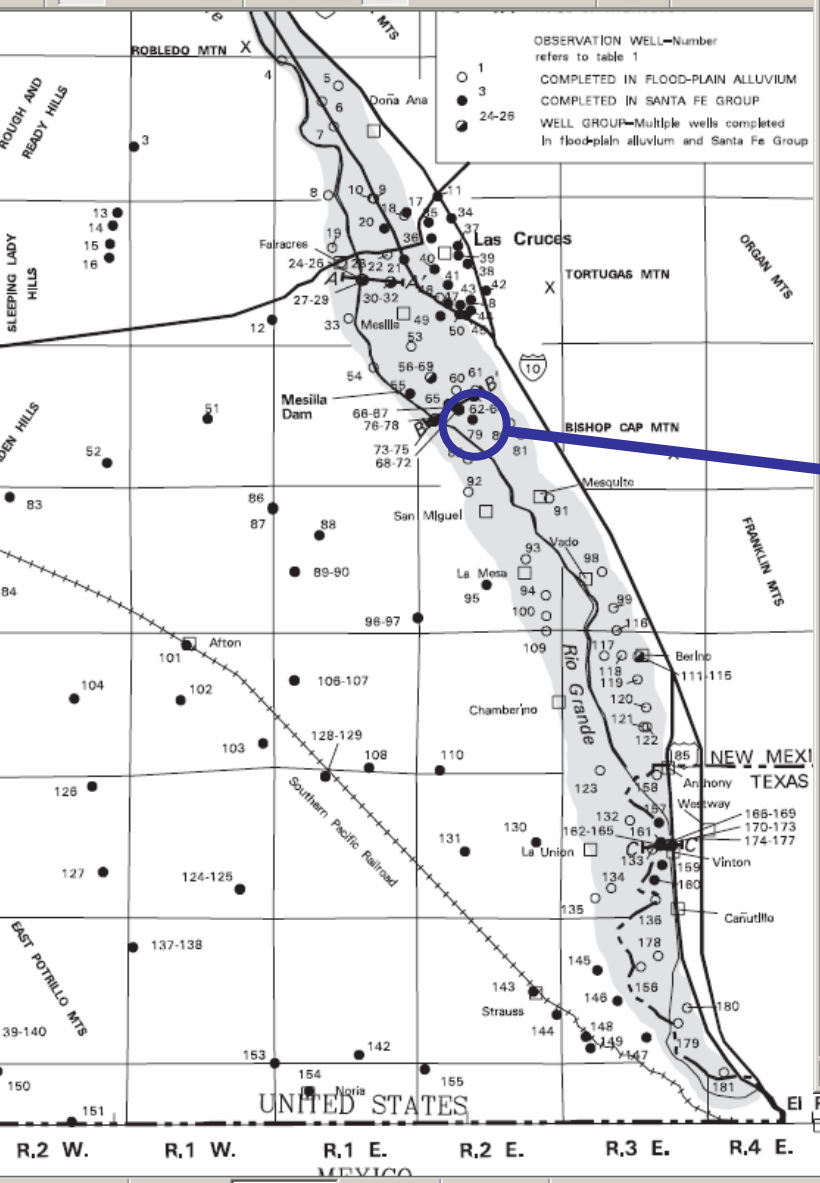

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Dona Ana County, New Mexico
Hydrologic Unit Code 13030102
Latitude 32°12'38", Longitude 106°44'40" NAD27
Land-surface elevation 3,855 feet above sea level NGVD29
The depth of the well is 480.0 feet below land surface.
The depth of the hole is 480.0 feet below land surface.
This well is completed in the SANTA FE FORMATION (112SNTF) local aquifer.

