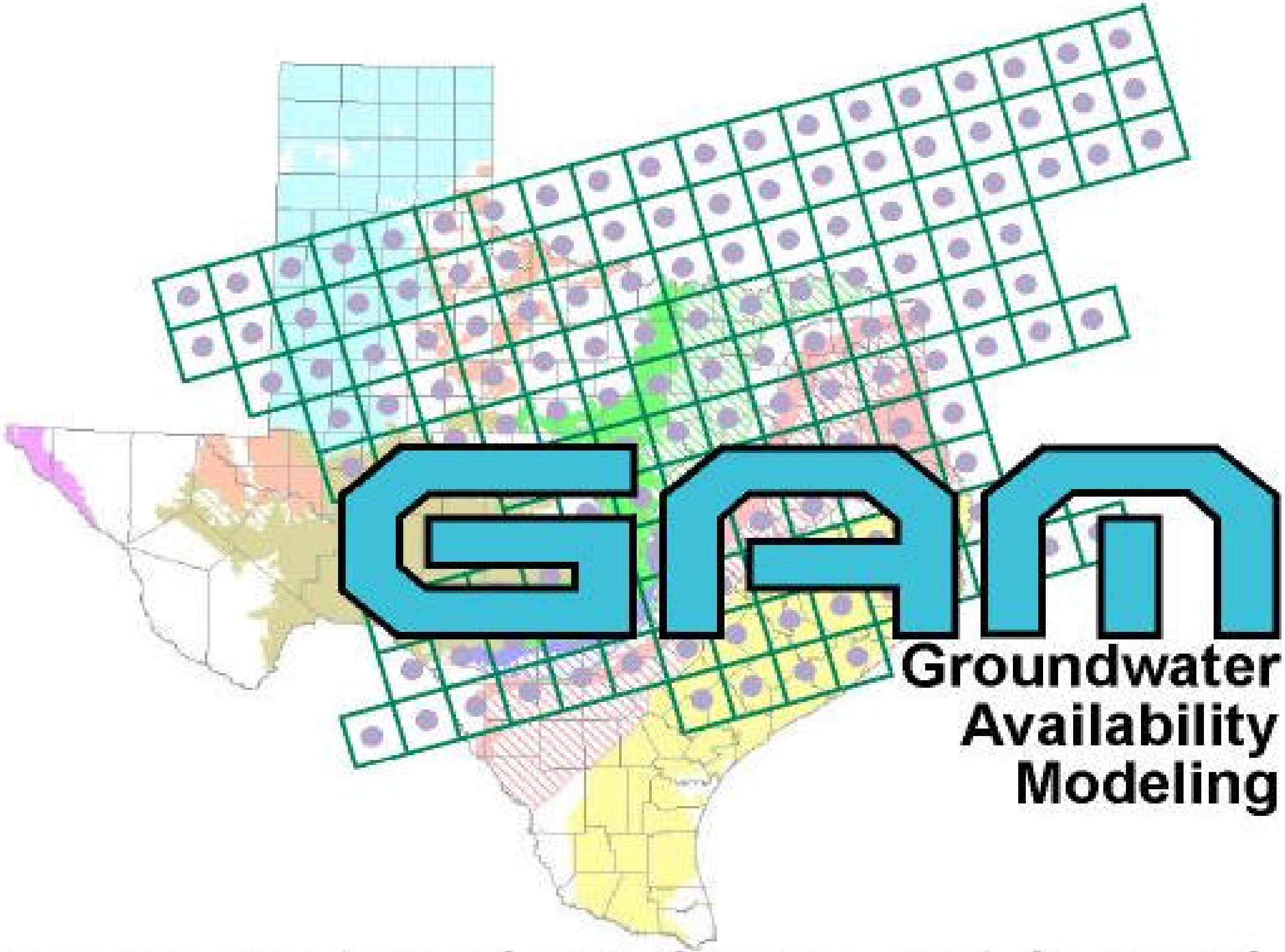


texas water development board

Presented by:
Ali Chowdhury Ph.D.
Hydrogeologist, GAM Unit

GAM Groundwater Availability Modeling

texas water development board

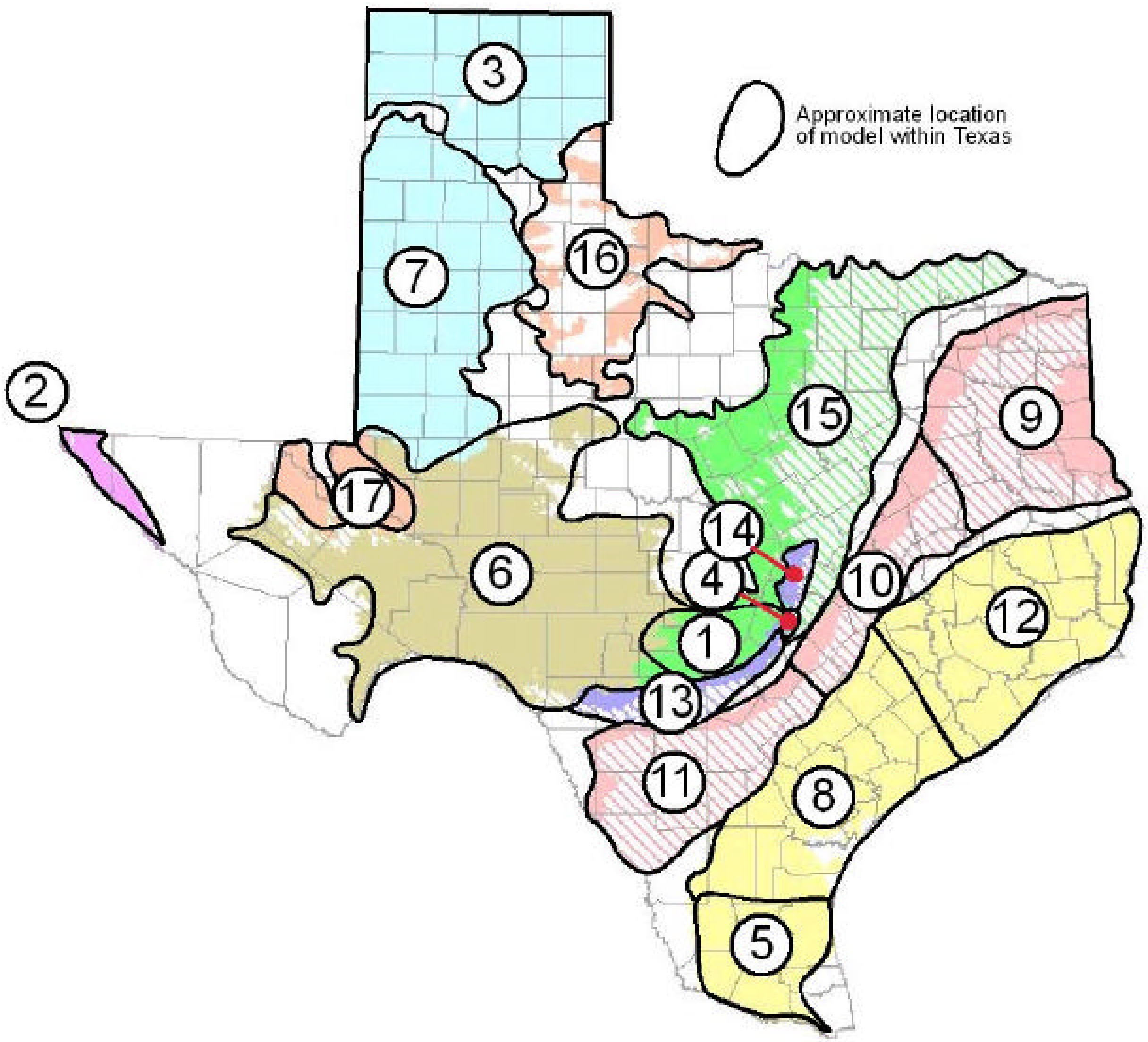
OUTLINES

- conceptual model
- model grid
- structure
- precipitation/recharge
- water levels and regional flow
- hydraulic conductivity
- discharge (evapo-transpiration, pumping)
- modeling protocol
- model calibration
- water quality
- preliminary results

Modeling Protocol

- conceptual model
- mathematical model (modflow)
- model design
- calibration ---- steady state model (1980)
- ----- transient model (1981 -1990)
- verification (1991-2000)
- prediction (2001-2050)

