OWRB Groundwater Basin Studies

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What is the purpose of our studies?

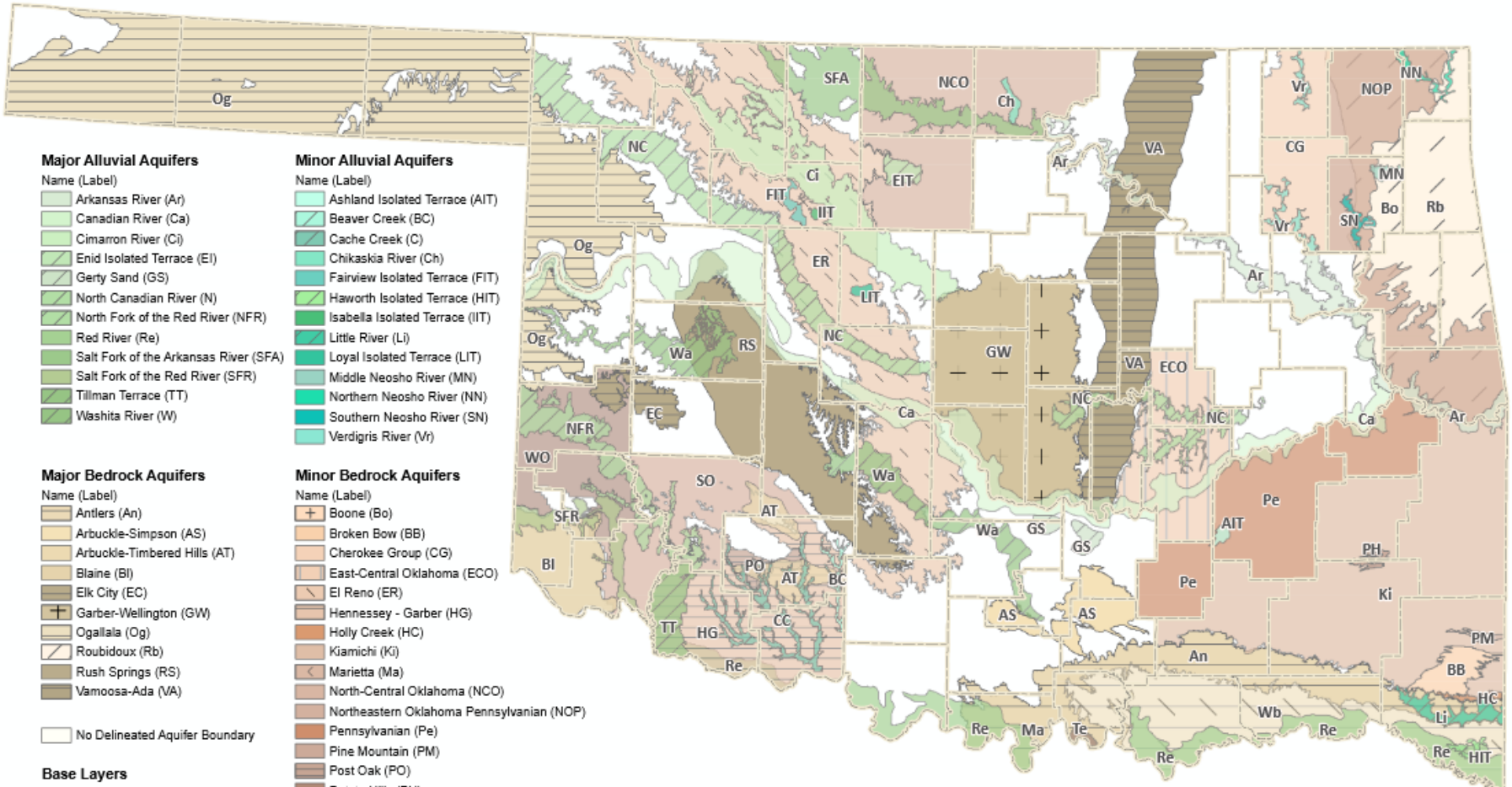
- **1973 Oklahoma Groundwater Law**

  It is declared to be the public policy of the State of Oklahoma, in the interest of the agricultural stability, domestic, municipal, industrial and other beneficial uses, general economy, and health and welfare of the State and its citizens, to utilize the ***groundwater resources*** *of the State, and for that purpose to provide* ***reasonable regulations*** *for the allocation for reasonable use based on* ***hydrologic surveys*** *of fresh groundwater basins or subbasins to* ***determine a restriction on the production*** *based upon the acres overlying the groundwater basin or subbasin.*

- 2012 Comprehensive Water Plan – Directs agency to complete all unstudied basins and complete 20-year reviews/updates.

Oklahoma Groundwater Resources

Major and Minor Aquifers of Oklahoma



Major Alluvial Aquifers

Name (Label)

- Arkansas River (Ar)
- Canadian River (Ca)
- Cimarron River (Ci)
- Enid Isolated Terrace (EI)
- Gerty Sand (GS)
- North Canadian River (N)
- North Fork of the Red River (NFR)
- Red River (Re)
- Salt Fork of the Arkansas River (SFA)
- Salt Fork of the Red River (SFR)
- Tillman Terrace (TT)
- Washita River (W)

Minor Alluvial Aquifers

Name (Label)

- Ashland Isolated Terrace (AIT)
- Beaver Creek (BC)
- Cache Creek (C)
- Chikaskia River (Ch)
- Fairview Isolated Terrace (FIT)
- Haworth Isolated Terrace (HIT)
- Isabella Isolated Terrace (IIT)
- Little River (Li)
- Loyal Isolated Terrace (LIT)
- Middle Neosho River (MN)
- Northern Neosho River (NN)
- Southern Neosho River (SN)
- Verdigris River (Vr)

Major Bedrock Aquifers

Name (Label)

- Antlers (An)
- Arbuckle-Simpson (AS)
- Arbuckle-Timbered Hills (AT)
- Blaine (Bl)
- Elk City (EC)
- Garber-Wellington (GW)
- Ogallala (Og)
- Roubidoux (Rb)
- Rush Springs (RS)
- Vamoosa-Ada (VA)

No Delineated Aquifer Boundary

Minor Bedrock Aquifers

Name (Label)

- Boone (Bo)
- Broken Bow (BB)
- Cherokee Group (CG)
- East-Central Oklahoma (ECO)
- El Reno (ER)
- Hennessey - Garber (HG)
- Holly Creek (HC)
- Kiamichi (Ki)
- Marietta (Ma)
- North-Central Oklahoma (NCO)
- Northeastern Oklahoma Pennsylvanian (NOP)
- Pennsylvanian (Pe)
- Pine Mountain (PM)
- Post Oak (PO)
- Potato Hills (PH)
- Southwestern Oklahoma (SO)
- Texoma (Te)
- Western Oklahoma (WO)
- Woodbine (Wb)

Base Layers

- Counties

N W E S

0 50 Miles

*Major groundwater basin (aquifer) is defined as a distinct underground body of water overlain by contiguous land and having substantially the same geological and hydrological characteristics and from which groundwater wells yield at least fifty (50) gallons per minute on the average basinwide if from a bedrock aquifer and at least one hundred fifty (150) gallons per minute on the average basinwide if from an alluvium and terrace aquifer, or as otherwise designated by the Board.

*Minor groundwater basin (aquifer) is defined as a distinct underground body of water overlain by contiguous land and having substantially the same geological and hydrological characteristics and which is not a major groundwater basin.

For more information please visit the OWRB's web site at: (http://www.owrb.ok.gov)