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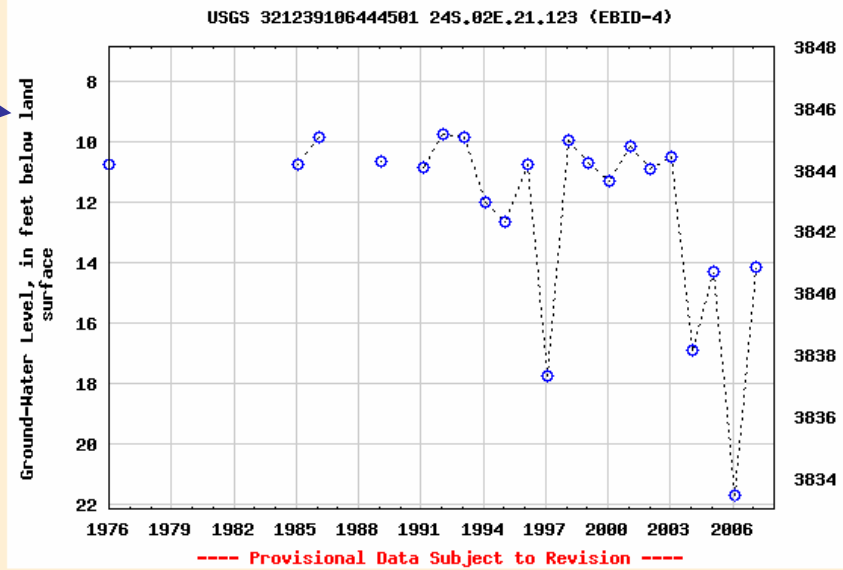

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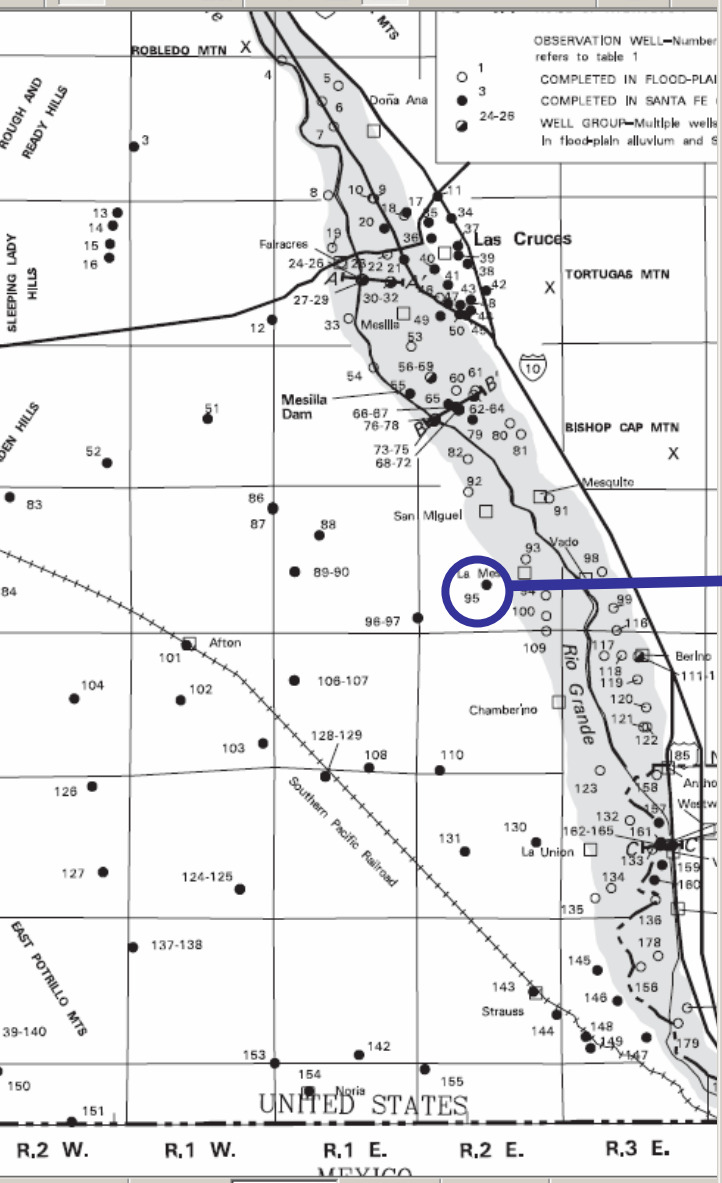

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USGS 320638106440502 25S.02E.28.222B (OLD RANCH WELL)

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Dona Ana County, New Mexico
Hydrologic Unit Code 13030102
Latitude 32°06'38", Longitude 106°44'05" NAD27
Land-surface elevation 3,922 feet above sea level NGVD29
The depth of the well is 120 feet below land surface.
This well is completed in the SANTA FE FORMATION (112SNTF) local aquifer.

