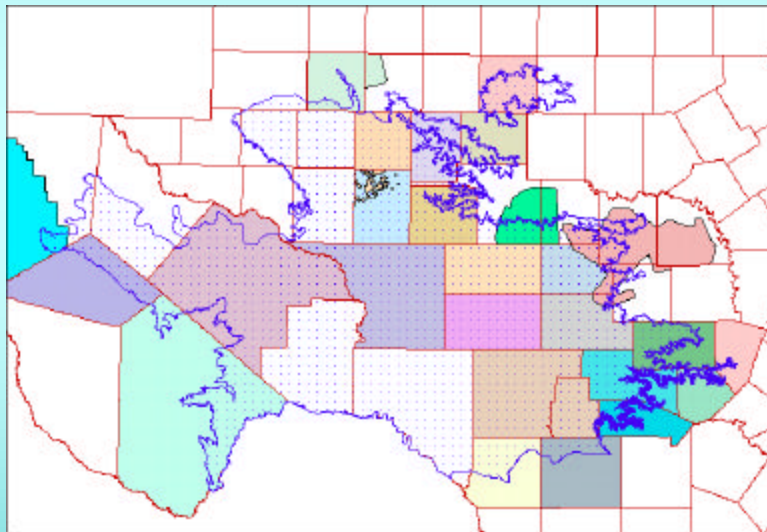




# Welcome To The Second Quarterly Edwards-Trinity Aquifer Model Stakeholders Advisory Forum



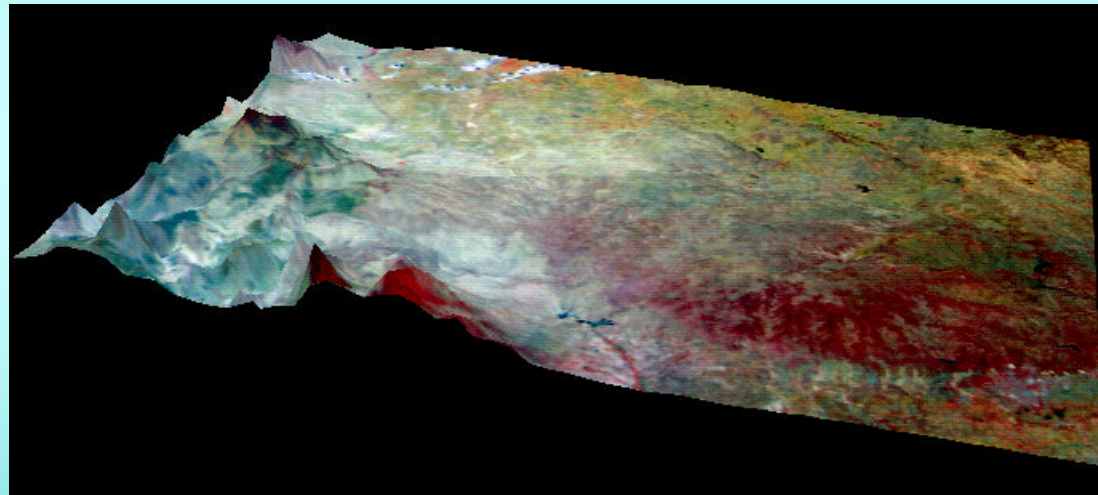
**ET SAF 2**

**August 29, 2001**

**Texas Water Development Board  
Groundwater Availability Modeling**



# **A Groundwater Flow Model for the Edwards-Trinity Aquifer of West-Central, Texas**



**Roberto Anaya**

**Texas Water Development Board**

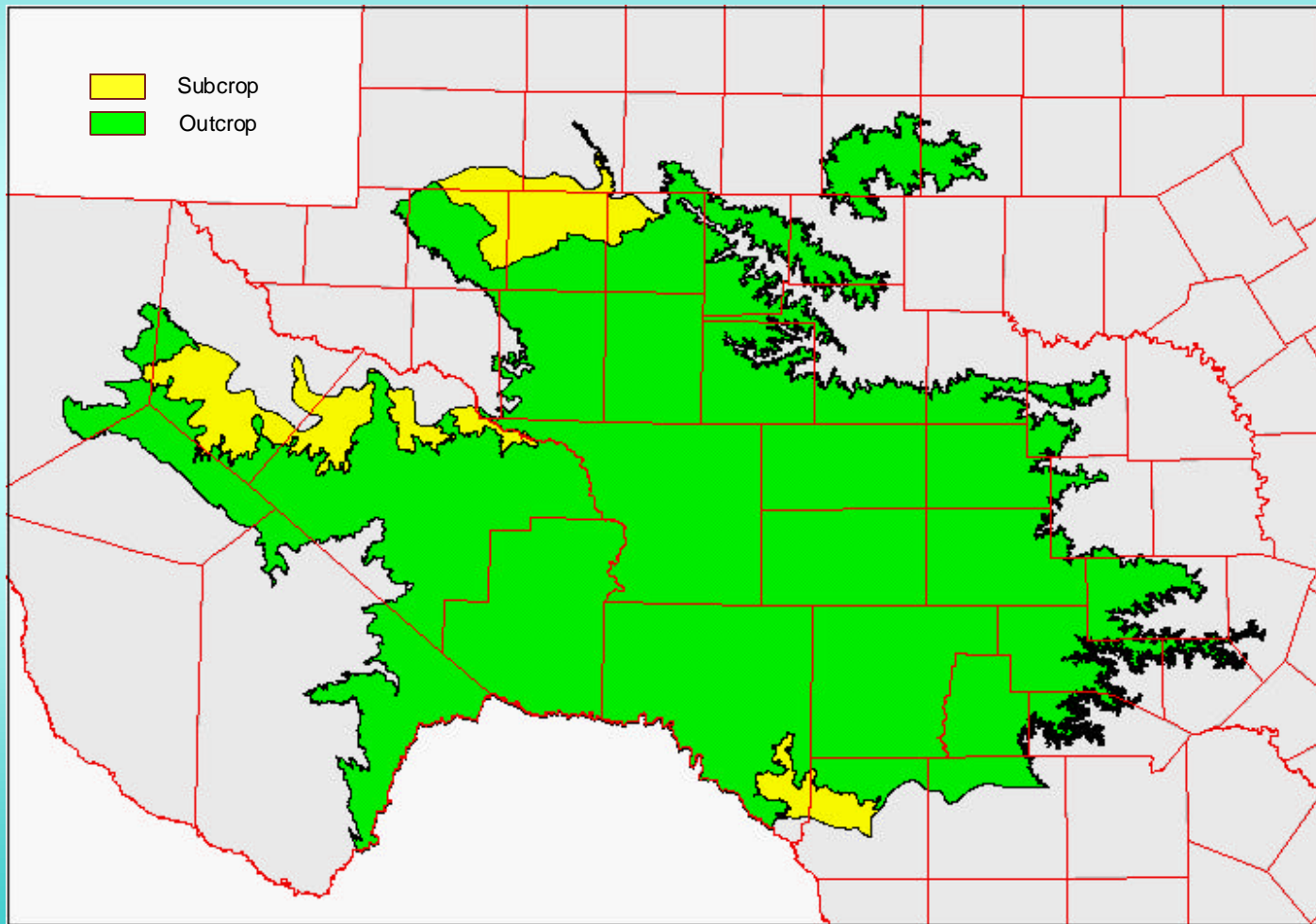


# Edwards-Trinity Stakeholders Advisory Forum Objectives

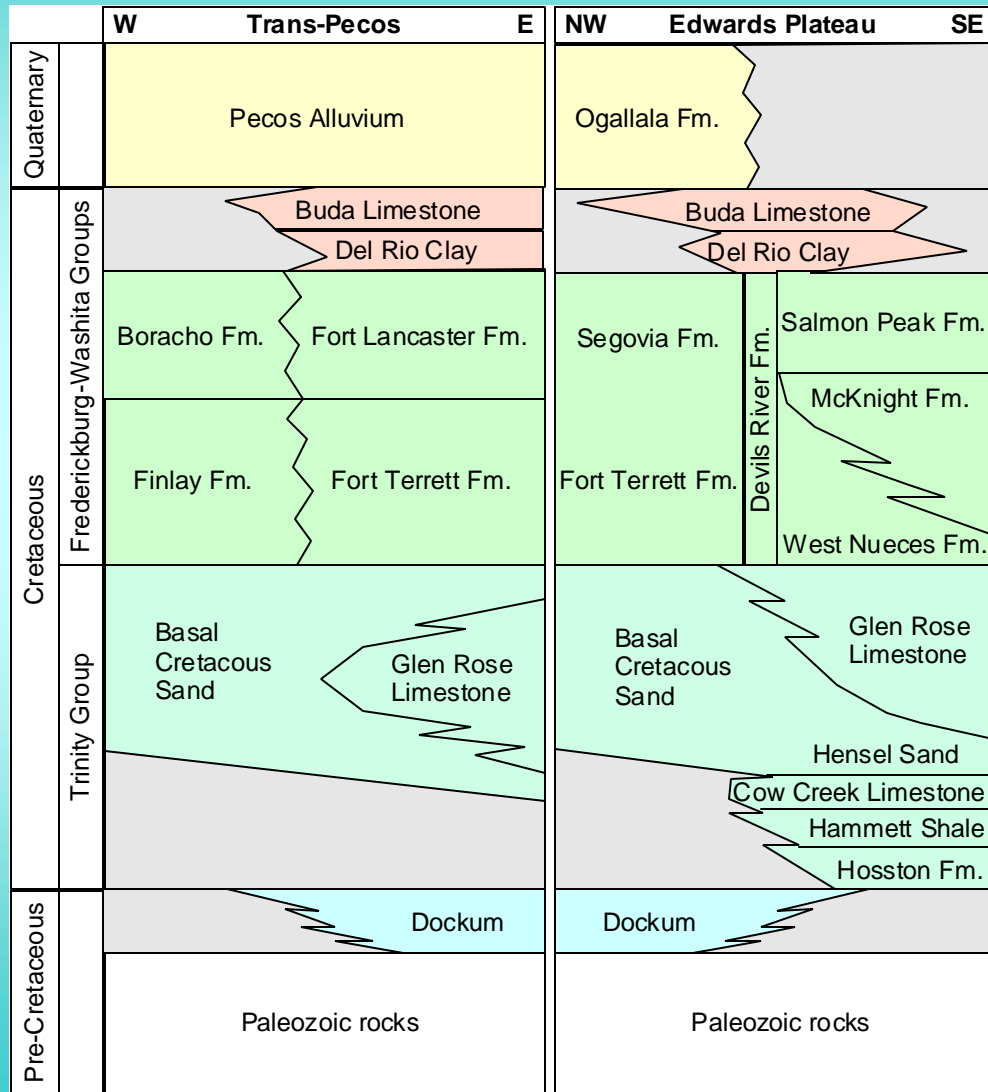
- Provide Public Awareness of GAM
- Update Interested Participants
- Solicit Data and Information
- Encourage Comments and Criticism