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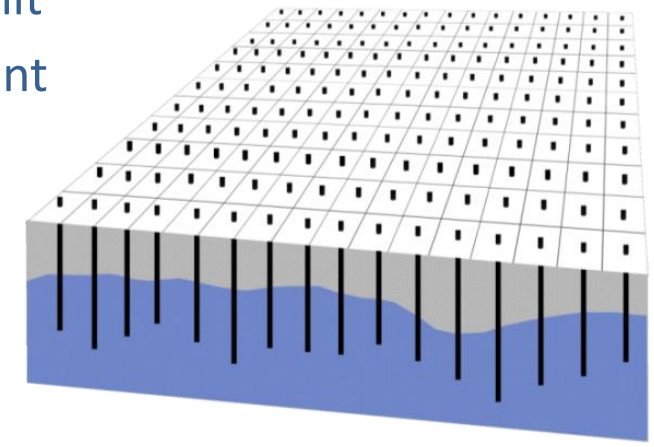
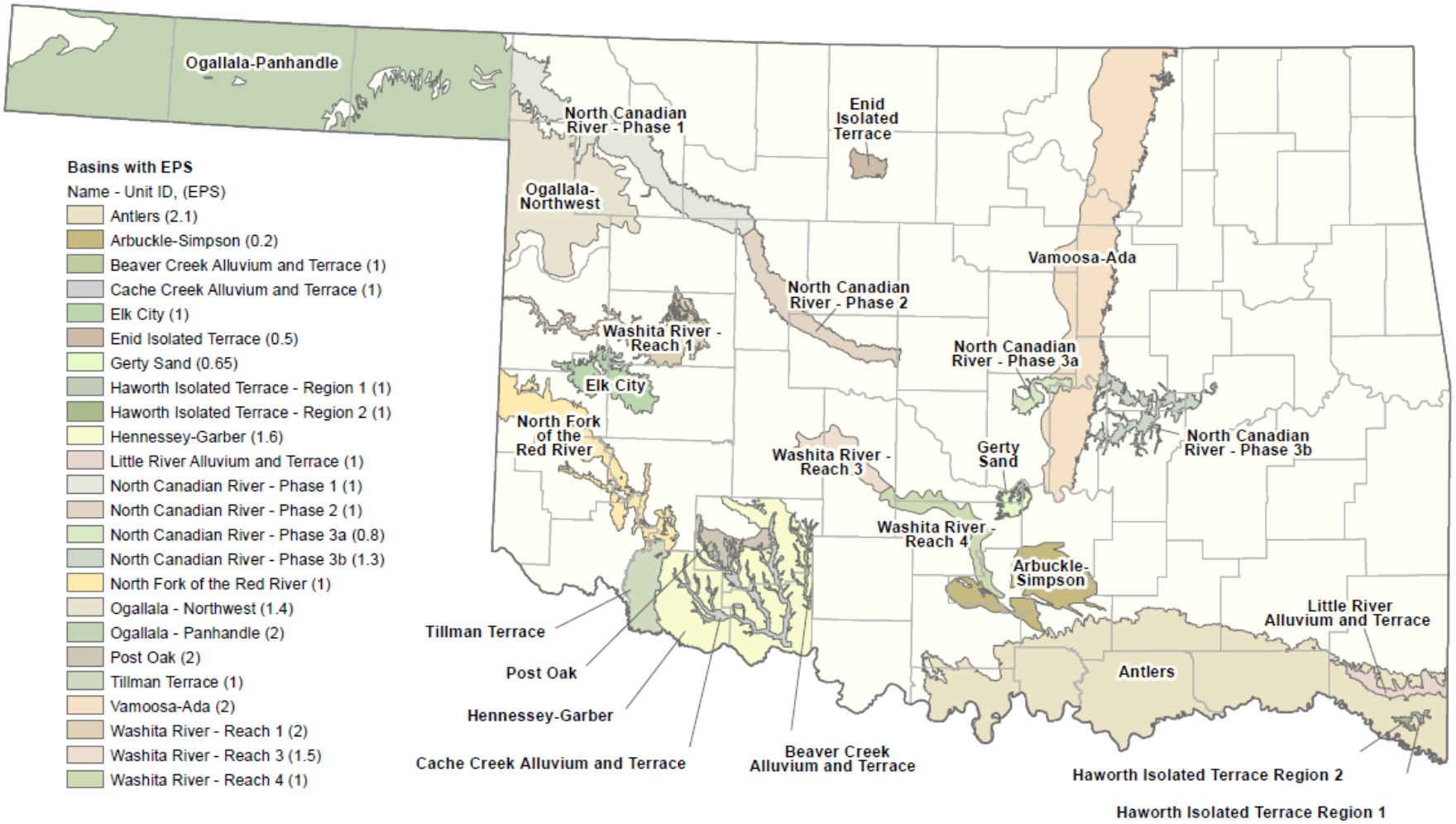
Maximum Annual Yield/Equal Proportionate Share

- Maximum Annual Yield (MAY)
  - The total amount of fresh groundwater that can be withdrawn while allowing a minimum 20-year life of the basin.
- Equal Proportionate Share (EPS)
  - Once the maximum annual yield has been established, the amount of water allocated to each permit applicant will be proportionate to the amount of land owned or leased by that applicant.
  - Each groundwater user is entitled to withdraw an equal share of water proportional to the amount of land owned.



Oklahoma Groundwater Resources

Groundwater Basins with Final Maximum Annual Yield Determination



This map represents groundwater basins that have a final maximum annual yield determination by the Oklahoma Water Resources Board. TITLE 785. OKLAHOMA WATER RESOURCES BOARD, CHAPTER 30. TAKING AND USE OF GROUNDWATER, SUBCHAPTER 9. MAXIMUM ANNUAL YIELD DETERMINATIONS.
http://www.owrb.ok.gov 10/18/2017

N W E S

0 50 Miles

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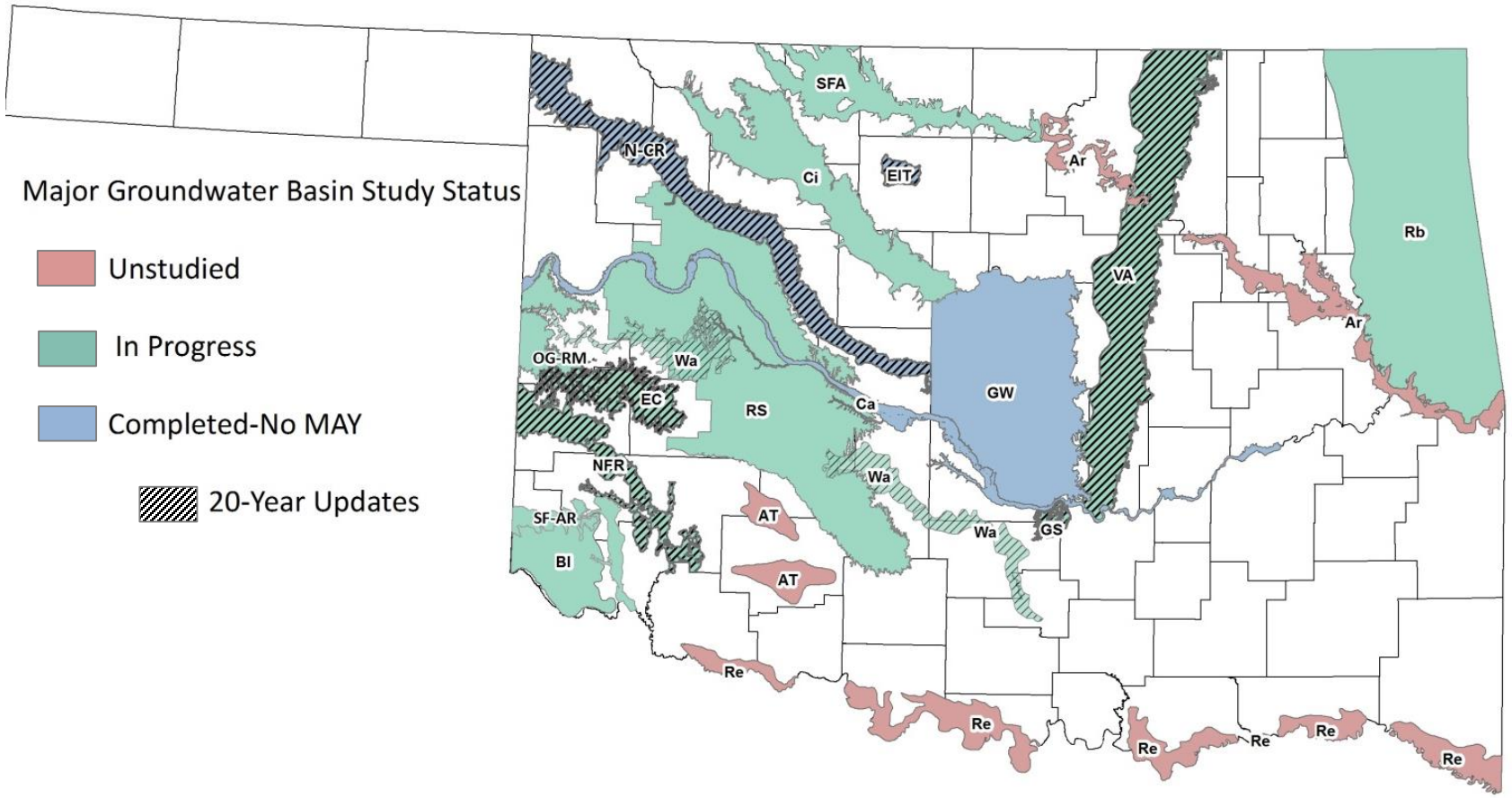
Hydrologic Studies

- Performed by the OWRB or in collaboration with outside expert agency or institution such as the U.S. Geological Survey
- Seven ongoing studies by OWRB
- Five ongoing studies with USGS
- Three studies completed in 2017