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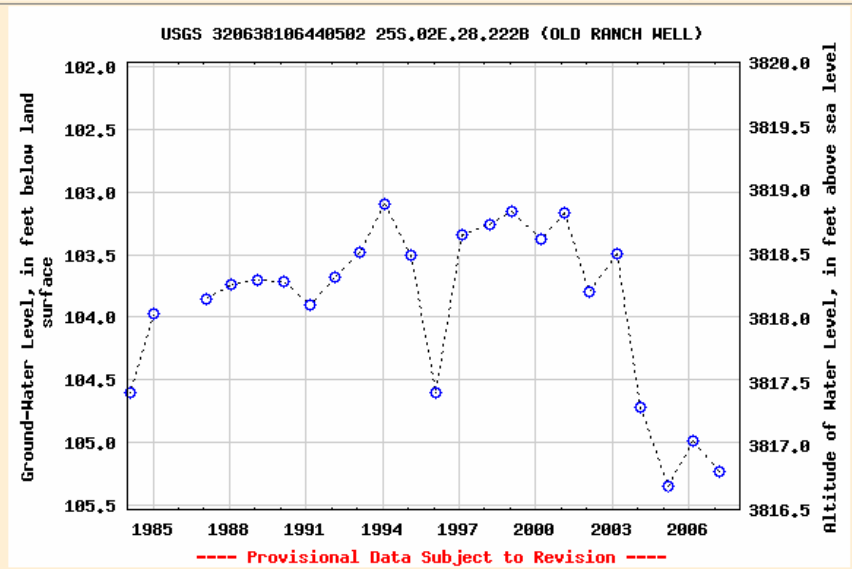

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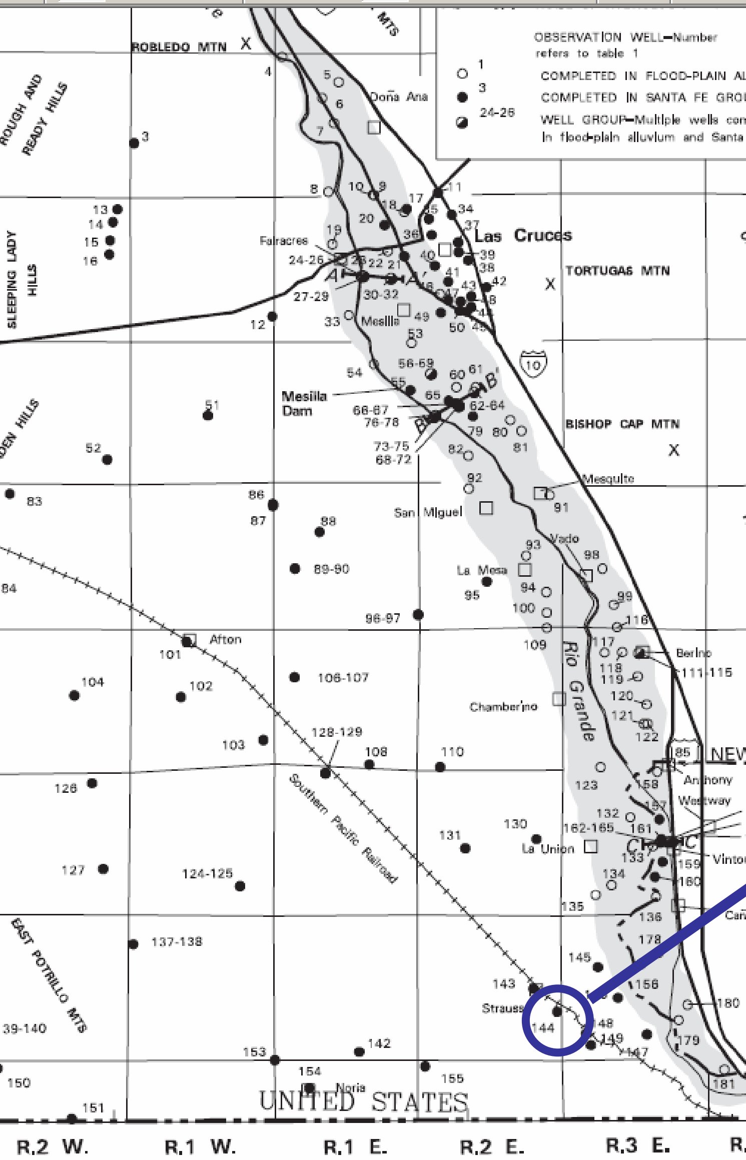

