Texas Water Development Board

Role of BRACS in the State Water Plan

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Texas A&M AWRA Student Chapter
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Texas Water Development Board
Water Science and Conservation
Innovative Water Technologies

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The statements contained in this presentation are my current views and opinions and are not intended to reflect the positions of, or information from, the Texas Water Development Board, nor is it an indication of any official policy position of the Board.

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- What is TWDB?
  - State agency, founded in 1957
  - Response to drought of record
  - The name has changed but the mission's the same
- Mission
  - Provide leadership, planning, funding, & education for conservation and responsible water development
- TWDB is not a regulator
  - That role is served by Texas Commission on Environmental Quality (TCEQ)

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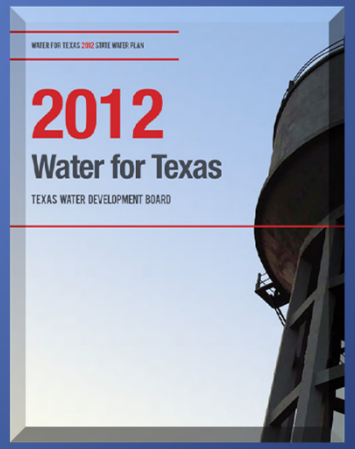
The Big Report

- The State Water Plan
  - Established by SB 1 in 1997 in current form
  - Compilation of reports from the 16 Regional Planning Groups
  - Revised every 5 years with a 50-year horizon
  - Serves as a guide to state water policy
  - Provides information on demand, supply, and strategies
- By 2060
  - 82% increase in population
  - 22% increase in water demand
  - 10% decrease in existing supplies
  - 8.3M acre-foot need by 2060
  - How do we cover this need?



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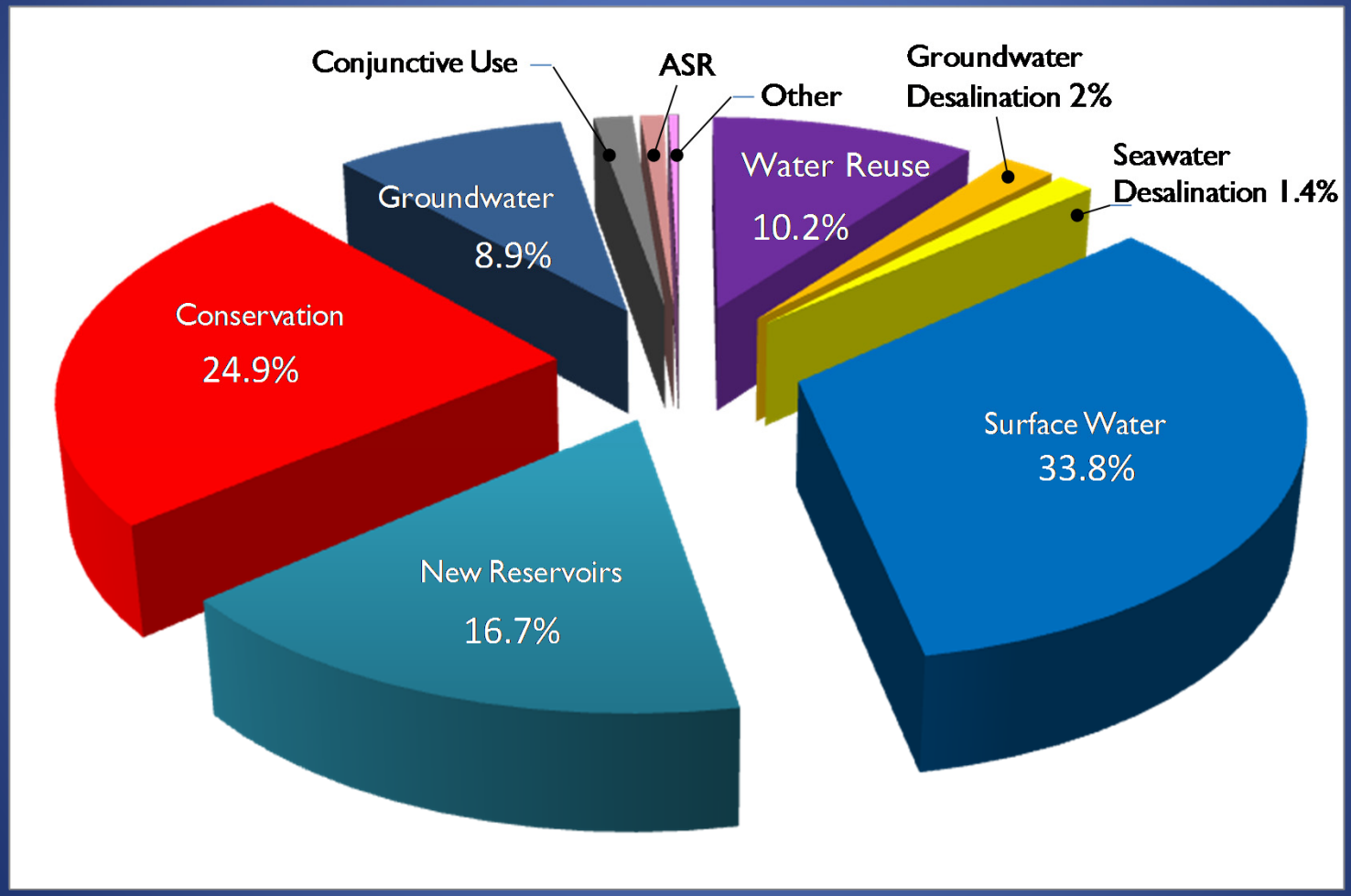
Recommended Water Management Strategies for 2060



Source: 2012 State Water Plan

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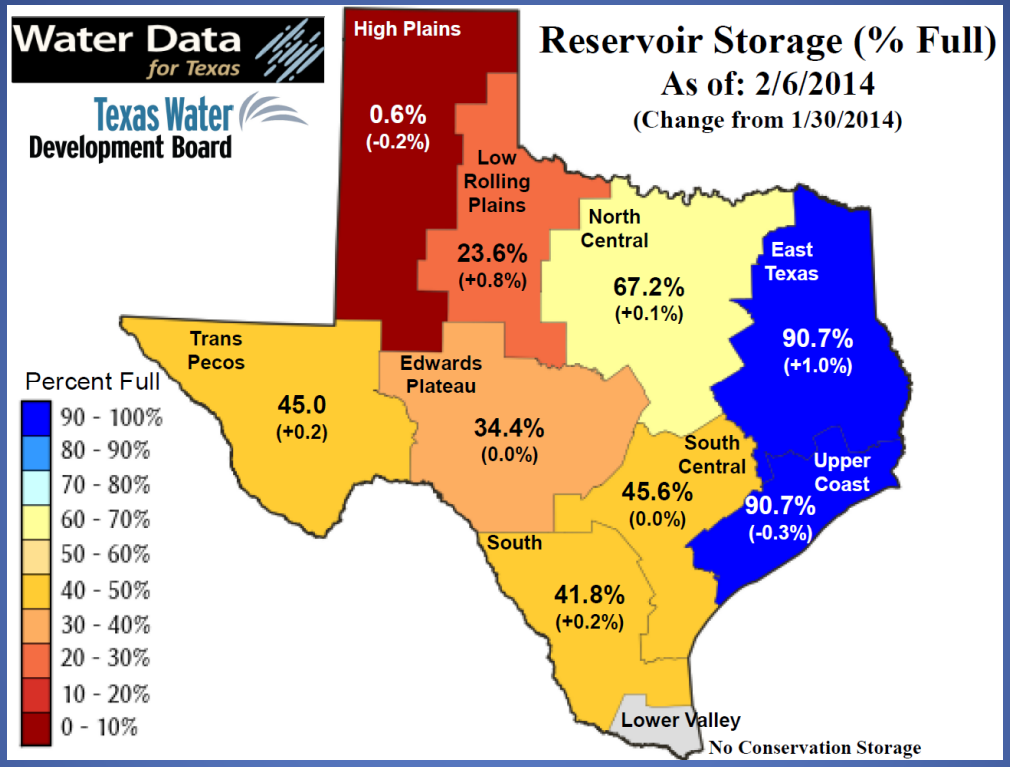
Historical Means Challenges