OWRB Hydrologic Investigations

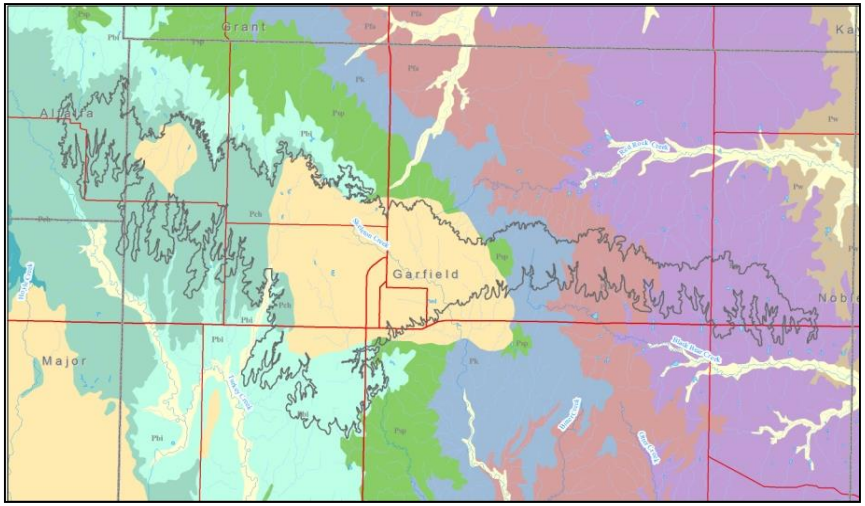


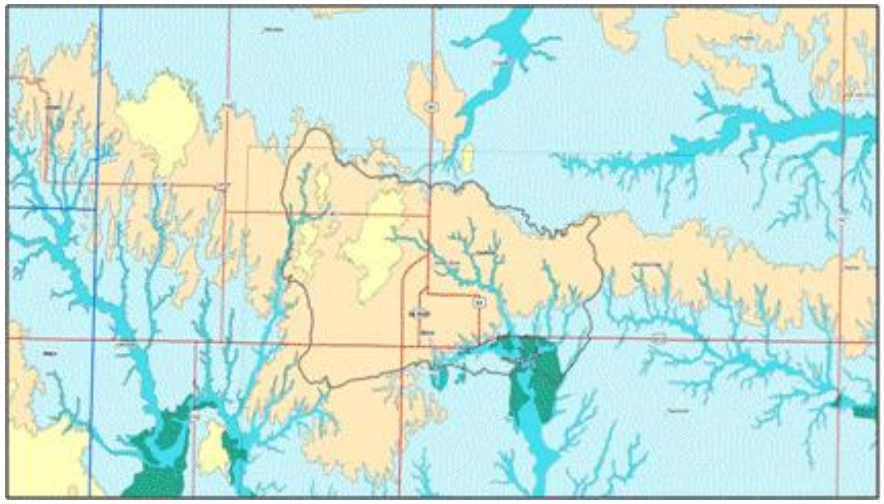
Hydrologic Studies

Study Goals

- Define aquifer boundary
- Determine aquifer base
- Measure wells, create water table/potentiometric surface map
- Hydraulic properties of the aquifer
- Analyze permitted groundwater use
- Climate data
- Estimate aquifer recharge
- Streamflow/baseflow measurements
- Water quality

Hydrologic Studies





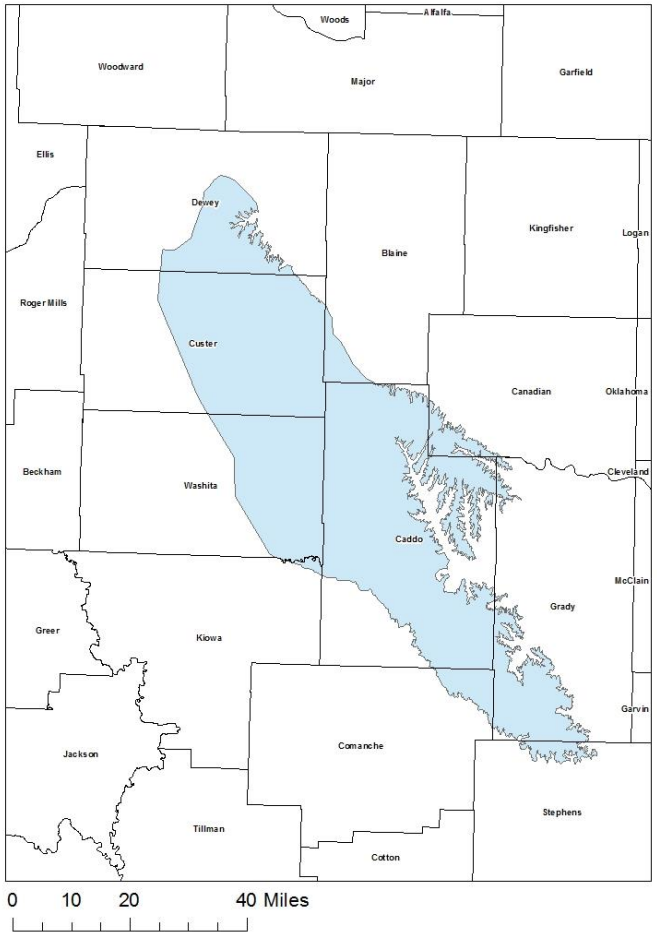
- Hydrologic Atlas, 1980
  - With 2008 terrace boundary
- Oklahoma Geological Survey, 2008
  - With 1980 terrace boundary

Hydrologic Studies

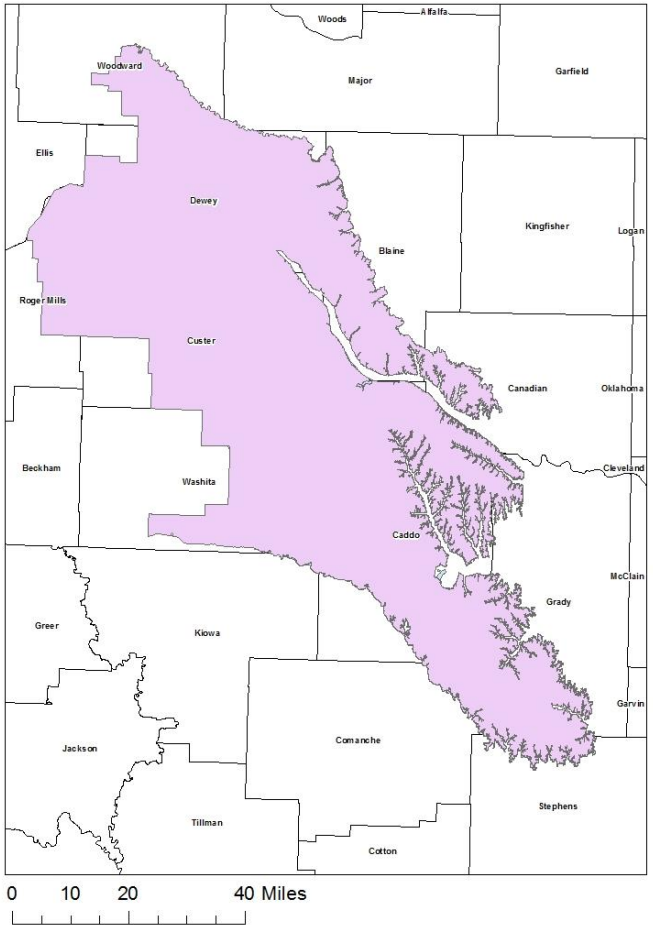
Quaternary					Quaternary Deposits: Unconsolidated terrace gravels, sand dunes, and alluvium deposits.	10 -65
Tertiary					Ogallala Formation: Late Tertiary-age rocks composed of grey to light-brown, fine- to medium-grained sand is interbedded with clay, silt, gravel, volcanic ash, and caliche beds	0 - 155
Permian					Elk City Sandstone: Late-Permian-age rocks composed of reddish-brown, fine -grained sandstone with minor amounts of silt and clay. Sand grains are very friable, sub-rounded, well sorted, and display vuggy porosity; cemented by gypsum, calcite, clay, and iron oxide.	0 - 260
					Doxey Shale: Consists of blocky reddish-brown silty shales and siltstone interbedded with thin beds of siltstone and sandstone.	160 - 200
					Cloud Chief Formation: Consists of red-brown to orange-brown shale, with interbedded fine- to medium-grained cross-bedded sandstone and siltstone in the middle section, the base of the formationa is marked by a gypsum bed called the Moccasin Creek.	365 - 458
					Rush Springs Formation: Consists of orange-brown cross-bedded, fine-grained, quartz sandstone interbedded with dolomite and gypsum, with minor silt.	300 - 500
	Clay	Silt	Sand	Gravel	Notes	Thickness (ft)