# Spatial Extent Of The Edwards-Trinity Sediments



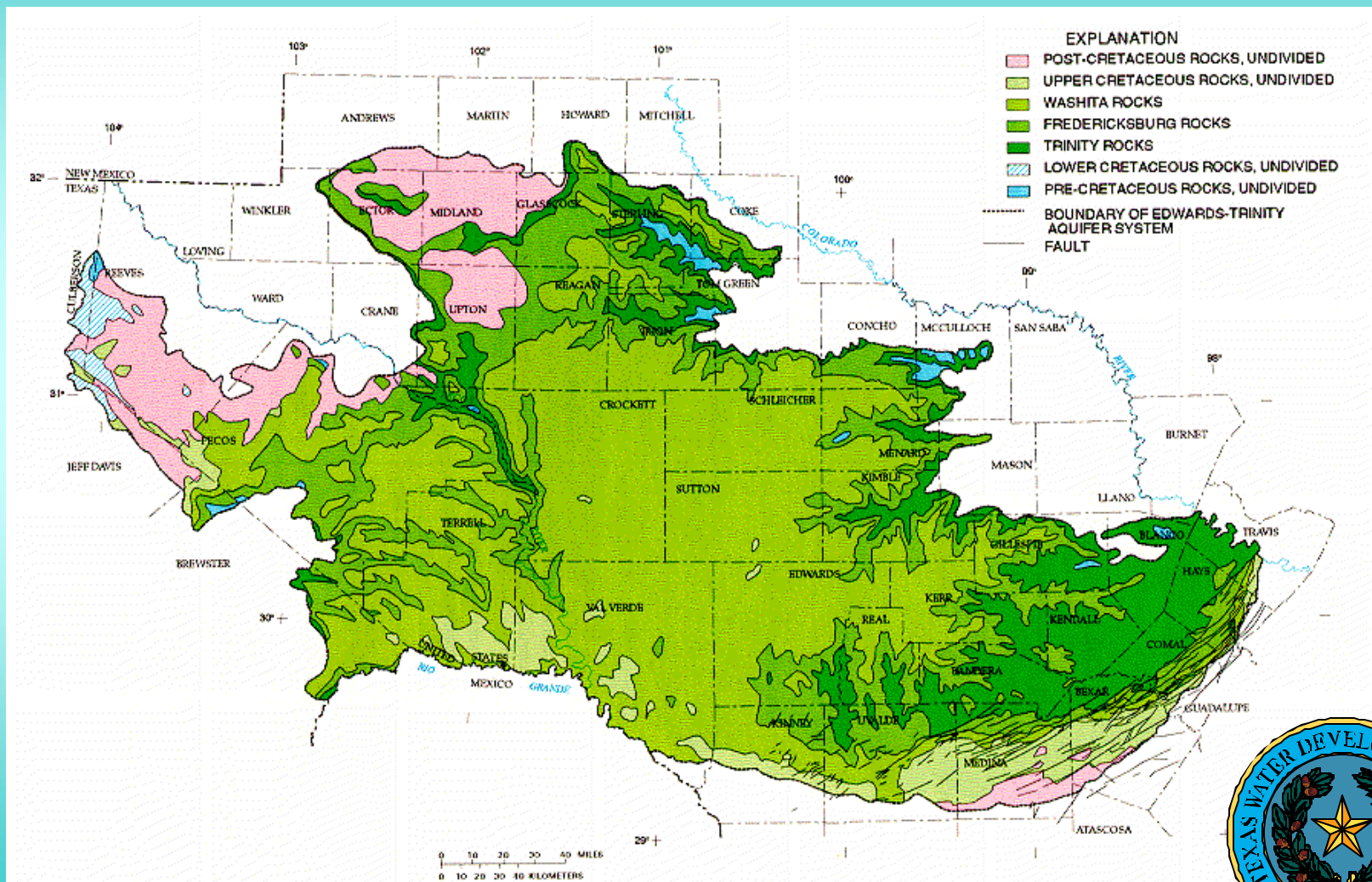
# Stratigraphic Units



Modified From Barker and Ardis, 1996

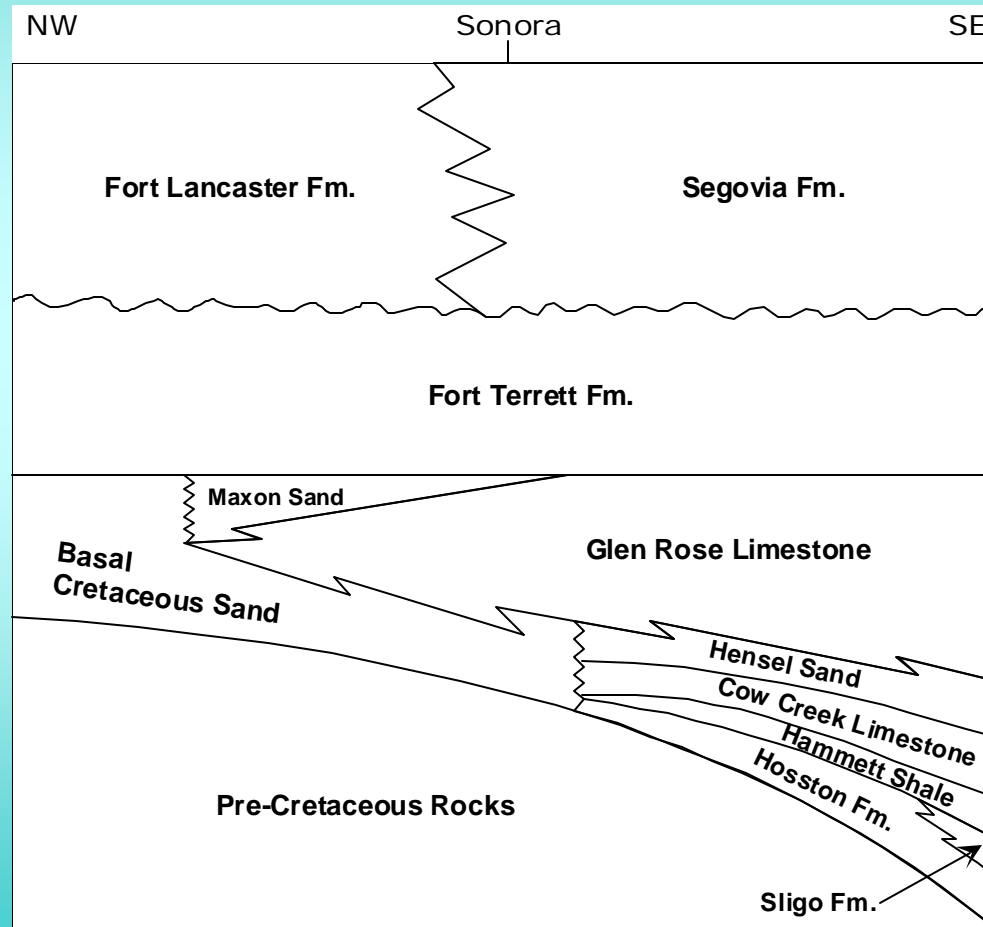


# Surface Geology



From Barker and Ardis, 1996

# Vertical Profile Of The Edwards-Trinity Aquifer Sediments

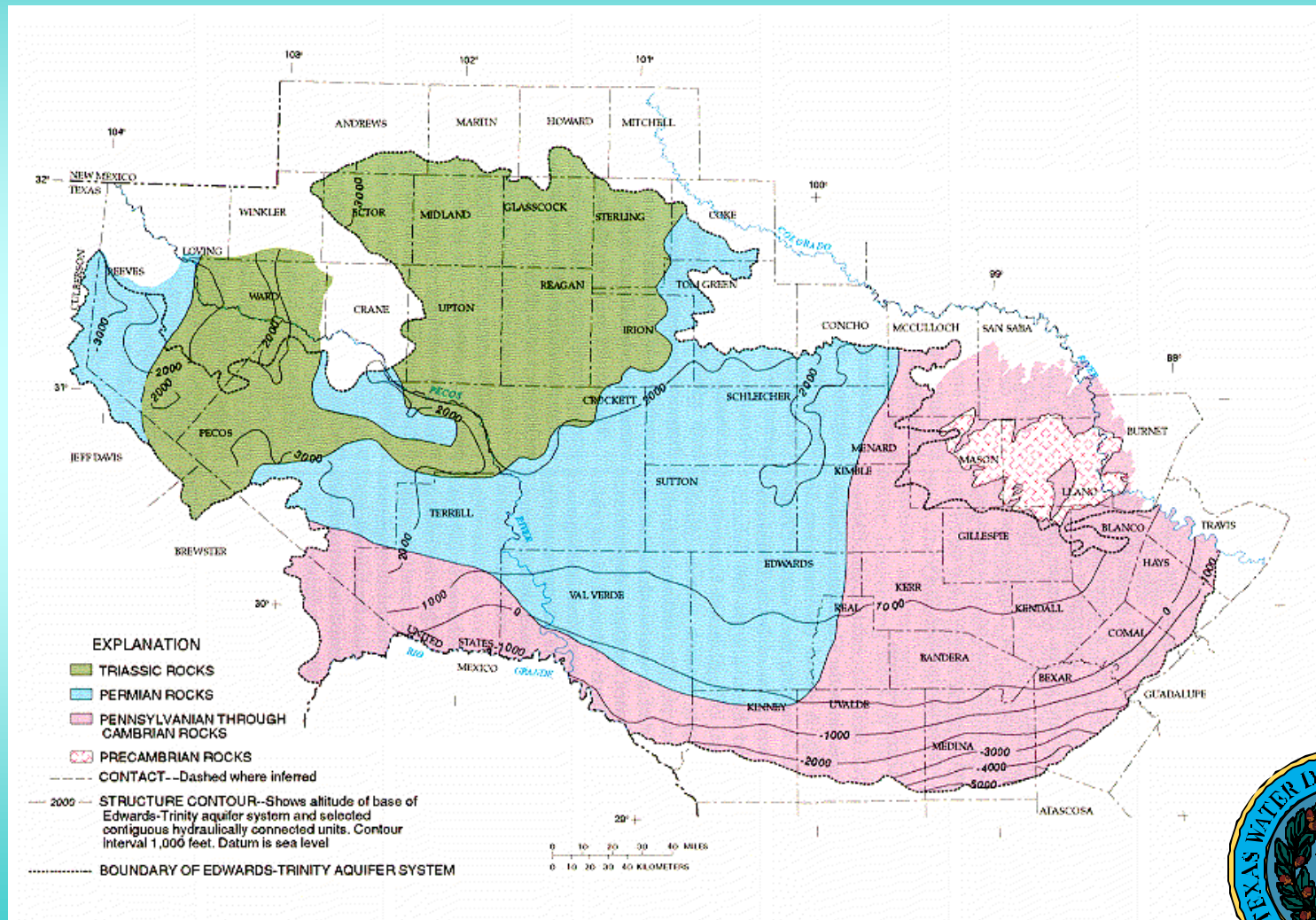


Modified From Barker and Ardis, 1996



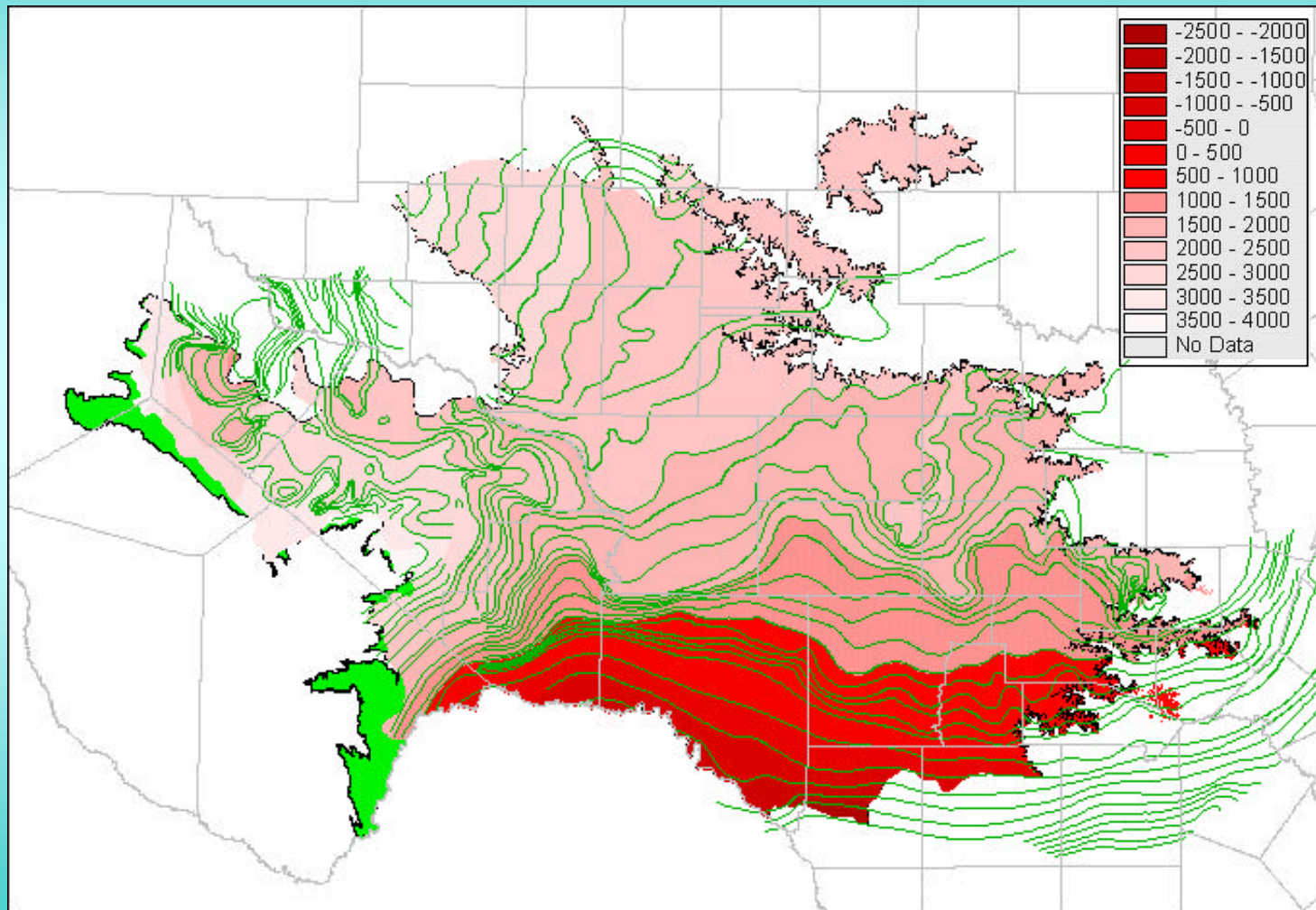


# Structural Base For Trinity Group



From Barker and Ardis, 1996

# Structural Base of Edwards-Trinity

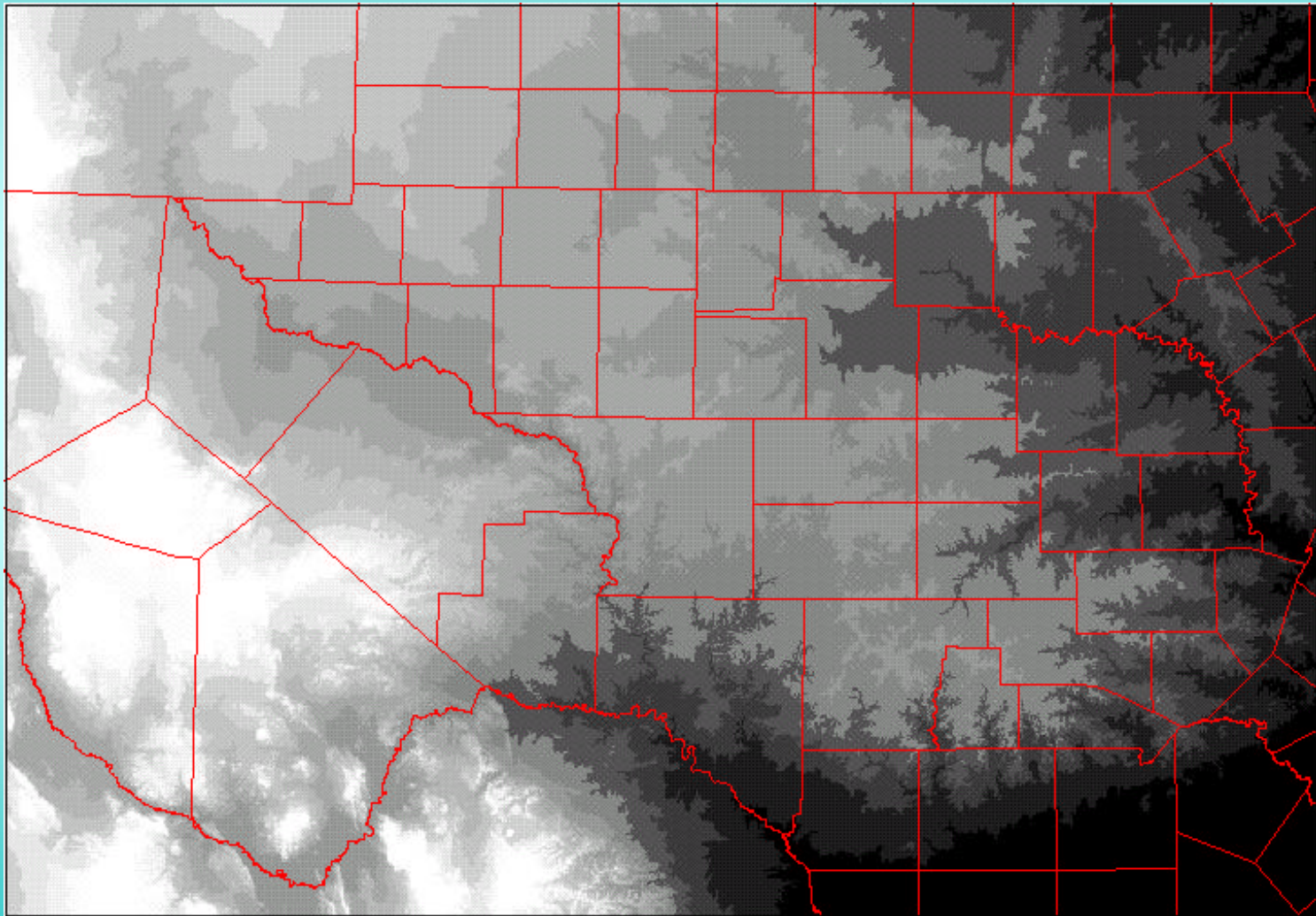


From - USGS unpublished data, 2001

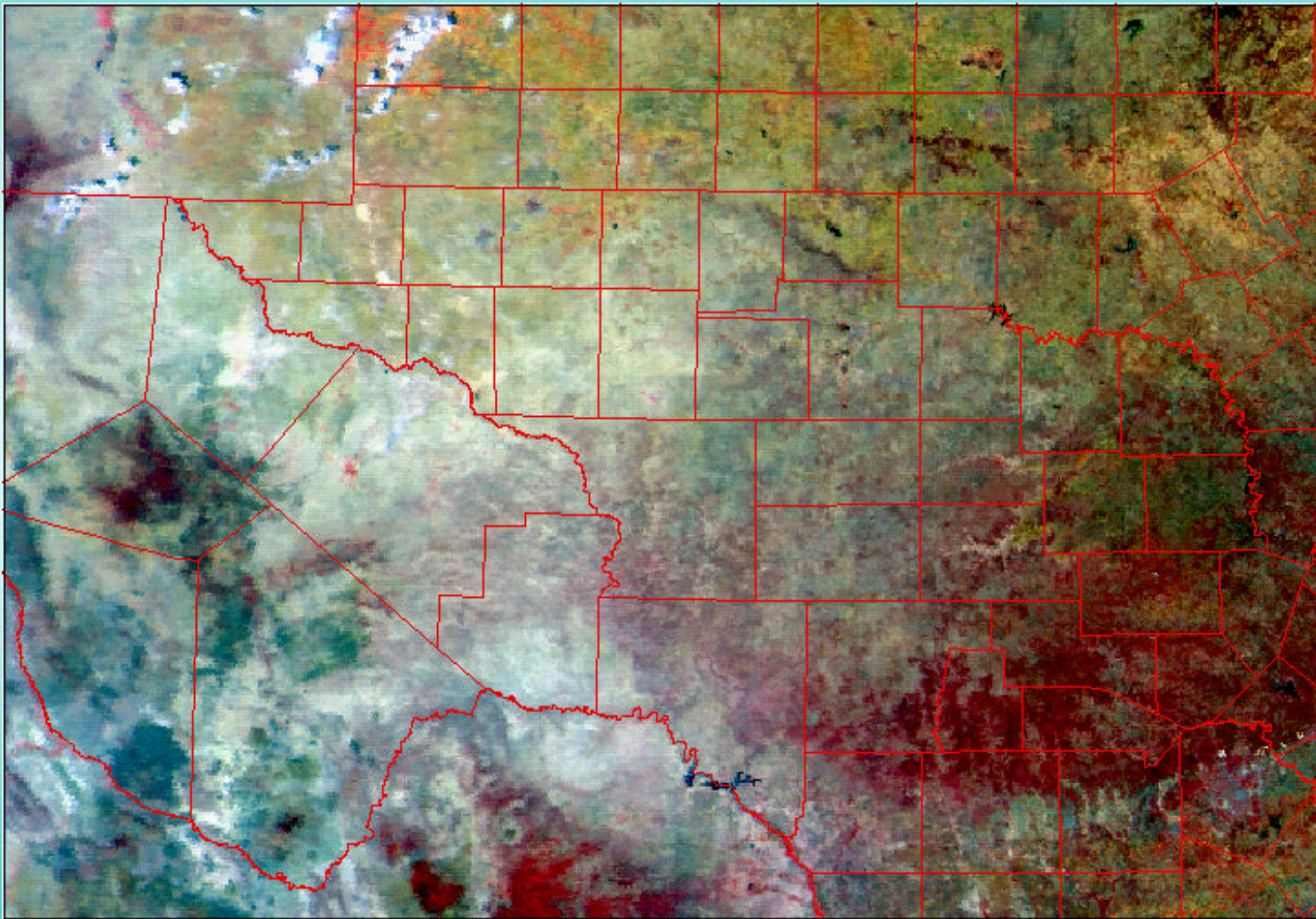




# Digital Elevation Model



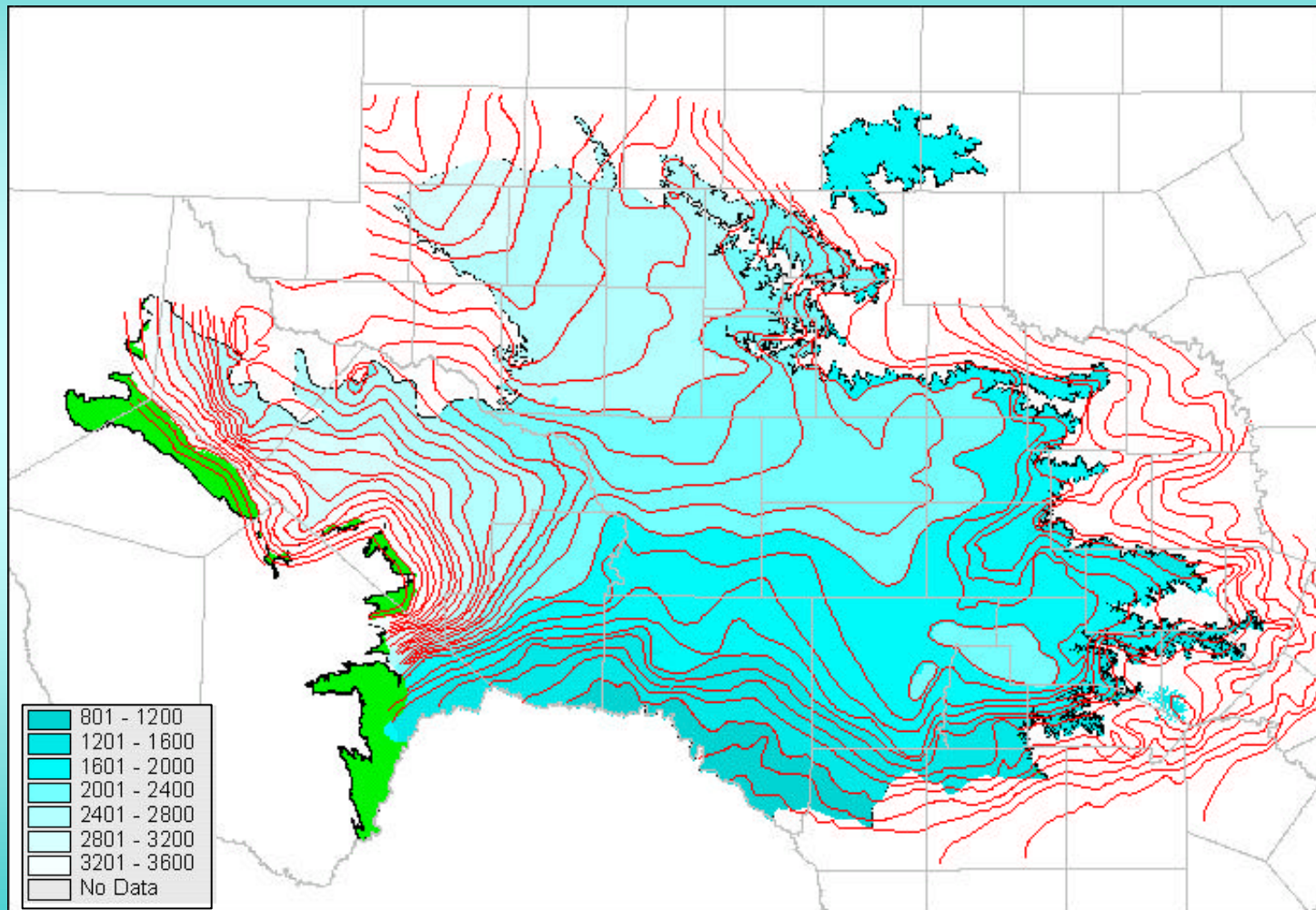
# How about a 15 minute break?