- Surface Reservoirs Snapshot since 2012
  - Storage has been below long term median since at least 1990
  - 10 of 12 months of 2013 set low records back to at least 1990
- GW depletion and subsidence
  - Decrease from 2010 to 2060 from 13.3M ac-ft to 10.1M ac-ft

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Innovative Water Technologies (IWT)

- Area of growing interest
  - Result of aforementioned challenges with historical means
- Team goals
  - Participate in research and demonstrations
  - Disseminate information via outreach
- Team technologies
  - Rainwater harvesting
  - Water reuse
  - Aquifer Storage and Recovery
  - Desalination
  - Brackish Resources Aquifer Characterization System (BRACS)

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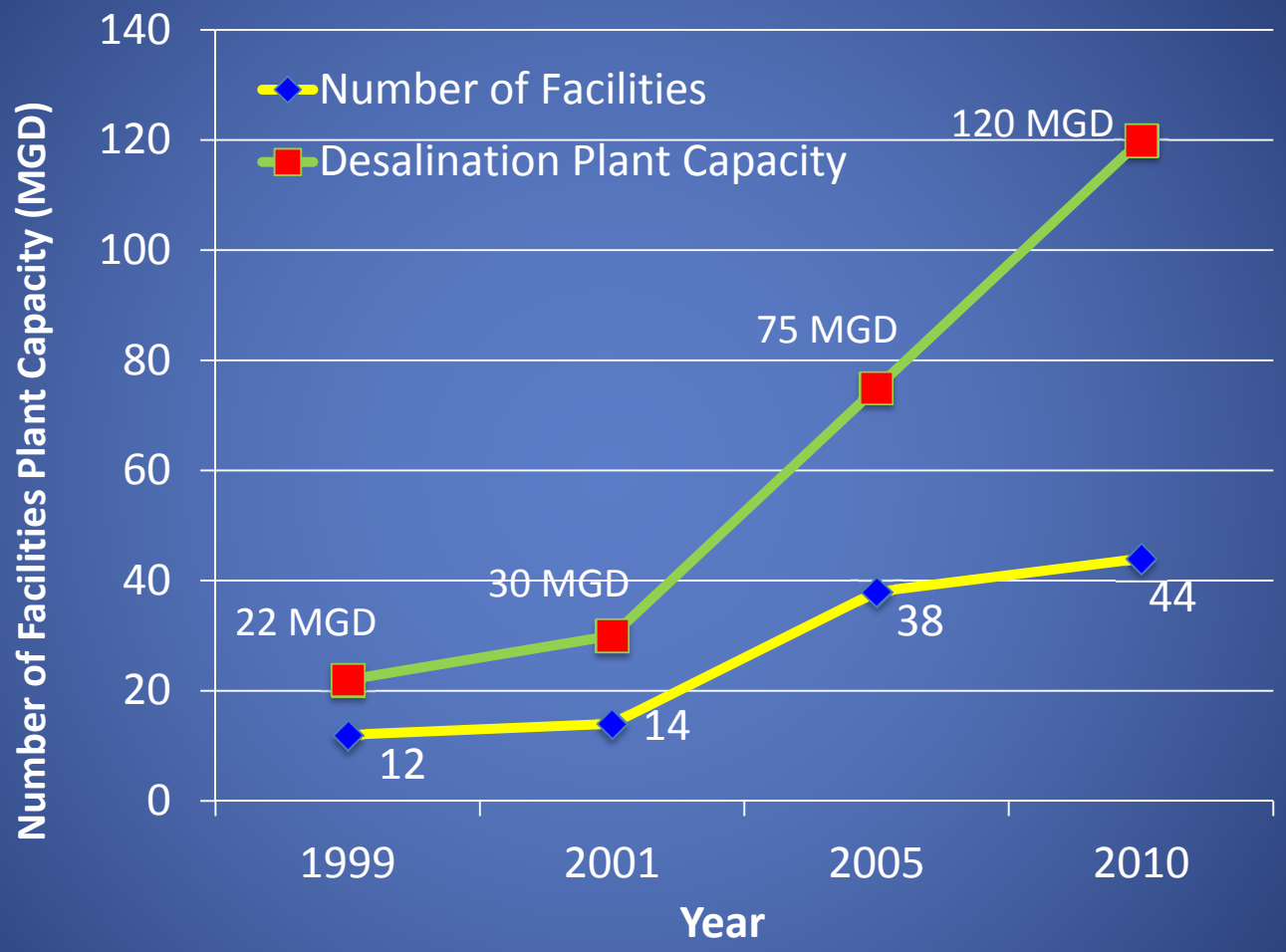
Real Quick – Salinity, TDS, and Desal

- Total Dissolved Solids (TDS) defines salinity (USGS)
  - Fresh (0-999mg/L); EPA limit for potable water
  - Slightly saline (1,000-2,999 mg/L)
  - Moderately saline (3,000-9,999 mg/L)
  - Very saline (>10,000 mg/L)
  - For reference, seawater is near 35,000 mg/L
  - “Brackish” is a flexible term
- Desalination - treatment to potable standards
  - Almost universally reverse osmosis (RO) in the U.S.
  - Energy costs are large portion of operating costs
  - Lower TDS equals lower operating costs

Desalination Interest



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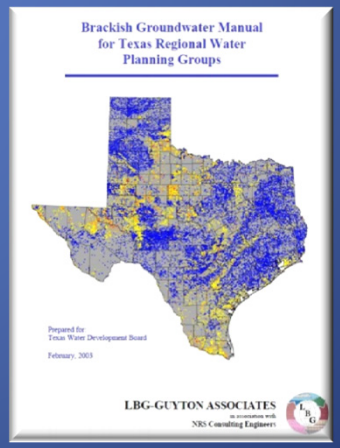
TWDB Brackish Water Studies

- TWDB Report 157 - 1971
  - Aquifers very broadly categorized
  - 1600 well logs interpreted across the state
  - 7 large volumes of data; very cumbersome
  - Be glad we have PC's!
- TWDB Contract Report #2001483395 - 2003
  - Estimated 2.7B acre-feet brackish water in place
  - Good report, but…
  - Regional in scope
  - Limited in areal extent
  - Generalized hydrologic parameters
  - Original data not public



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BRACS Background

- Funded by the 81st legislature in 2009
- Mission is to:
  - Map and characterize brackish aquifers
    - Geophysical well logs and other available data
  - Develop parameter-screening tools
  - Develop replicable groundwater flow models
- Purpose
  - Assist communities assess viability of resource
  - Not a substitute for specific site evaluation

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BRACS Projects

- Pecos Valley
  - Report published June 2012
  - Laid foundation for methods, sources, datasets
  - Available on TWDB website
- Gulf Coast Aquifer
  - Corpus Christi ASR Conservation District
  - Completed March 2012
- Queen City - Sparta Aquifer
  - Atacosa and McMullen counties
  - Final review in process
- Upper Coastal Plain, Central Texas
  - Centered around Gonzales County
  - Carrizo – Wilcox aquifer is part of the study area
  - In process
- Gulf Coast Aquifer
  - Lower Rio Grande Valley
  - In process