Hydrologic Studies

Old Boundary



New Boundary



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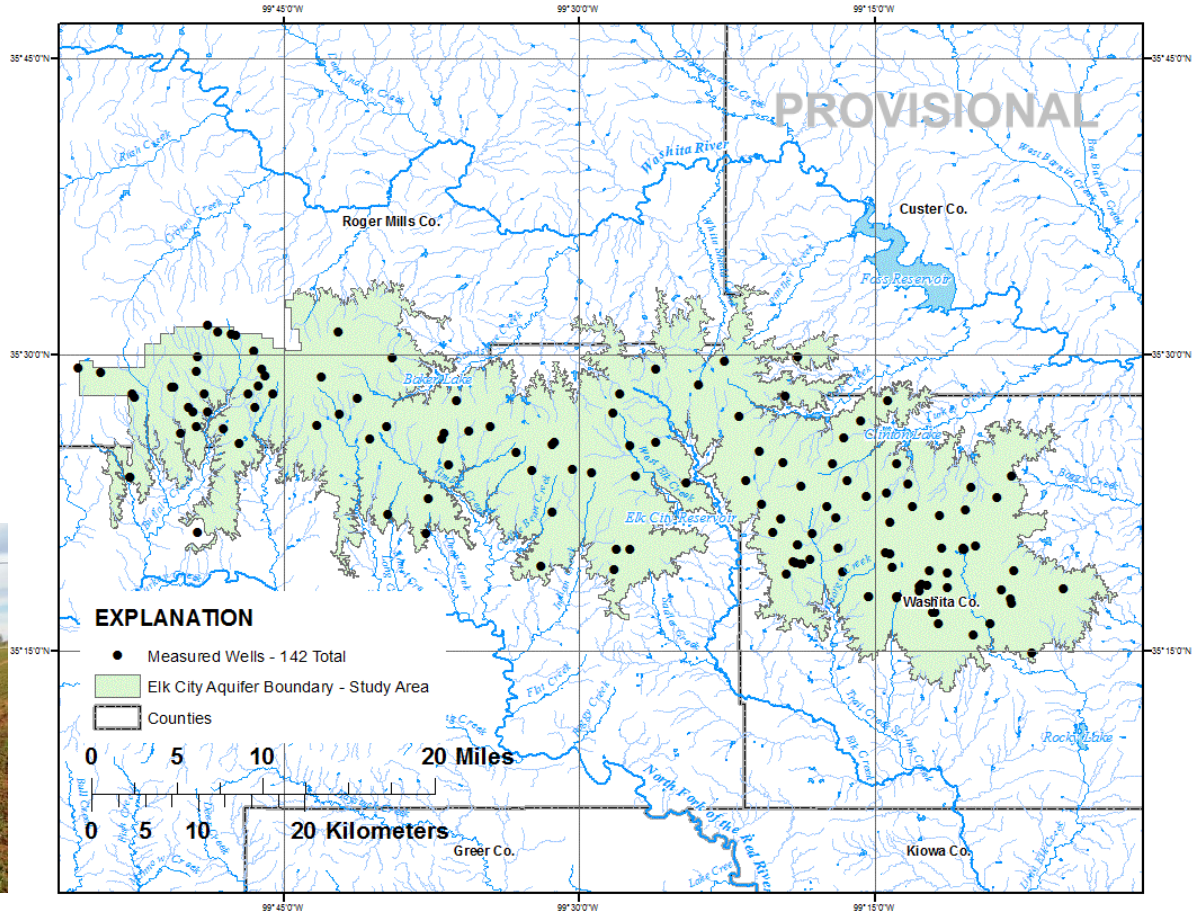
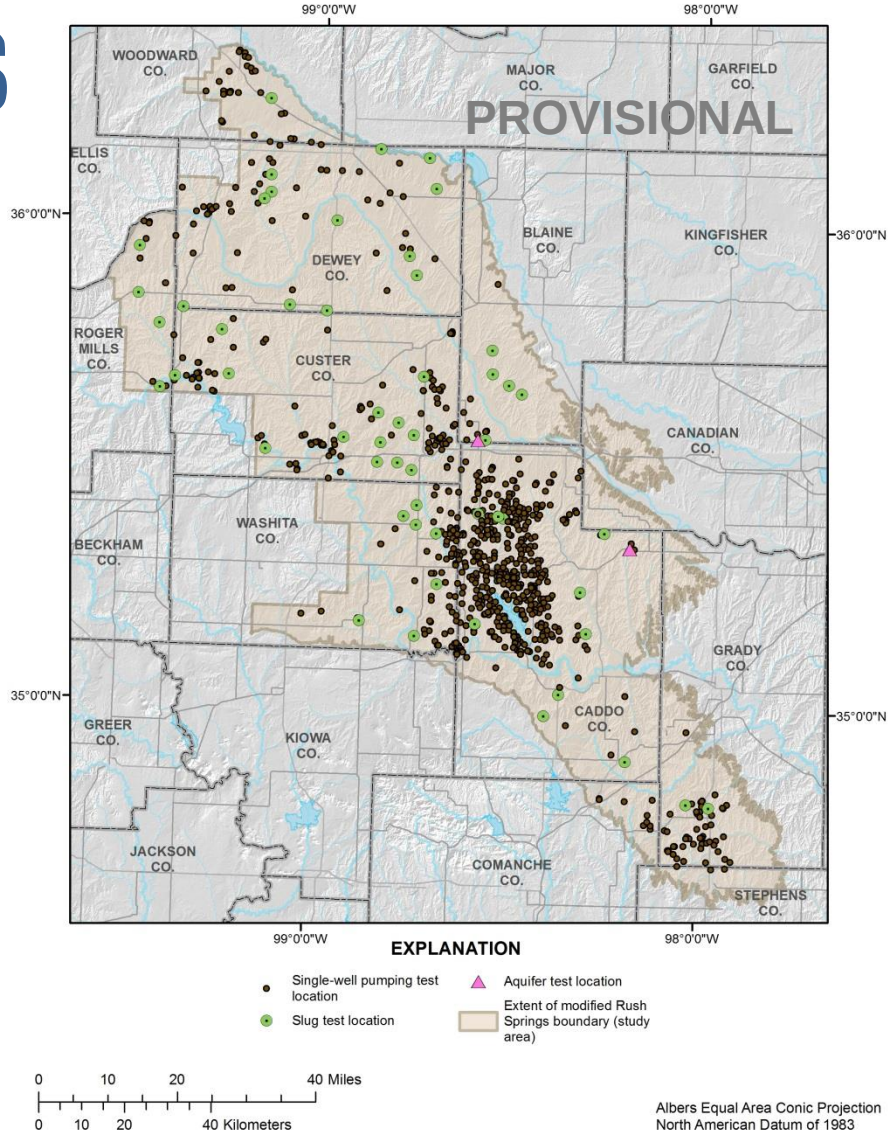
Hydrologic Studies



Hydrologic Studies



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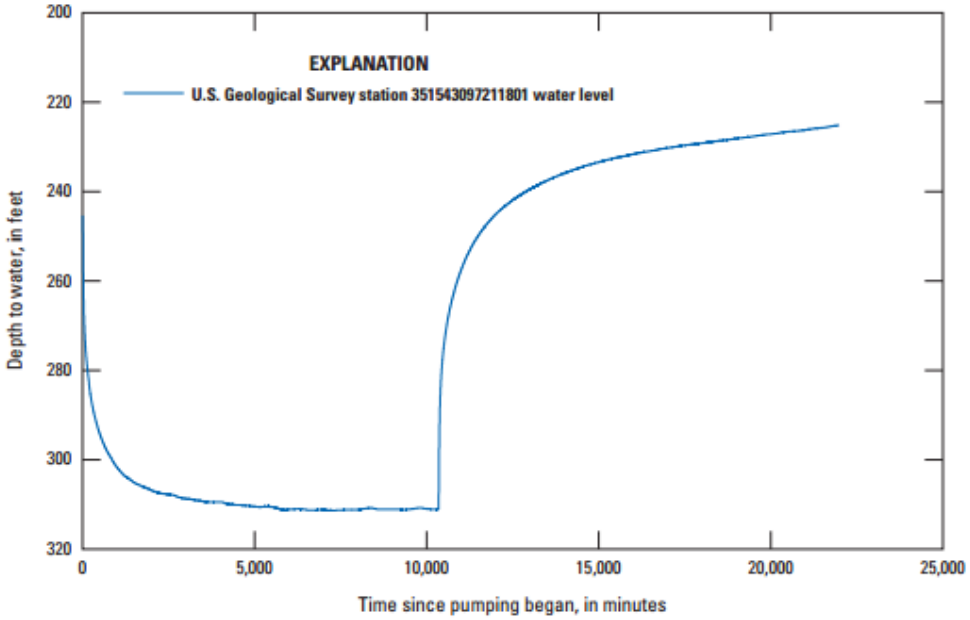