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Available data for this site Ground-water: Field measurements GO

Dona Ana County, New Mexico
Hydrologic Unit Code 13030102
Latitude 31°51'04", Longitude 106°41'07" NAD27
Land-surface elevation 4,080 feet above sea level NGVD29
The depth of the well is 524 feet below land surface.
This well is completed in the SANTA FE FORMATION (112SNTF) local aquifer.

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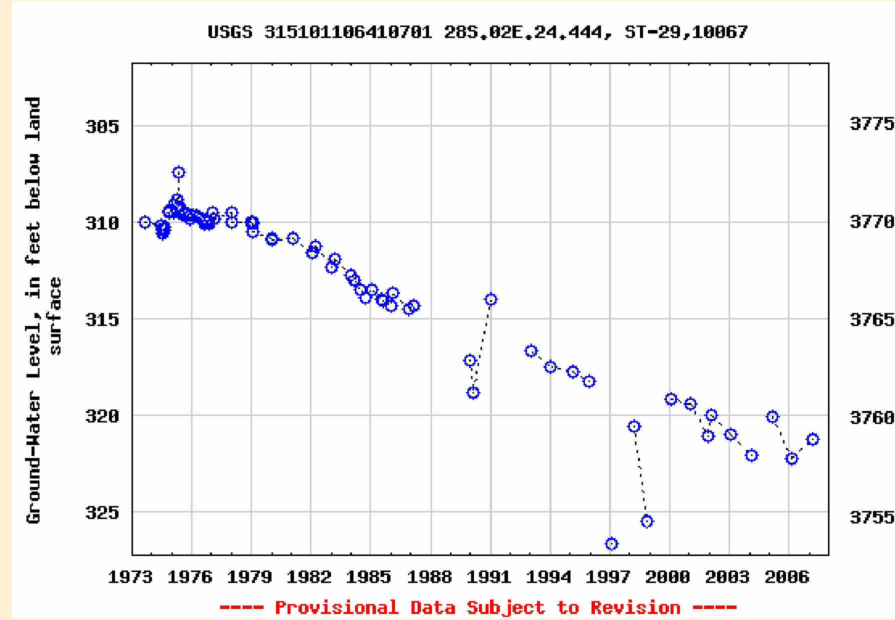
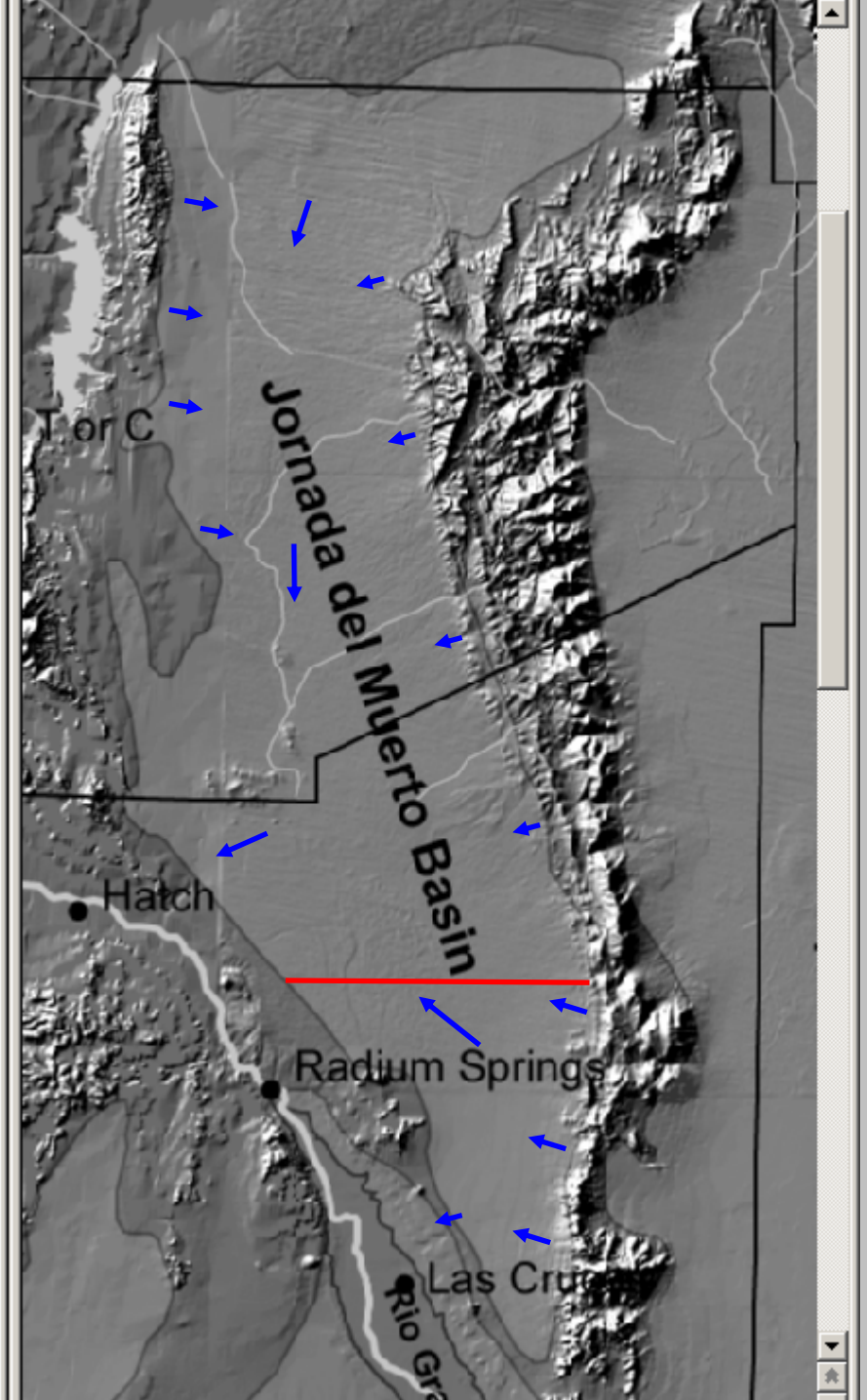