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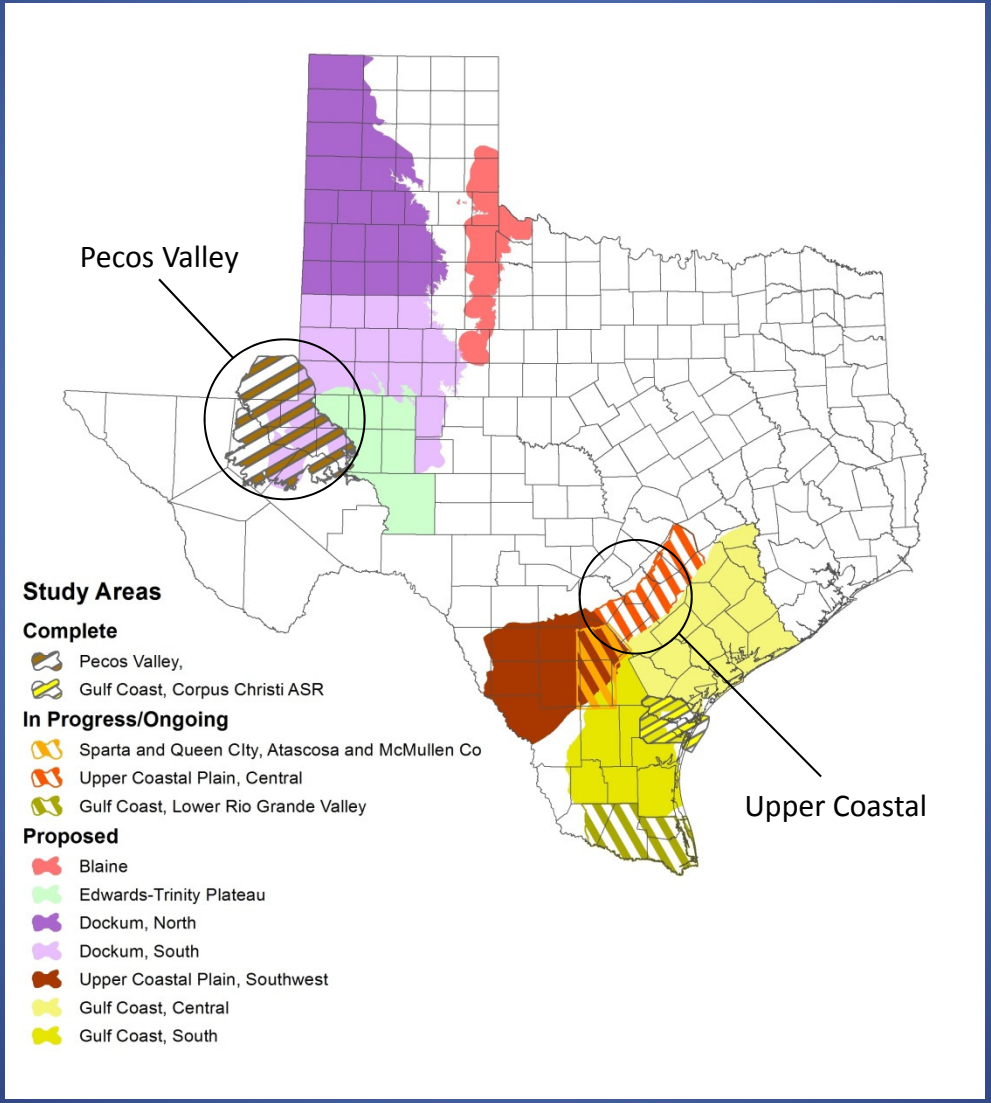
Referenced Study Areas



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BRACS Deliverables

- Dataset construction (database, GIS) of project information
- Well data (water, oil/gas) collection for interpretation
  - 43,737 data records to date
- Aquifer properties compilation
- Map of aquifer extent to 10,000 mg/L TDS
- Water volume calculation
- Each aquifer may require unique analysis based on data availability and local hydrogeology
- Provide ***all*** information to interested stakeholders

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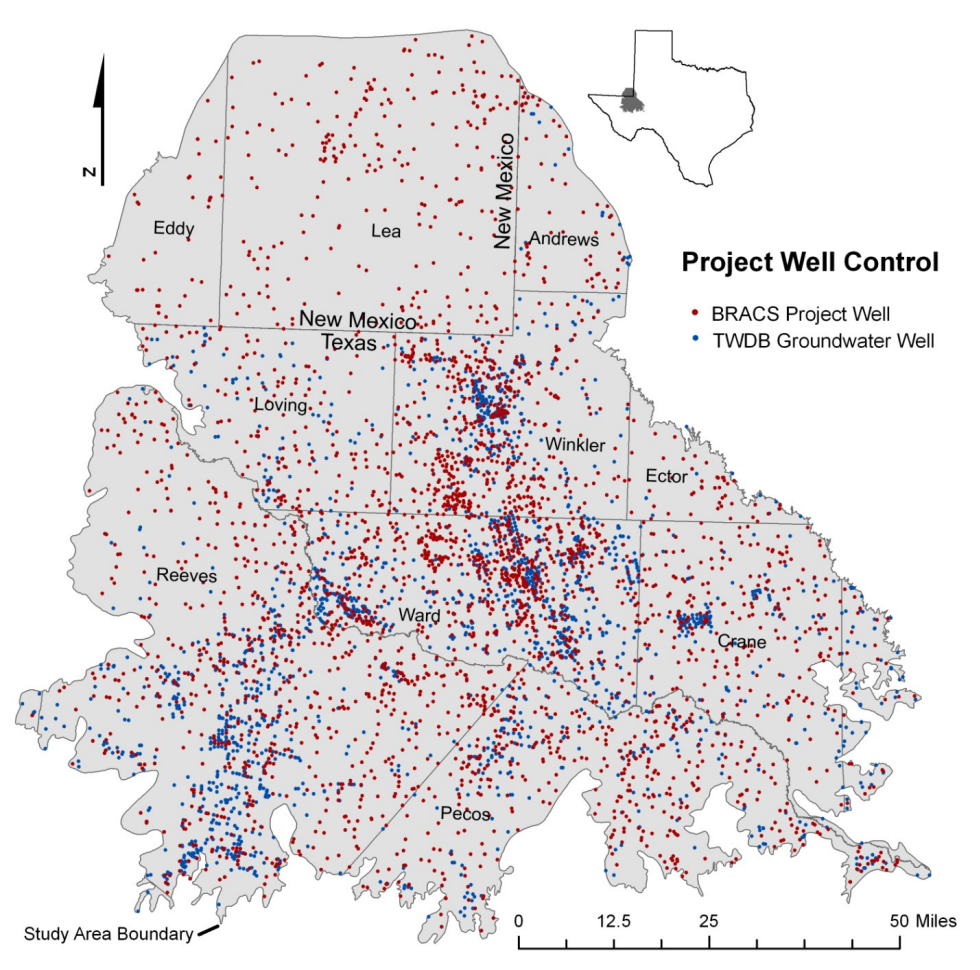
Well Control

- Lots of well control!!
  - Not always sure what you need until you need it



Sources

- Bureau of Economic Geology
- Texas Railroad Commission
- Texas Water Development Board
- Texas Commission on Environmental Quality
- Others