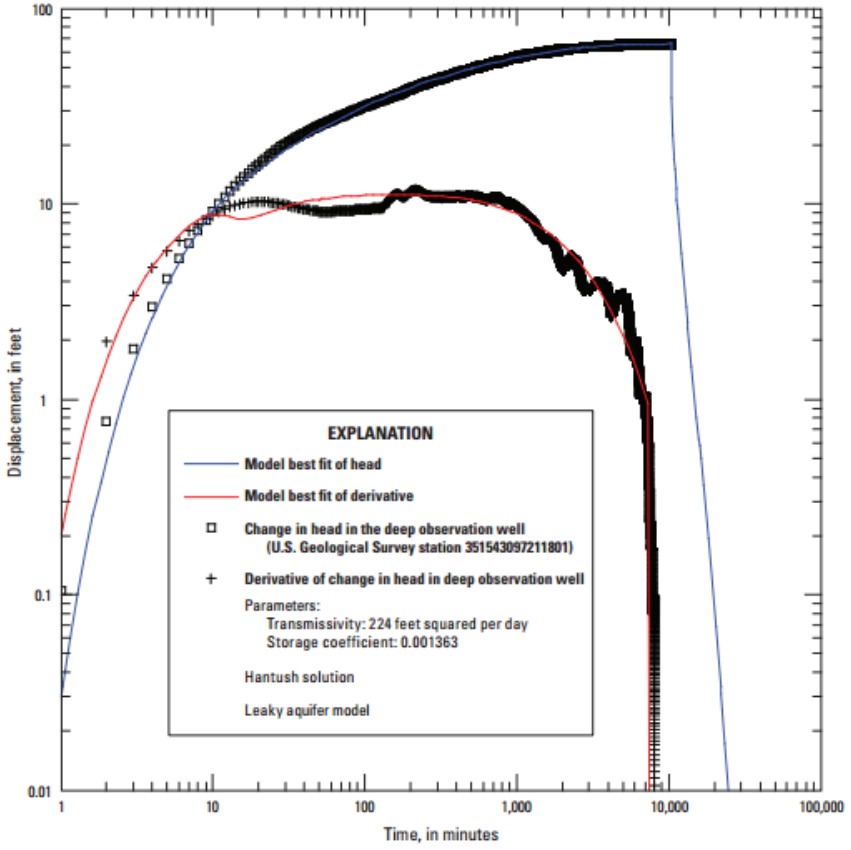

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Hydrologic Studies

Well Driller's Logs

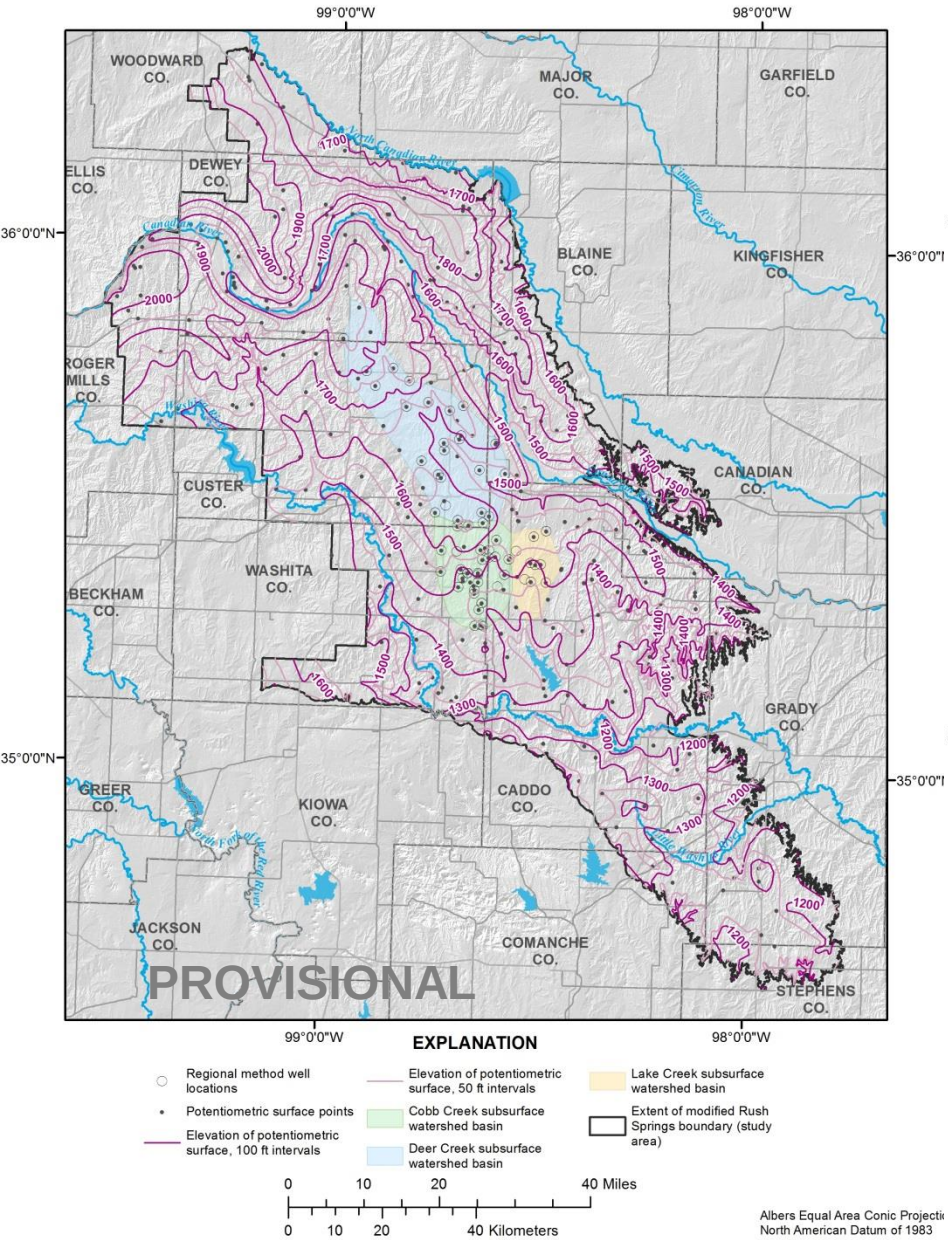
LITHOLOGY DESCRIPTION

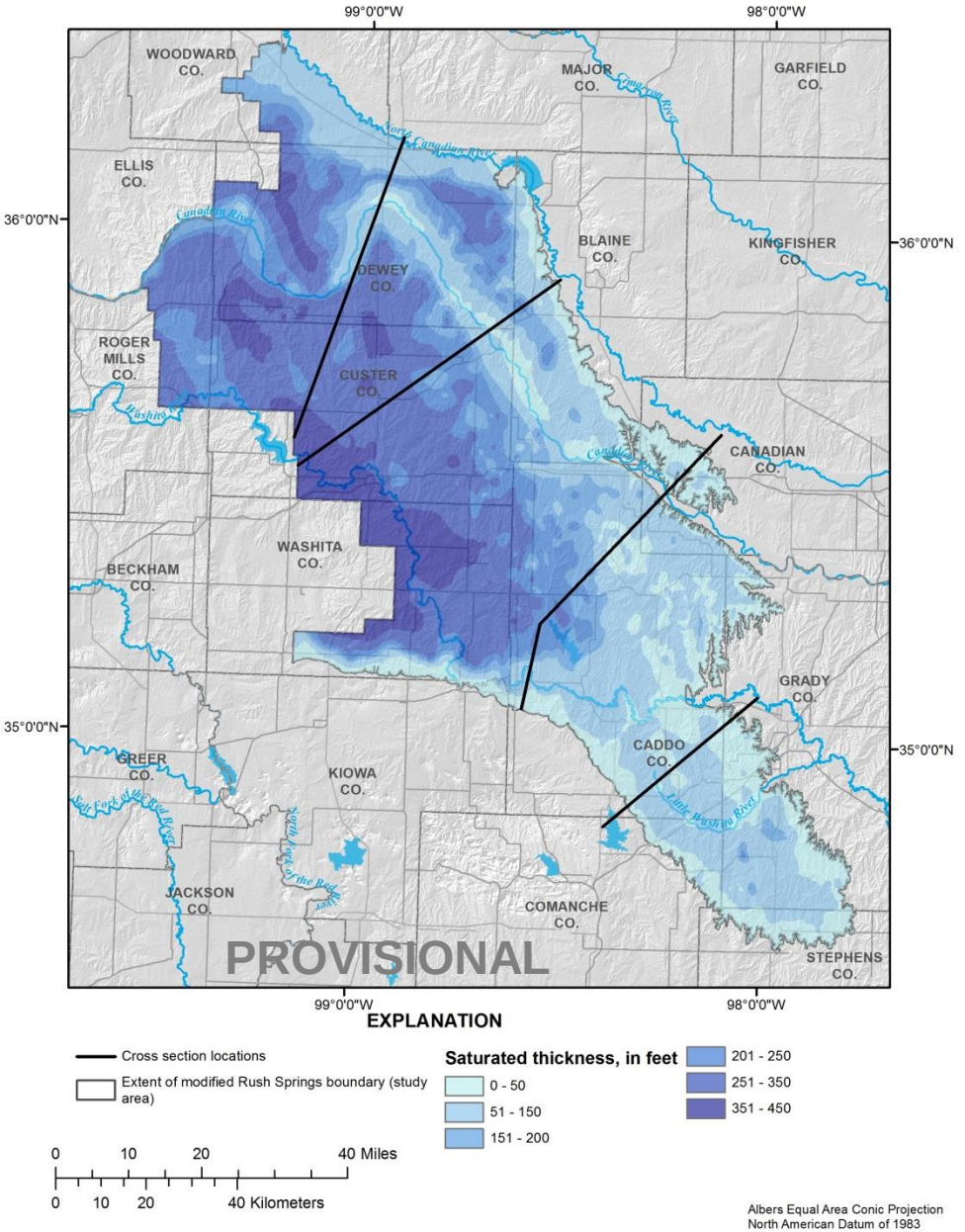
Aquifer→

MATERIAL	ENCOUNTERED FROM (ft.)	ENCOUNTERED TO (ft.)
Sandy red tan surface	0	2
Med red sand & sandy clay	2	10
Med light red sandstone	10	20
Red clay	20	23
Med red sandstone	23	38
Med coarse red sandstone	38	42
Med red sandstone	42	110
streaks	110	120
Med red sandstone	120	140
shale layers	140	177