**MODIS Color Infrared Image**



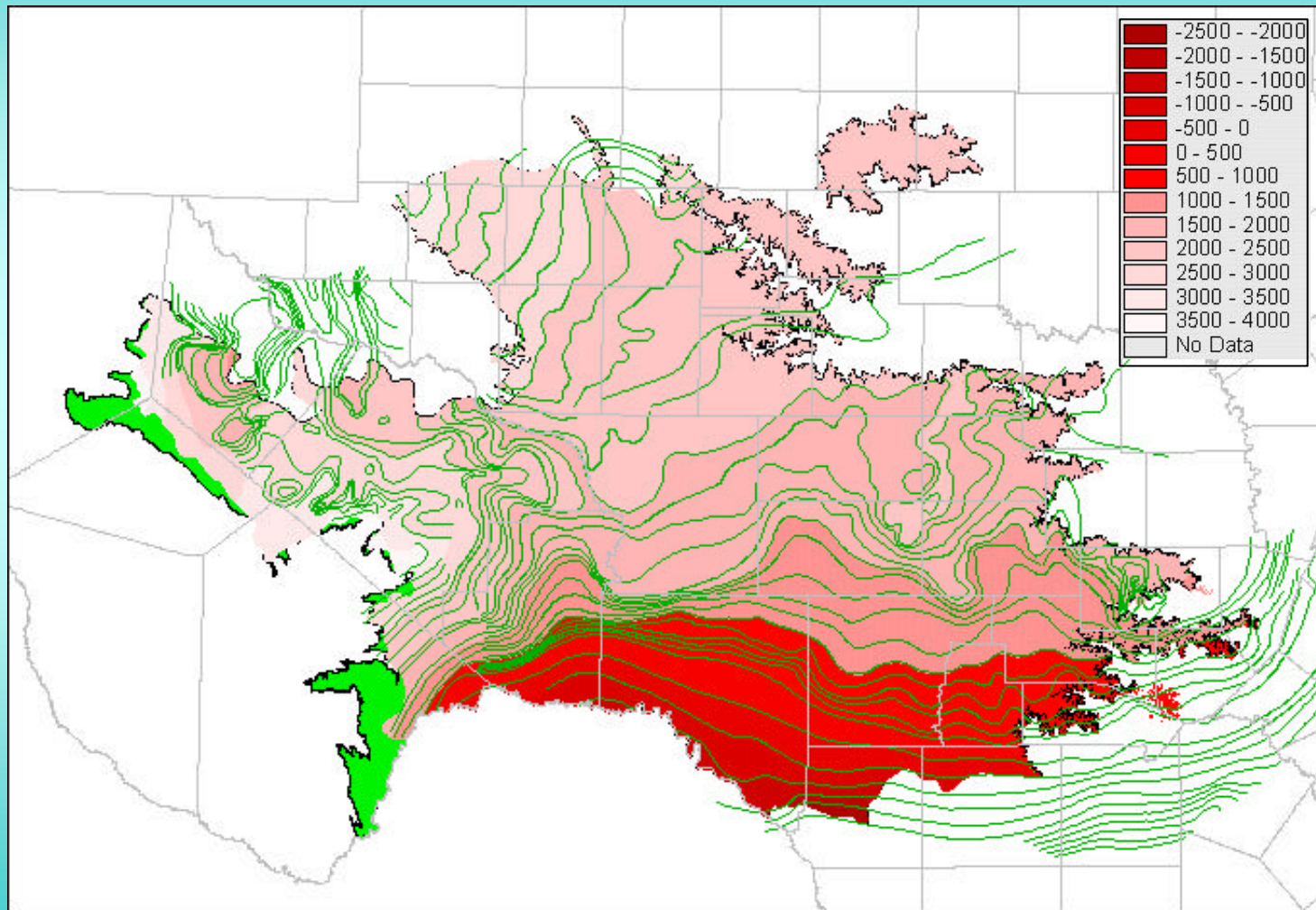
# Edwards-Trinity Water Levels



From - USGS unpublished data, 2001



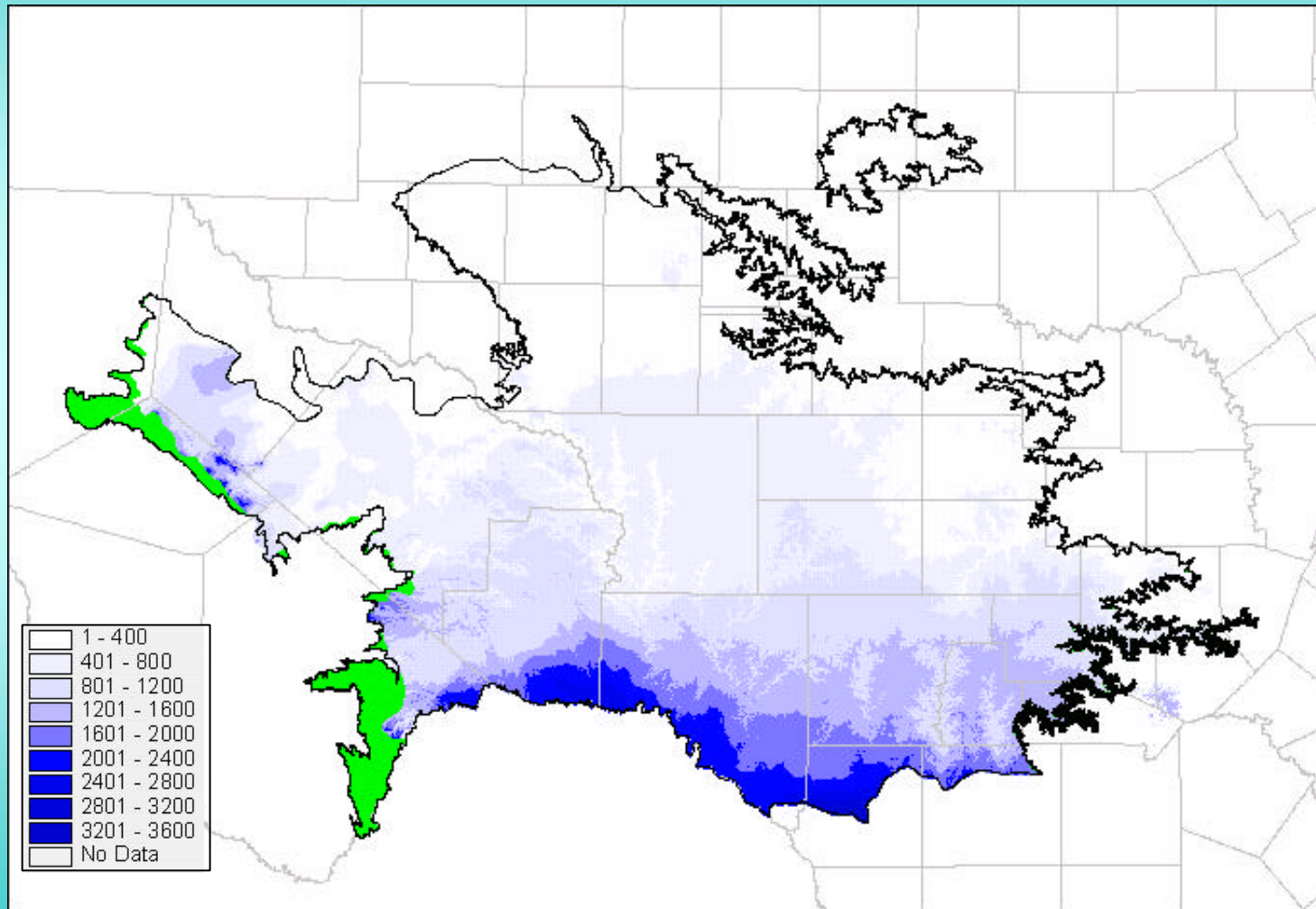
# Structural Base of Edwards-Trinity



From - USGS unpublished data, 2001



# Edwards-Trinity Saturated Thickness

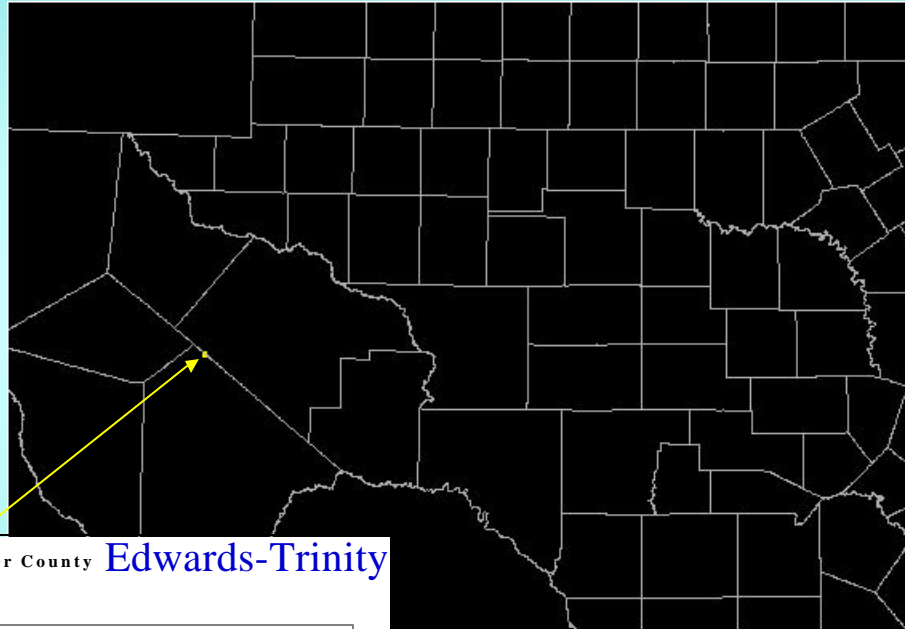


From - USGS unpublished data, 2001

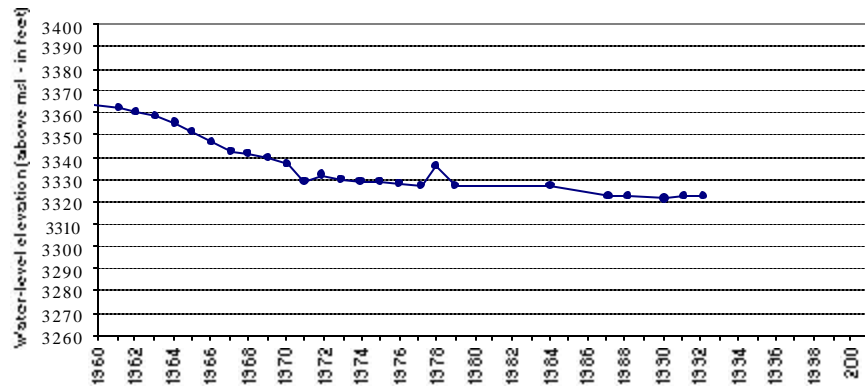




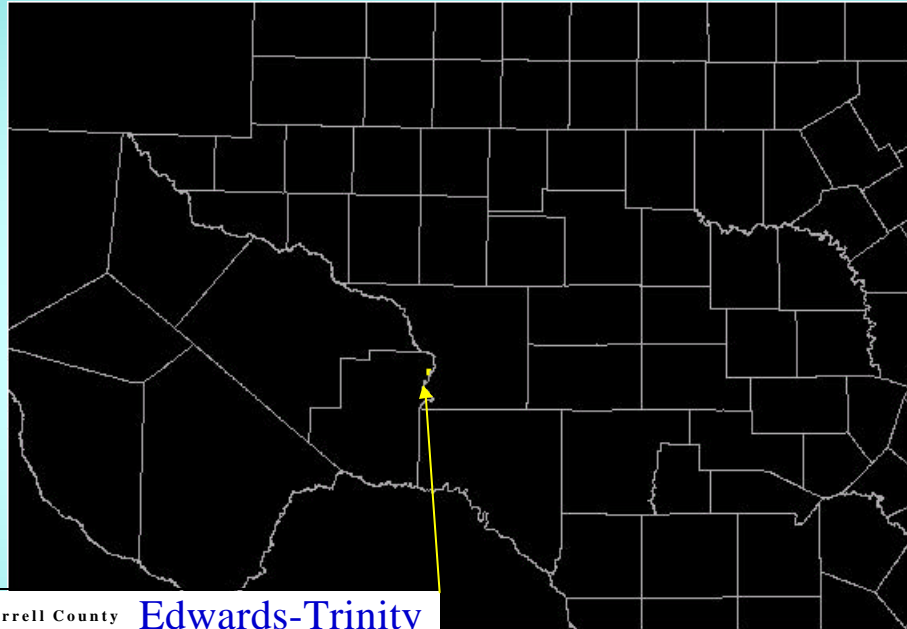
# Edwards-Trinity Water Level Brewster County



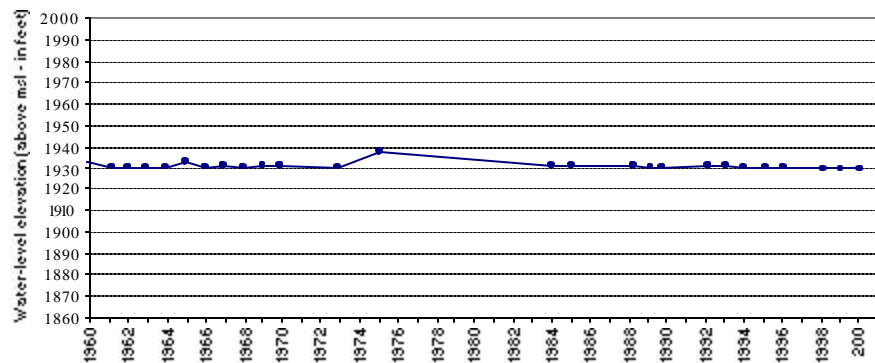
Well 52-30-105 Brewster County Edwards-Trinity



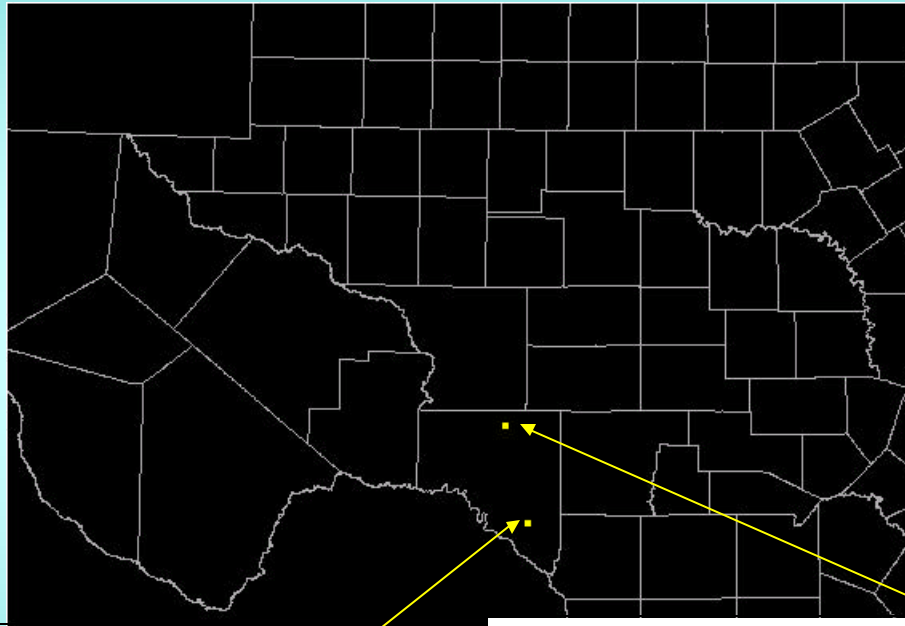
# Edwards-Trinity Water Level Terrel County



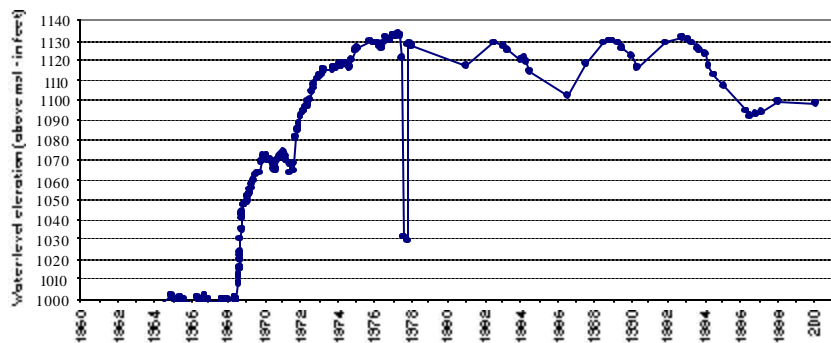
Well 54-27-802 Terrell County Edwards-Trinity



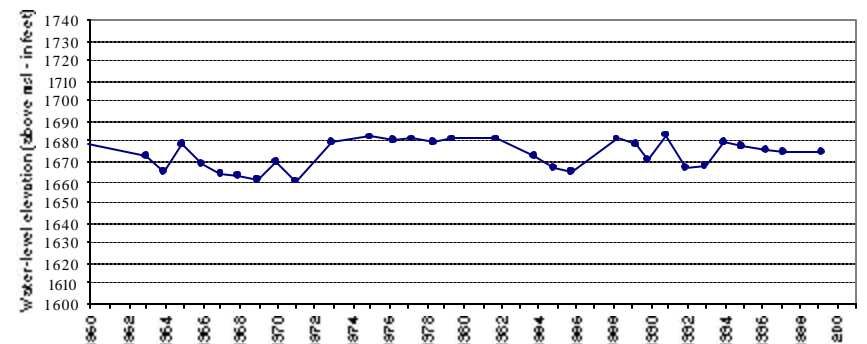
# Edwards-Trinity Water Level Val Verde County



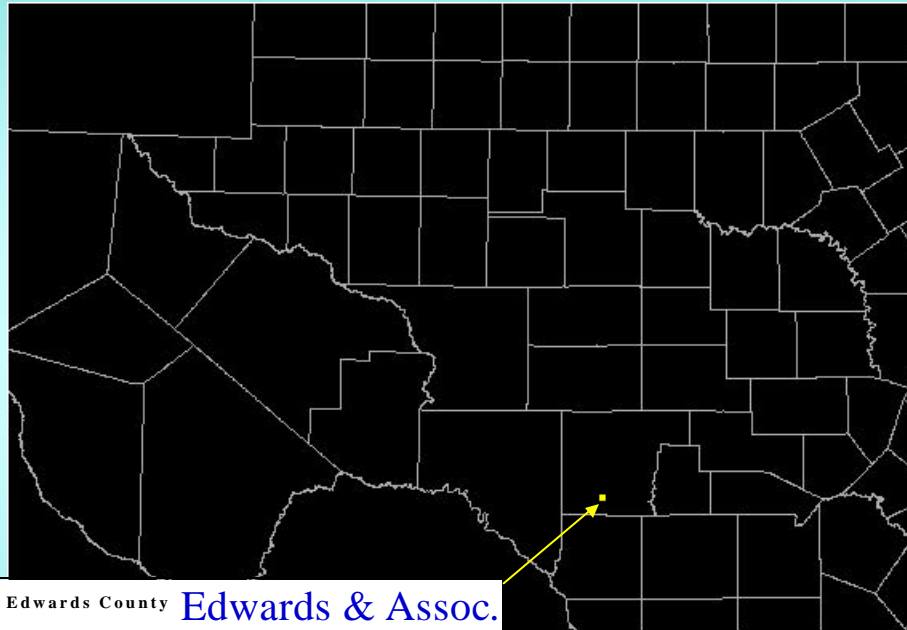
Well 70-25-502 Val Verde County Edwards Limestone



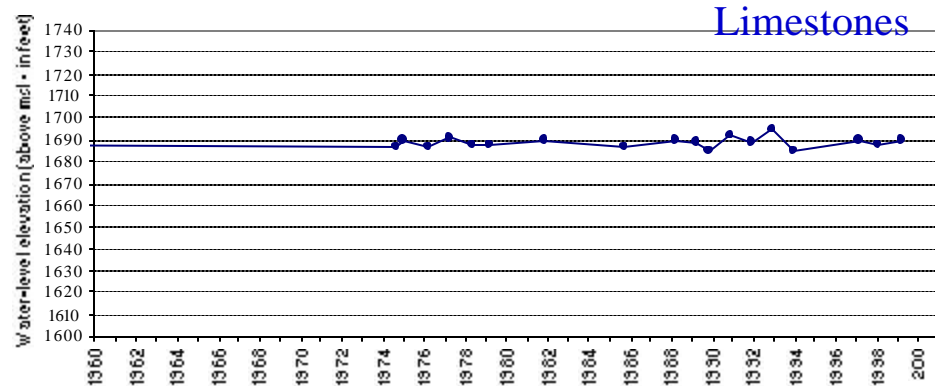
Well 54-56-403 Val Verde County Edwards Limestone



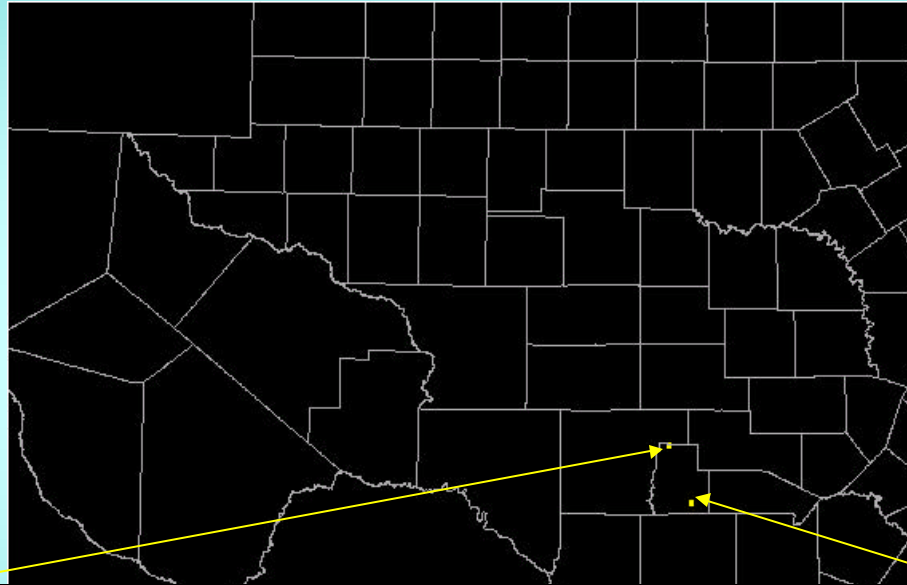
# Edwards-Trinity Water Level Edwards County



Well 70-21-301 Edwards County Edwards & Assoc.

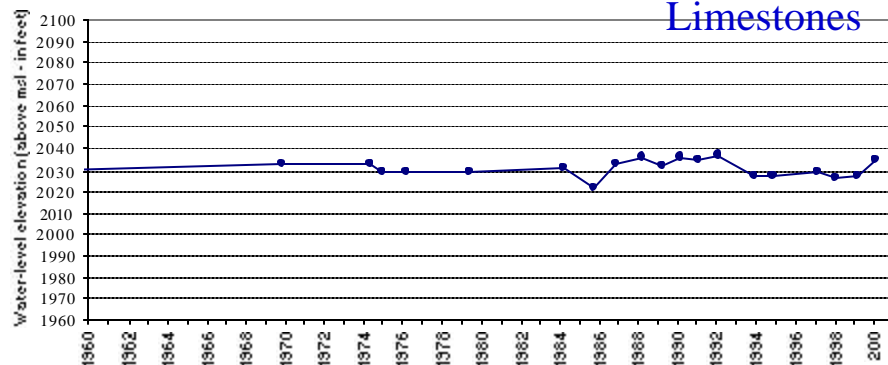


# Edwards-Trinity Water Level Real County



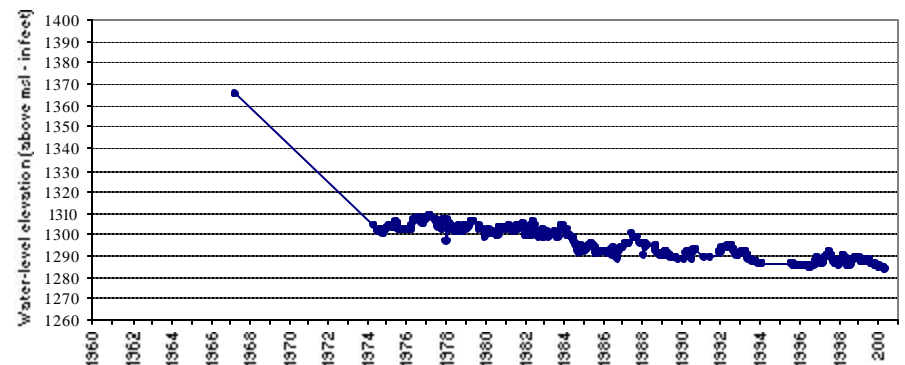
Well 56-58-602 Real County **Edwards & Assoc.**