Source: Pecos Valley Aquifer Project

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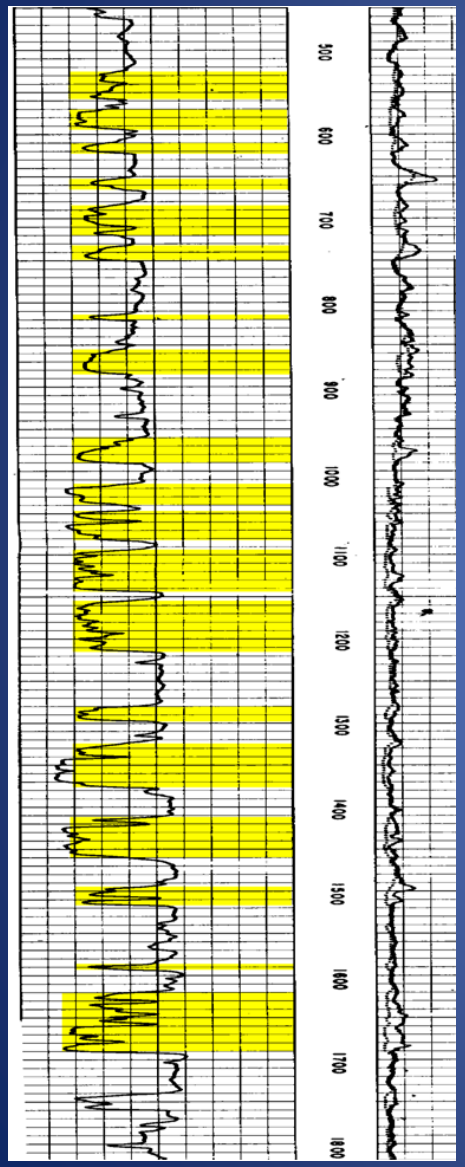
Geophysical Well Logs



- Sensor packs pulled up the well bore on wire
- Most common “tool” types
  - Spontaneous potential
    - Electrochemical between drilling mud and formation
  - Gamma Ray
    - From natural radioactive decay
    - Generally higher in clays/shales, lesser in sands
  - Resistivity
    - Long – represents the formation chemistry
    - Short – represents the mud filtrate chemistry
- TWDB Report 343 for further information

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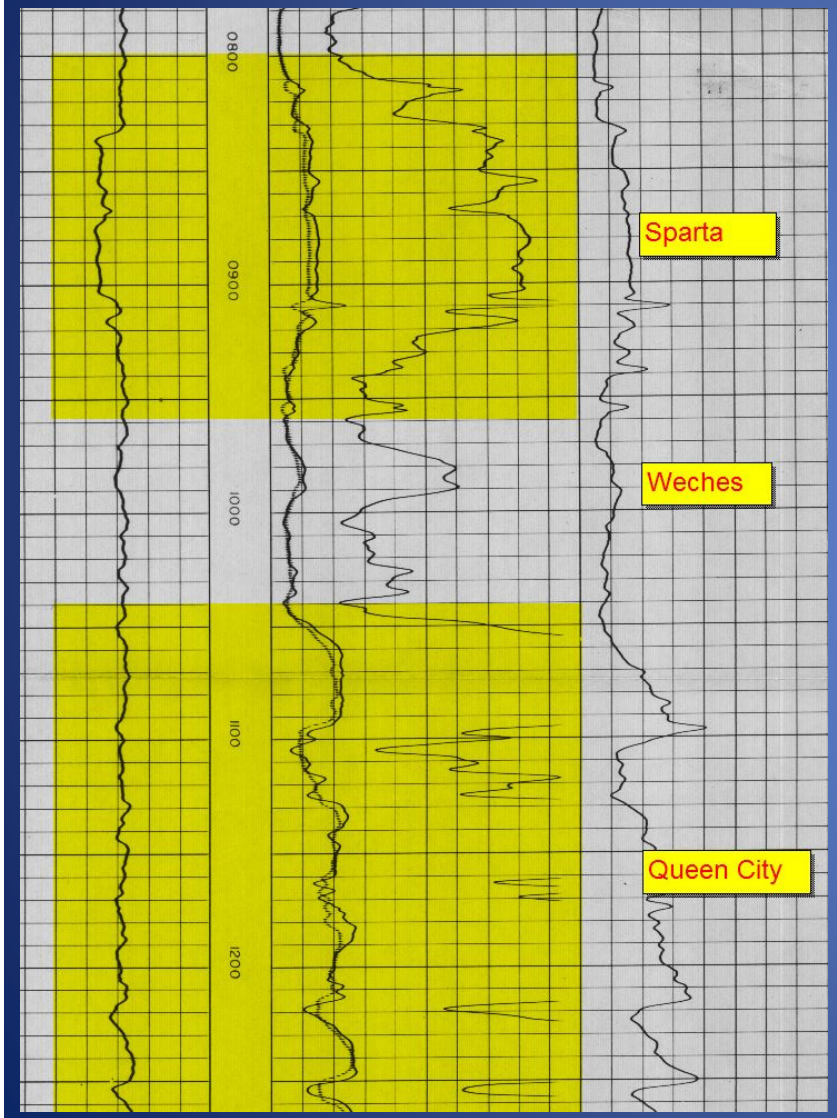
Source: Gulf Coast Aquifer Project, Corpus Christi ASR

Interpretation Uses



Source: Sparta – Queen City Aquifer Project

- Lithology
  - Sand thickness
  - Clay thickness
  - Net sand calculation
  - Water volume calculation
- Stratigraphy
  - Formation vertical extent
  - Formation lateral extent
  - Formation sand content
  - Correct aquifer assignment of water quality and aquifer properties

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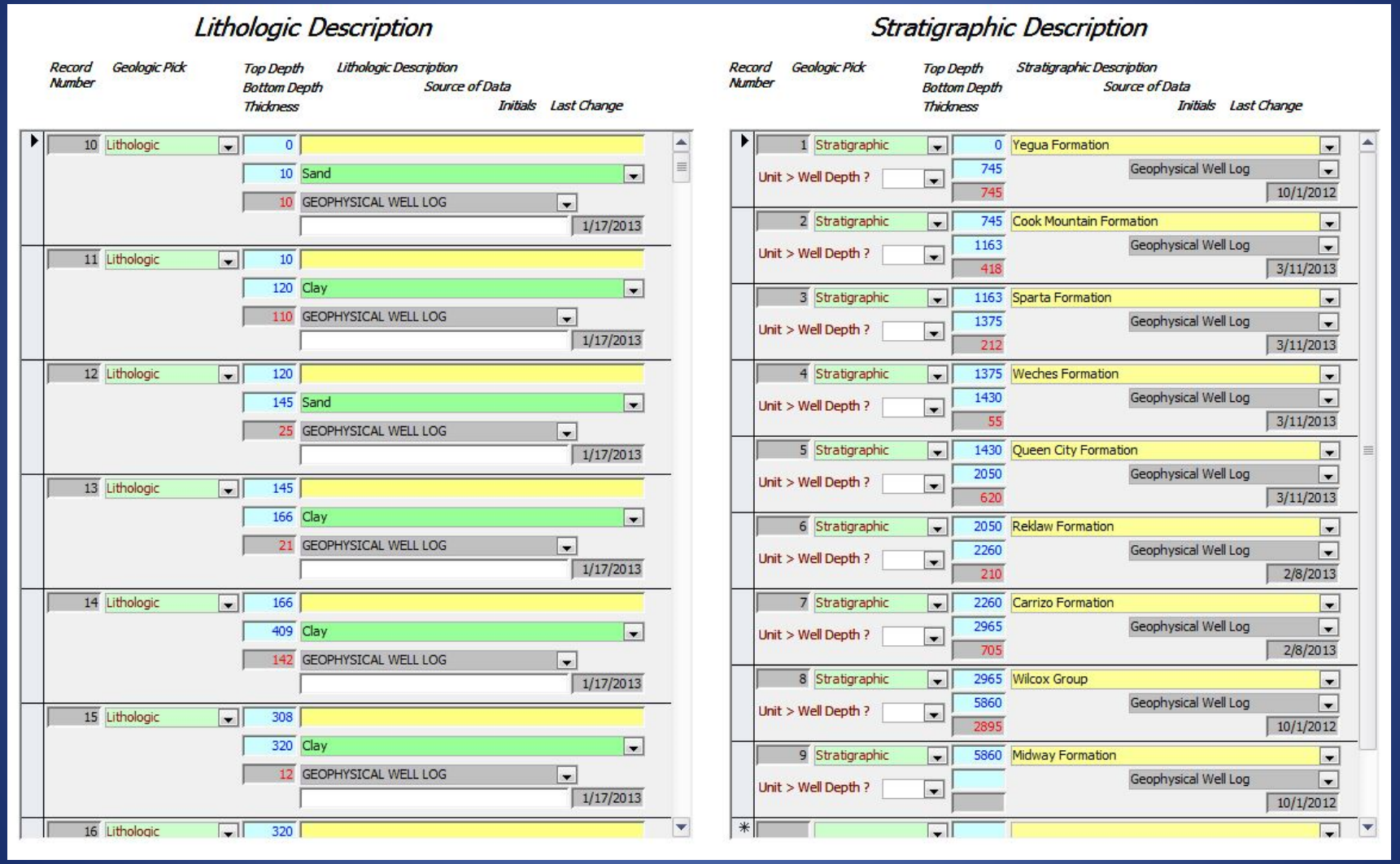
Database Entry