Aquifer→

MATERIAL	ENCOUNTERED FROM (ft.)	ENCOUNTERED TO (ft.)
Sand & Sandstone	0	20
Sandstone	20	85
Sand	85	105
Sand & Sandstone	105	180
Shale	180	205





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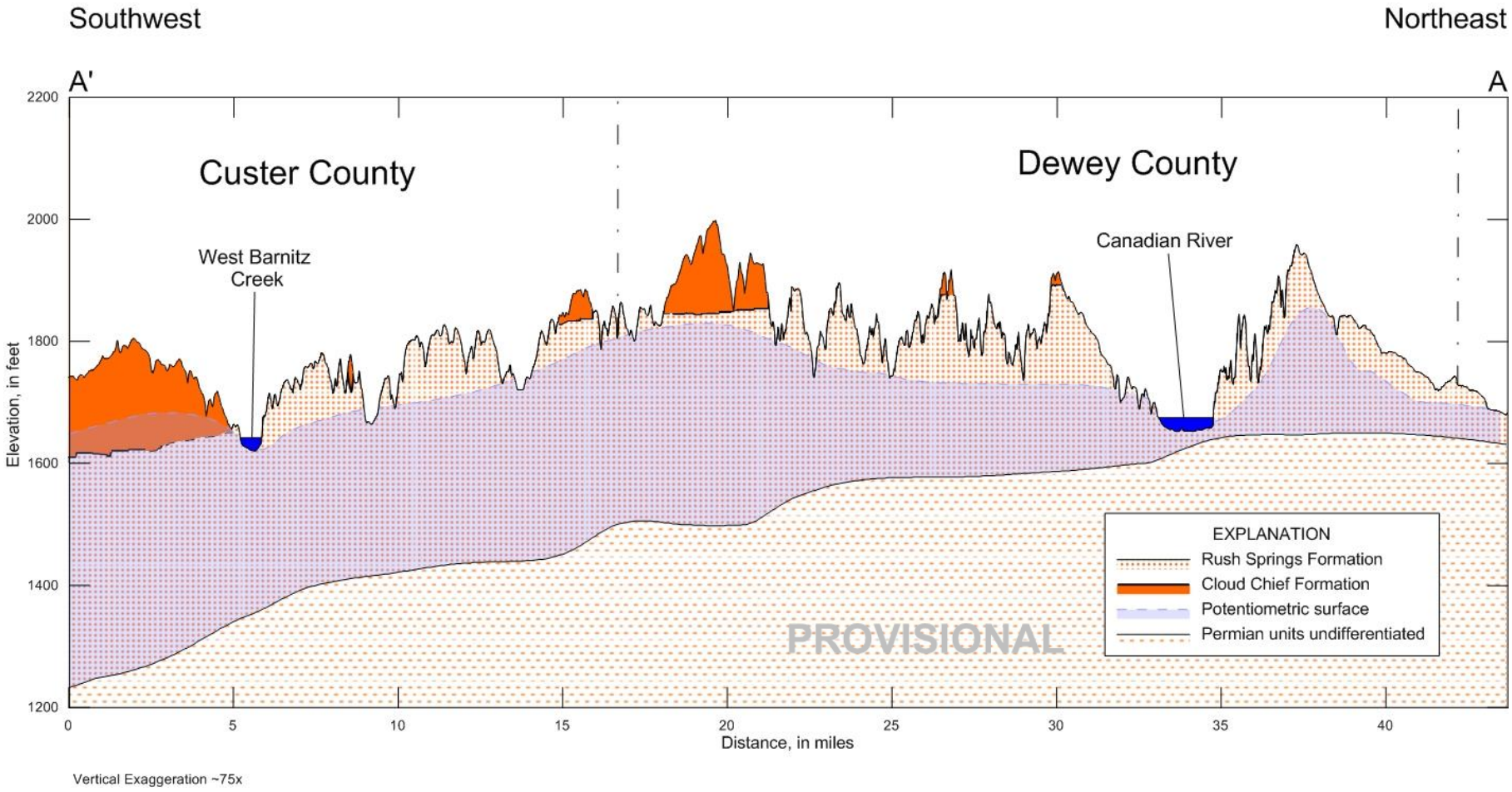
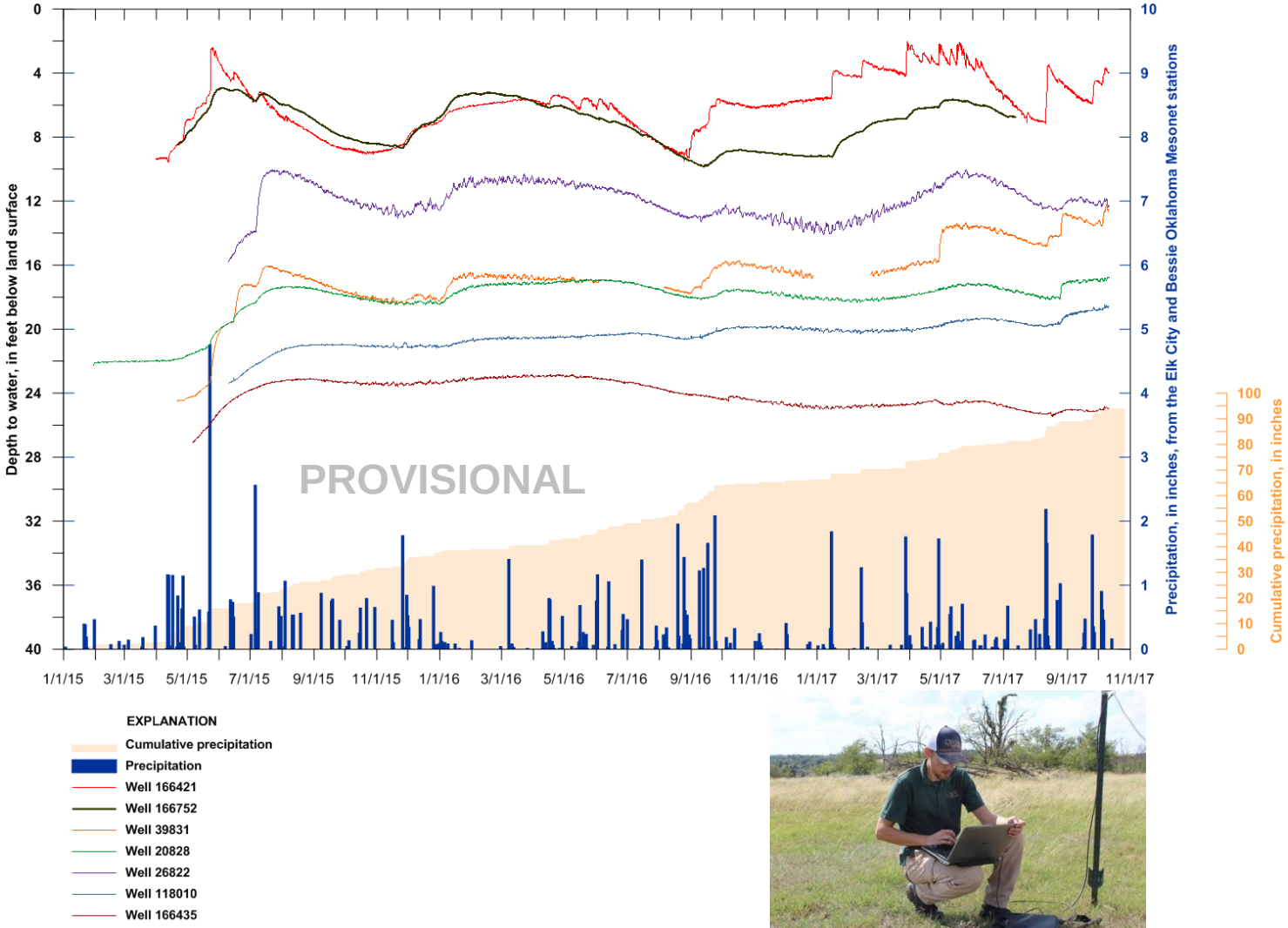


Hydrologic Studies

Table 13. Storage coefficients calculated from streamflows and change in water stored in subsurface watershed, December 16, 2013 through March 24, 2014.