Location of Completed, Ongoing, and Proposed Models for GAM

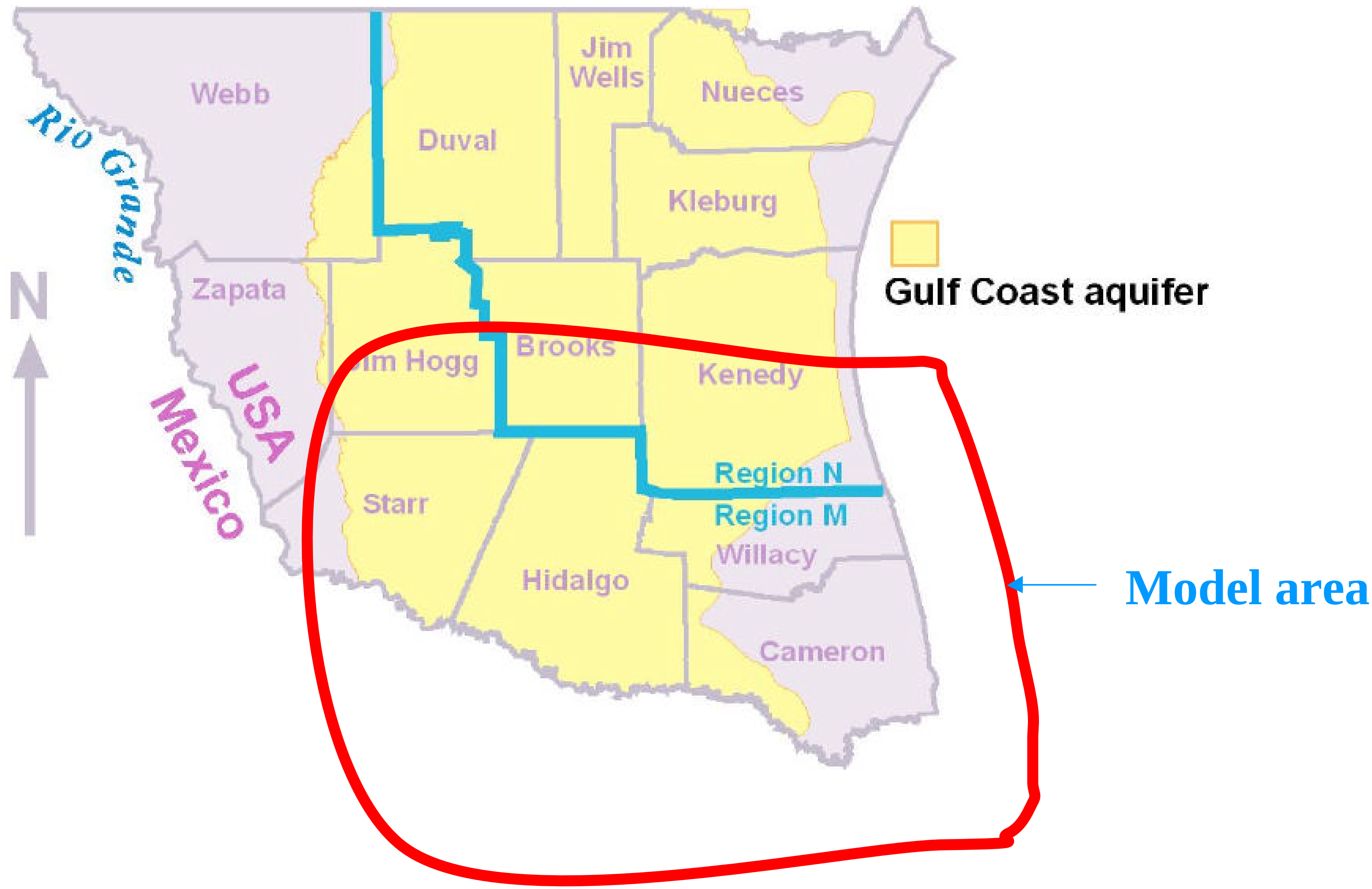


c = completed
o = ongoing
p = proposed

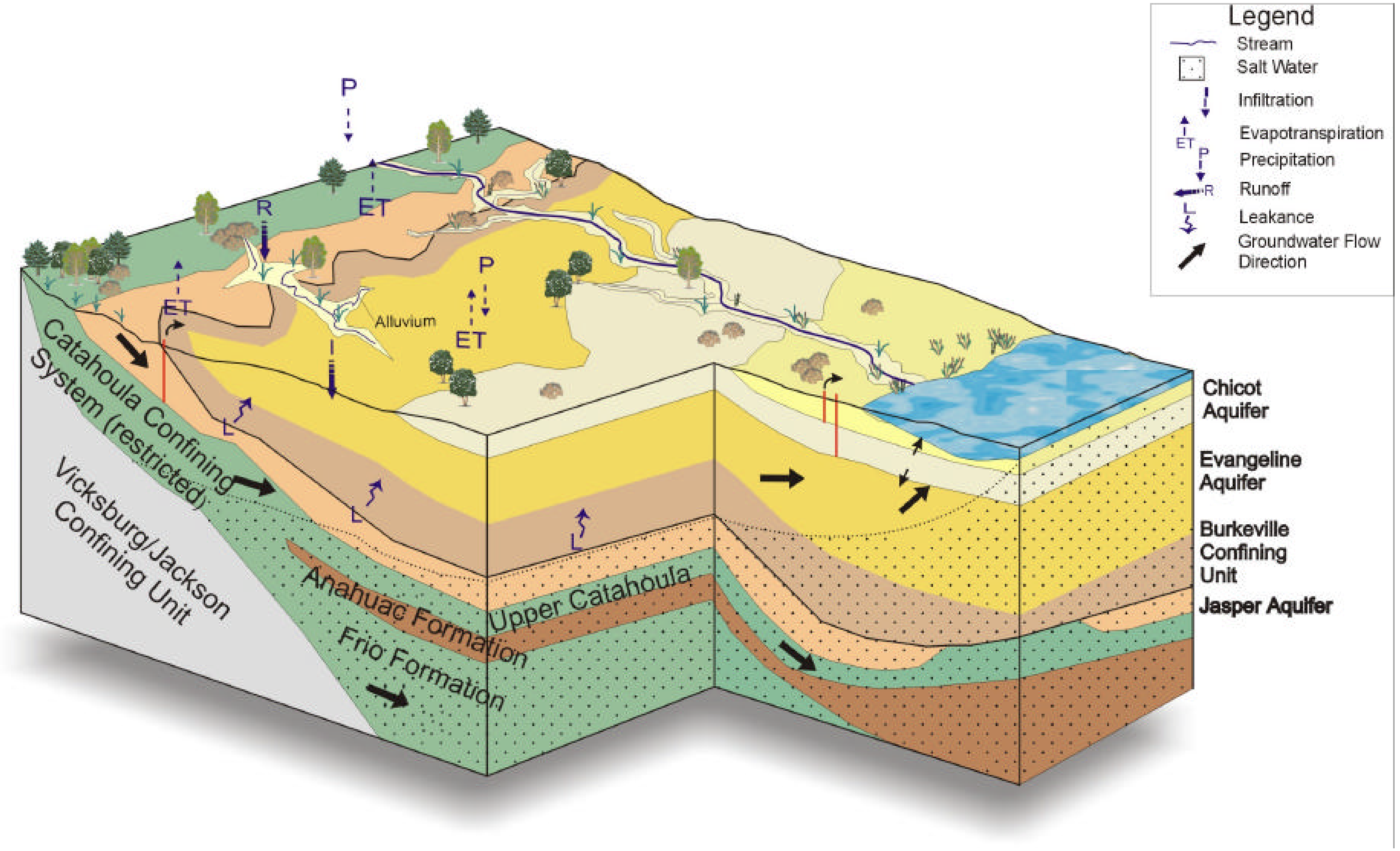
1. Trinity (Hill Country) c
2. Hueco Bolson c
3. Ogallala (northern part) c
4. Edwards (Barton Springs segment) c
5. Lower Rio Grande Valley o
6. Edwards-Trinity Plateau o
7. Ogallala (southern part) o
8. Gulf Coast (central part) o
9. Carrizo-Wilcox (northern part) o
10. Carrizo-Wilcox (central part) o
11. Carrizo-Wilcox (southern part) o
12. Gulf Coast (northern part) o
13. Edwards (San Antonio segment) o
14. Edwards (northern segment) p
15. Trinity (northern part) p
16. Seymour p
17. Pecos Alluvium p