Lithologic Description

Record Number	Geologic Pick	Top Depth / Bottom Depth / Thickness	Lithologic Description	Source of Data	Initials	Last Change
10	Lithologic	0				
		10	Sand			
		10		GEOPHYSICAL WELL LOG		1/17/2013
11	Lithologic	10				
		120	Clay			
		110		GEOPHYSICAL WELL LOG		1/17/2013
12	Lithologic	120				
		145	Sand			
		25		GEOPHYSICAL WELL LOG		1/17/2013
13	Lithologic	145				
		166	Clay			
		21		GEOPHYSICAL WELL LOG		1/17/2013
14	Lithologic	166				
		409	Clay			
		142		GEOPHYSICAL WELL LOG		1/17/2013
15	Lithologic	308				
		320	Clay			
		12		GEOPHYSICAL WELL LOG		1/17/2013
16	Lithologic	320				

Stratigraphic Description

Record Number	Geologic Pick	Top Depth / Bottom Depth / Thickness	Stratigraphic Description	Source of Data	Initials	Last Change
1	Stratigraphic	0	Yegua Formation			
Unit > Well Depth ?		745		Geophysical Well Log		
		745				10/1/2012
2	Stratigraphic	745	Cook Mountain Formation			
Unit > Well Depth ?		1163		Geophysical Well Log		
		418				3/11/2013
3	Stratigraphic	1163	Sparta Formation			
Unit > Well Depth ?		1375		Geophysical Well Log		
		212				3/11/2013
4	Stratigraphic	1375	Weches Formation			
Unit > Well Depth ?		1430		Geophysical Well Log		
		55				3/11/2013
5	Stratigraphic	1430	Queen City Formation			
Unit > Well Depth ?		2050		Geophysical Well Log		
		620				3/11/2013
6	Stratigraphic	2050	Reklaw Formation			
Unit > Well Depth ?		2260		Geophysical Well Log		
		210				2/8/2013
7	Stratigraphic	2260	Carrizo Formation			
Unit > Well Depth ?		2965		Geophysical Well Log		
		705				2/8/2013
8	Stratigraphic	2965	Wilcox Group			
Unit > Well Depth ?		5860		Geophysical Well Log		
		2895				10/1/2012
9	Stratigraphic	5860	Midway Formation			
Unit > Well Depth ?				Geophysical Well Log		
						10/1/2012

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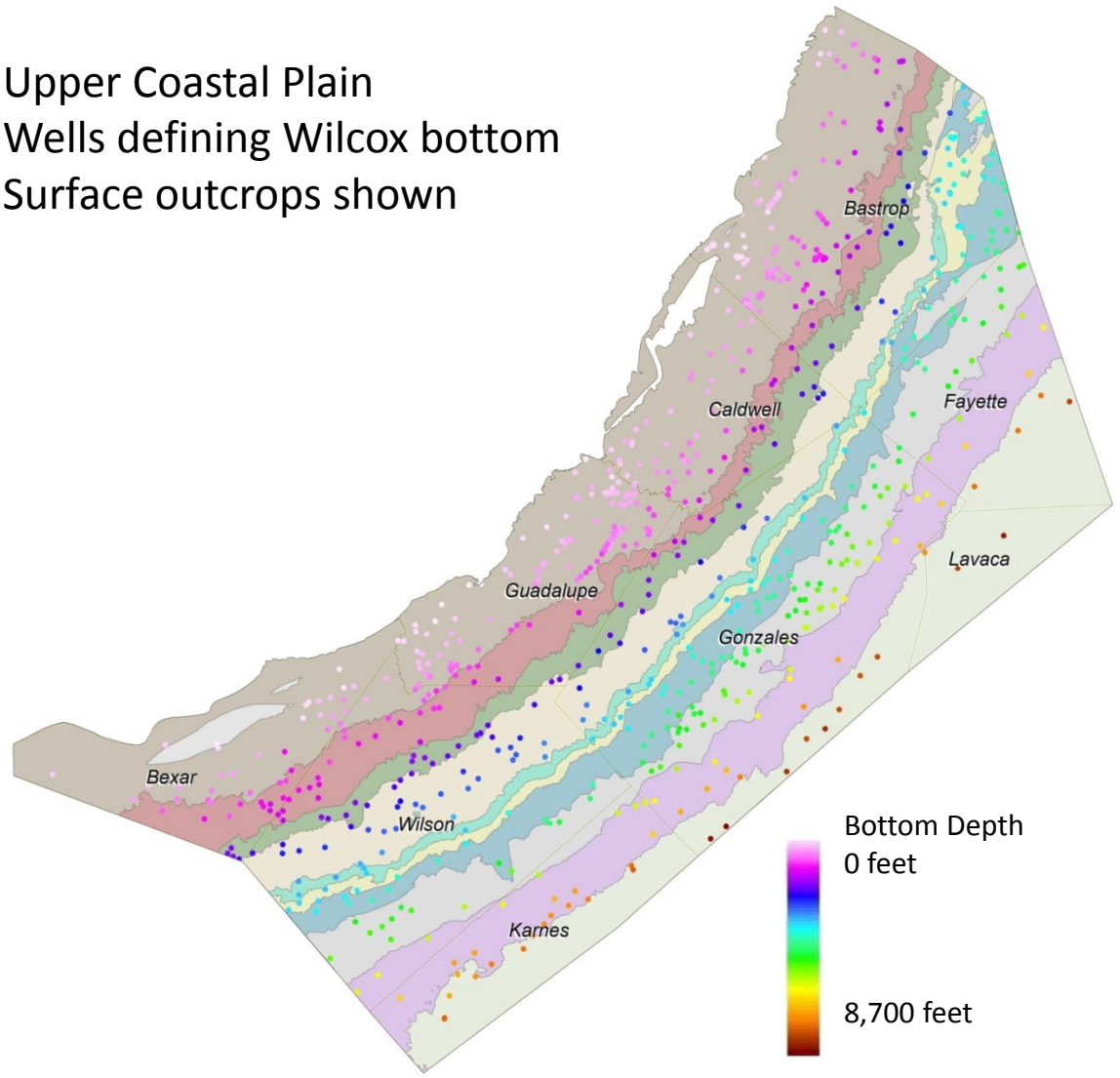
Source: BRACS Database