**Limestones**

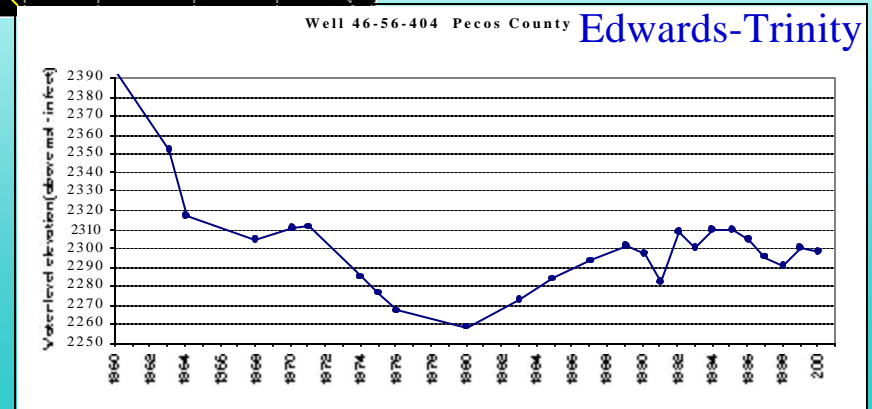
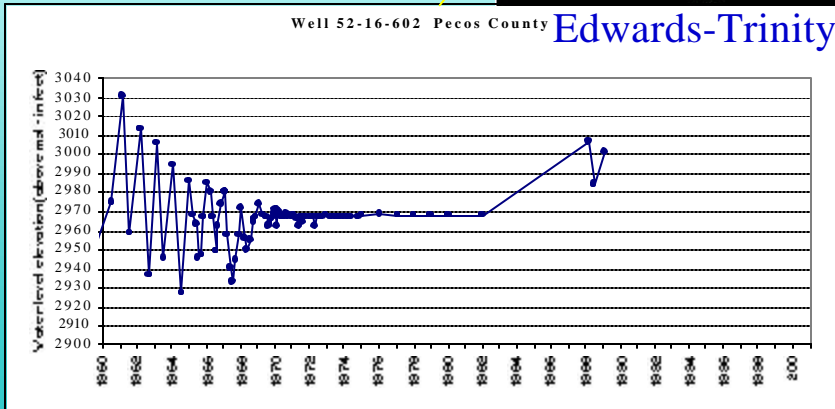
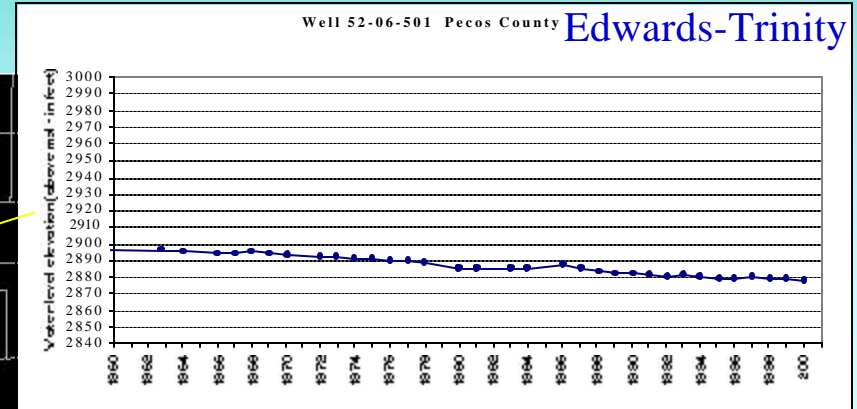
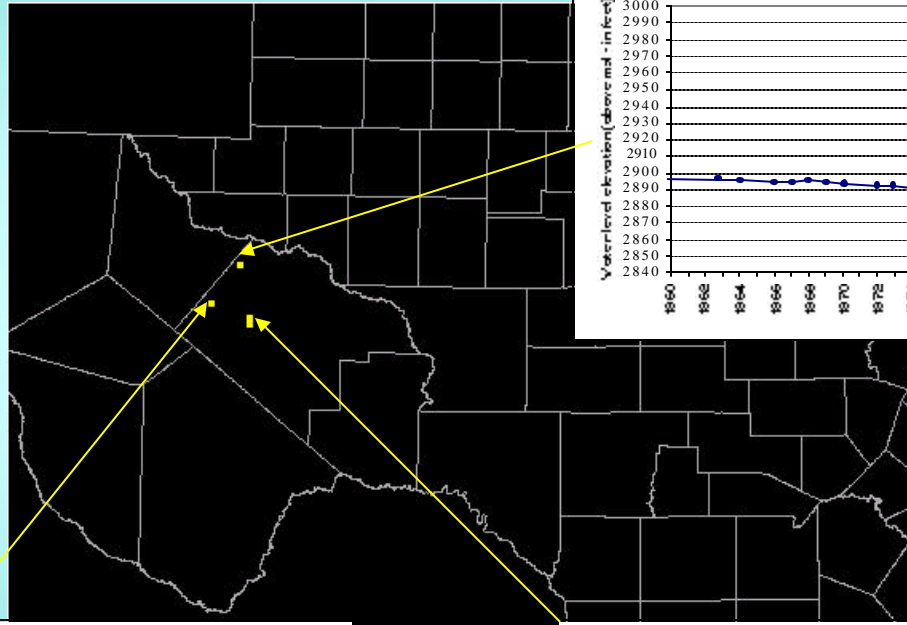


Well 69-19-401 Real County

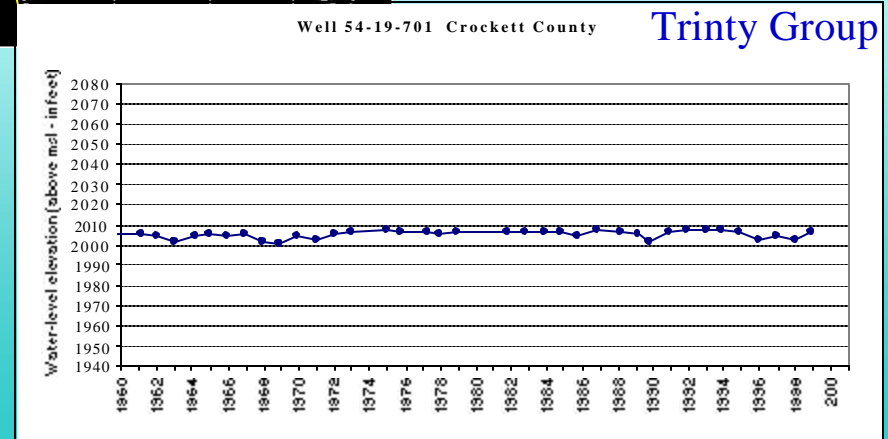
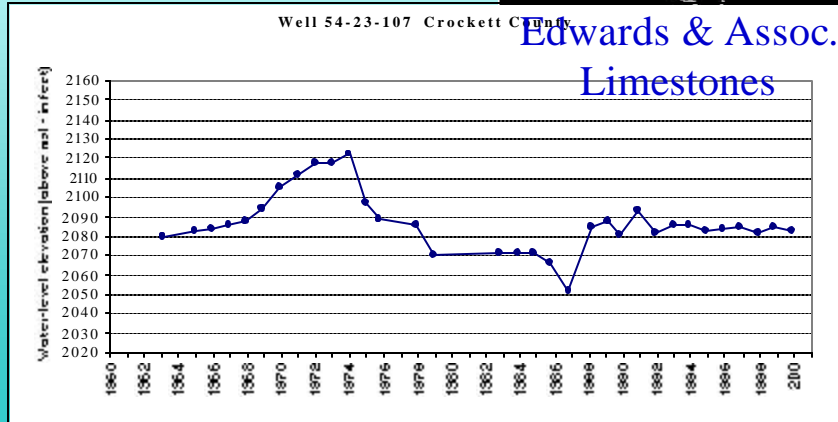
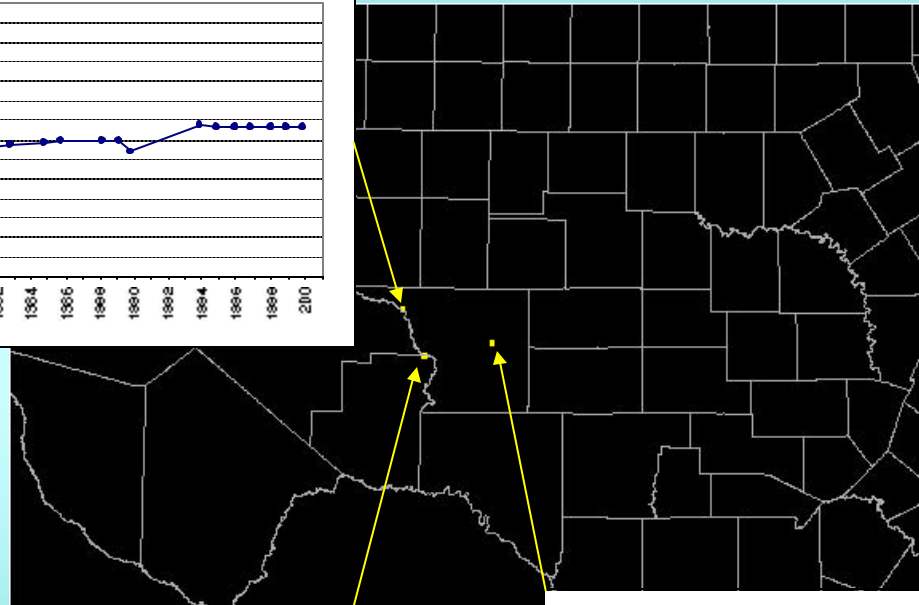
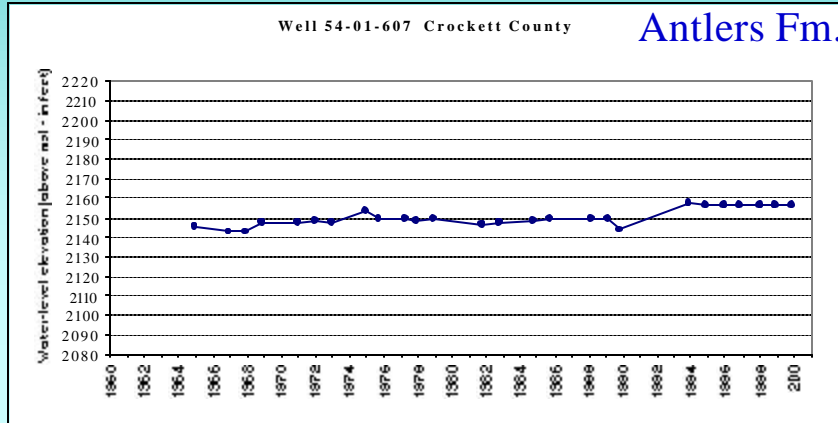
**Hosston Fm.**



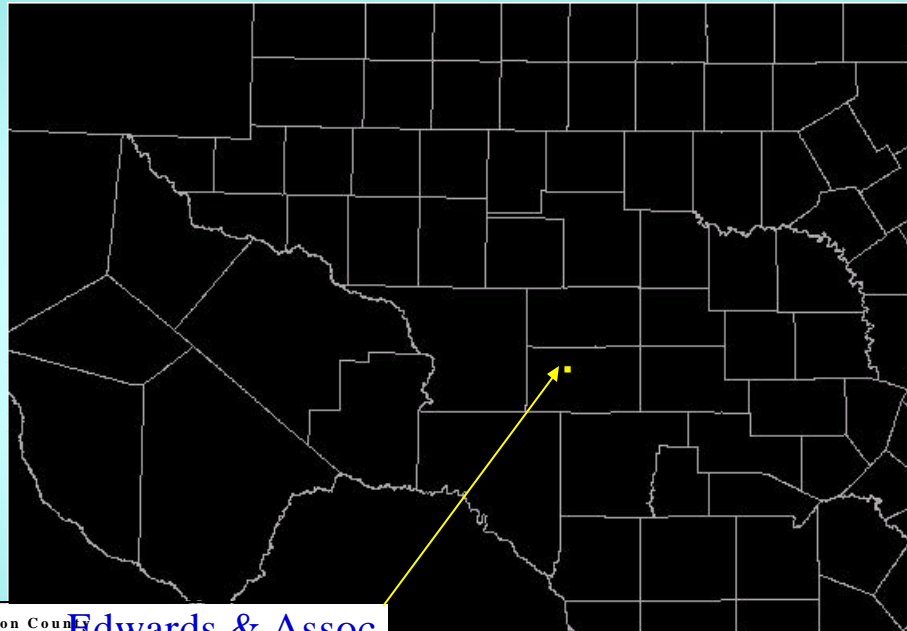
# Edwards-Trinity Water Level Pecos County



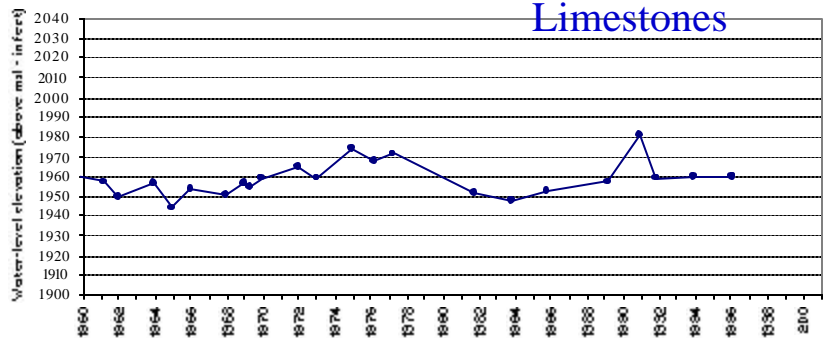
# Edwards-Trinity Water Level Crockett County



# Edwards-Trinity Water Level Sutton County

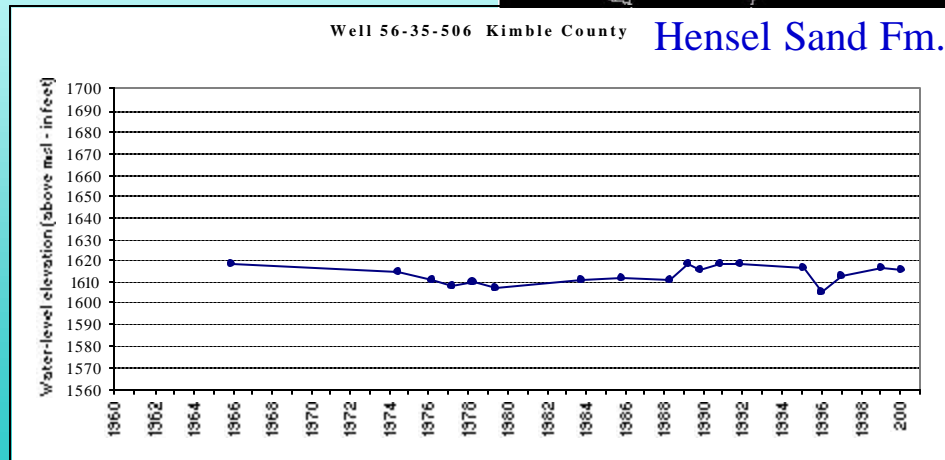
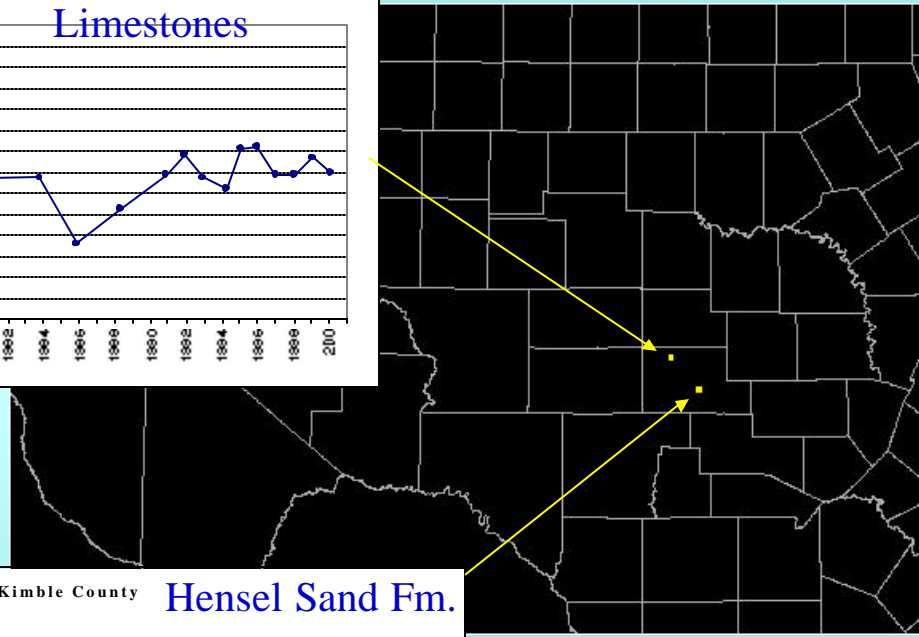
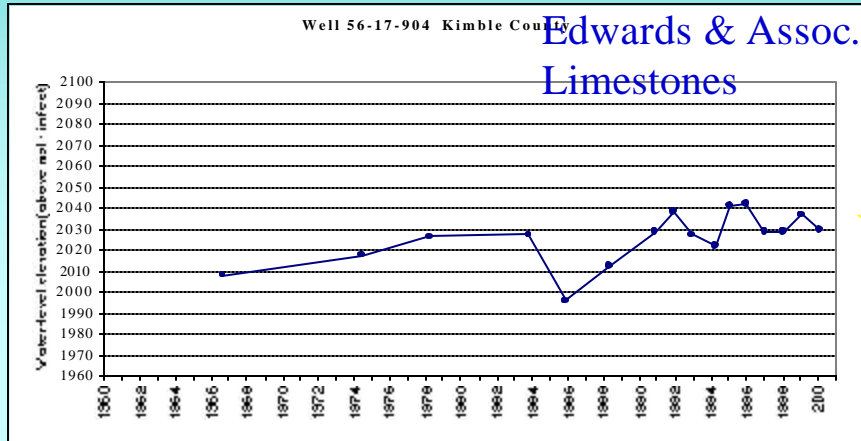


Well 55-27-606 Sutton County  
Edwards & Assoc.  
Limestones

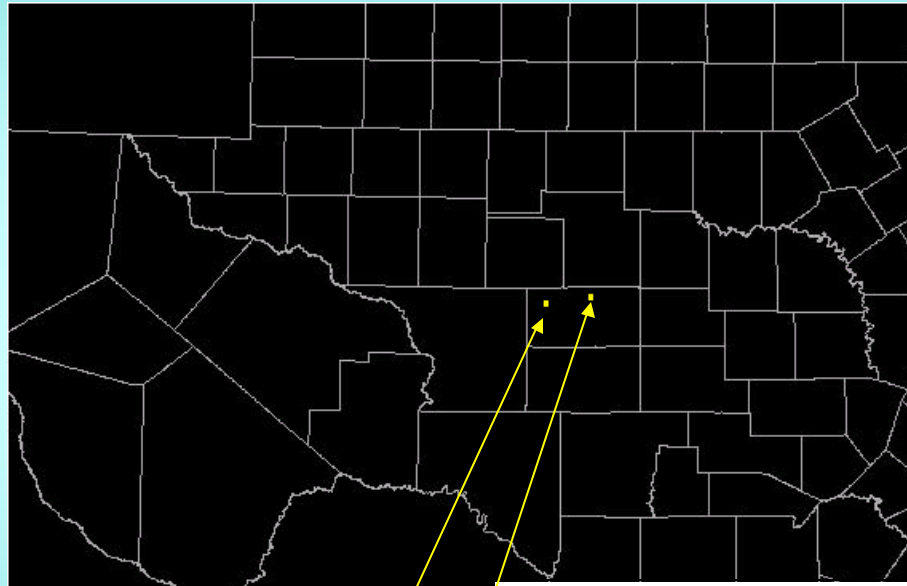




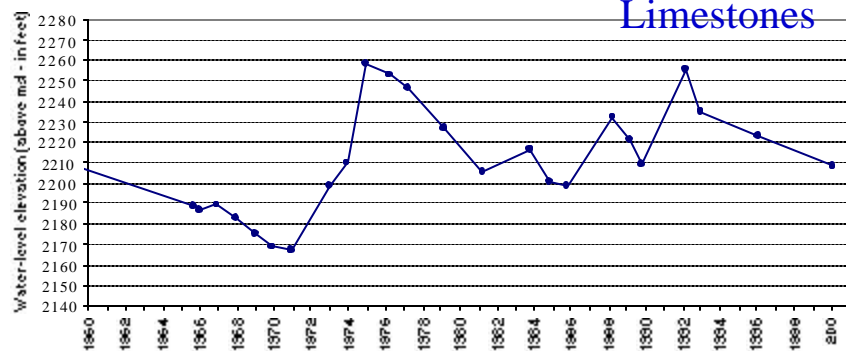
# Edwards-Trinity Water Level Kimble County



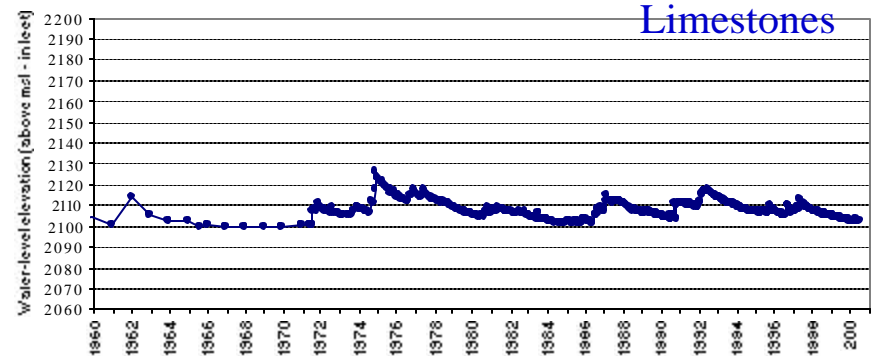
# Edwards-Trinity Water Level Schleicher County



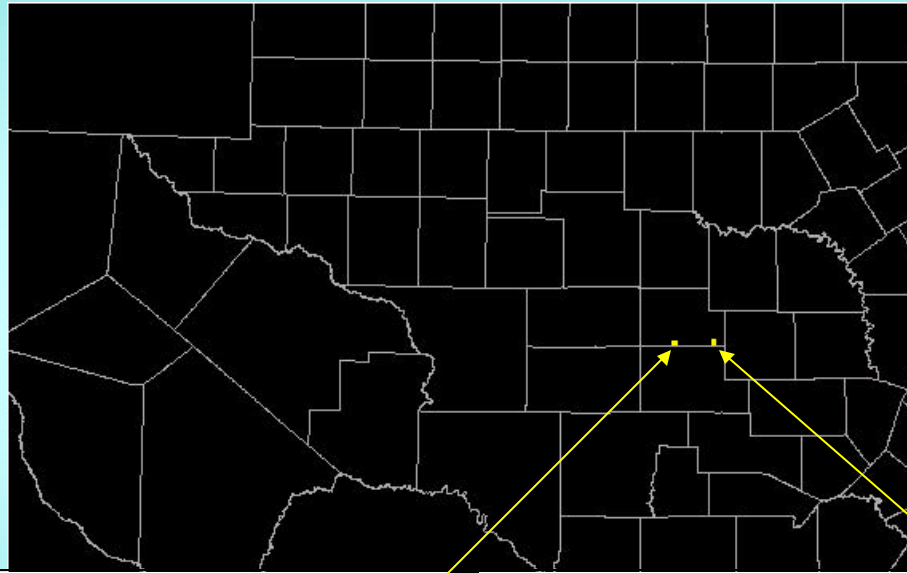
Well 55-02-202 Schleicher County Edwards & Assoc.