October 2000

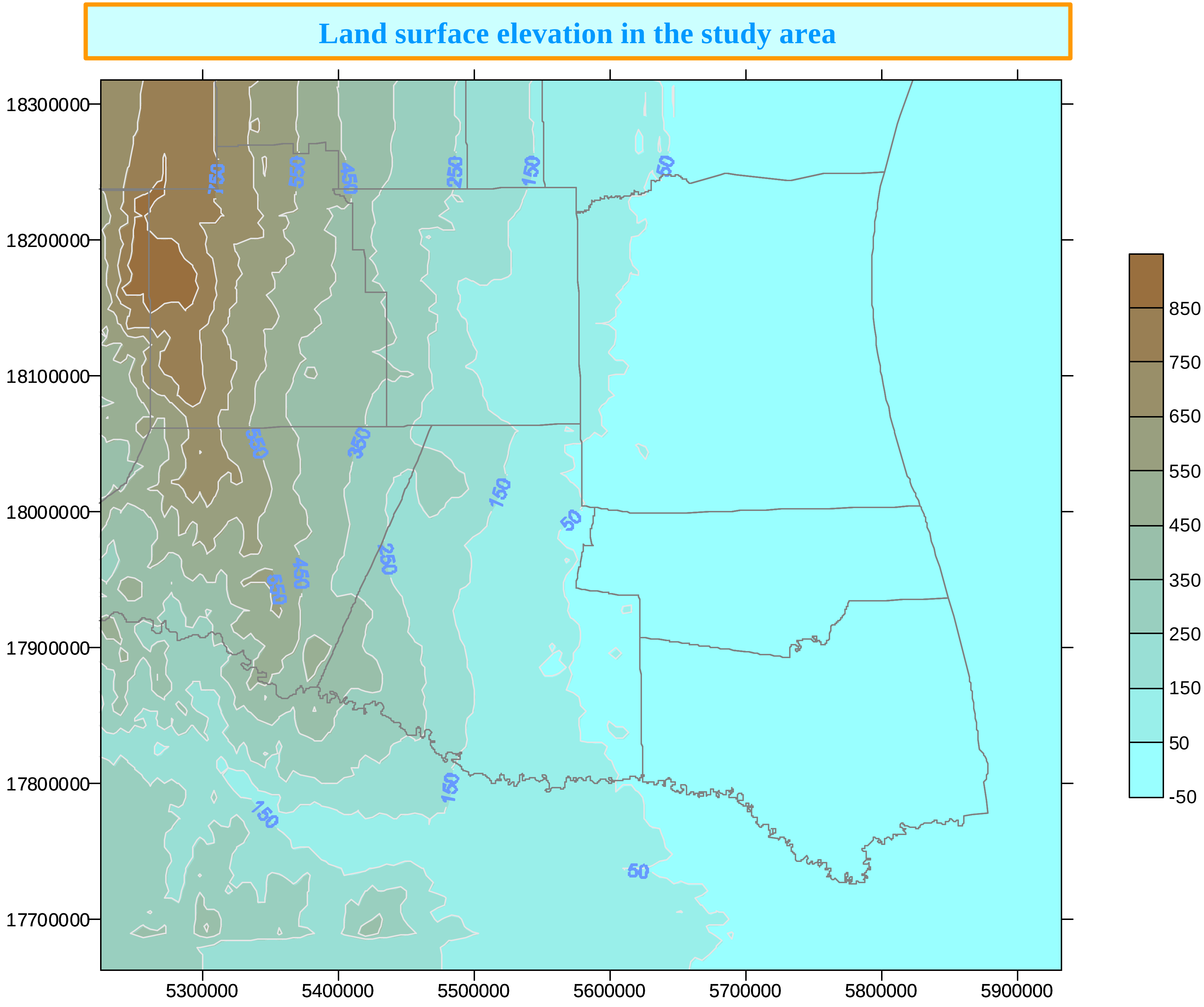
Study area for the LRGV model



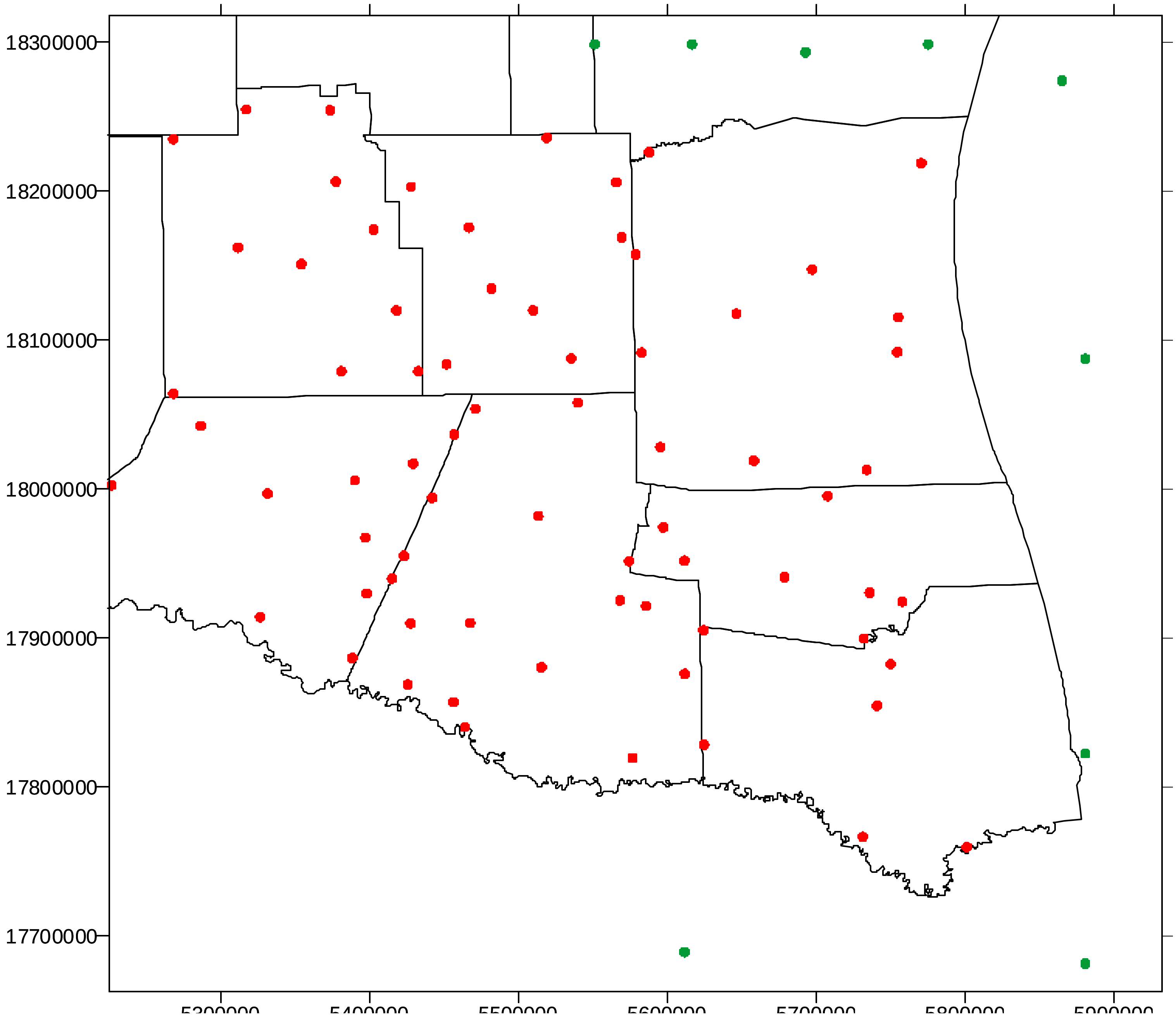
CONCEPTUAL MODEL

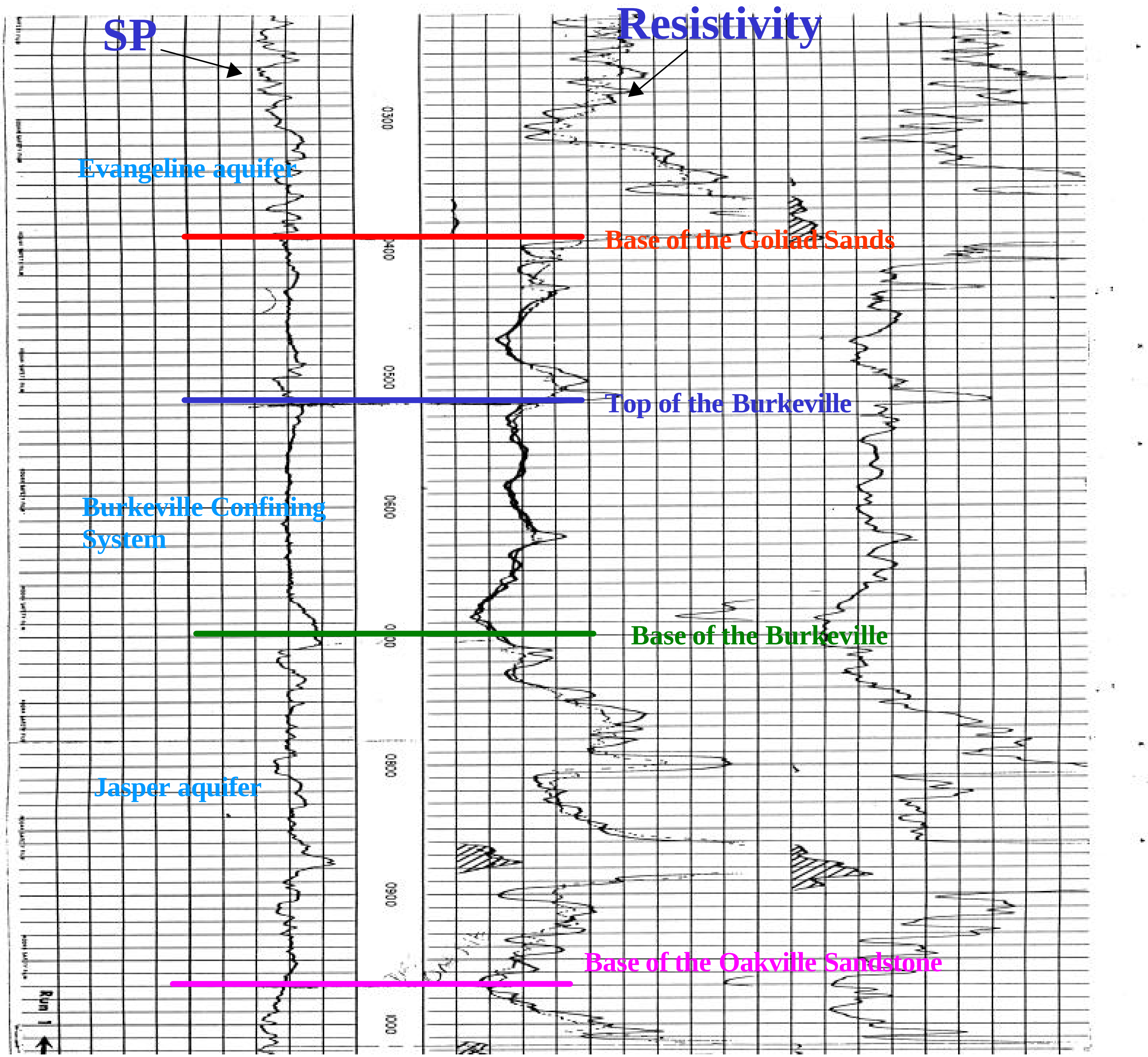


(Waterstone, 2001)

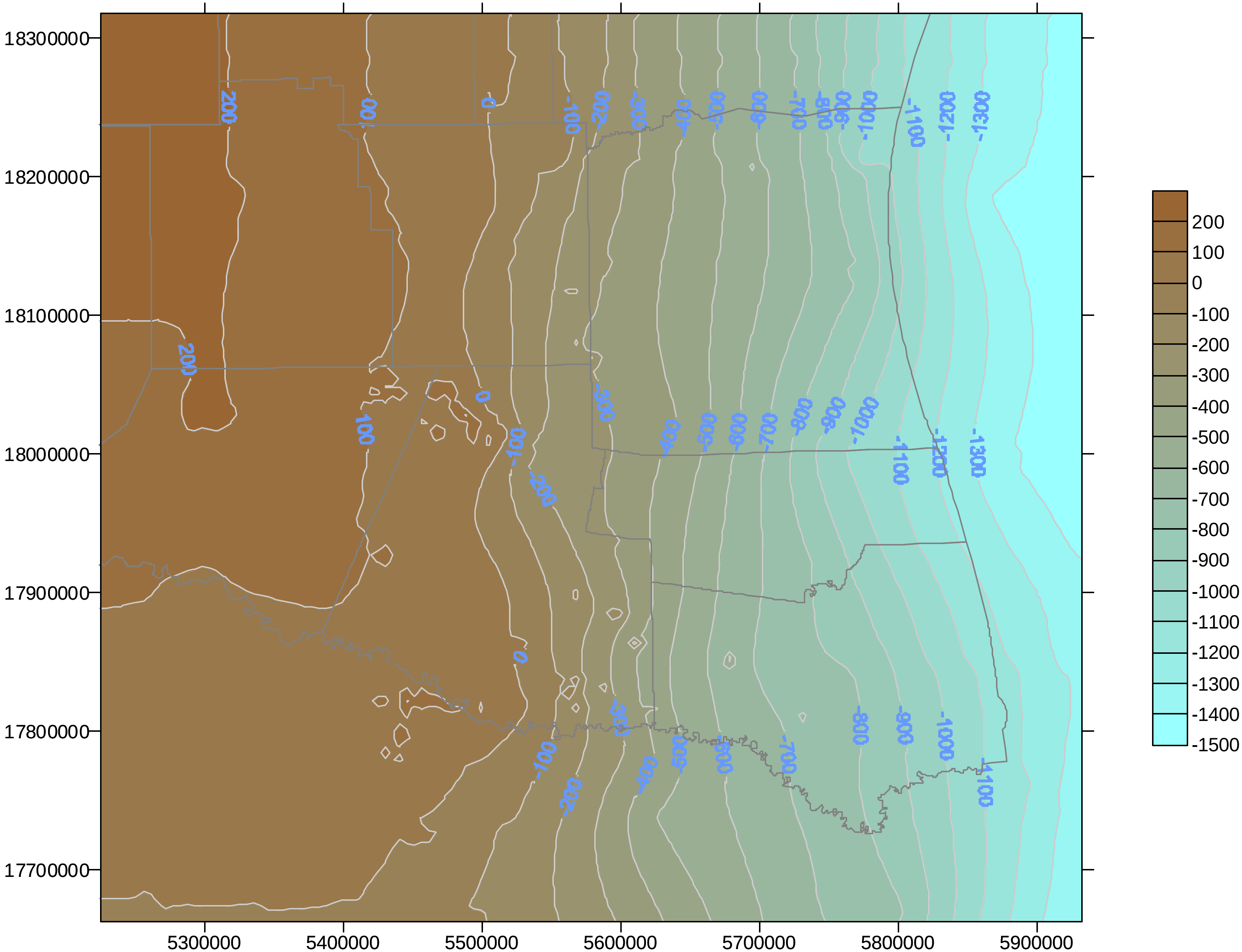

Land surface elevation in the study area
18300000
18200000
18100000
18000000
17900000
17800000
17700000
5300000
5400000
5500000
5600000
5700000
5800000
5900000
850
750
650
550
450
350
250
150
50
-50

Locations of control points used for determining structure surfaces

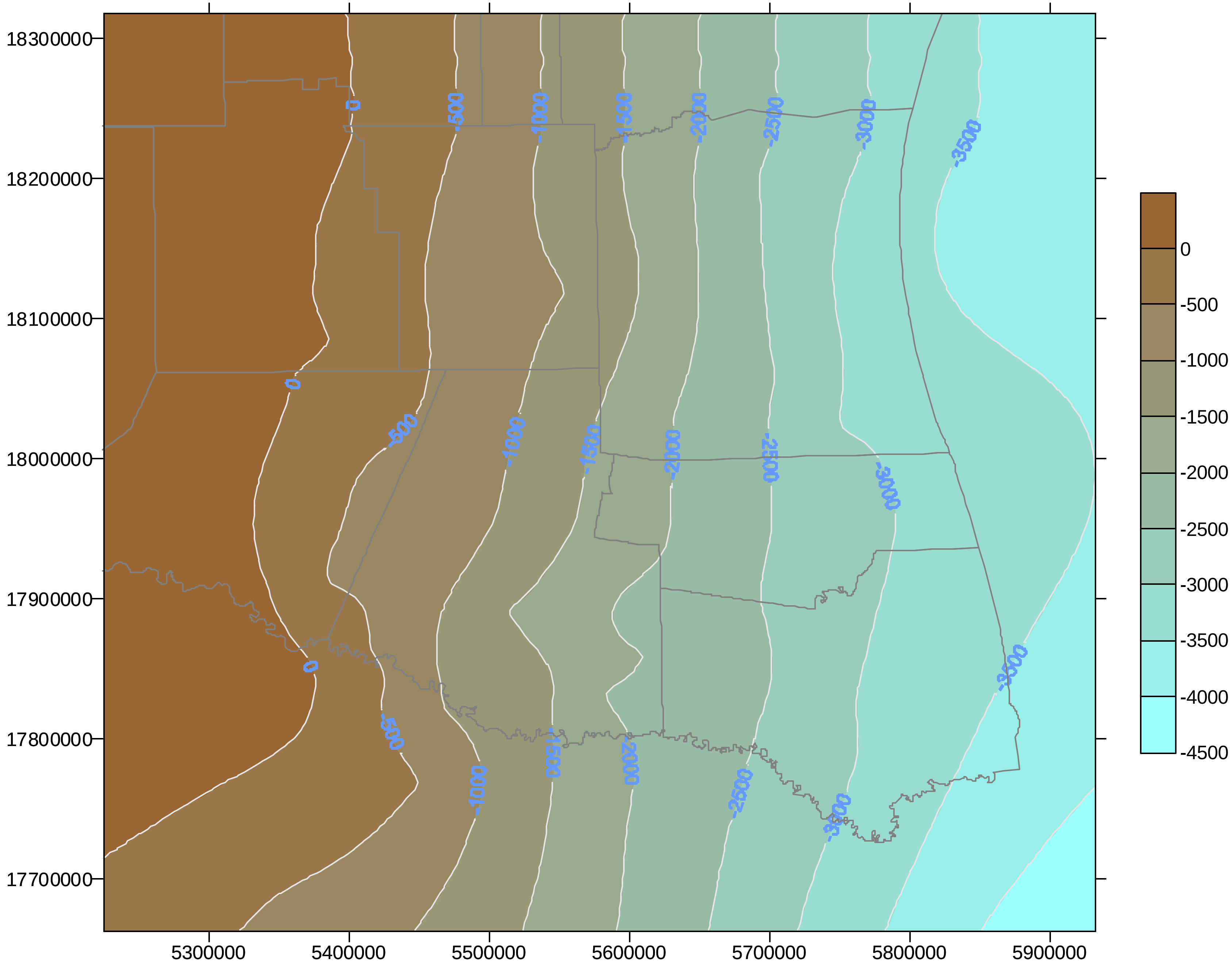



SP
Resistivity
Evangeline aquifer
Base of the Goliad Sands
Top of the Burkeville
Burkeville Confining System
Base of the Burkeville
Jasper aquifer
Base of the Oakville Sandstone
Run 1