GIS Point Depth Control

Upper Coastal Plain
Wells defining Wilcox bottom
Surface outcrops shown



Source: Carrizo – Wilcox Aquifer Project

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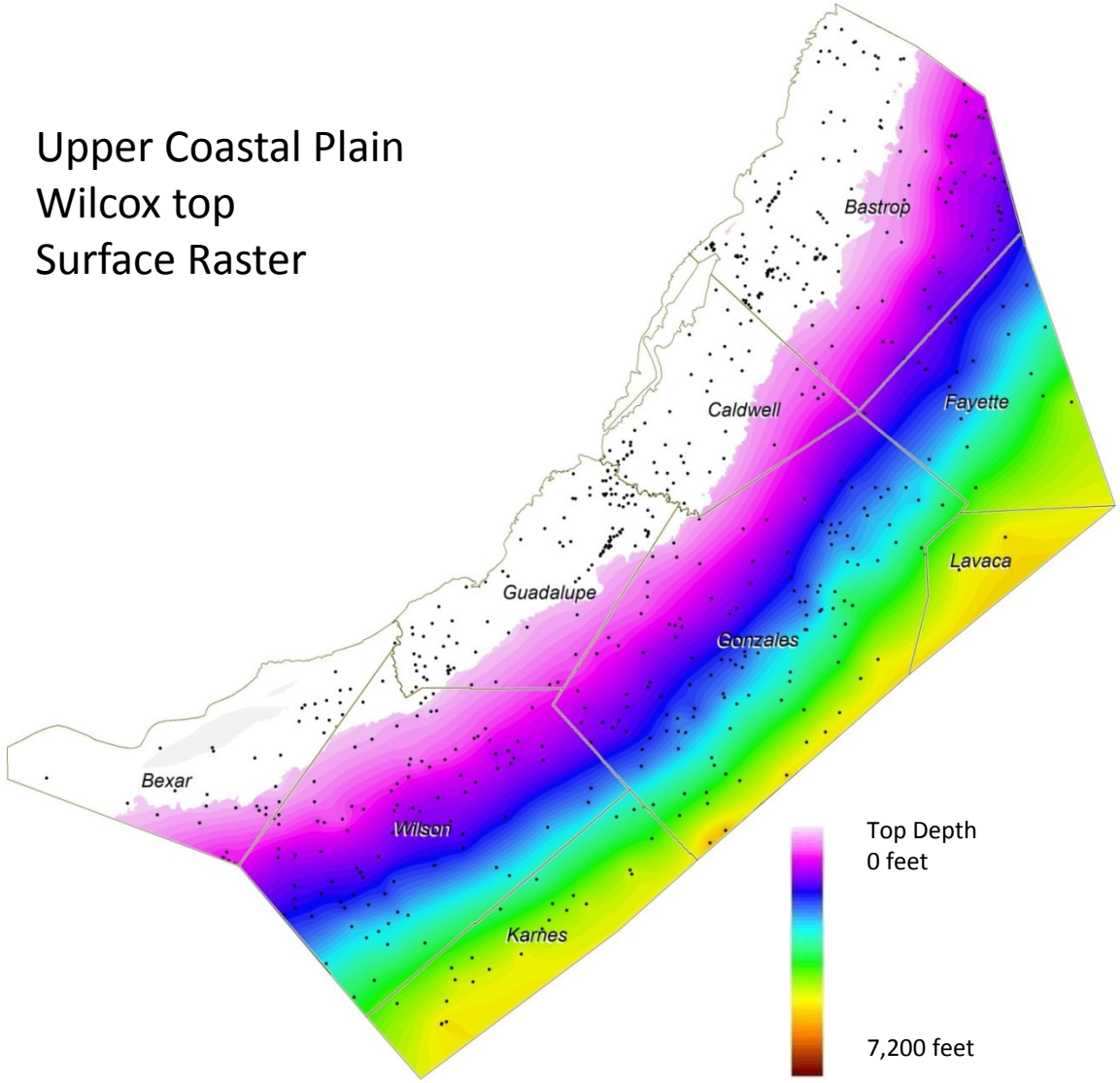
GIS Surface Control

Upper Coastal Plain
Wilcox top
Surface Raster



Source: Carrizo – Wilcox Aquifer Project

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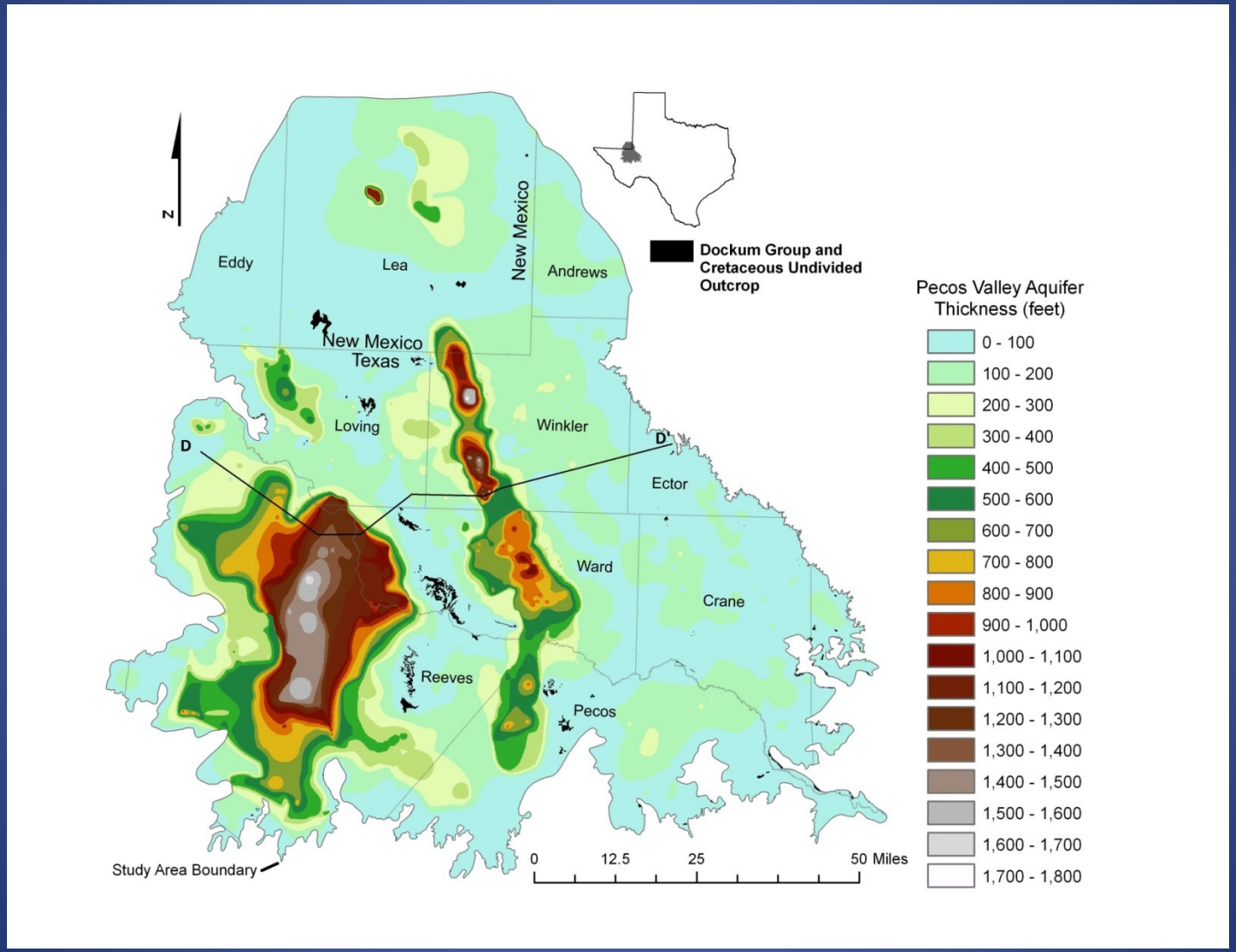
Apply GIS Raster Math – Pecos Valley