Well 43-61-706 Schleicher County Edwards & Assoc.

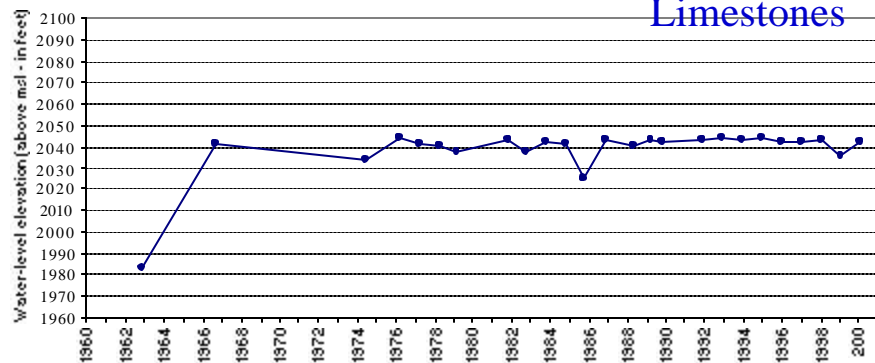


# Edwards-Trinity Water Level Menard County

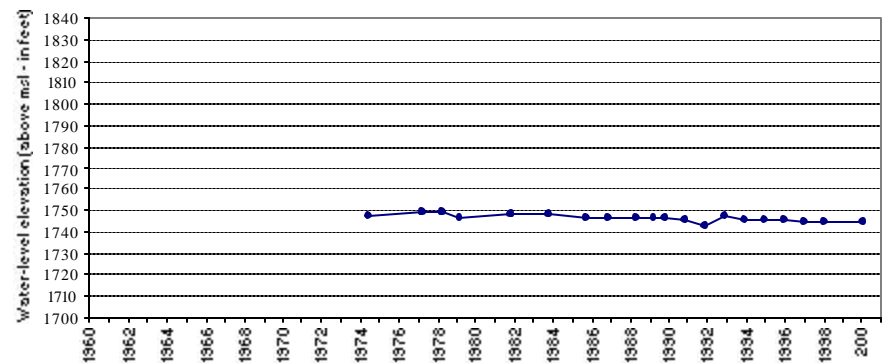


Well 56-18-104 Menard County **Edwards & Assoc.**

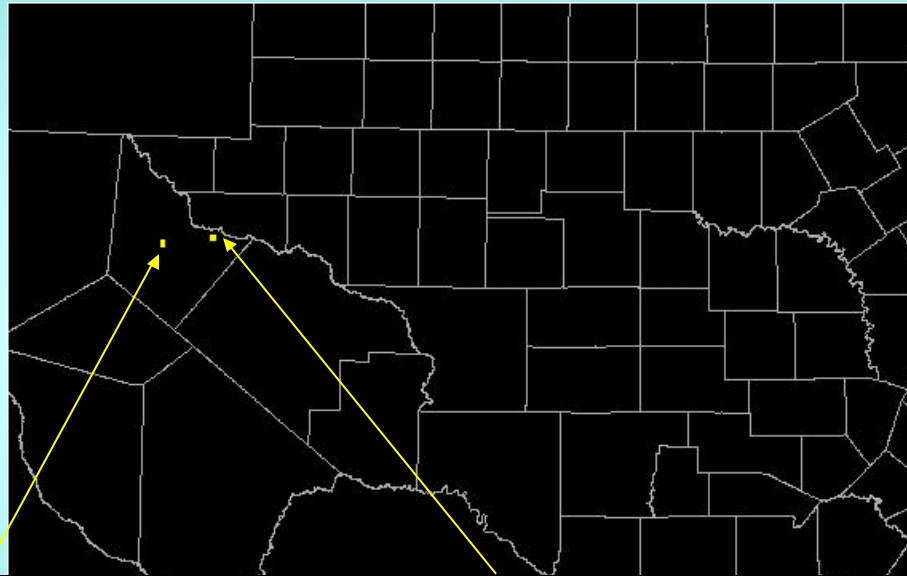
**Limestones**



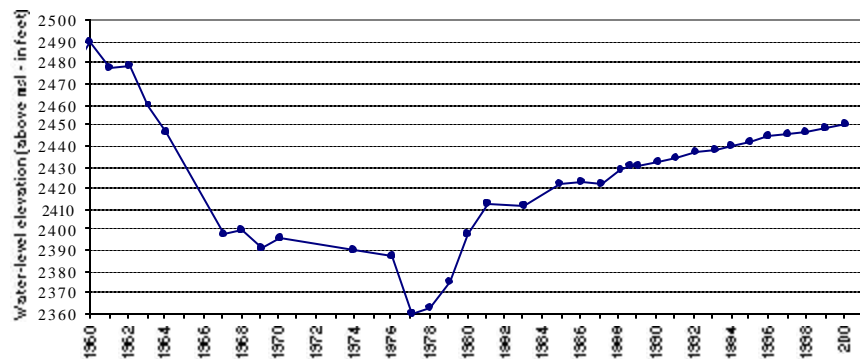
Well 56-20-212 Menard County **Hensel Sand Fm.**



# Edwards-Trinity Water Level Reeves County

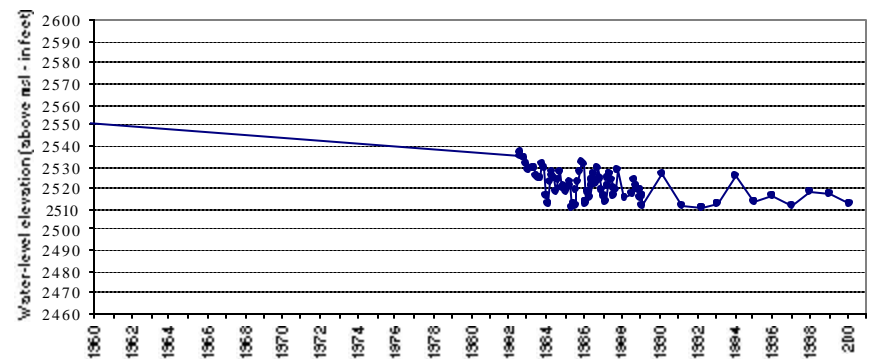


Well 46-43-501 Reeves County **Edwards-Trinity**

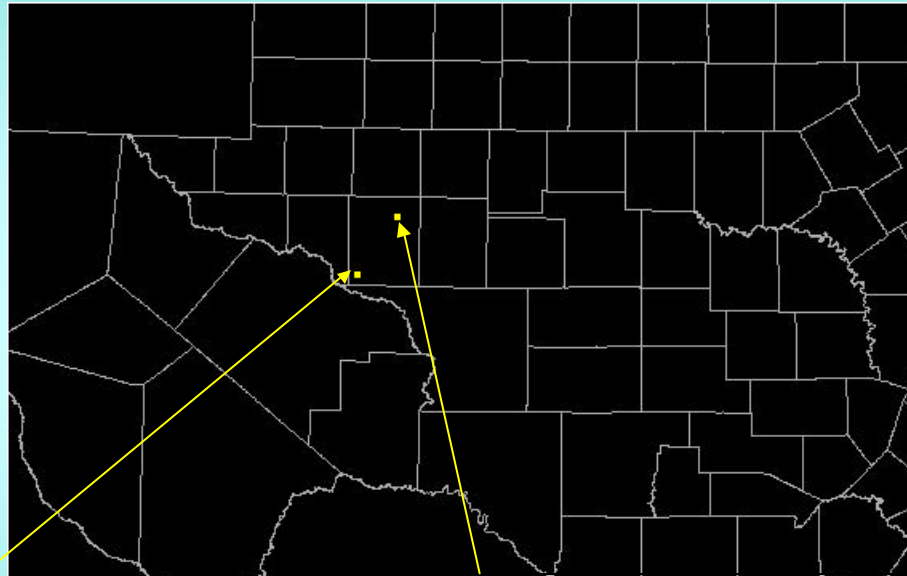


Well 46-46-211 Reeves County

**Dockum**

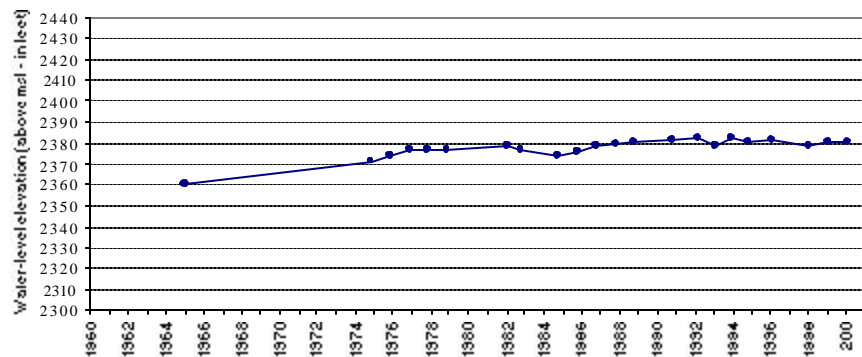


# Edwards-Trinity Water Level Upton County



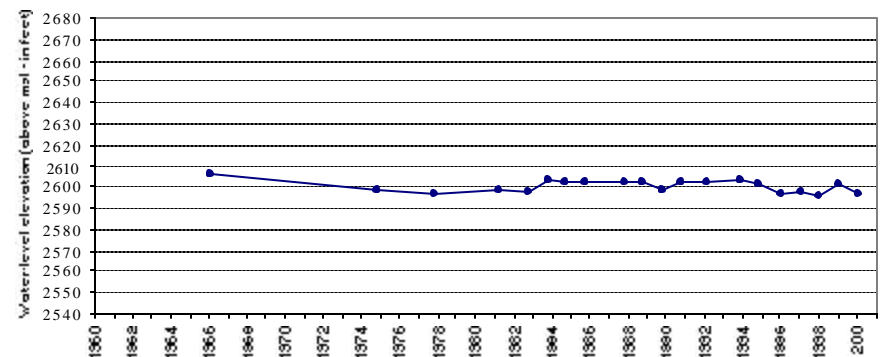
Well 45-55-702 Upton County

Dockum Fm.

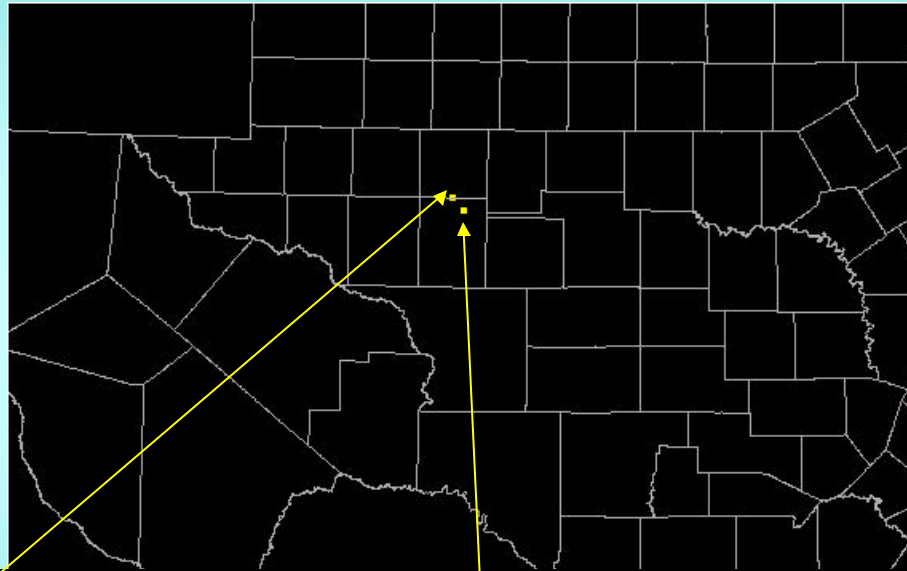


Well 44-25-805 Upton County

Antlers Fm.

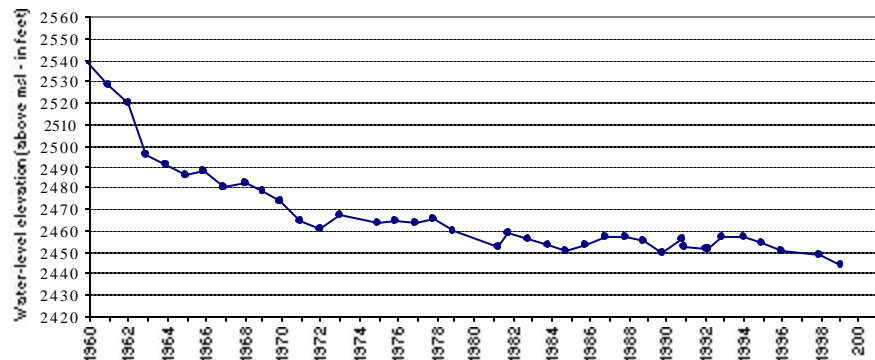


# Edwards-Trinity Water Level Reagan County



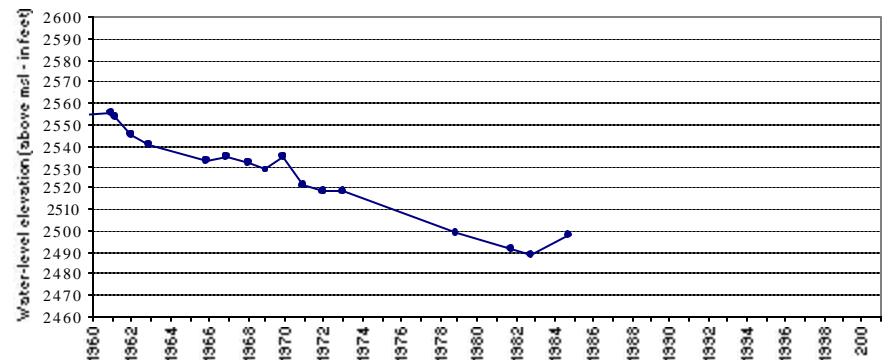
Well 44-20-911 Reagan County

Antlers Fm.

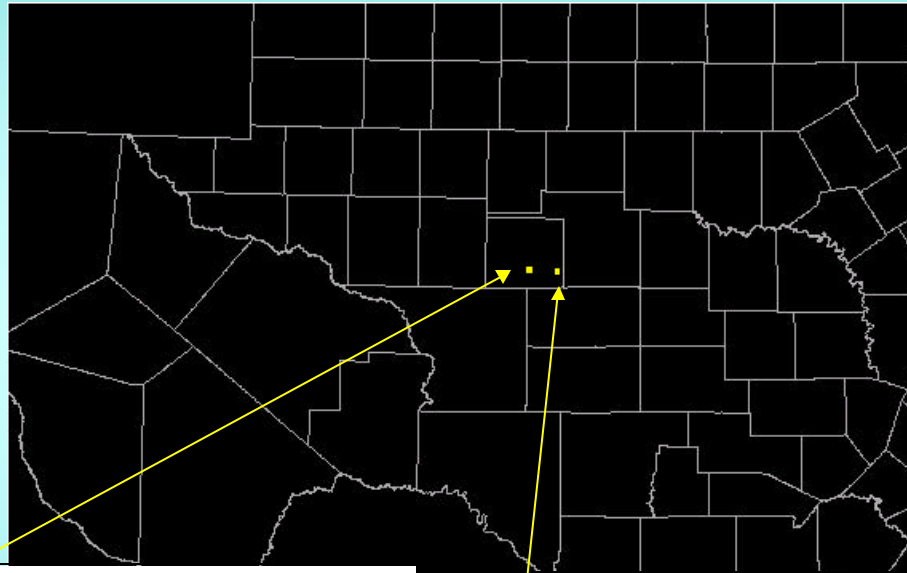


Well 44-29-501 Reagan County

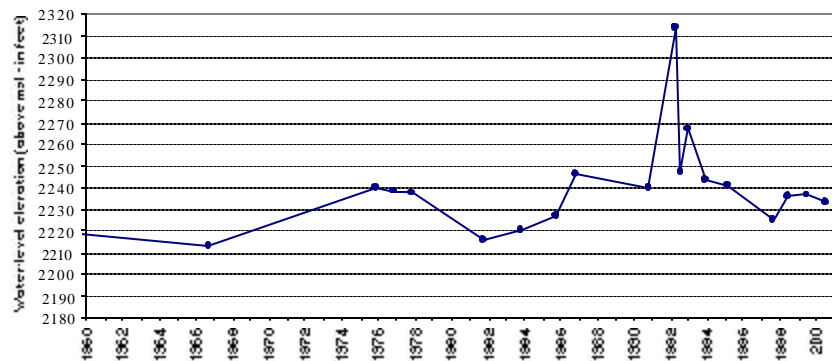
Edwards-Trinity



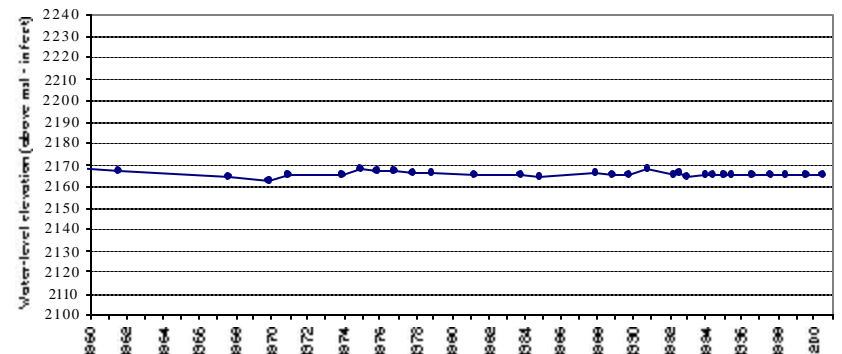
# Edwards-Trinity Water Level Irion County



Well 43-49-501 Irion County **Edwards-Trinity**



Well 43-51-401 Irion County **Antlers Sand Fm.**



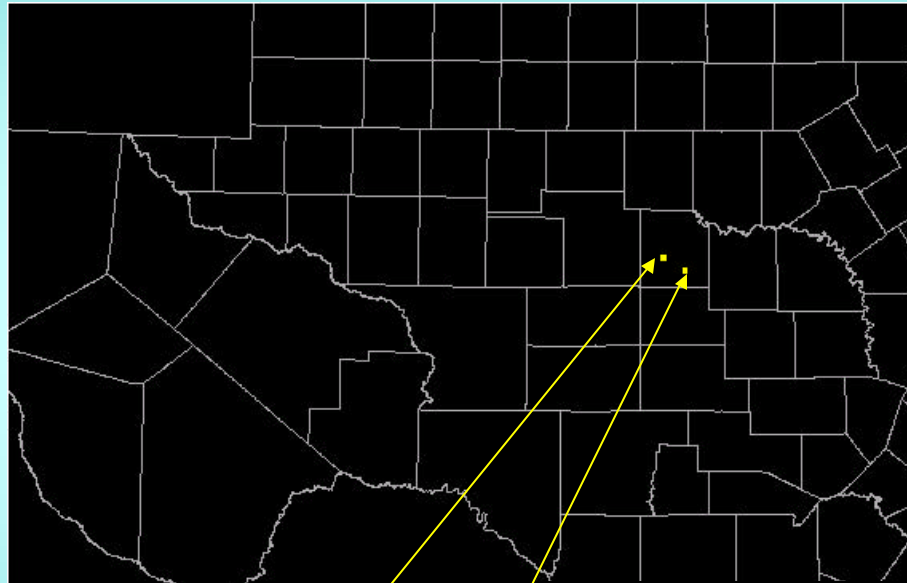
# Edwards-Trinity Water Level Tom Green County