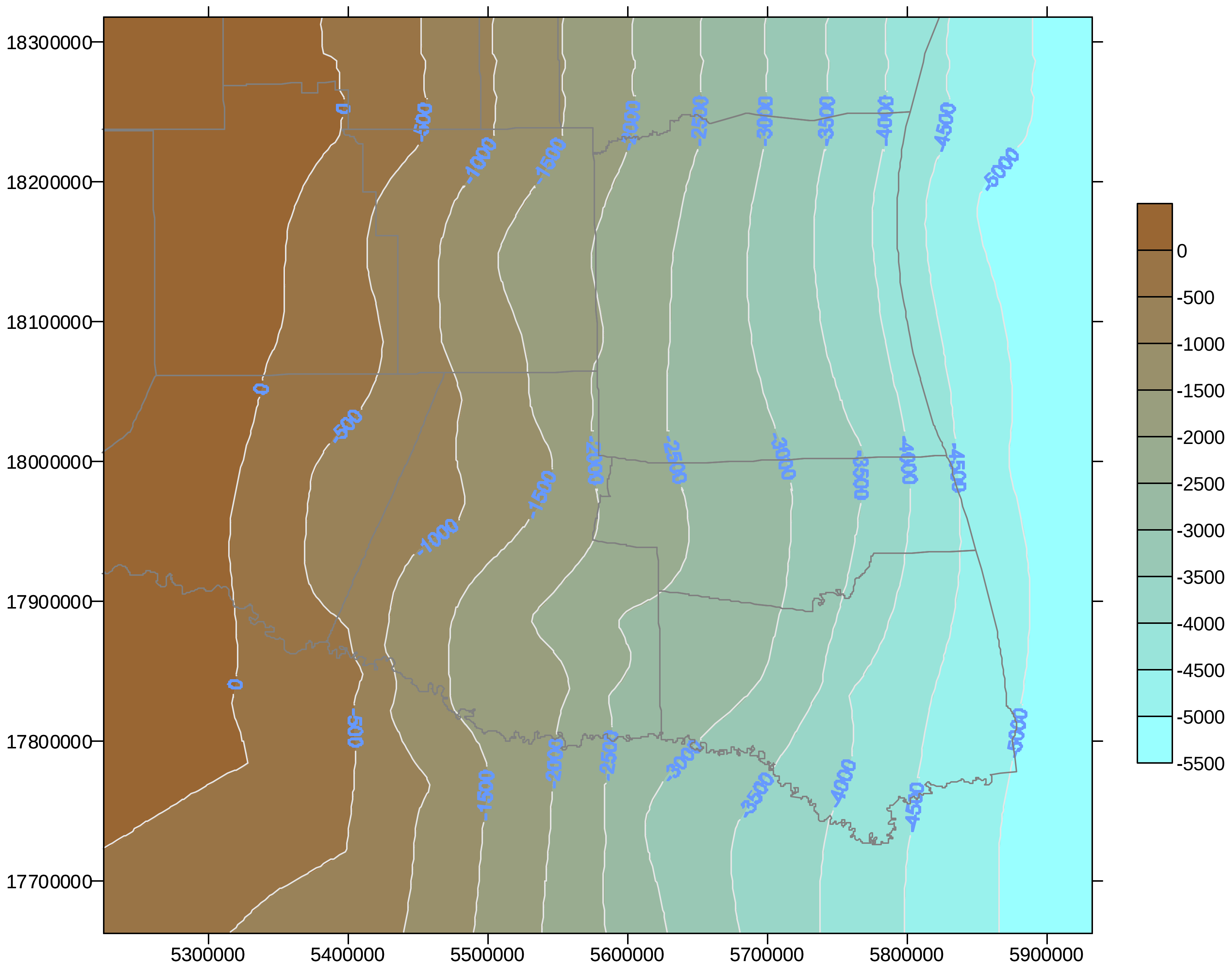
Elevation of the base of the Chicot aquifer



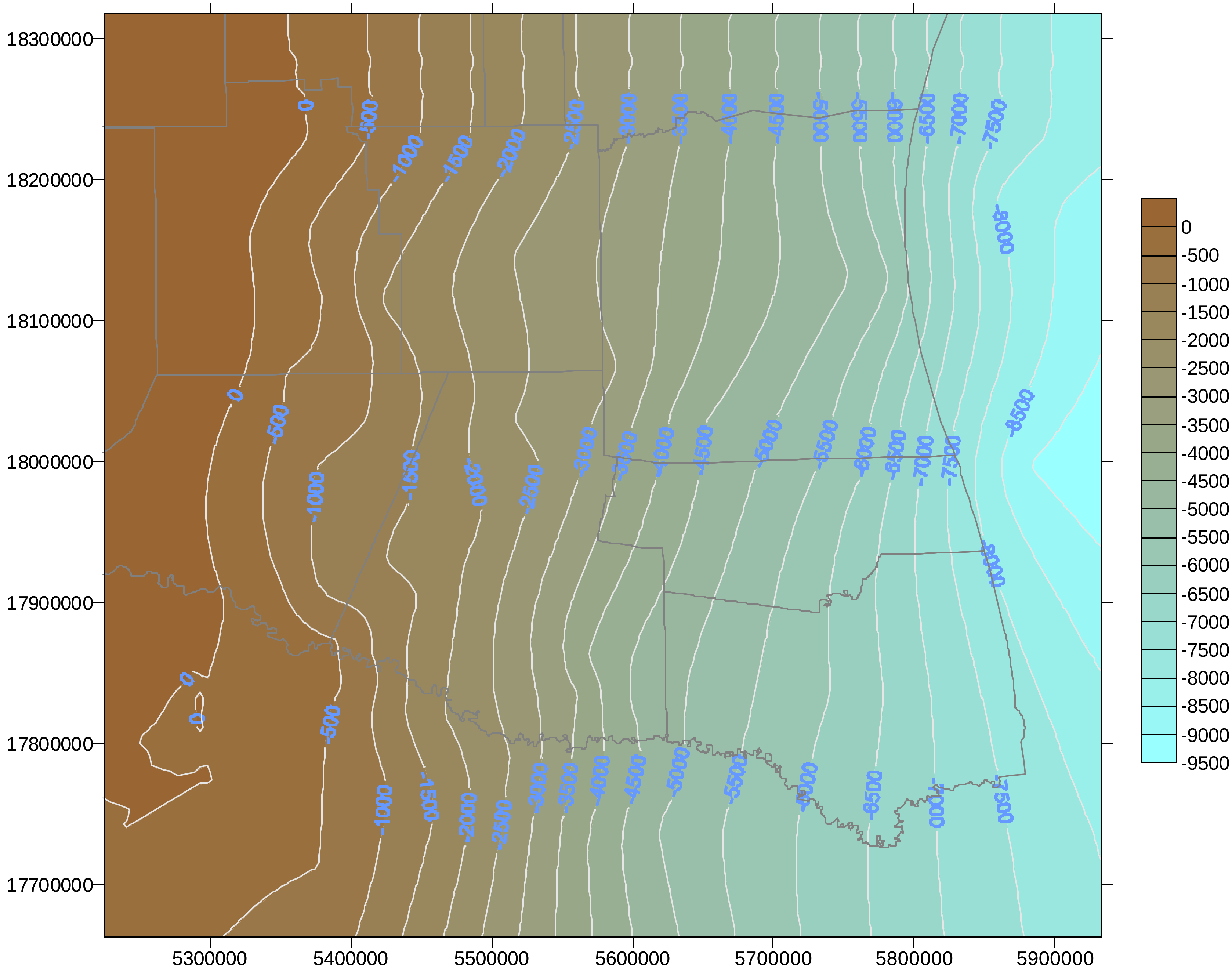
Elevation of the base of the Evangeline aquifer



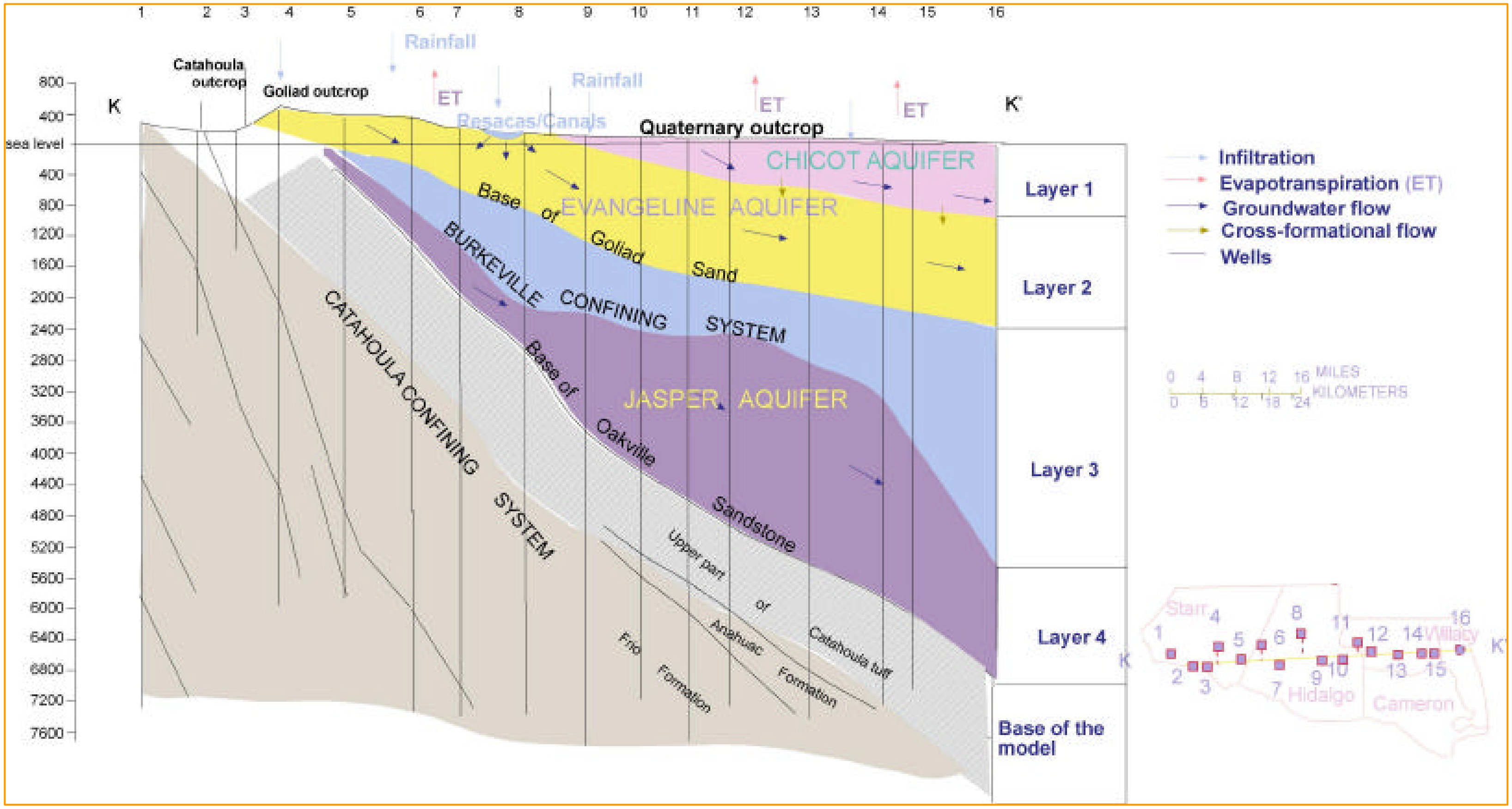
Elevation of the base of the Burkeville confining unit