Subsurface watershed	Total baseflow discharge based on daily gaged flow, in acre-feet	Volume of aquifer drained in subsurface watersheds, in acre-feet	Storage coefficient
Cobb Creek above USGS gage 07325800	1,798	36,790	0.05
Deer Creek above OWRB gage 520620060010-003RS	4,510	62,728	0.07
Lake Creek above USGS gage 07325850	449	6,902	0.07

Hydrologic Studies



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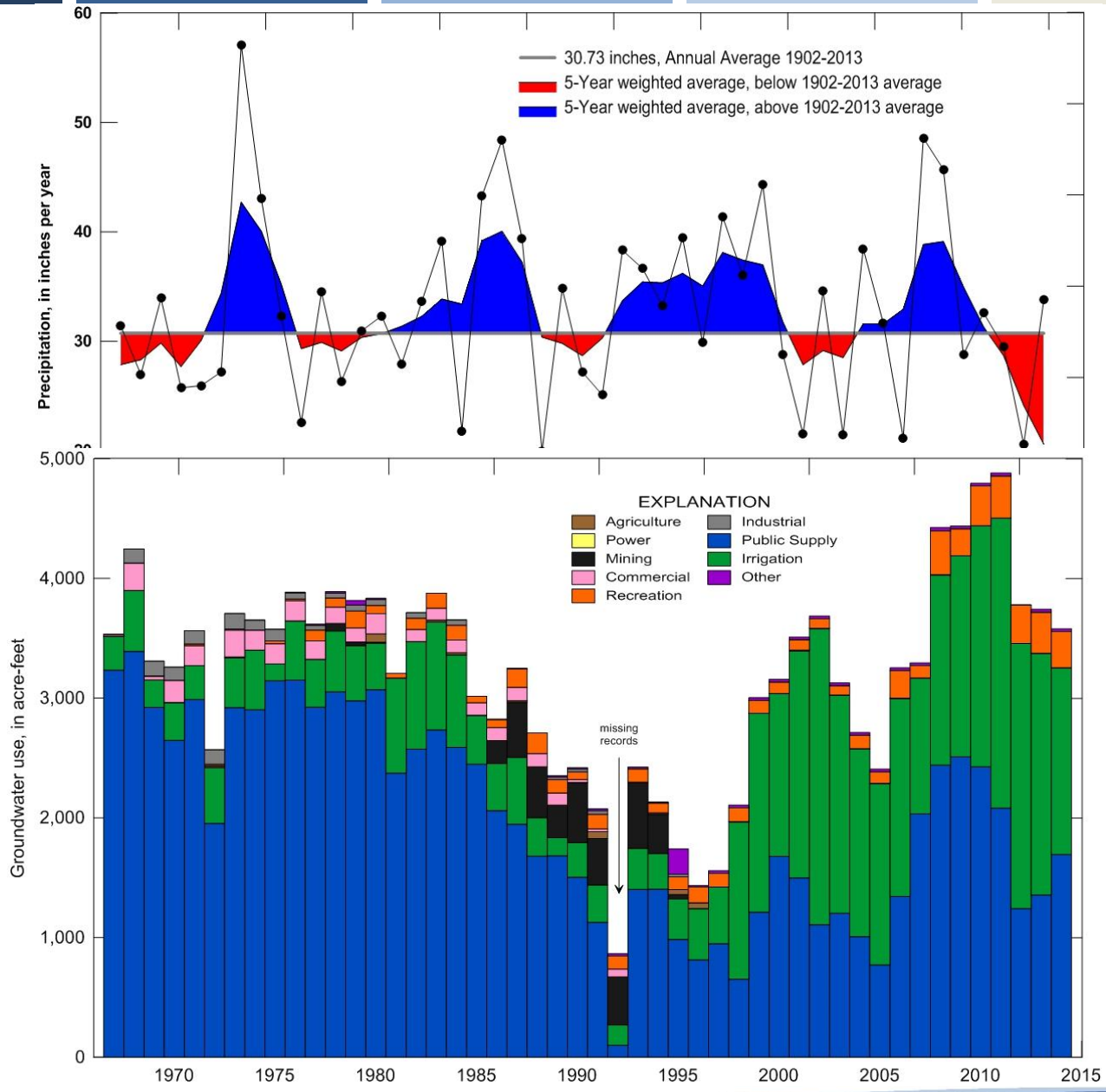

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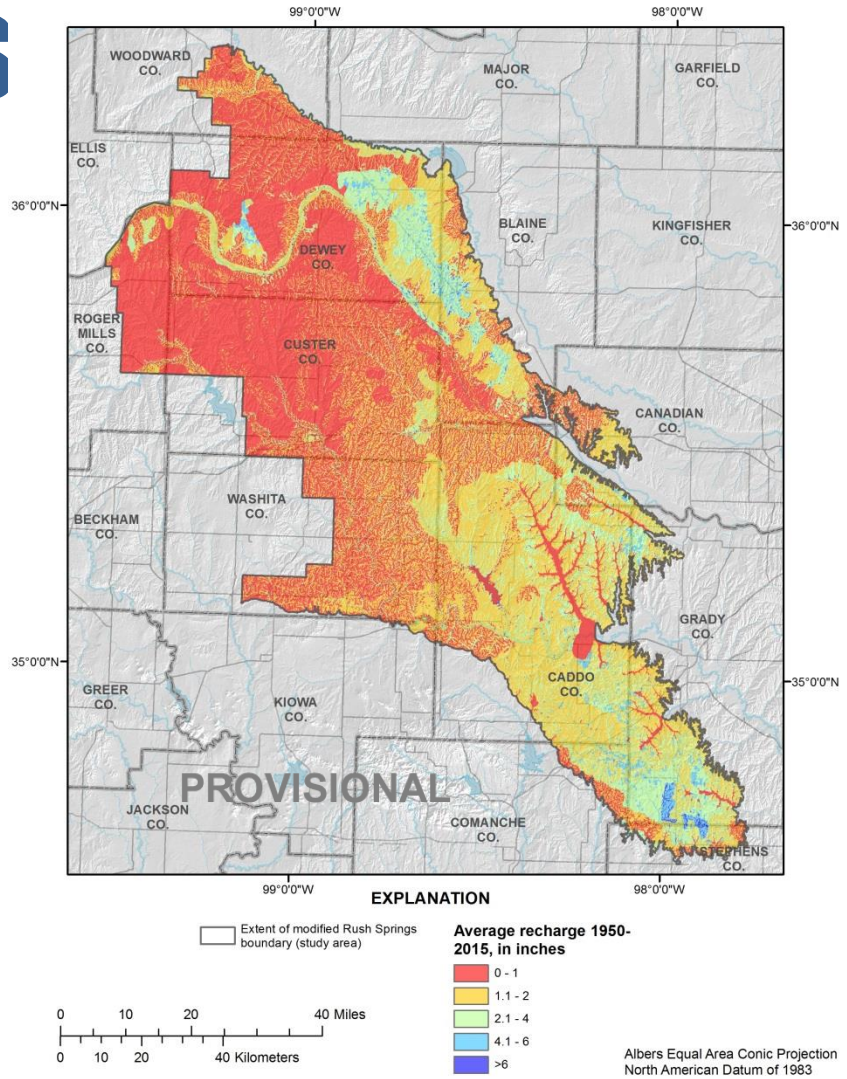
Hydrologic Studies

Statistic	Average annual SWB recharge, in inches			
	1950-2015	1950-84	1985-2001	2002-15
Minimum	0.03	0.03	0.76	0.03
Maximum	4.63	3.61	4.15	4.63
Mean	1.40	1.07	2.18	1.30
Median	1.01	0.88	2.00	0.80



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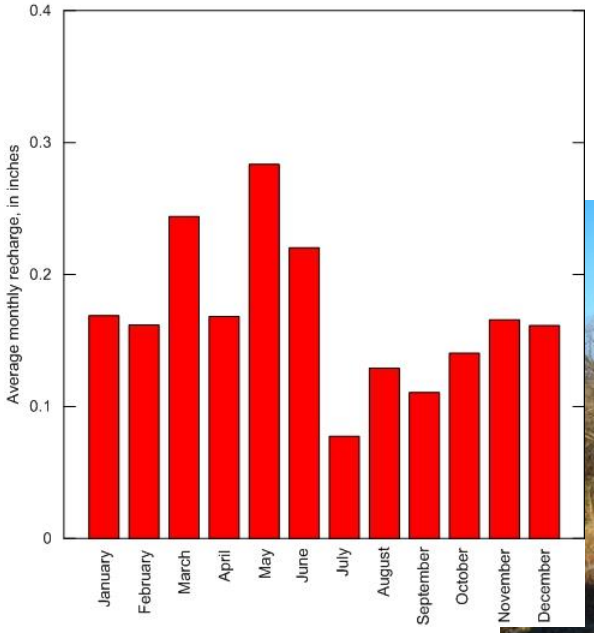
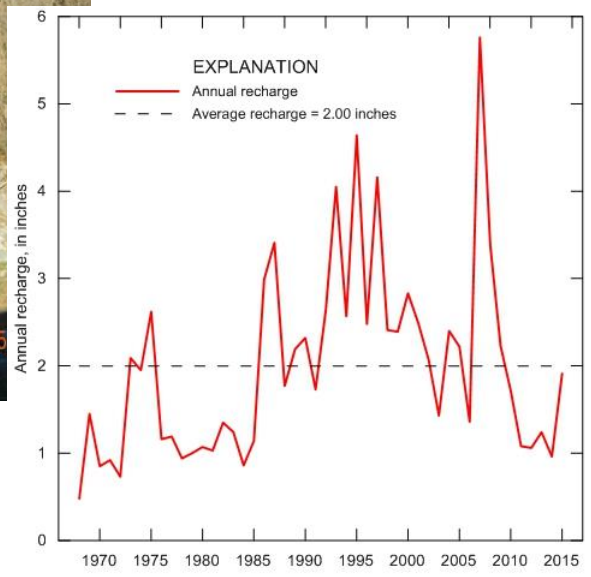
Hydrologic Studies