Some scattered water levels in the Antlers  
but not enough for well hydrographs

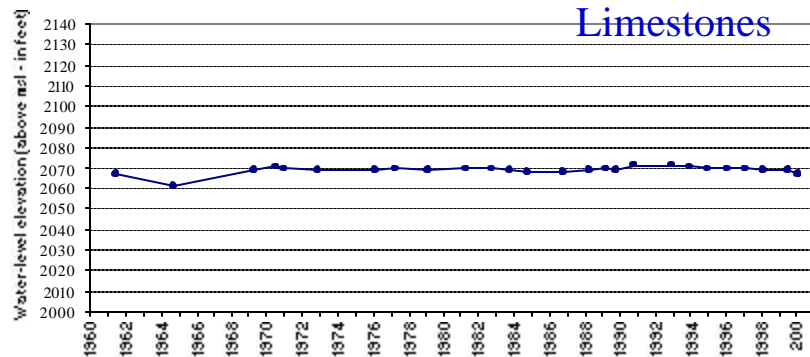




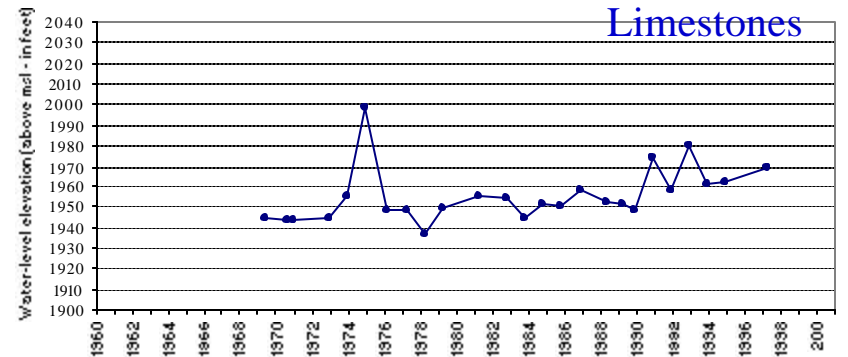
# Edwards-Trinity Water Level Concho County



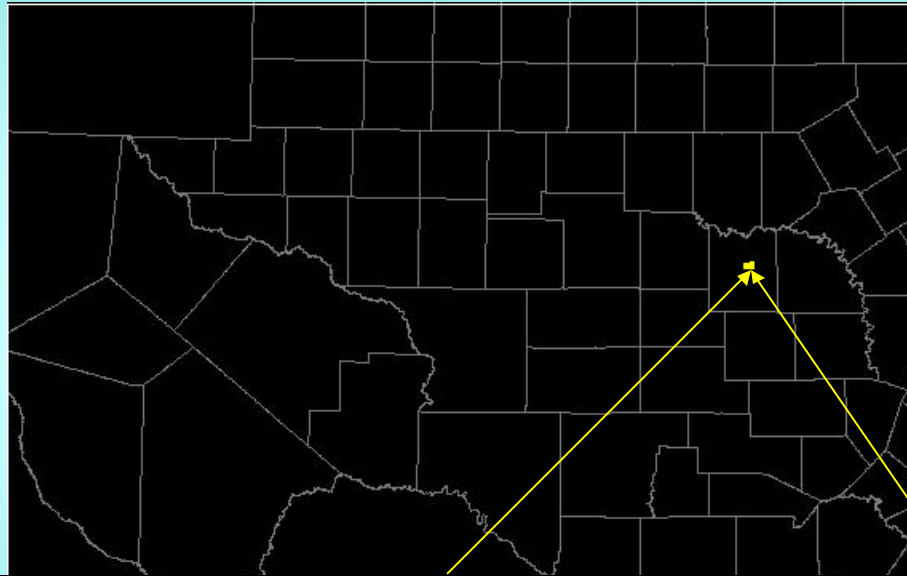
Well 42-41-801 Concho County  
**Edwards & Assoc.  
Limestones**



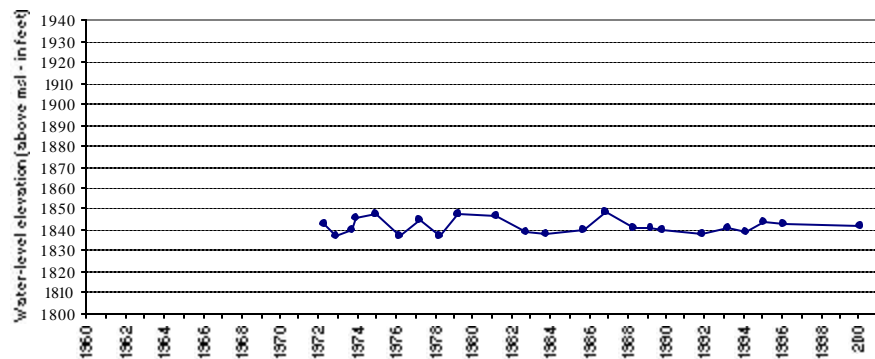
Well 42-50-601 Concho County  
**Edwards & Assoc.  
Limestones**



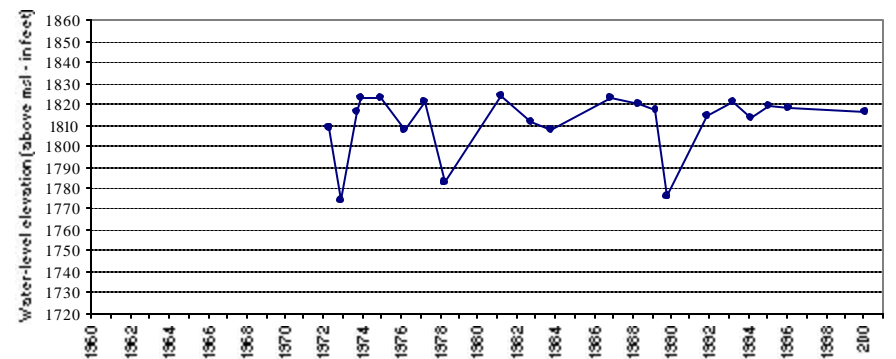
# Edwards-Trinity Water Level McCulloch County



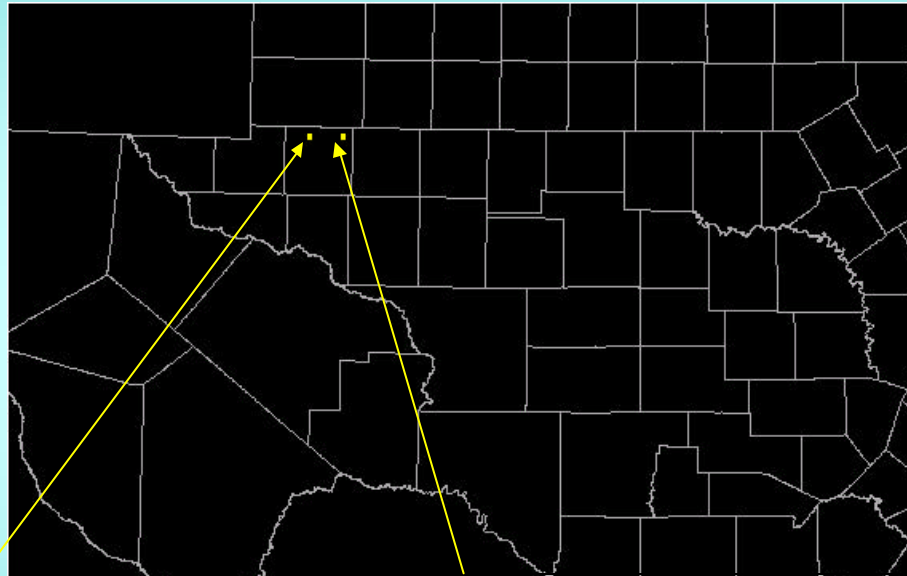
Well 42-54-201 McCulloch County Edwards-Trinity



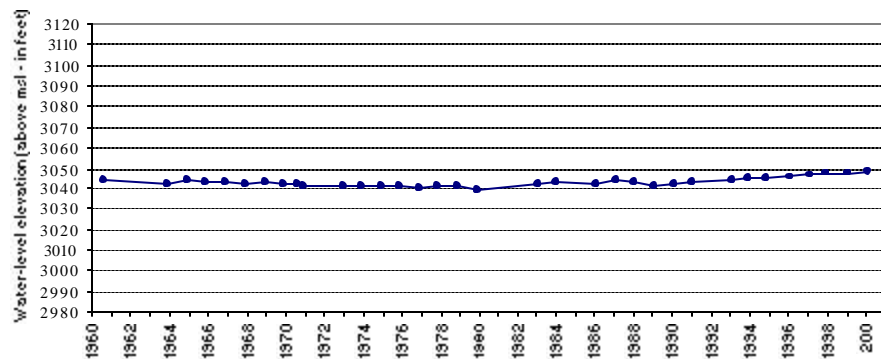
Well 42-54-301 McCulloch County Edwards-Trinity



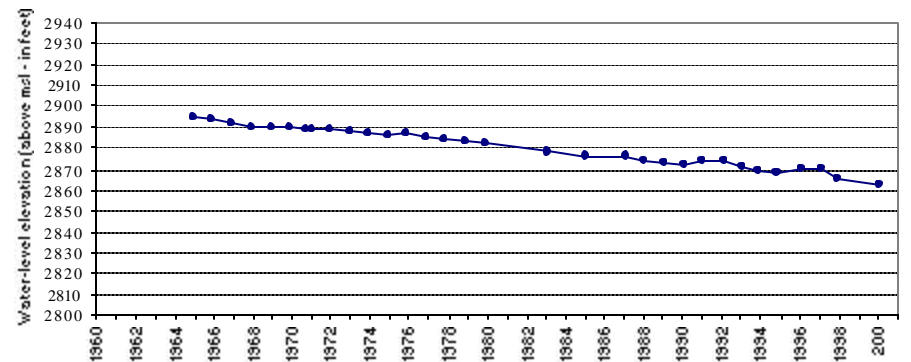
# Edwards-Trinity Water Level Ector County



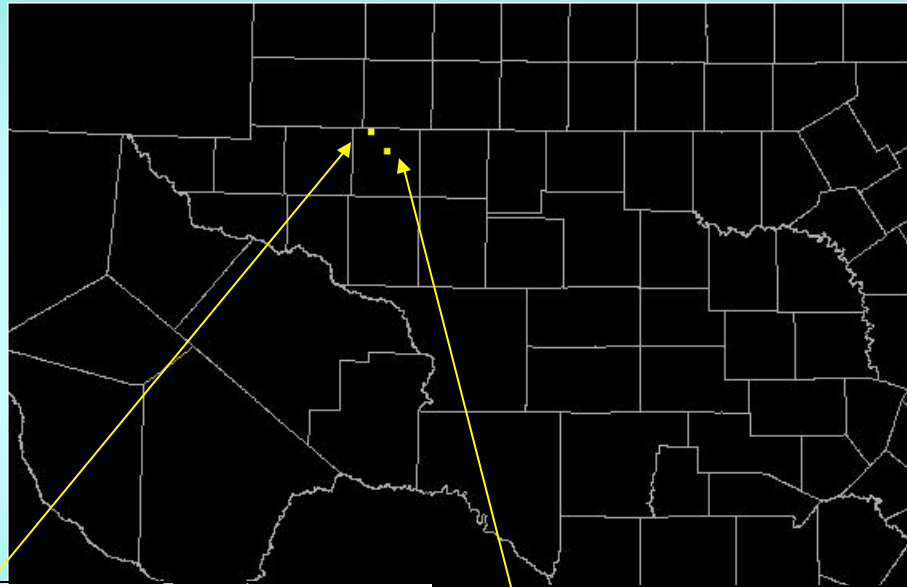
Well 27-60-701 Ector County **Antlers Sand Fm.**



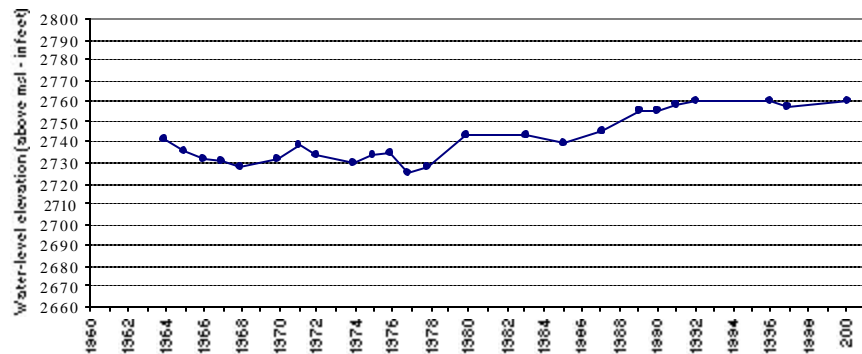
Well 27-62-703 Ector County **Antlers Sand Fm.**



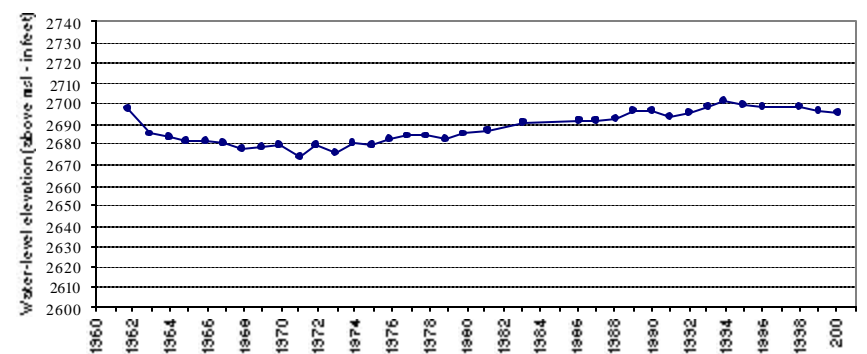
# Edwards-Trinity Water Level Midland County



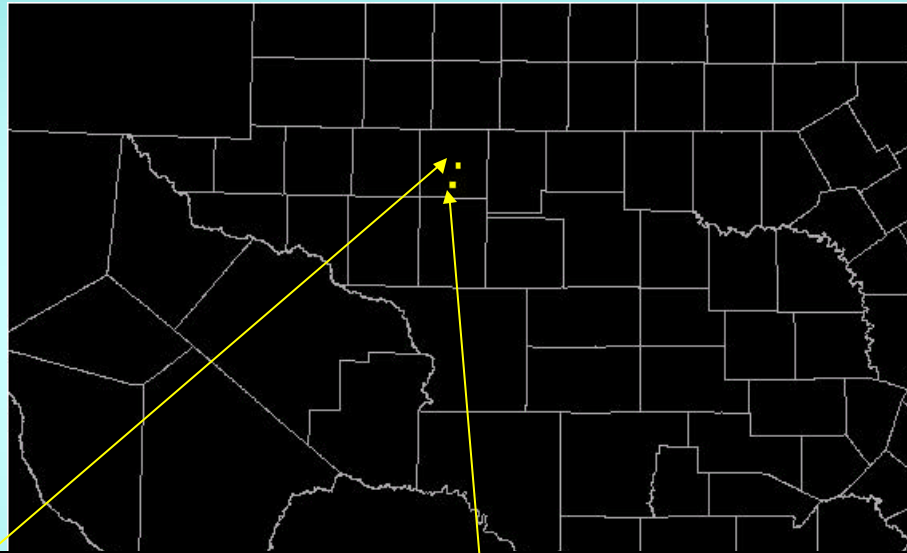
Well 27-63-601 Midland County Antlers Sand Fm.



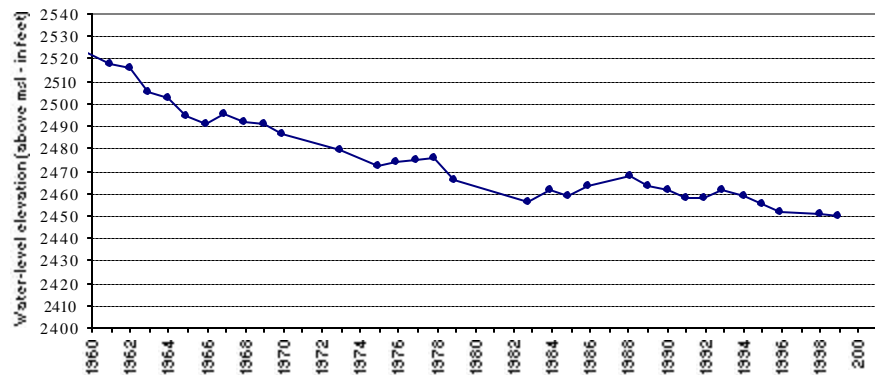
Well 45-08-692 Midland County Antlers Sand Fm.



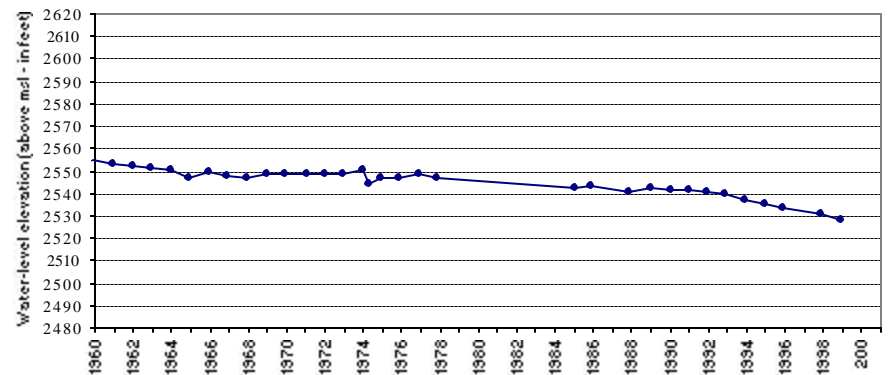
# Edwards-Trinity Water Level Glasscock County



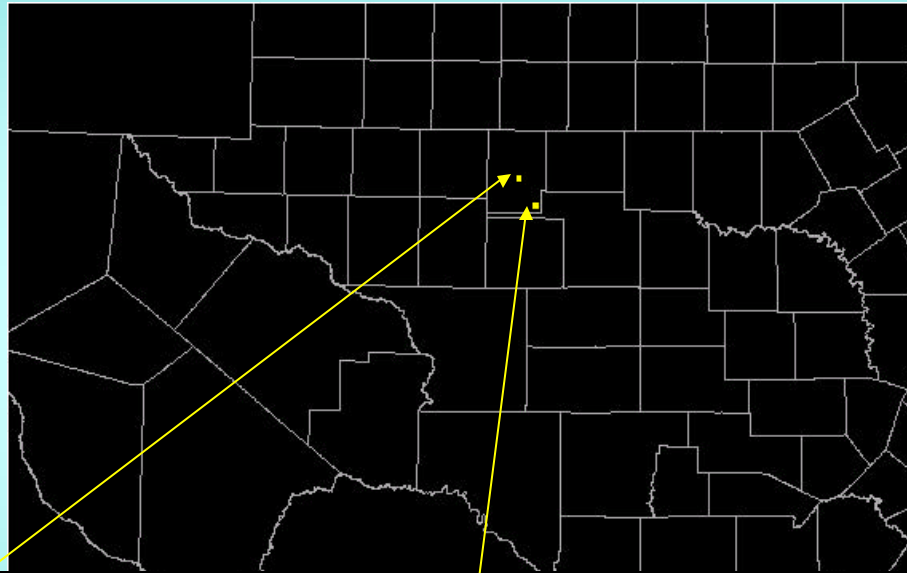
Well 44-20-305 Glasscock County Antlers Sand Fm.



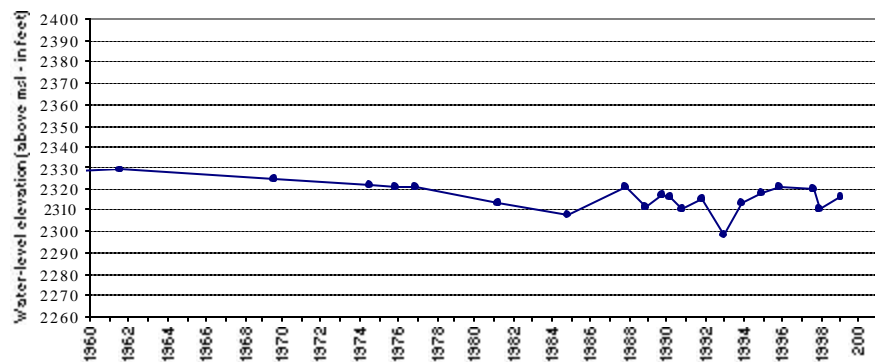
Well 44-13-102 Glasscock County Antlers Sand Fm.