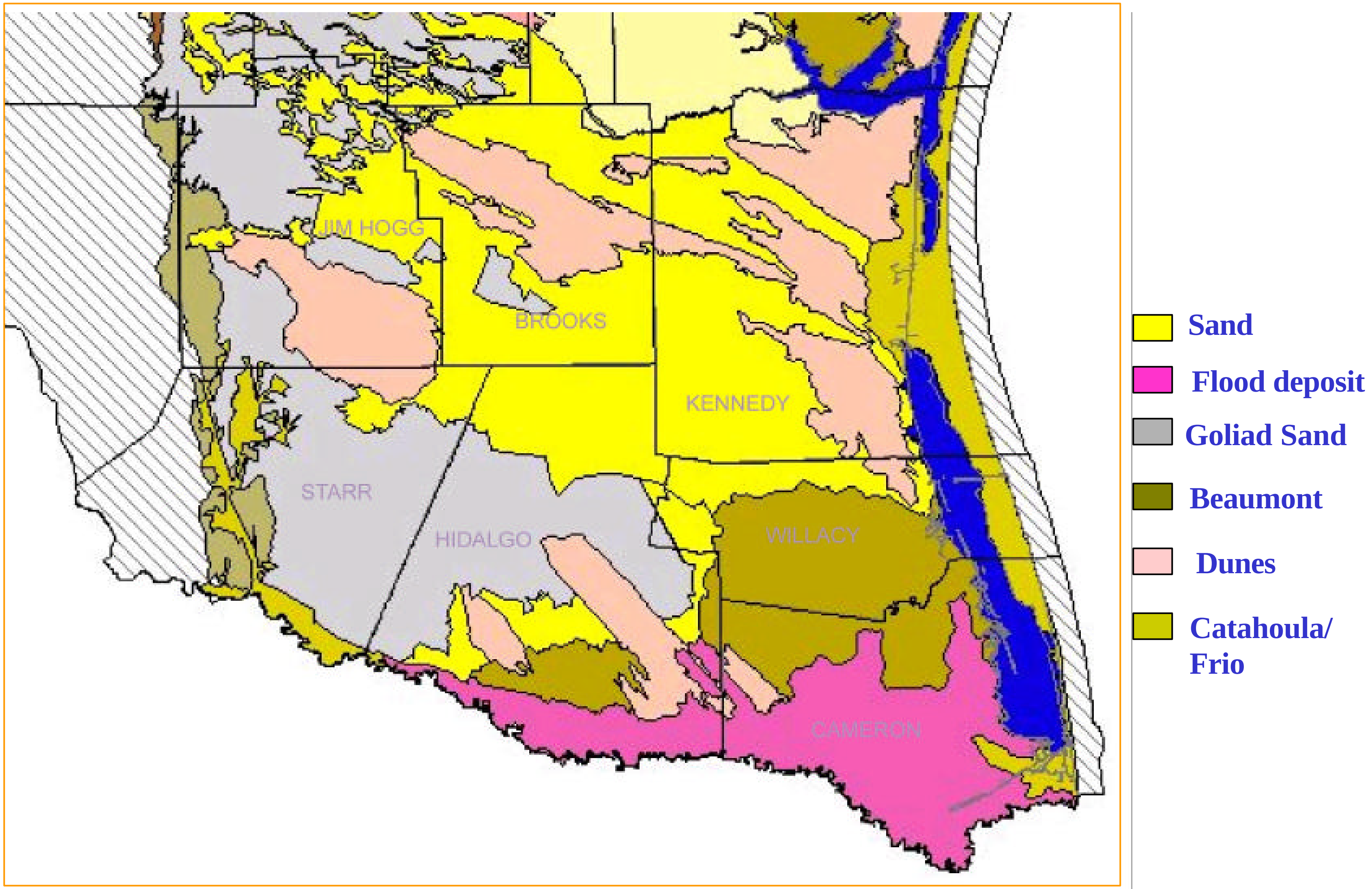
Elevation of the base of the Jasper aquifer



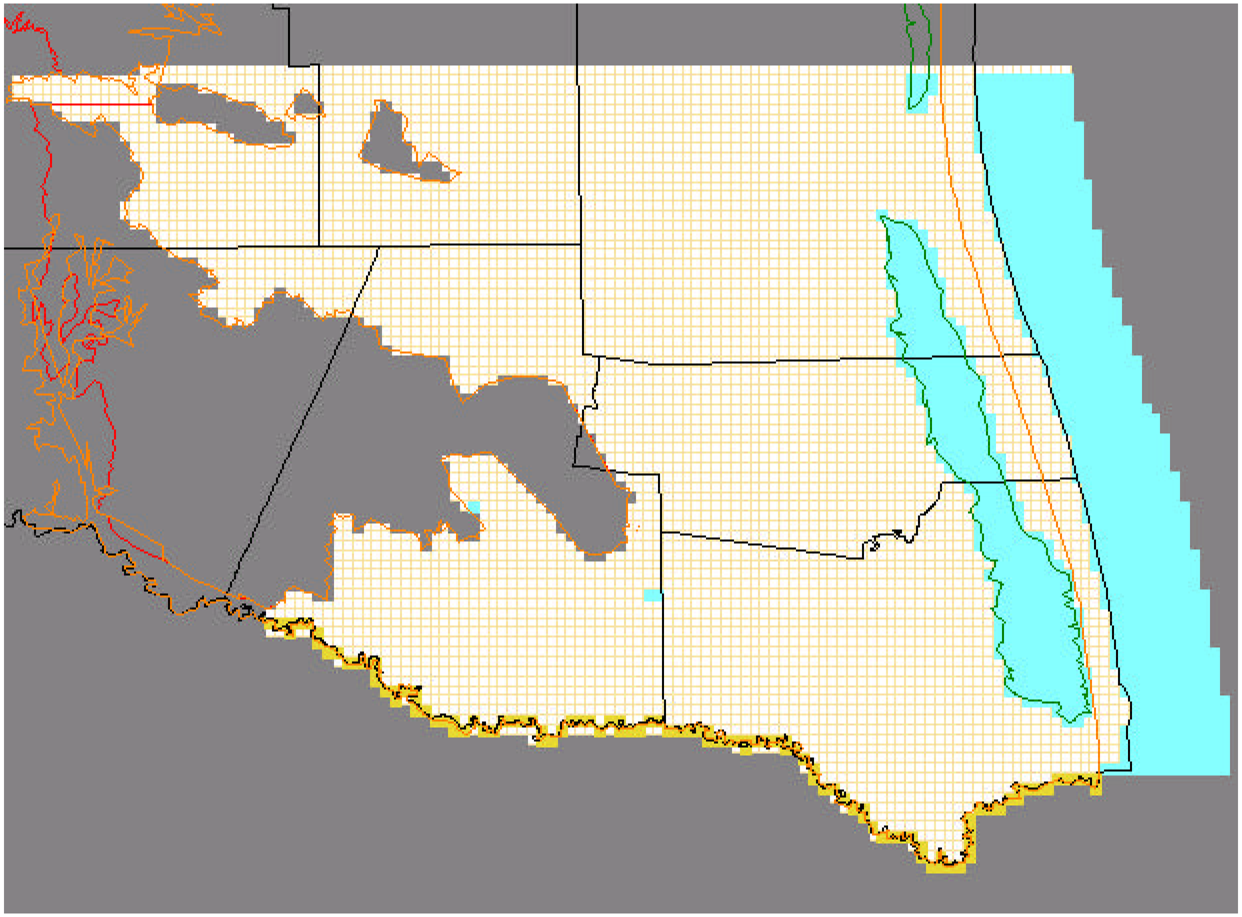
Groundwater flow system in the Lower Rio Grande Valley



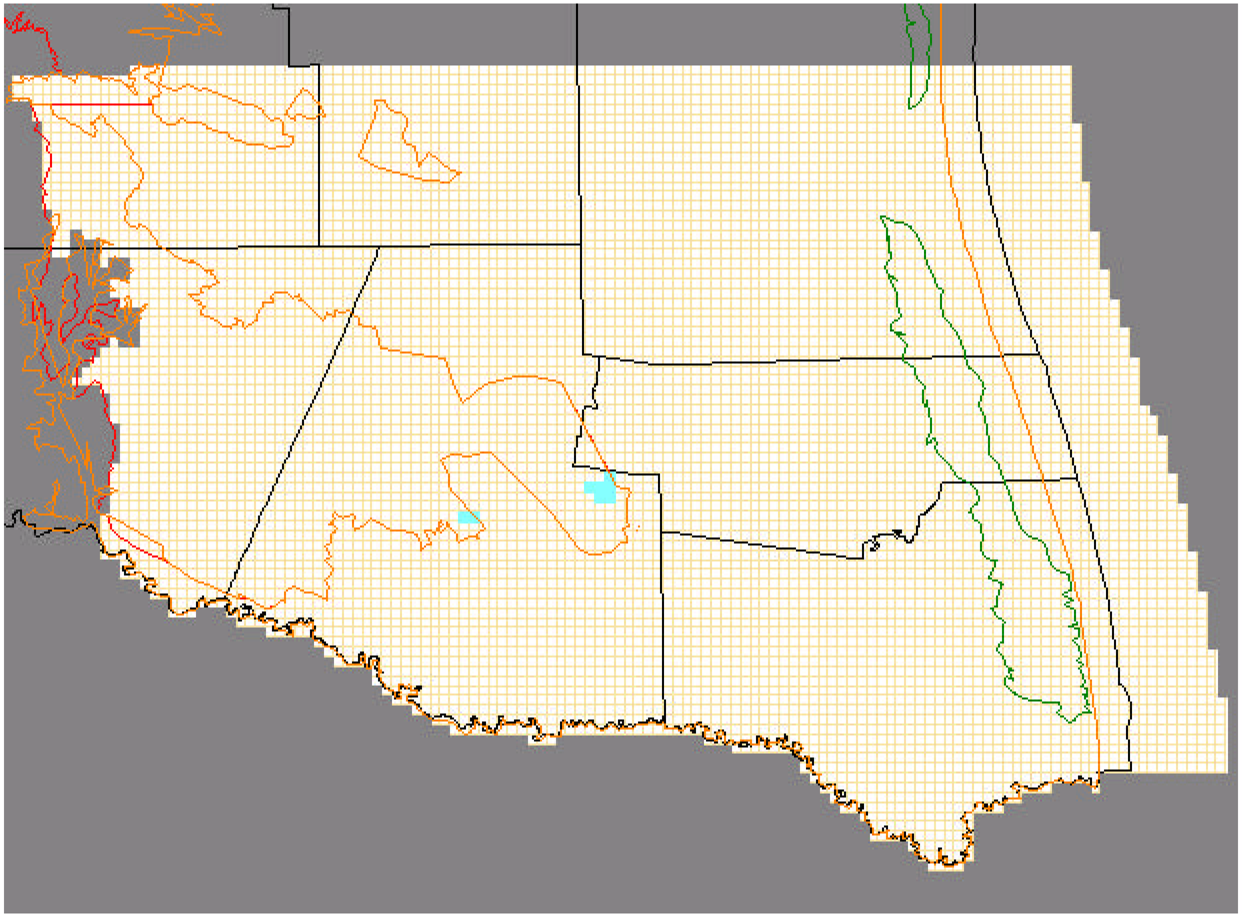
Surface Geology of the Lower Rio Grande Valley