Breaks in the plot represent a gap of at least one calendar year between two consecutive points.
Download a presentation-quality graph

Questions about sites/data?
Feedback on this web site
Ground water for USA: Water Levels
http://waterdata.usgs.gov/nwis/gwlevels?



JORNADA BASIN

3,344 mi^2 in area

— northern limit of a basinfill aquifer system that is capable of producing significant quantities of fresh water

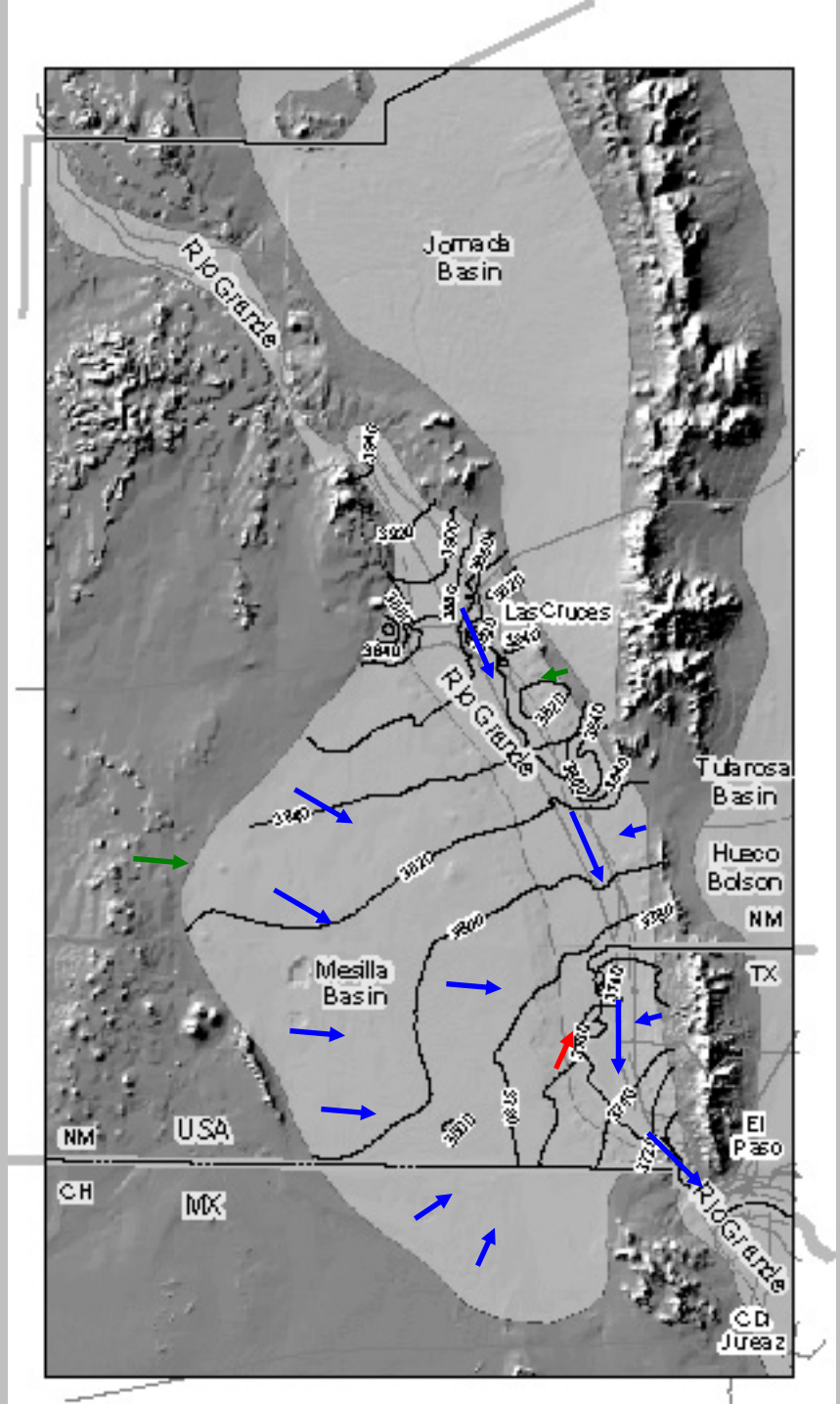
most wells tapping middle Santa Fe unit

recharge in the southern part of the basin estimated to be 5,350 acre-feet/year (Shomaker and Finch, 1996)

estimated volume of groundwater in storage is 100.36 million acre-feet in southern part (Shomaker and Finch, 1996)