Source: Pecos Valley Aquifer Project

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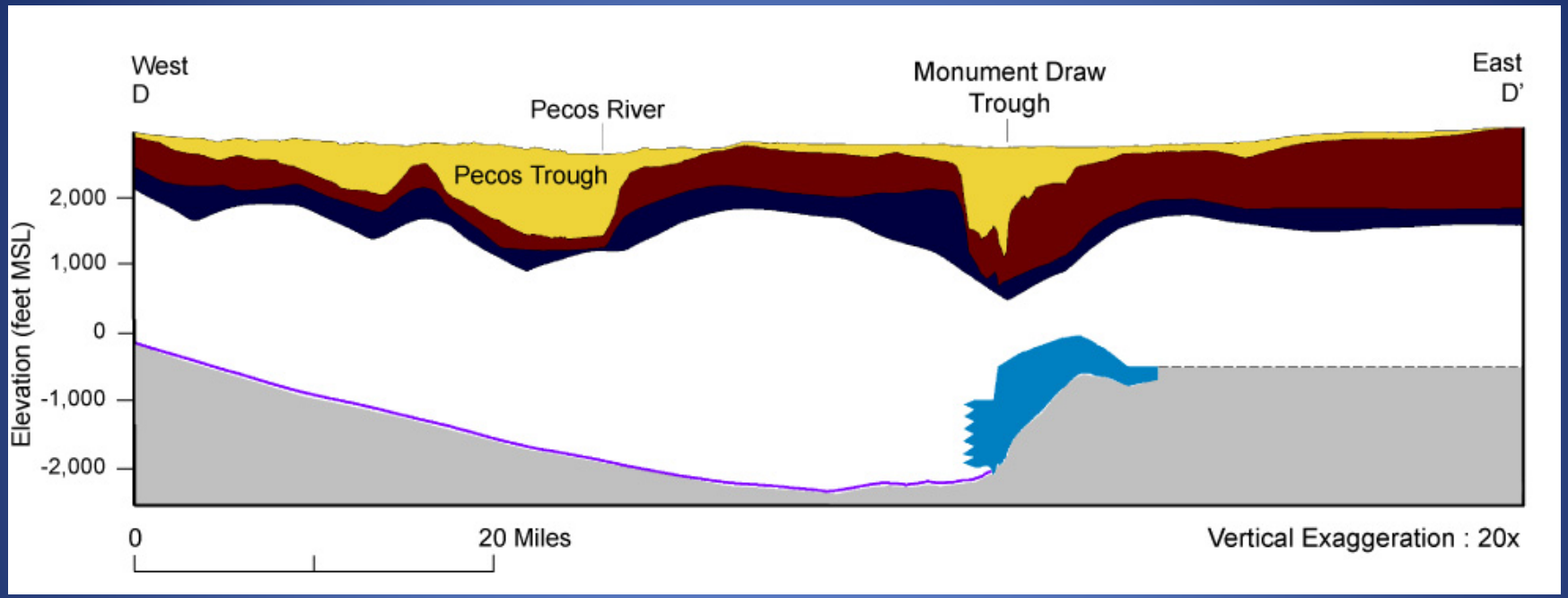
Cross Section Generation for GIS



Pecos Valley Alluvium
Cretaceous Undivided
Dockum Group and Dewey Lake Formation
Rustler Formation
Salado and Castille Formations
Capitan Reef Complex
Pre-Salado beds east of Capitan Reef Complex and Pre-Castile beds west of Capitan Reef Complex

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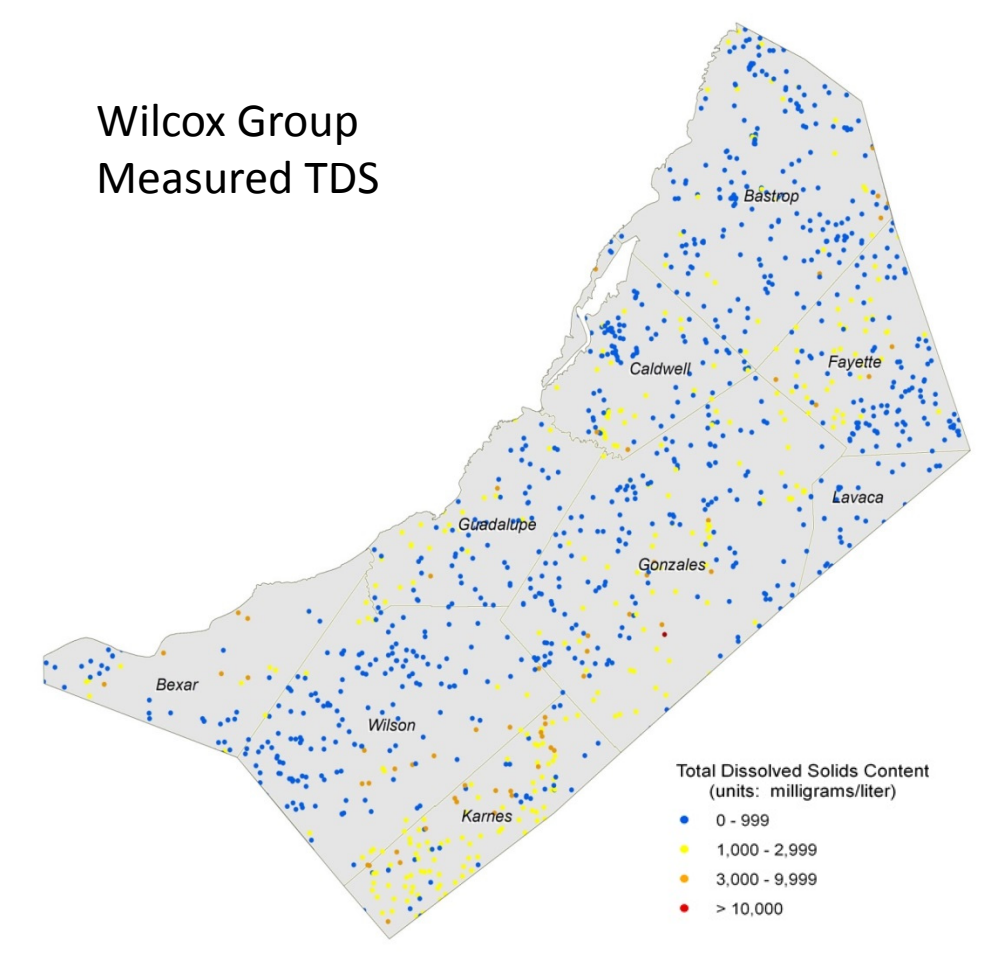
Source: Pecos Valley Aquifer Project

Gather More Data



- Aquifer and Well Test Data
  - Well yield
  - Transmissivity
  - Storativity
- Water Quality Data
  - Primarily TDS for this study
  - Bias is towards lower TDS