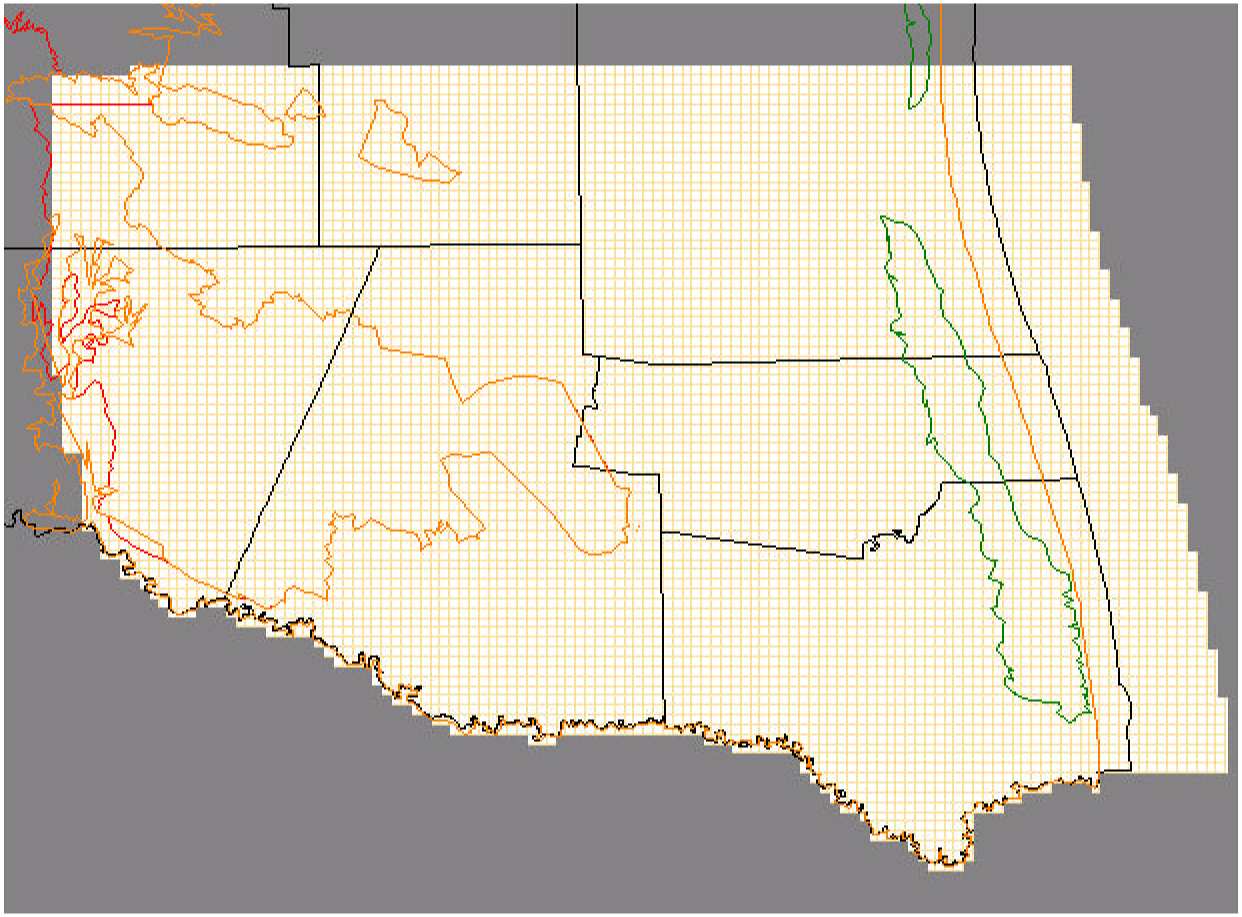
Model grid, Chicot aquifer



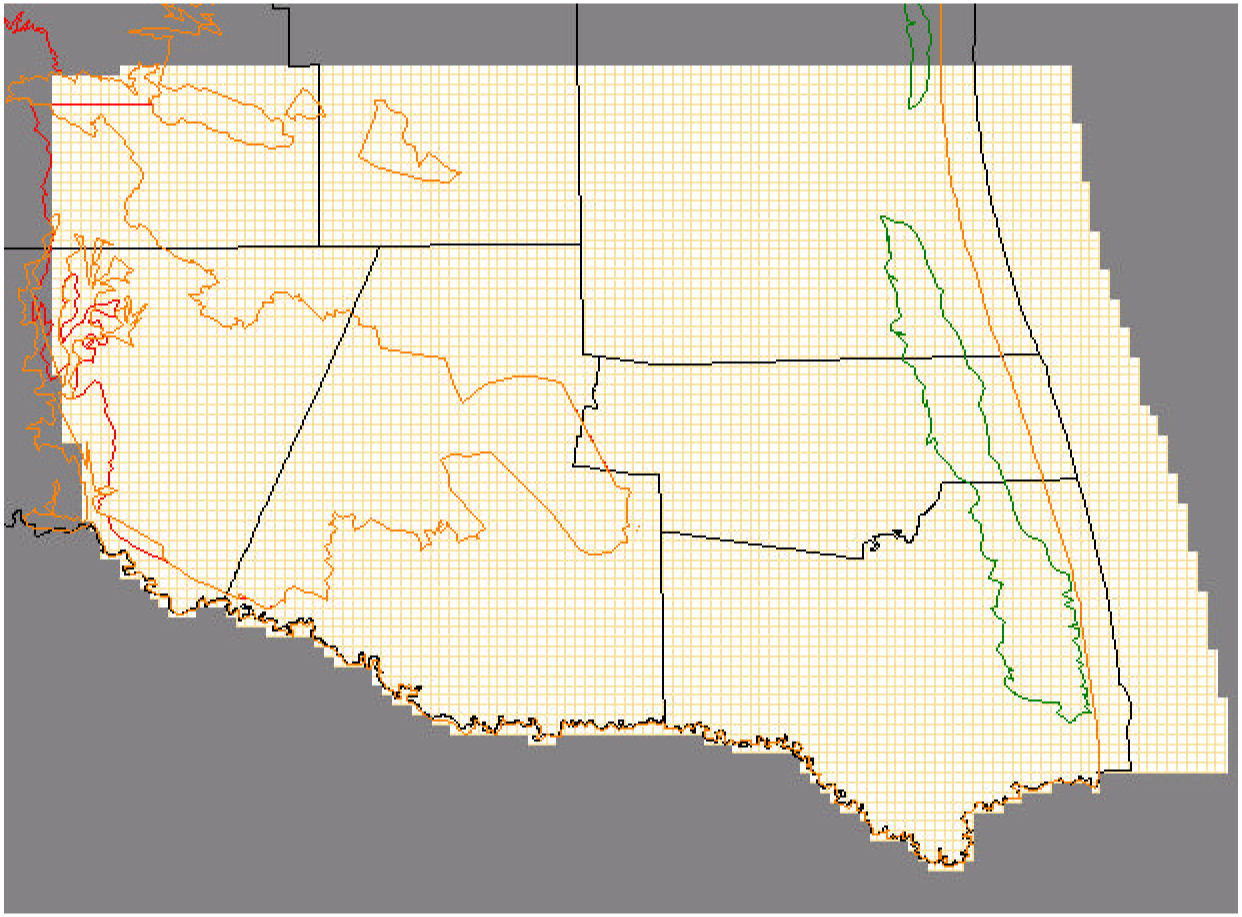
Model grid, Evangeline aquifer

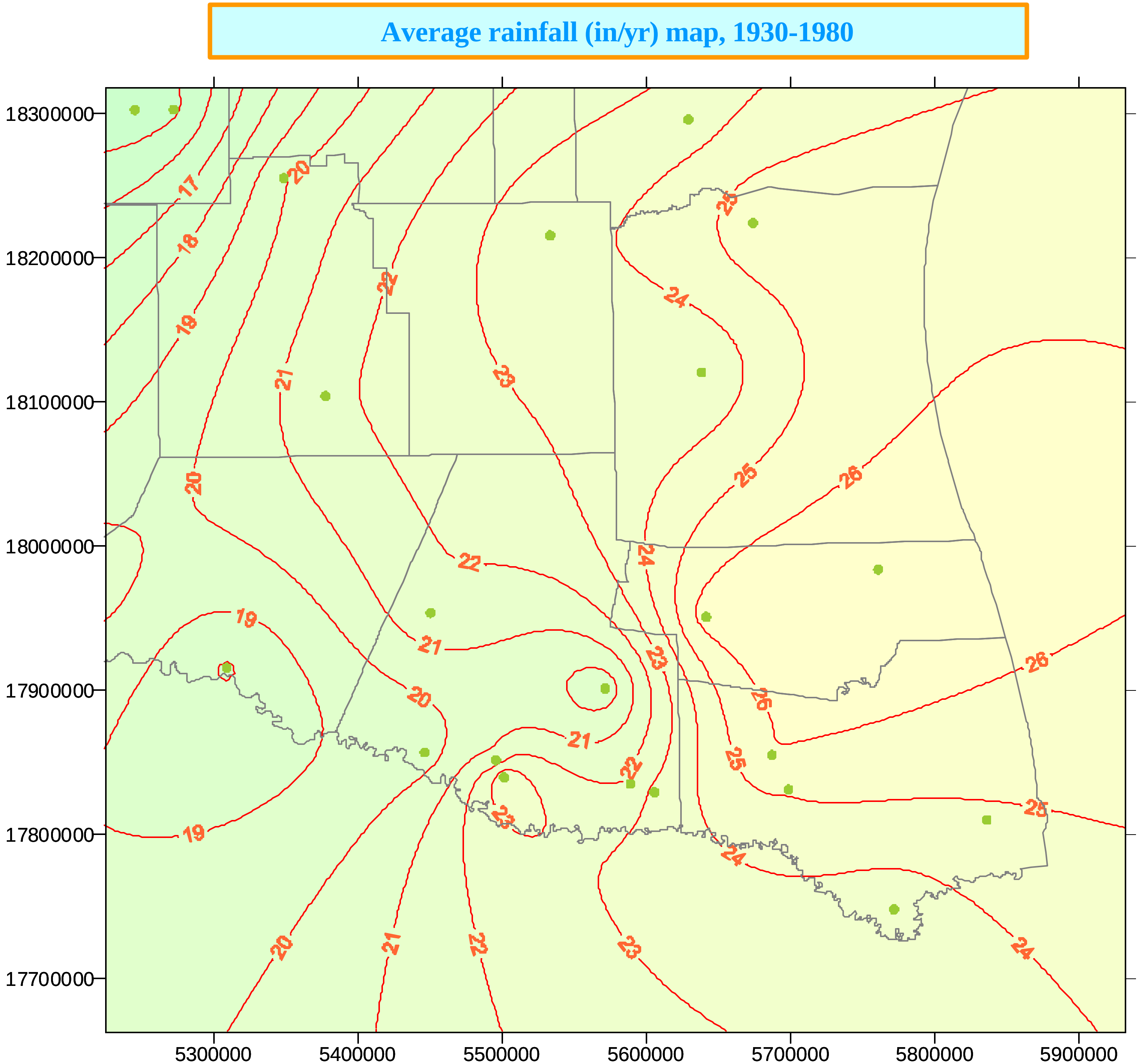


Model grid, Burkeville confining system



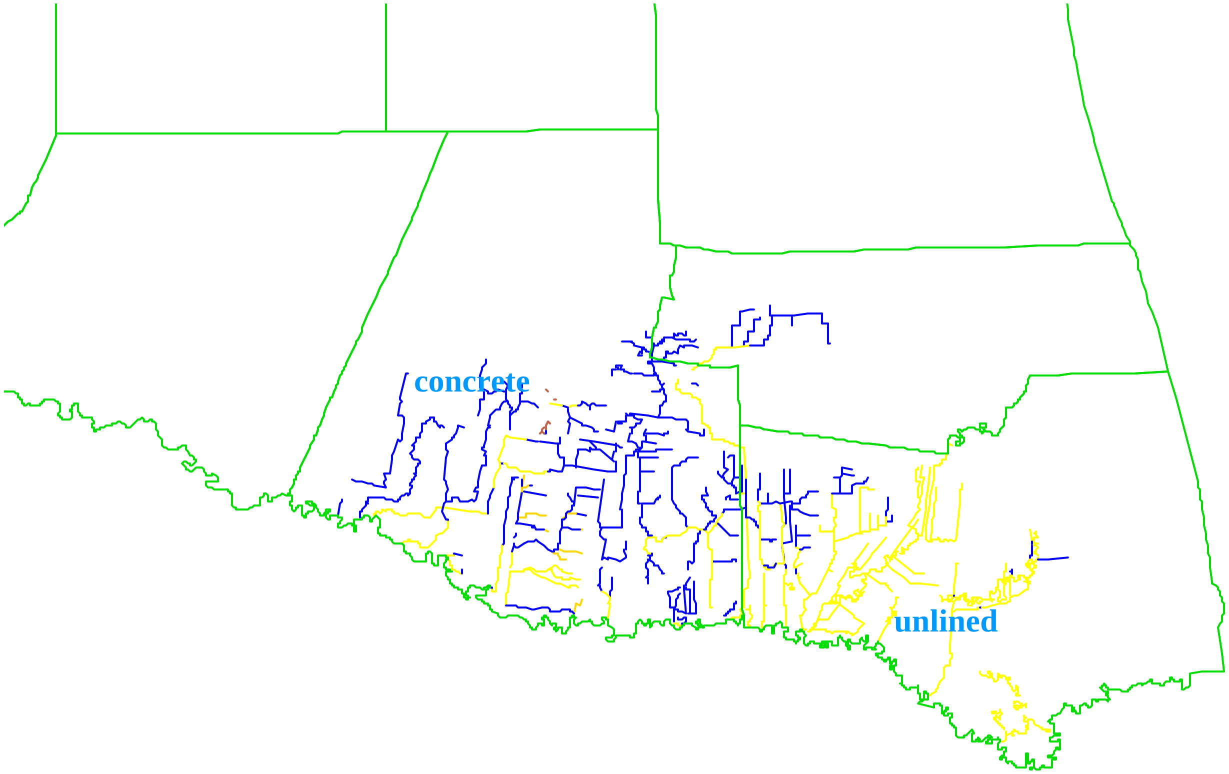
Model grid, Jasper aquifer





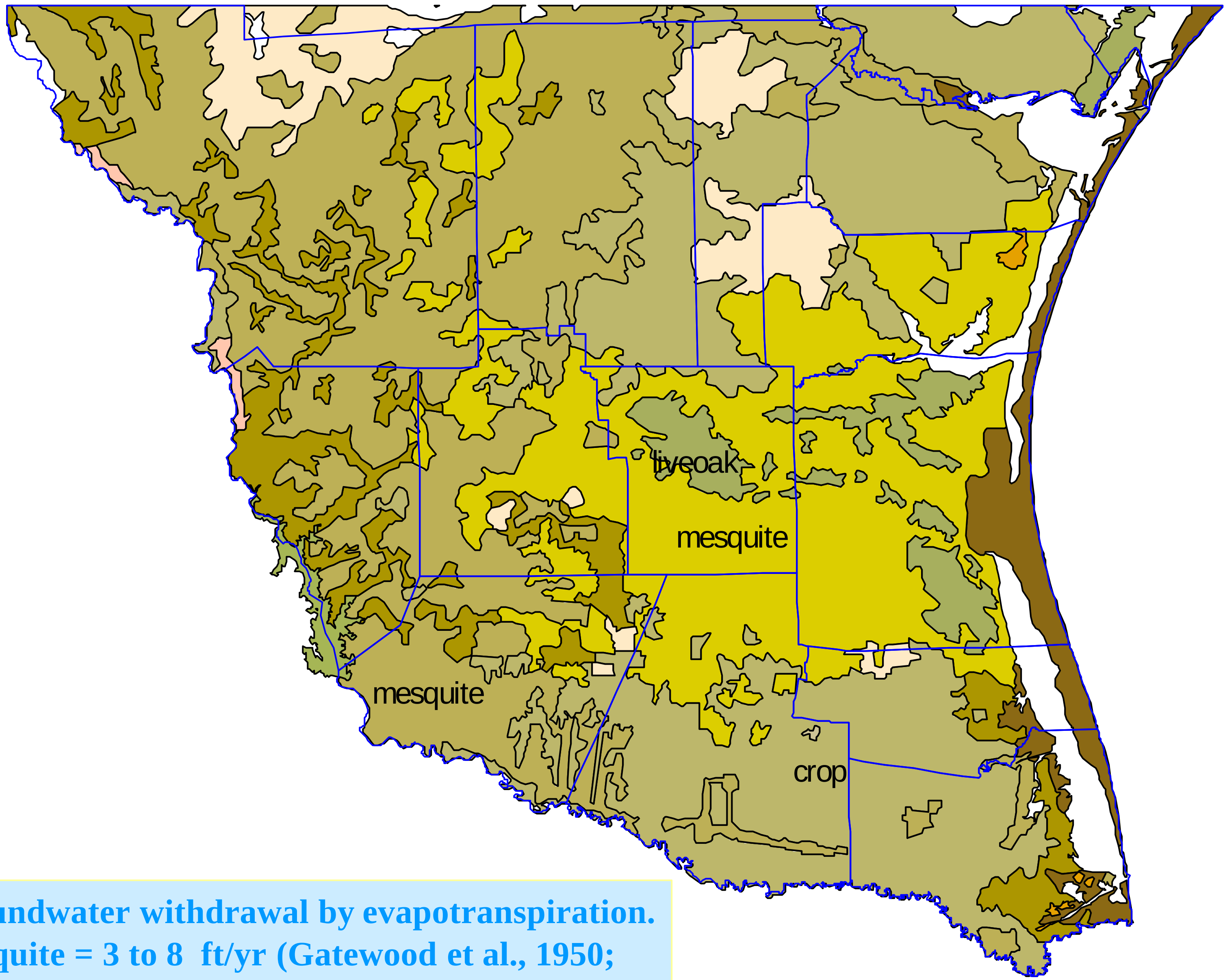
Average rainfall (in/yr) map, 1930-1980