<1,000 mg/L TDS in southern part

>1,000 mg/L TDS in northern part



MESILLA BASIN

1,100 mi² (2,849 Km2) in area

Maximum saturated thickness ~3,000 ft

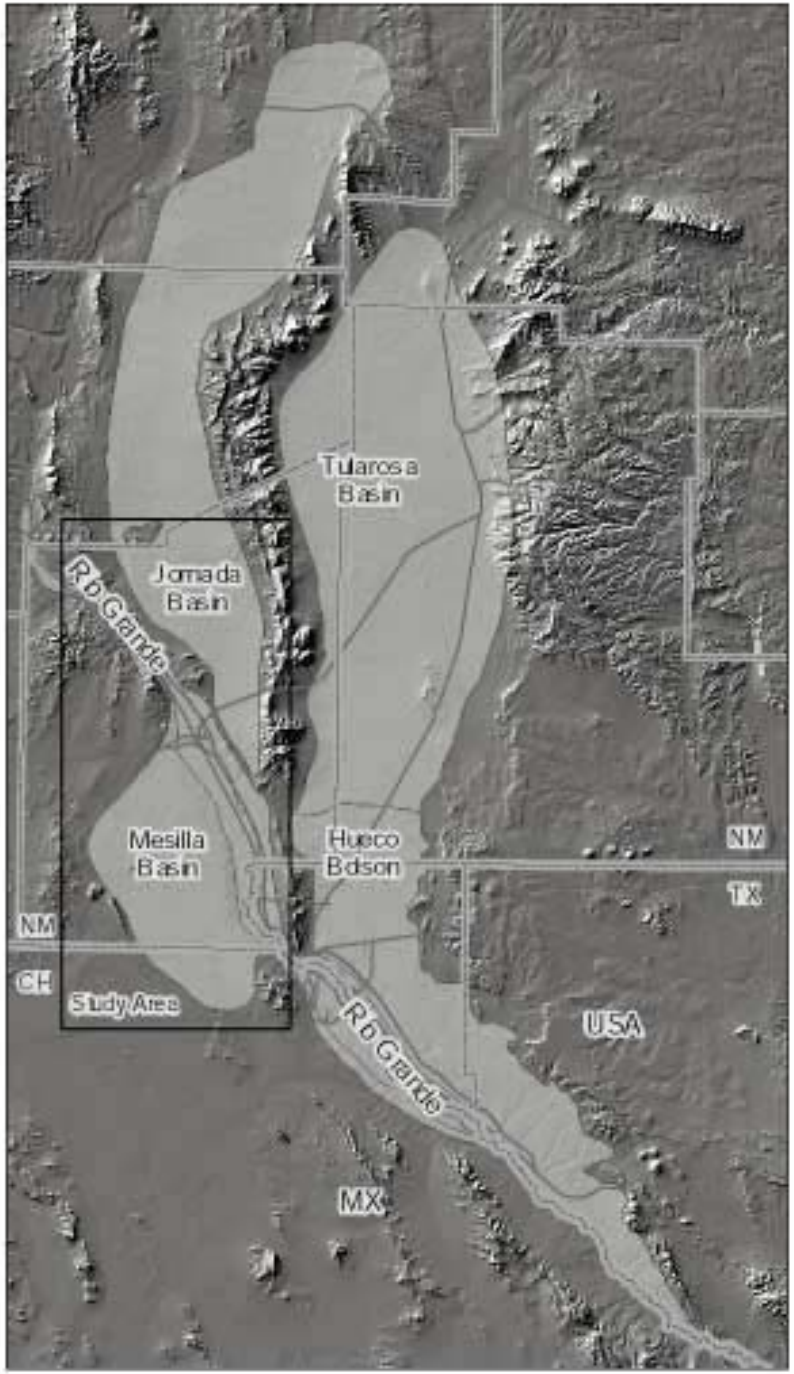
~100 million acre-feet water in storage
recoverable fresh water in storage
~52 million acre-feet

Productive aquifer zone <1,000 ft in upper and middle Santa Fe units

<1,000 mg/L TDS in upper & middle units
>3,000 mg/L TDS in lower unit

Mountain-front recharge contribution, exclusive of the 215 mi² Mesilla Valley area, is probably less than 10,000 ac-ft/yr.

losing reaches of the Rio Grande channel and associated irrigation-canal systems are the major present sources of ground-water replenishment.



“Therefore, while very large quantities (millions of ac-ft) of fresh to slightly saline water are stored in the basin-fill aquifer system, much of it is not being effectively recharged under the warm-dry environmental conditions of the past 5 to 10 thousand years.

Current research in the Rio Grande rift region indicates that most groundwater in storage is thousands to tens thousands of years old and was recharged during cooler and wetter parts of Quaternary glacial-pluvial cycles (Plummer et al. 2000; Scanlon et al. 2001).”

Hawley & Kennedy, 2004

Questions?