Cobb Creek - Rush Springs



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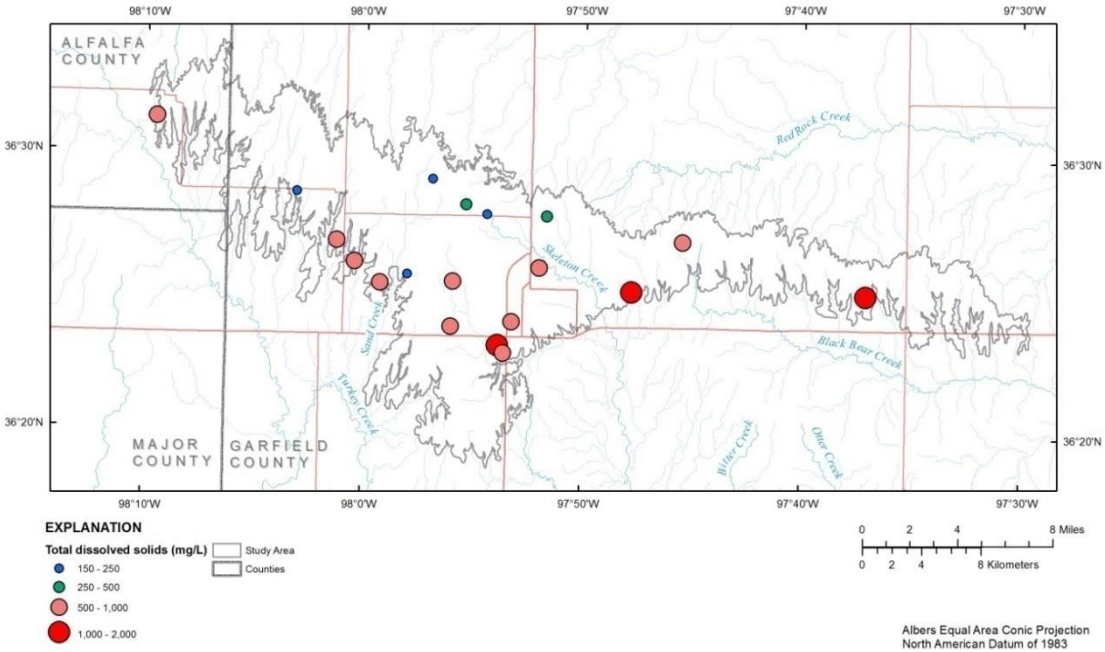
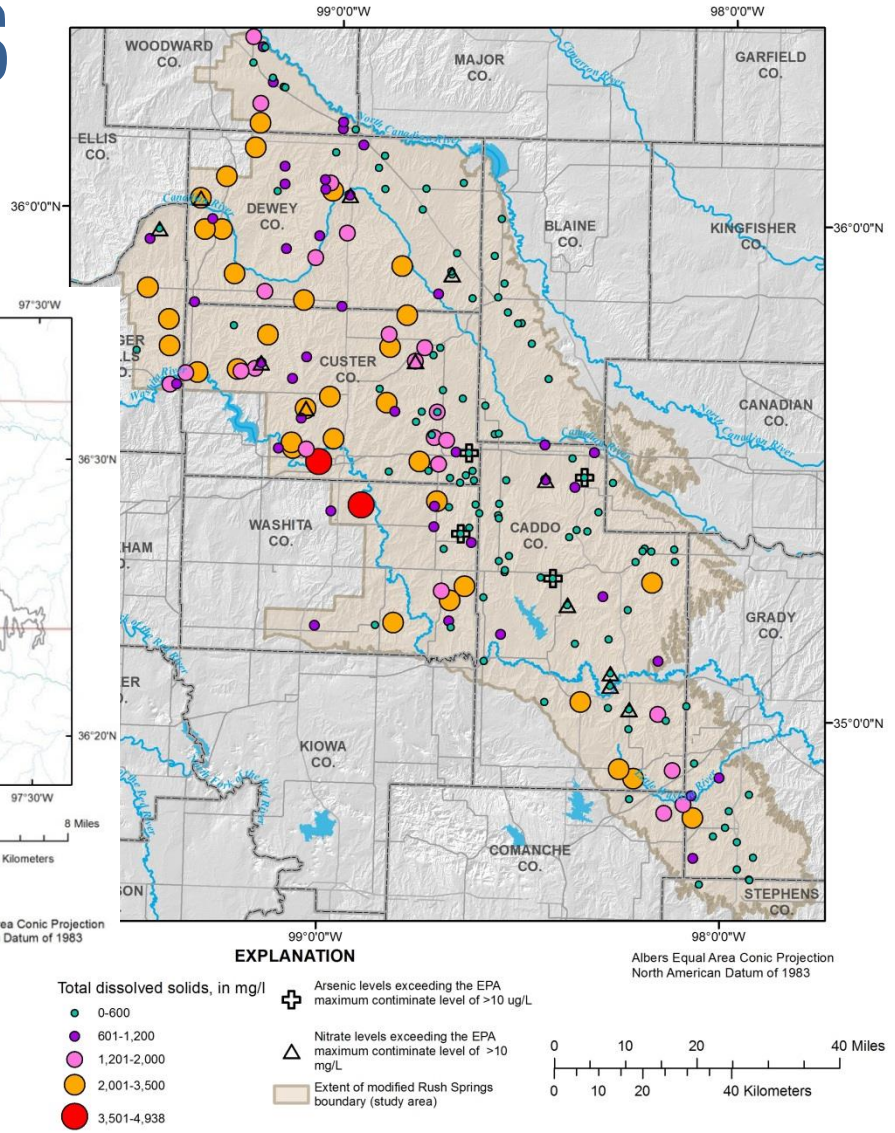
Hydrologic Studies





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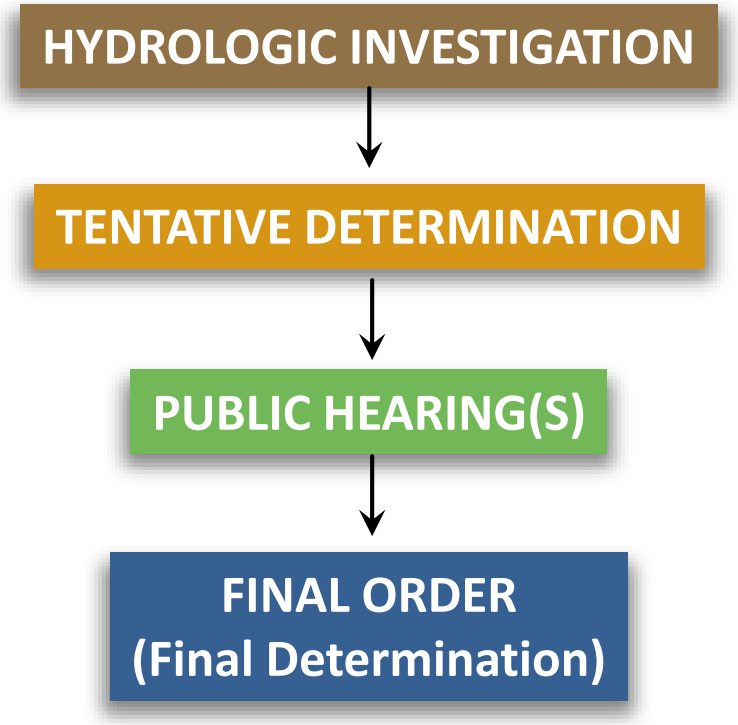
What happens after the study

Maximum Annual Yield Determination Process



Senate Bill 1294

- Allows flexibility by the Board to delay or gradually implement the Equal Proportionate Share until the Total Allocated Amount reaches 25% of the Maximum Annual Yield.

- Establishes well spacing.

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Questions?

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House Bill 3405

- Defines Marginal Quality Groundwater as groundwater containing 5000-10000 Parts Per Million Total Dissolved Solids. Allows the Board to promulgate rules regarding construction standards for marginal quality wells and permit the use of marginal quality groundwater.