18300000
18200000
18100000
18000000
17900000
17800000
17700000
5300000
5400000
5500000
5600000
5700000
5800000
5900000
17
18
19
20
21
22
23
24
25
26

How much water is lost into the groundwater through canals?



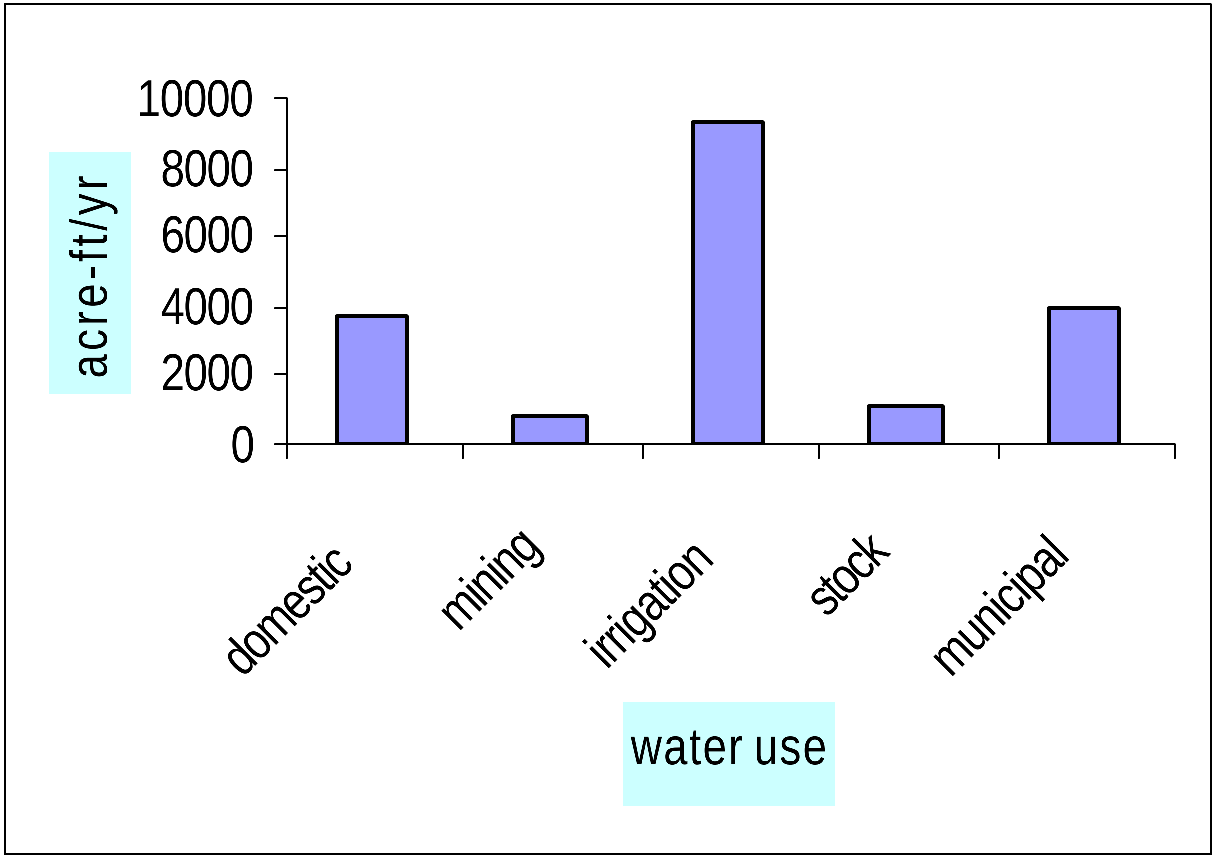
Unlined canals: 0.25 ft/d
Concrete canals: 1.37 ft/d
Rio Grande Regional Water Plan (Fipps, 2000)