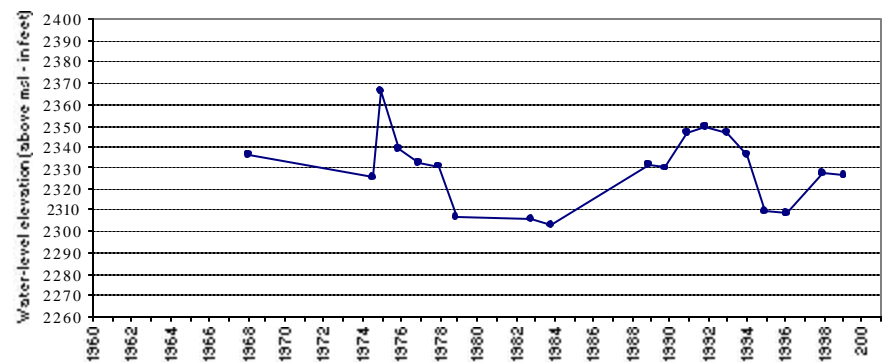
# Edwards-Trinity Water Level Sterling County



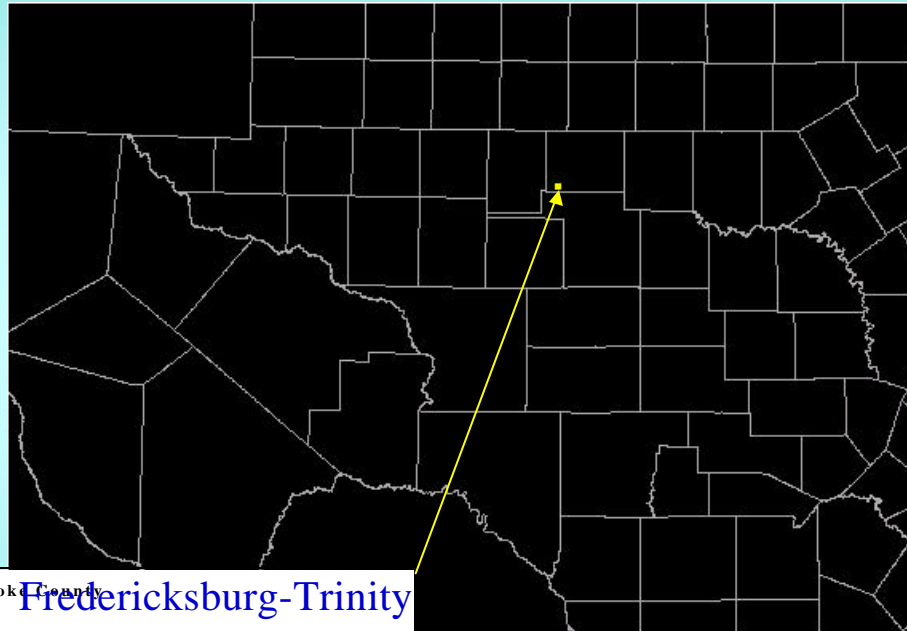
Well 44-16-901 Sterling County **Antlers Sand Fm.**



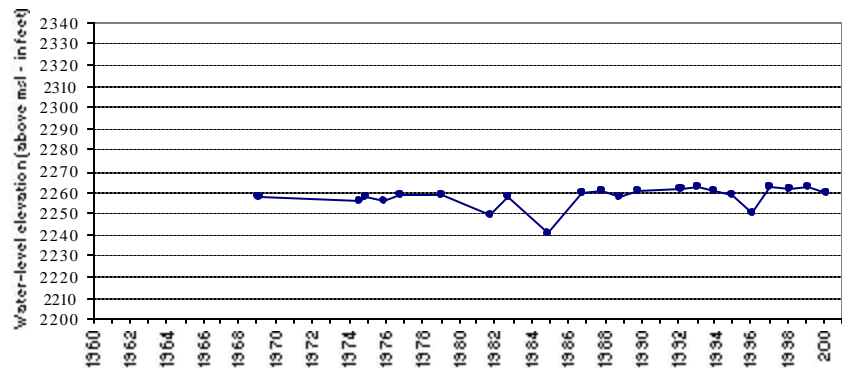
Well 43-25-302 Sterling County **Ewards-Trinity**



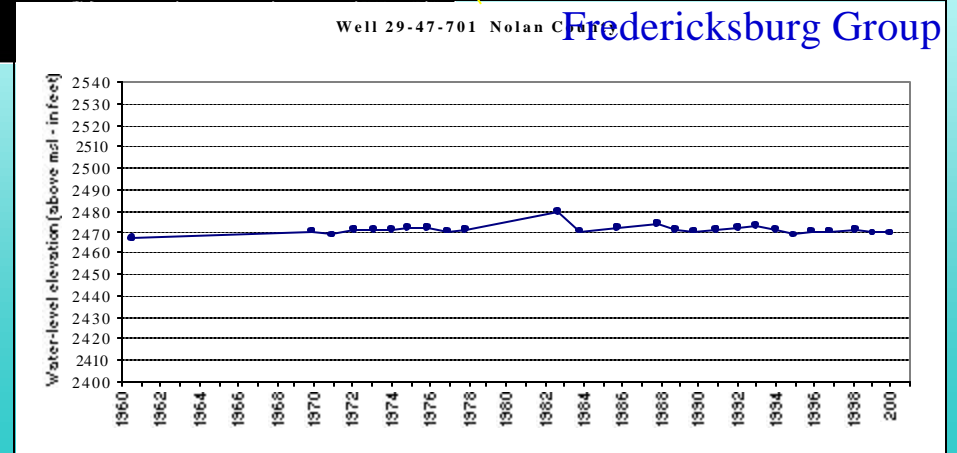
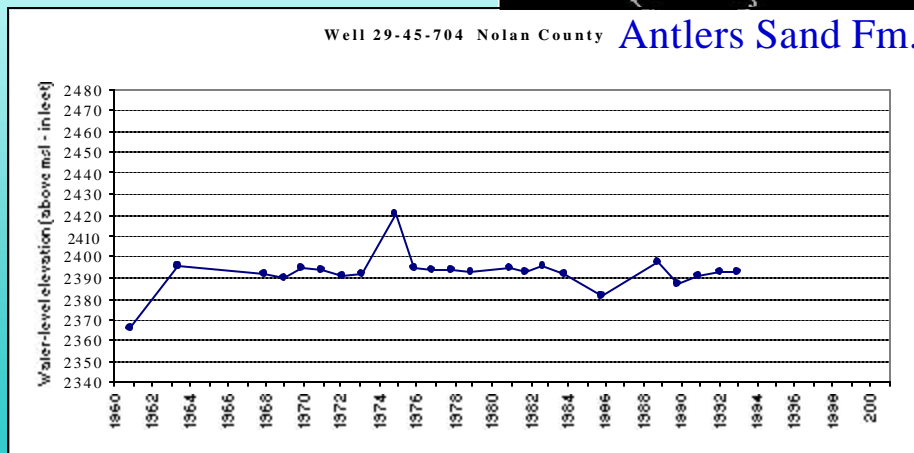
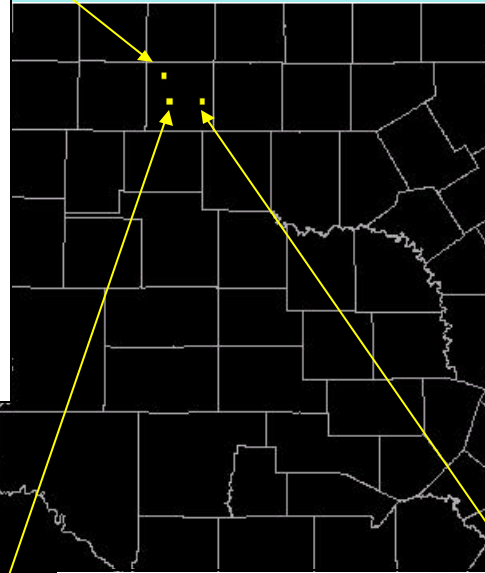
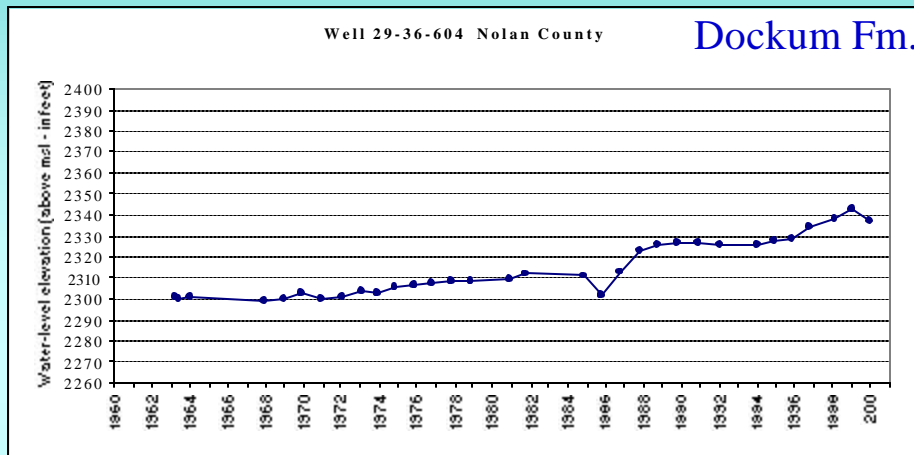
# Edwards-Trinity Water Level Coke County



Well 43-19-104 Coke County  
Fredericksburg-Trinity

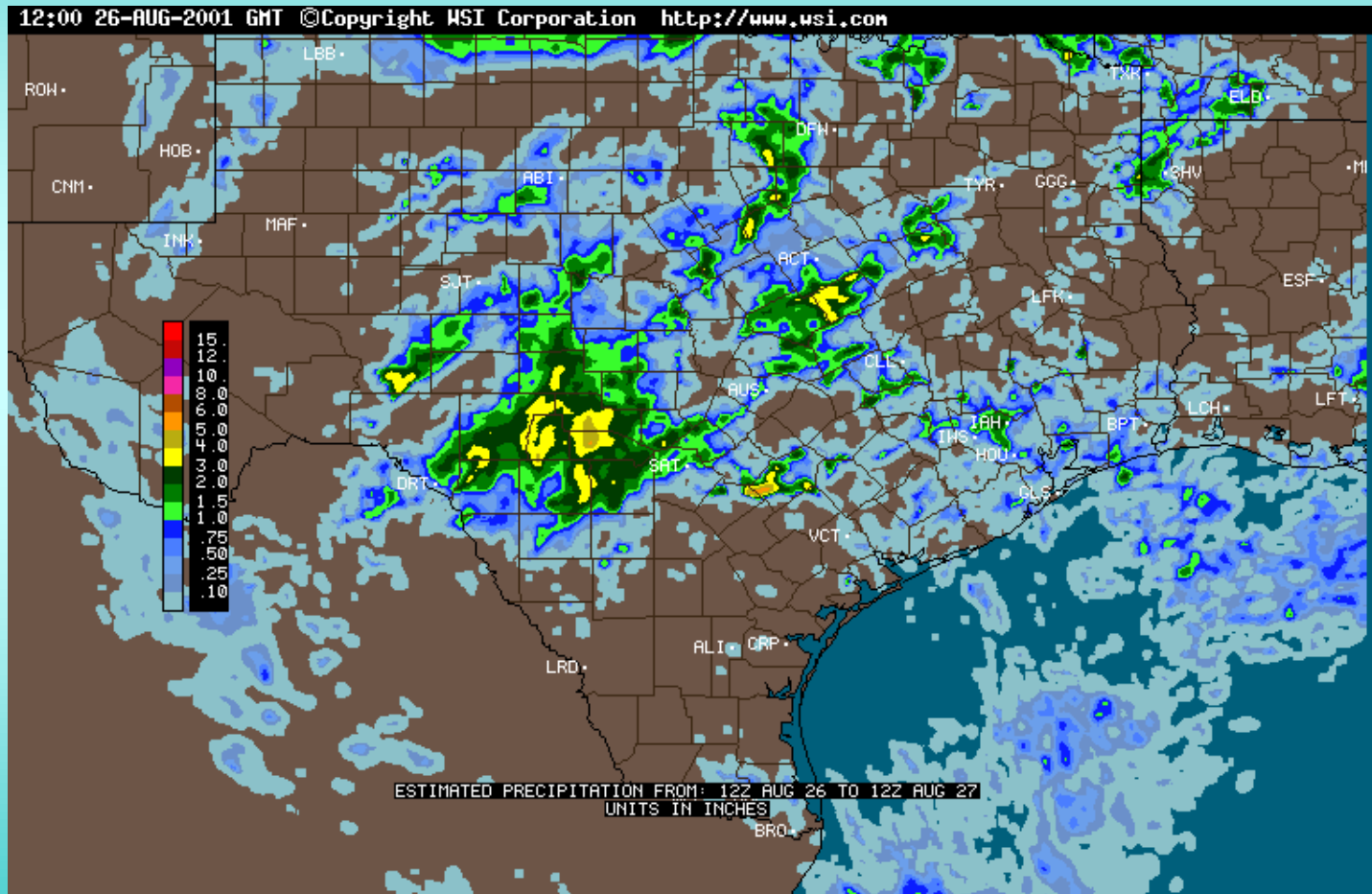


# Edwards-Trinity Water Level Nolan County





# Recharge!



Sunday's Potential Recharge



# Previous Recharge Estimates

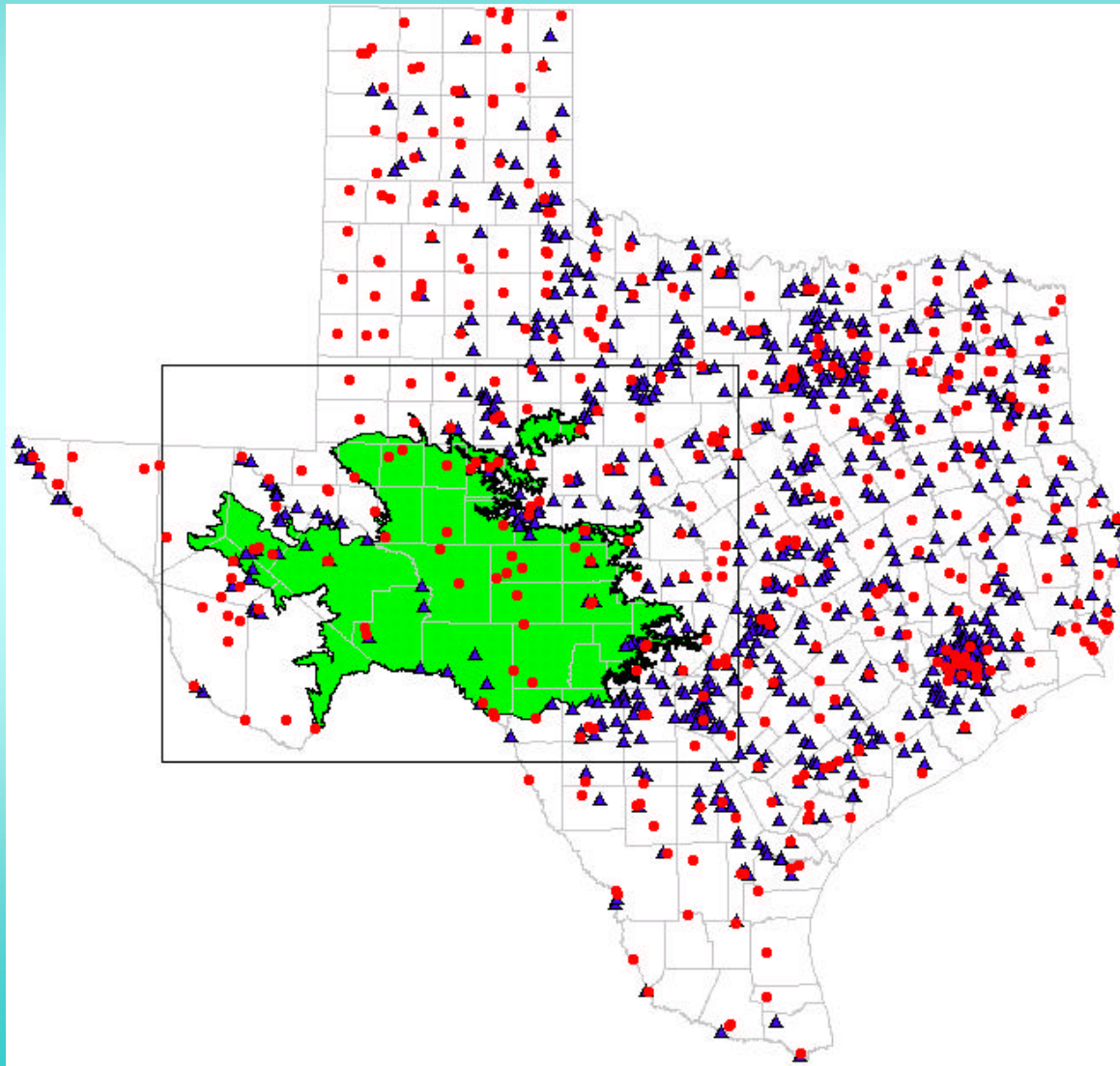
all estimates based on baseflow

- 2.0 in/yr (Real) - Long, 1958
- 1.4 in/yr (Kinney) - Bennett and Sayre, 1962
- 0.3 in/yr (Crockett) - Iglehart, 1967
- 1.0 in/yr (Kerr) - Reeves, 1969
- 0.12 to 2.24 in/yr (eastern plateau) - Kuniatsky, 1989

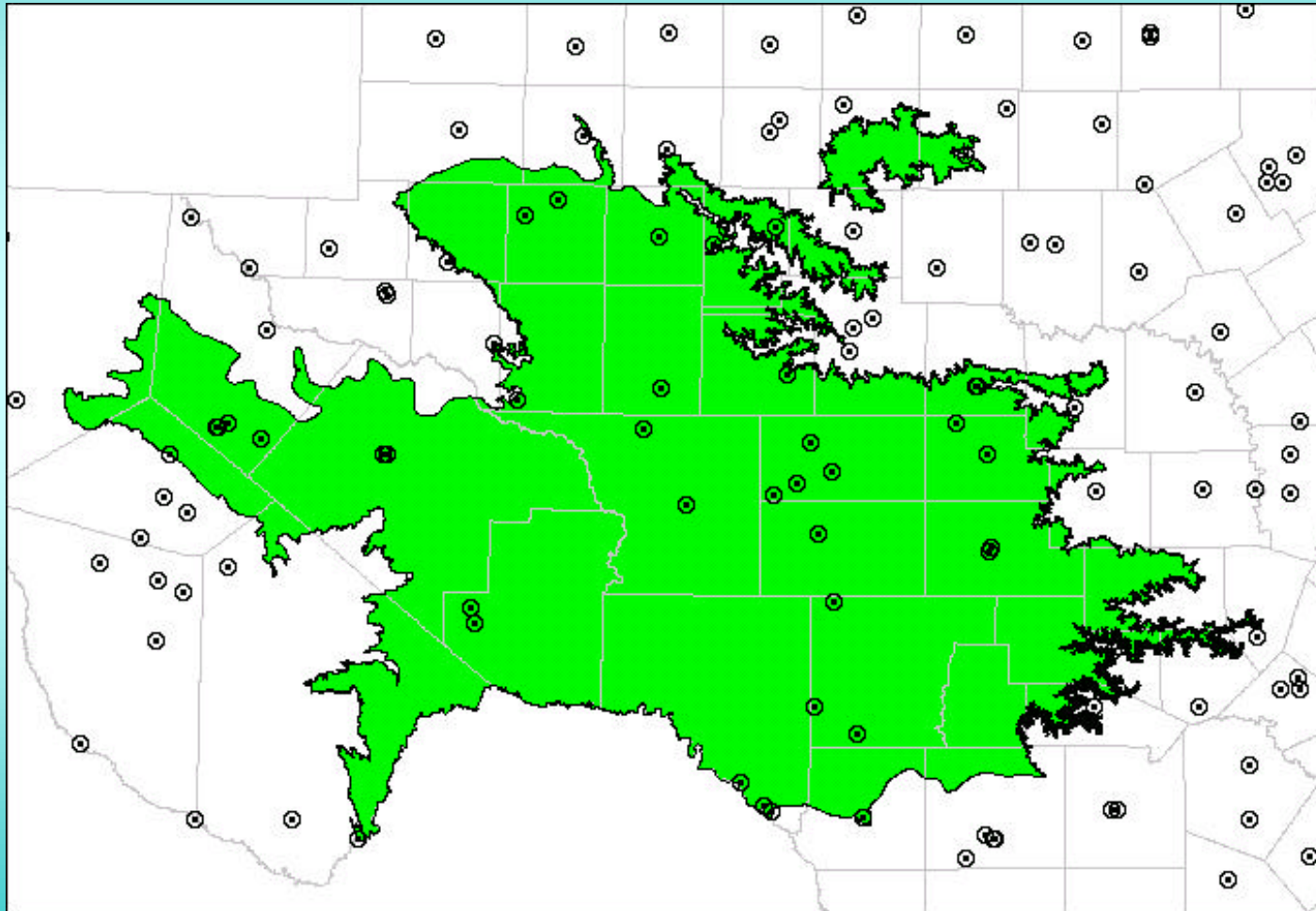
(From : Scanlon, 2001 - unpublished report)