Source: Carrizo – Wilcox Aquifer Project

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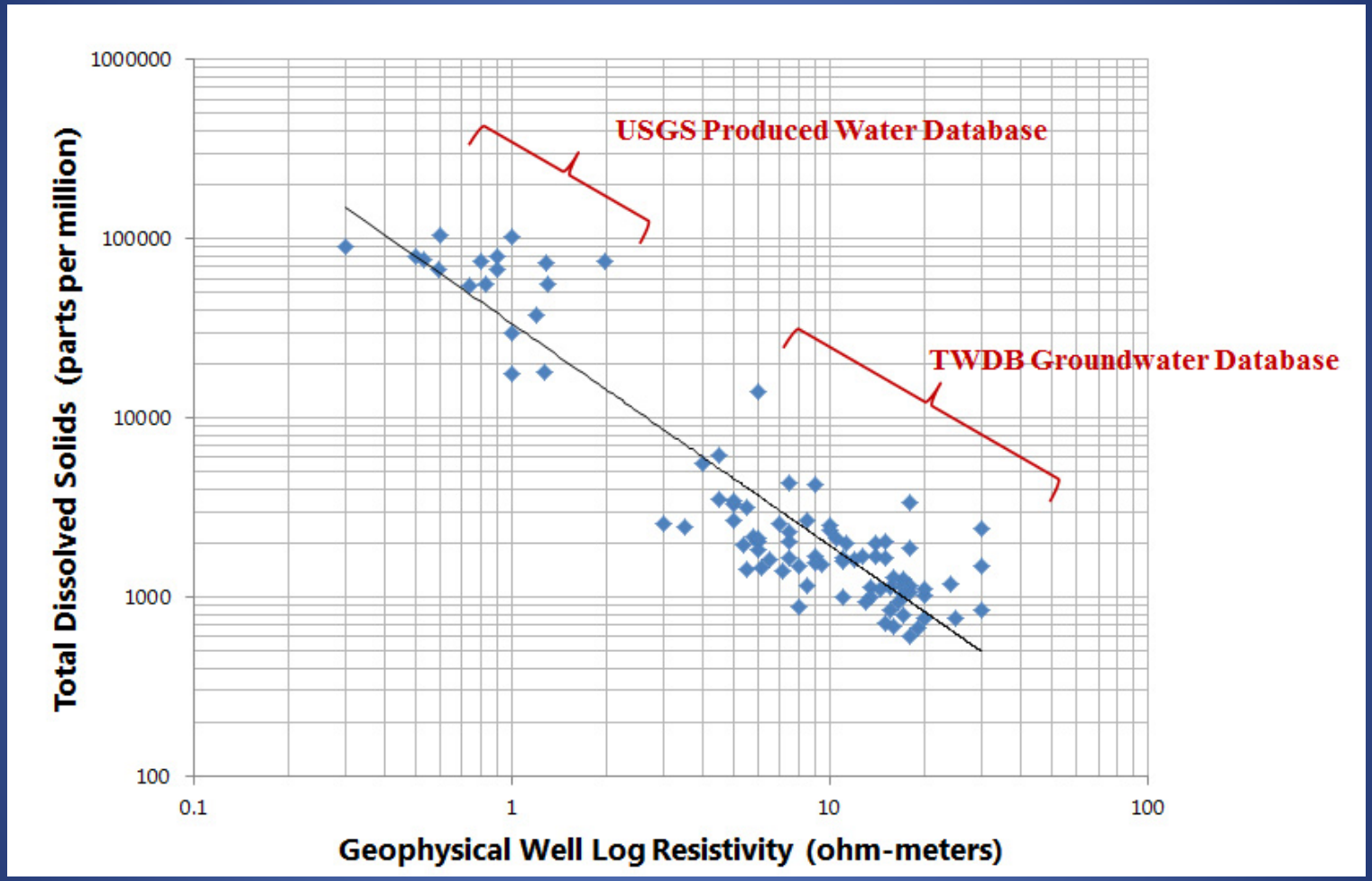
Now Tie Measured TDS to Log Data



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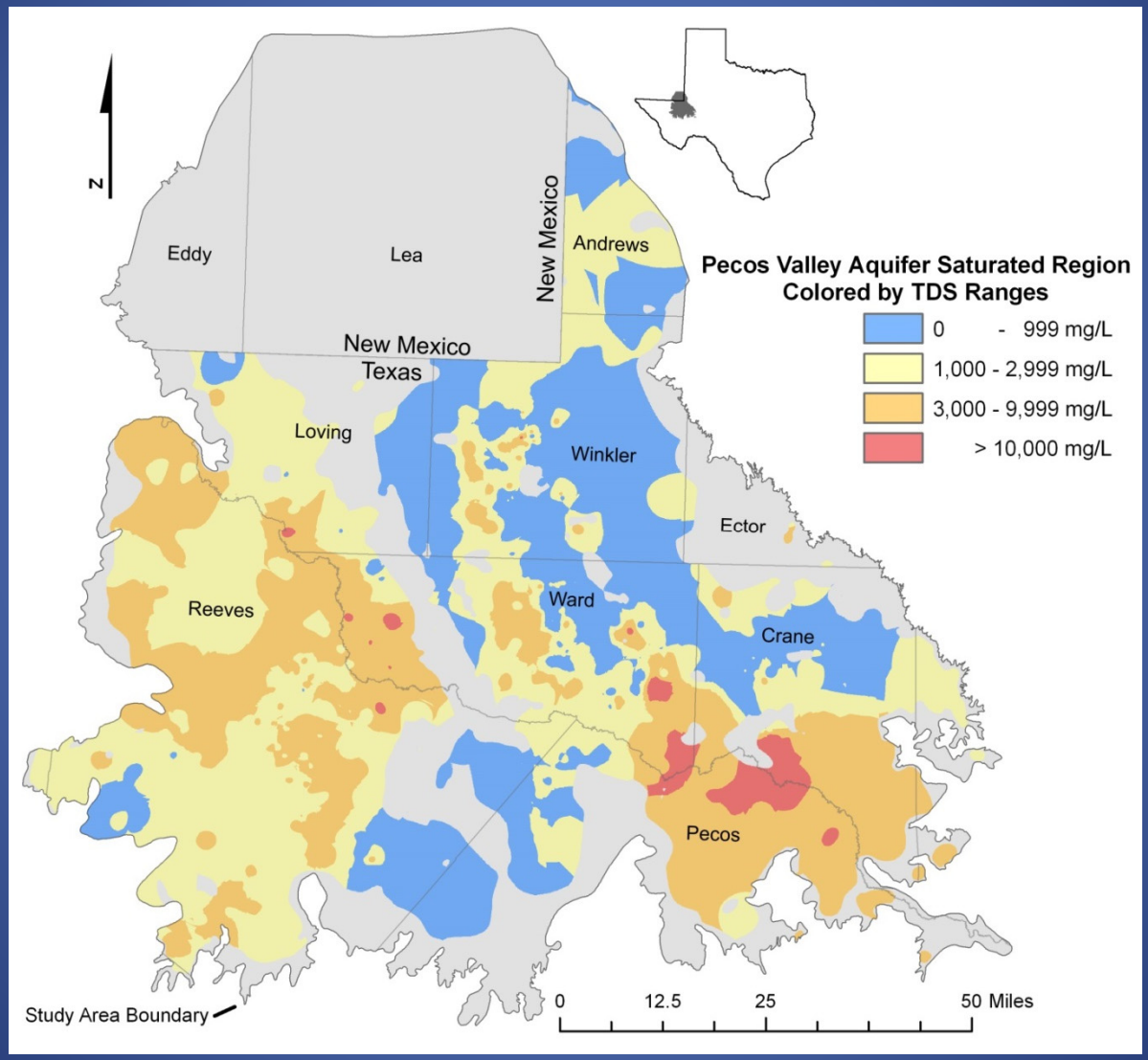
Source: Gulf Coast Aquifer Project, Corpus Christi ASR

Bring it Back Together in GIS



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Source: Pecos Valley Aquifer Project

And Now Get to Volumes

- Apply known (or estimated) values
  - Control location
  - Formation thickness
  - Percent sand
  - Storativity
  - TDS
- Pecos Valley Results
  - 15M acre-feet (<1,000 mg/L)
  - 46M acre-feet (1,000 – 2,999 mg/L)
  - 39M acre-feet (3,000 – 9,999 mg/L)
  - 1M acre-feet (>10,000 mg/L)

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BRACS Summary

- Detailed brackish groundwater resource evaluation
- BRACS project deliverables available on TWDB website
- Geophysical well log files available upon request
- Contract reports and deliverables available on TWDB website
- All in support of the State Water Plan

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www.twdb.texas.gov

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