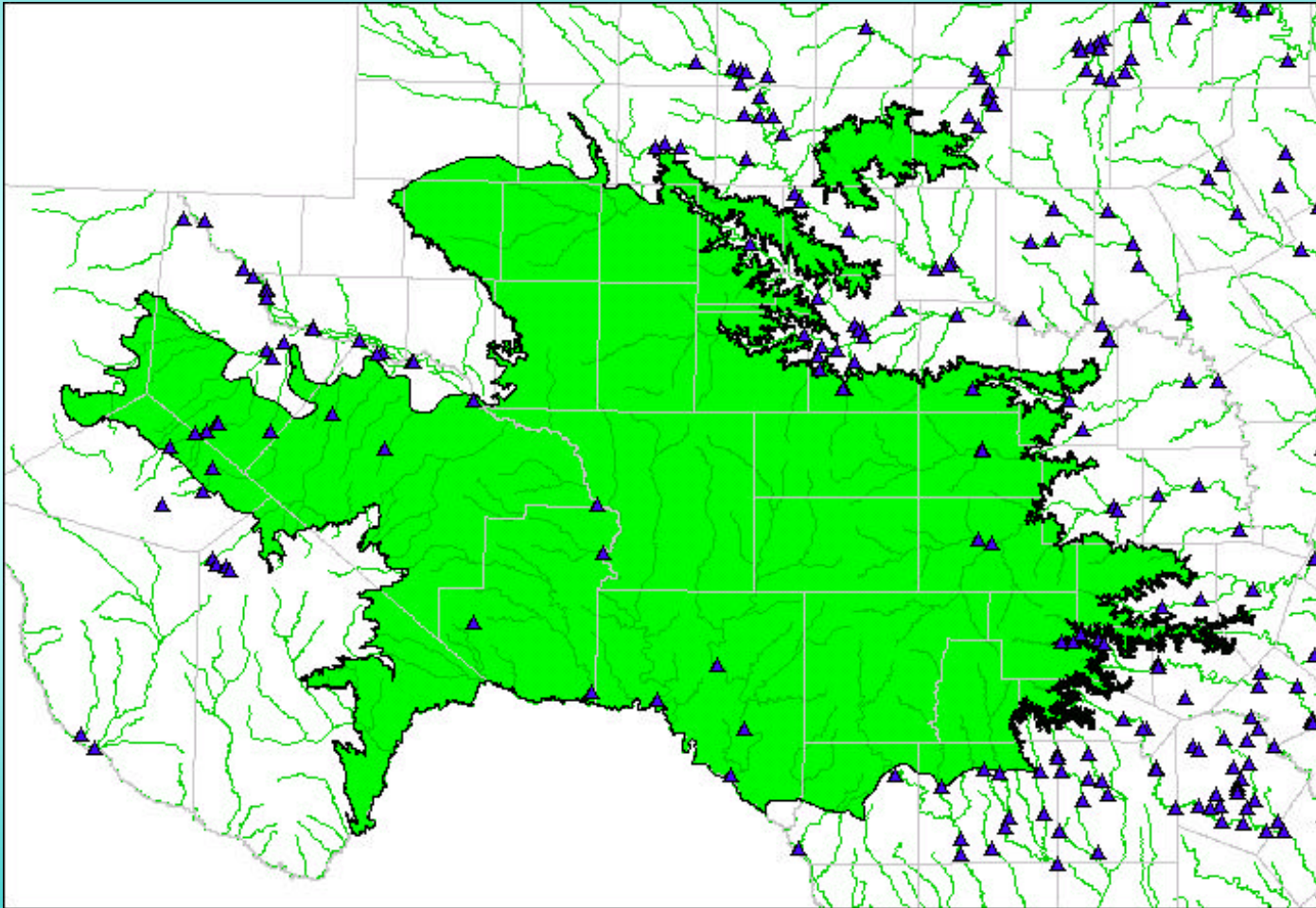
# Stream and Rain Gage Sites



# NWS Rain Gage Sites



# USGS Surface Water Gage Sites



# Lunch Time!

## 90 Minute Break

We will reconvene to discuss a few  
Edwards-Trinity Aquifer  
Conceptualization Issues

FOR MORE INFO VISIT...

[www.twdb.state.tx.us/gam](http://www.twdb.state.tx.us/gam)



# Conceptualization Issues

- Estimating recharge and ET?
- Number of model layers?
- Model adjacent minor aquifers?



# Recharge and ET

- Use baseflow analysis to estimate recharge
- Allow model to estimate recharge
- Use soil moisture model to estimate ET
- Allow recharge package to include ET



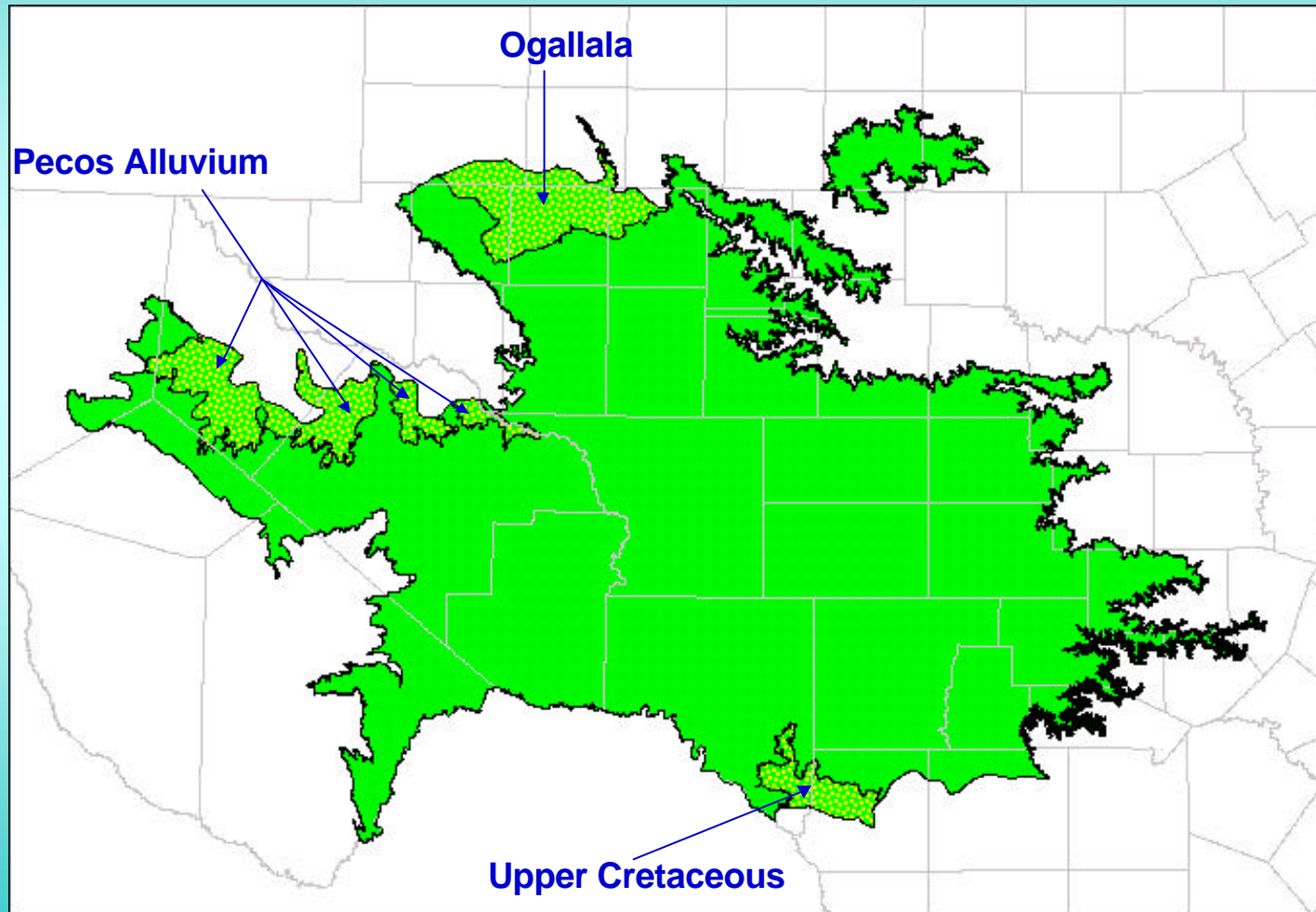


# How Many Layers?

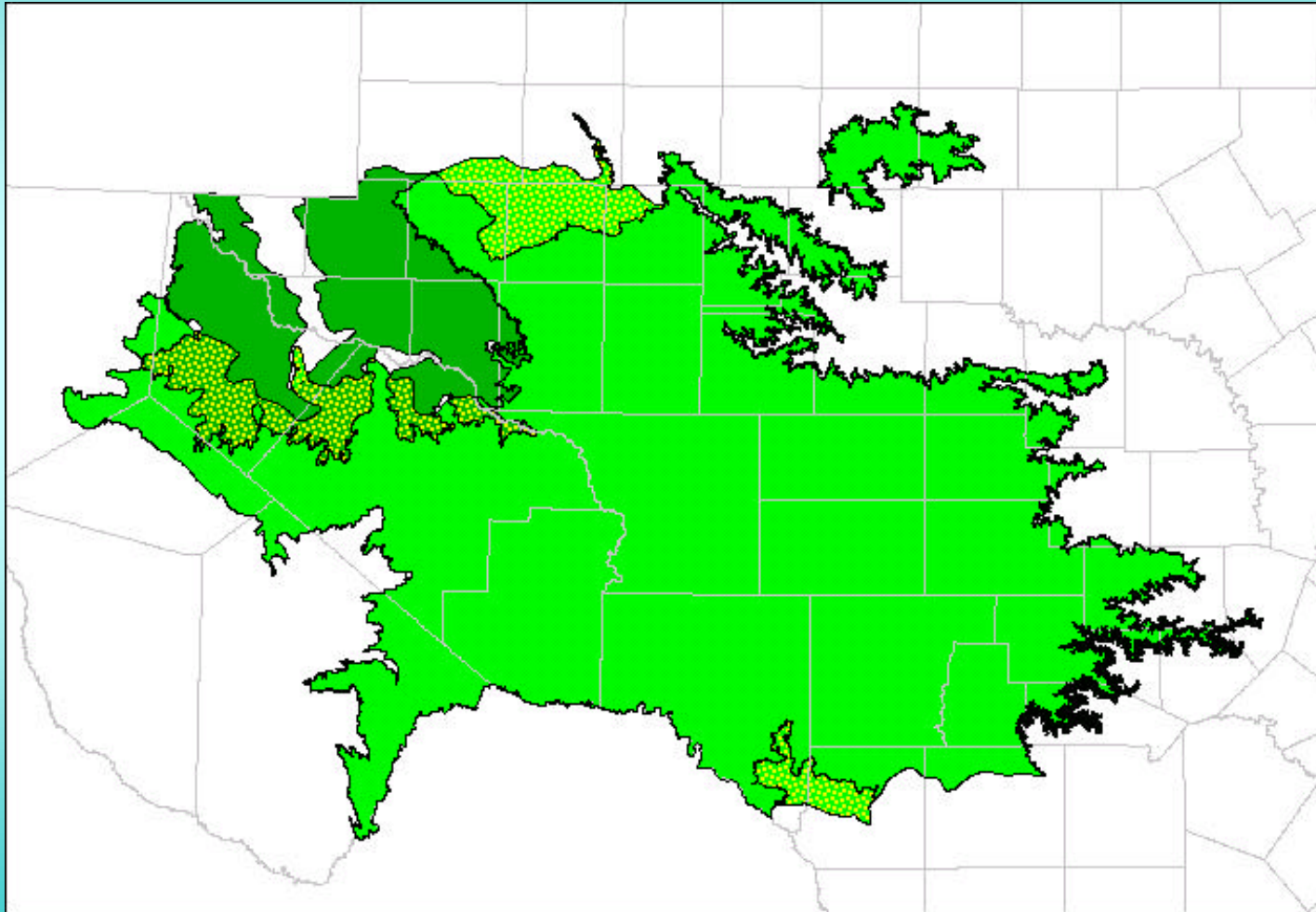
- 1 Layer, 2 layers, 3 layers ... more?
- Enough water level data for more ...
- However, the structure data is better suited for two layers ... Edwards and Trinity



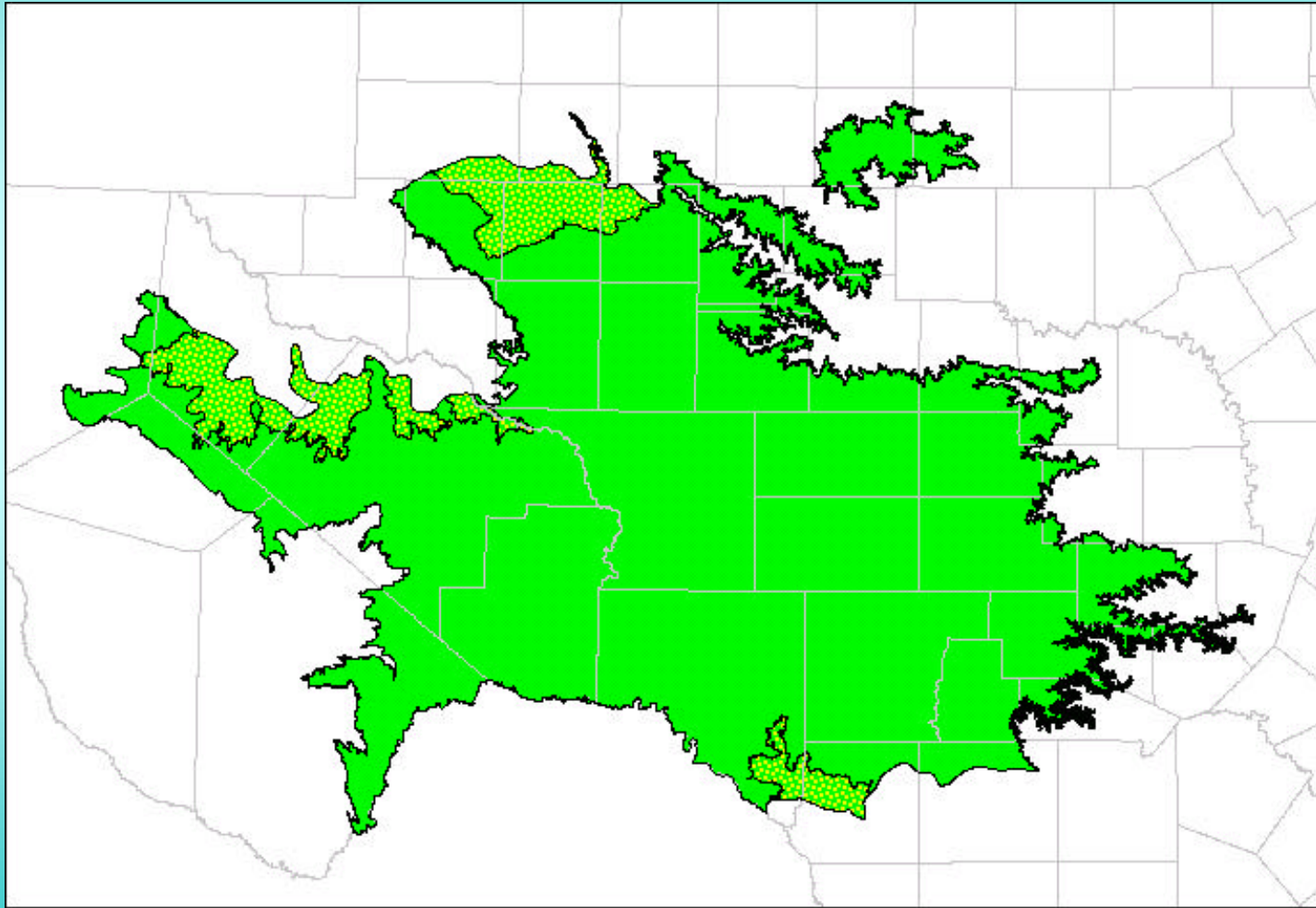
# Areal Extent of the Edwards-Trinity Sediments



# To Model the Pecos Alluvium or ...



# ...Not to Model the Pecos Alluvium?



# Current Project Status

- Completed Literature Review
- Continued Collection of Hydrogeologic Data
- Continued Data Processing and Analysis
- Completed 21 of 39 New Pumping Tests



# Anticipated Project Status For Next Quarter

- Complete Water Level Analysis
- Complete Recharge Analysis
- Finalize the Geologic Structure
- Complete New Pumping Tests
- Begin Hydraulic Properties Analysis
- Access Surface Water-Groundwater Interactions



# Topics For ET SAF 3

- Update on Hydrogeologic Data Sets
  - for Structural Geometry
  - Water Levels and Well Hydrographs
  - for Recharge Estimates
  - for Hydraulic Properties
  - for Surface Water-Groundwater Interactions
- Finalize Conceptual Model for the Edwards-Trinity Aquifer System



# Primary Literature Sources

- R. A. Barker and A. F. Ardis, *Hydrogeologic Framework of the Edwards-Trinity Aquifer System, West-Central Texas*, USGS Professional Paper 1421-B, 1996.
- L. E. Walker, *Occurrence, Availability, and Chemical Quality of Groundwater In The Edwards Plateau Region of Texas*, Texas Department of Water Resources Report 235, 1979.
- R. Rees and A. W. Buckner, *Occurrence and Quality of Groundwater In The Edwards-Trinity (Plateau) Aquifer in the Trans-Pecos Region of Texas*, Texas Department of Water Resources Report 255, 1980.
- E. L. Kuniansky and K. Q. Holligan, *Simulation of Flow in the Edwards-Trinity Aquifer System and Contiguous Hydraulically Connected Units, West-Central Texas*, USGS Water-Resources Investigation Report 93-4039, 1994.





# Questions or Comments?

## 15 Minute Break!

We will reconvene for the Specific Capacity  
Test Workshop by Dr. Robert Mace ...

FOR MORE INFO VISIT...

[www.twdb.state.tx.us/gam](http://www.twdb.state.tx.us/gam)



**Edwards-Trinity GAM Stakeholders Advisory Forum 2**  
**August 29, 2001 – Sonora, Texas**  
**List of Attendees**

<b>Name</b>	<b>Affiliation</b>
Cindy Cawley	Plateau UWCD
Scott Holland	Sterling County UWCD / Irion County Water Conservation District
Cameron Cornett	Headwaters UWCD
Winton Milliff	Coke County UWCD
Stan Reinhard	Hickory UWCD NO. 1
Virgil Poloeek	Sutton County UWCD
Allan Lange	Lipan-Kickapoo Water Conservation District
Dennis Clark	Emerald UWCD
Wendell Moody	Private Citizen
Rick Harston	Glasscock County UWCD
Ferrel Wheeler	Garza County UFWCD
Cindy Weatherby	Santa Rita UWCD
Robert Mace	Texas Water Development Board
Roberto Anaya	Texas Water Development Board

**Edwards-Trinity GAM Stakeholders Advisory Forum 2**  
**August 29, 2001 – Sonora, Texas**  
**Meeting Summary**

About 15 people attended the second quarterly Edwards-Trinity Aquifer Groundwater Availability Modeling Stakeholders Advisory Forum, held August 29, 2001 at the 4-H Civic Center in Sonora, Texas. All of the stakeholders present were from 13 local groundwater conservation districts.

Roberto Anaya presented an update on the geologic structure, water levels, recharge methodology, and conceptualization issues for some of the boundary conditions of the Edwards-Trinity model. The stakeholders were pleased that the Edwards limestones and the Trinity Group sediments would be modeled as two separate, but hydraulically connected layers. The stakeholders also agreed that the entire Cenozoic Pecos Alluvium aquifer should be included in the model to more accurately represent the hydraulic boundary conditions between the Pecos Alluvium and the Edwards-Trinity. The stakeholders were very enthusiastic about providing TWDB with any additional data and information that they could find at their local district offices. Robert Mace ended the meeting with a brief workshop on the use of Specific Capacity Tests.

The next SAF meeting was tentatively scheduled for mid-January in Ozona, Texas. Topics for the next forum include 1) final results from water level analysis and baseflow/recharge relationships; 2) a more complete picture of the geologic structure and of the hydraulic connectivity between the Edwards-Trinity aquifer system and other major and minor aquifer systems; and 3) initial findings on groundwater-surface water interactions and from pumping tests and specific capacity tests within the Edwards-Trinity.

Primary Stakeholder Issues Follow:

1) A couple of stakeholders are still concerned about the ability to accurately model flow through karst portions of the aquifer.

ANSWER: Individual conduits will not be modeled, instead, the model will average out the effects of conduit flow within 1 X 1 mile model grid cells.

2) Several stakeholders are still concerned that the model would infer the existence of large volumes of groundwater being available based on saturated thickness when in reality the aquifer more often than not has poor production yields.

ANSWER: The model will not generate groundwater availability, but instead provide a tool for quantifying availability based on the model users definition of availability.

3) One stakeholder was concerned about how domestic pumping would be distributed within the model.

ANSWER: Domestic pumping will be spatially distributed based on population density derived from US Census data as opposed to the uniform distribution over county/basin units as done for the Trinity Hill Country model.

-Roberto Anaya, 08/30/01