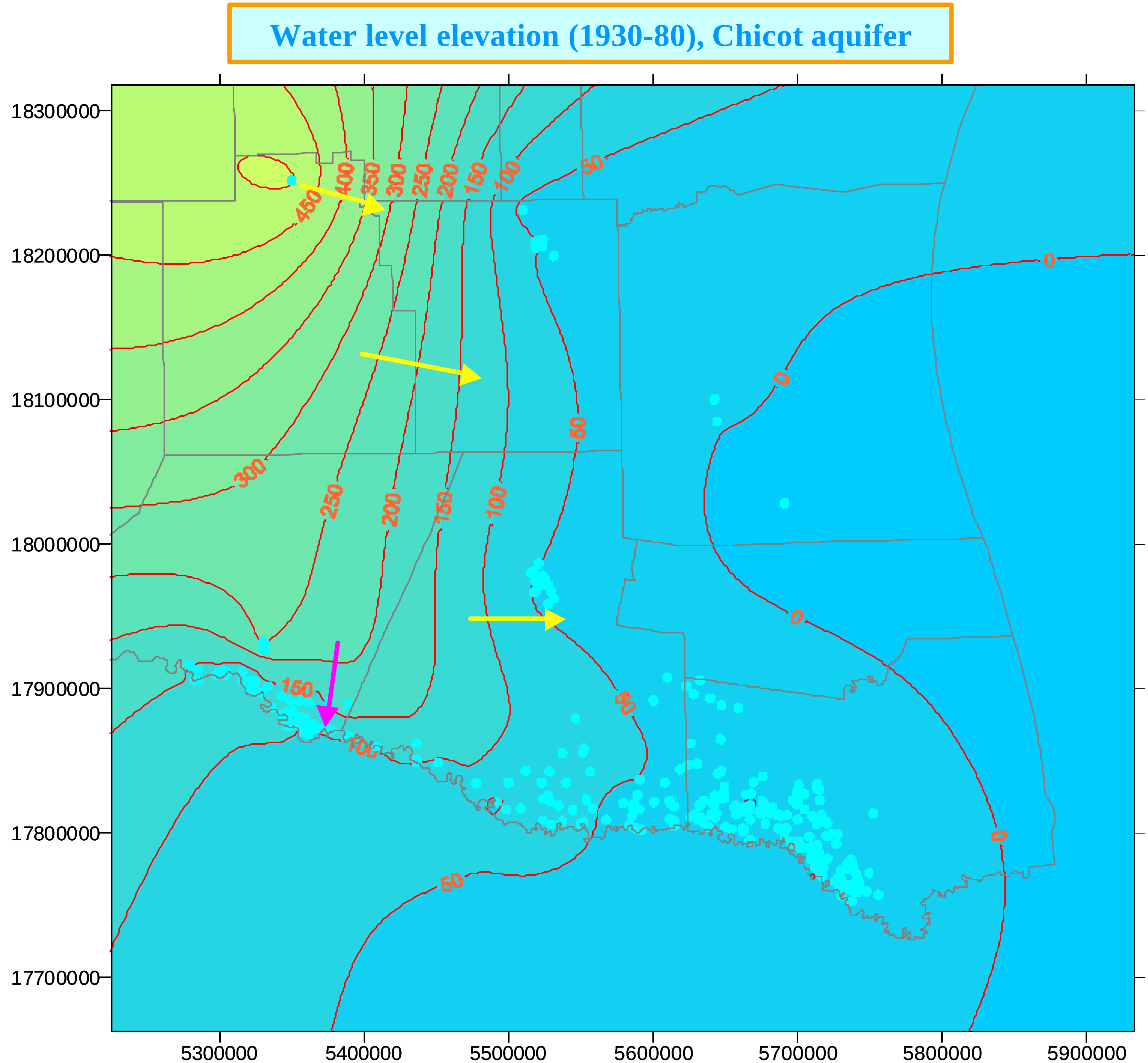
How much groundwater is extracted by Phreatophytes?



Groundwater withdrawal by evapotranspiration. Mesquite = 3 to 8 ft/yr (Gatewood et al., 1950; Anderson, 1970). Slightly higher for Salt Cedar

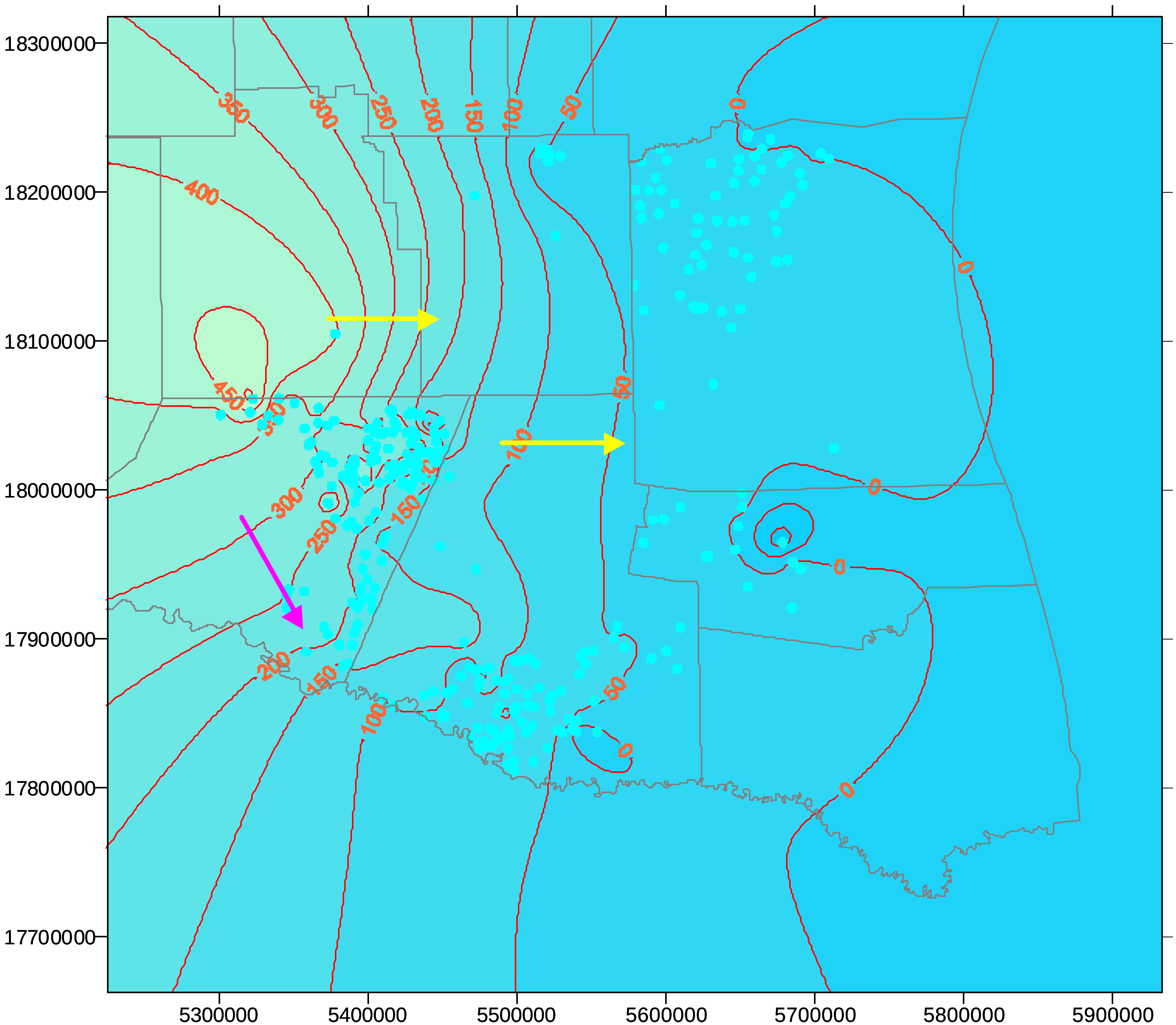
Groundwater Use 1980

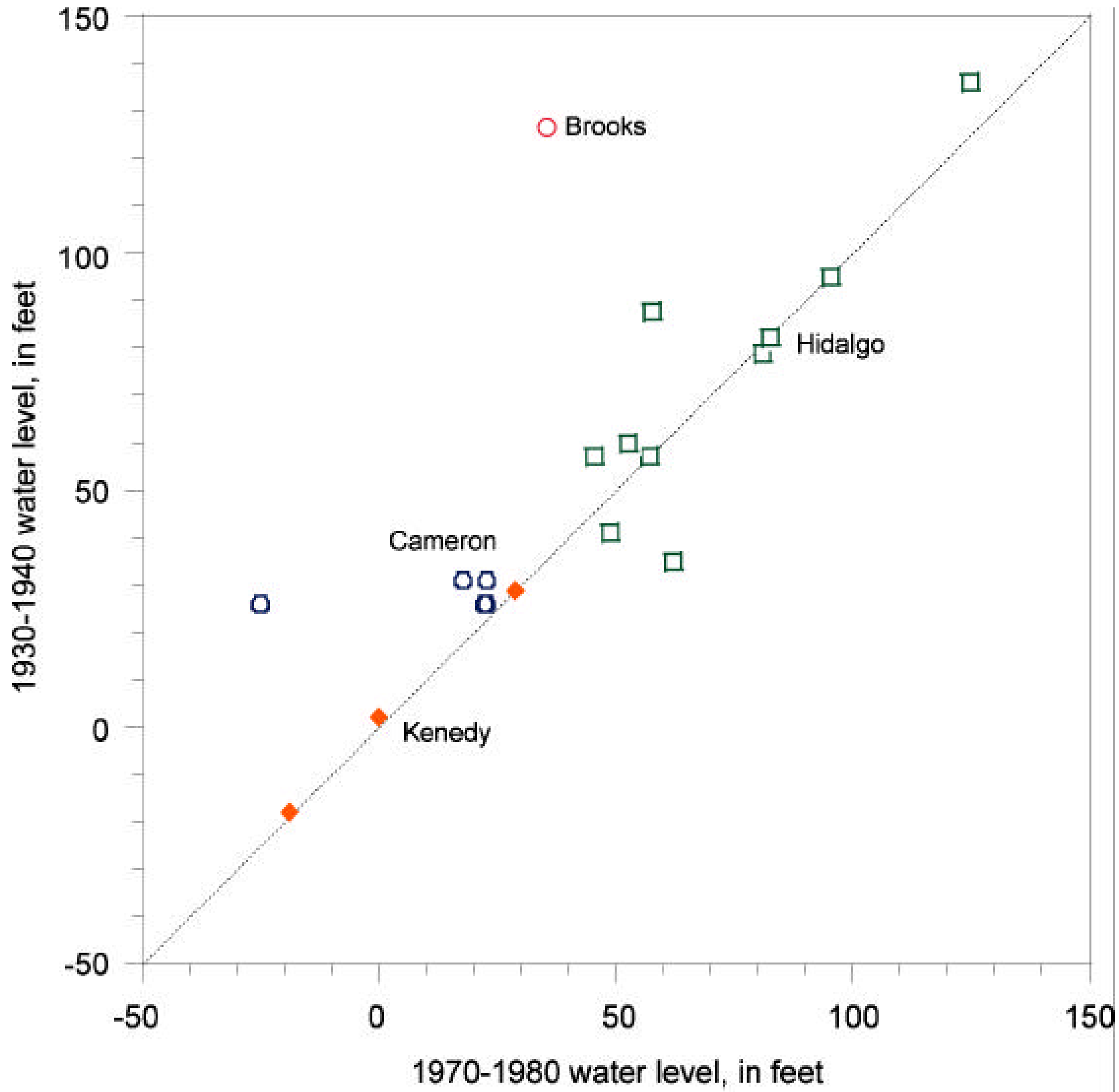




Water level elevation (1930-80), Chicot aquifer
18300000
18200000
18100000
18000000
17900000
17800000
17700000
5300000
5400000
5500000
5600000
5700000
5800000
5900000
450
400
350
300
250
200
150
100
50
0

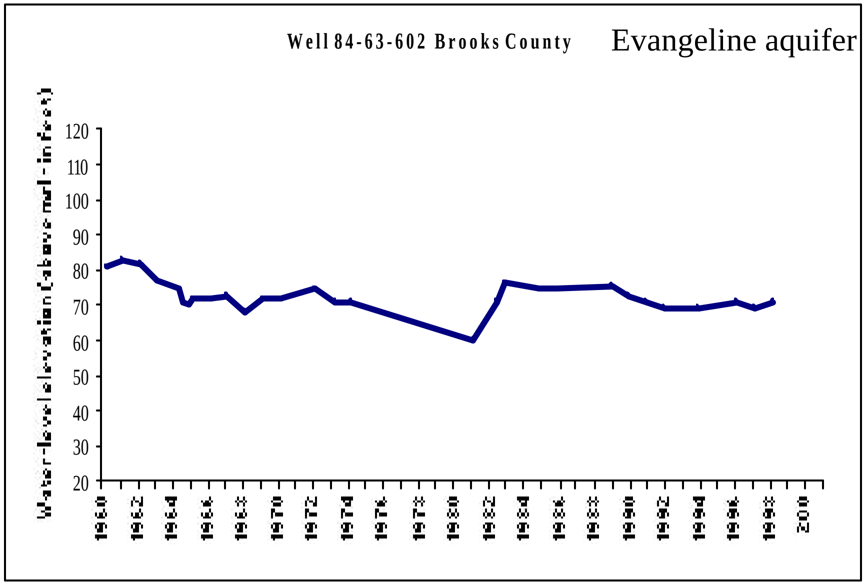
Water level elevation (1930-80), Evangeline aquifer

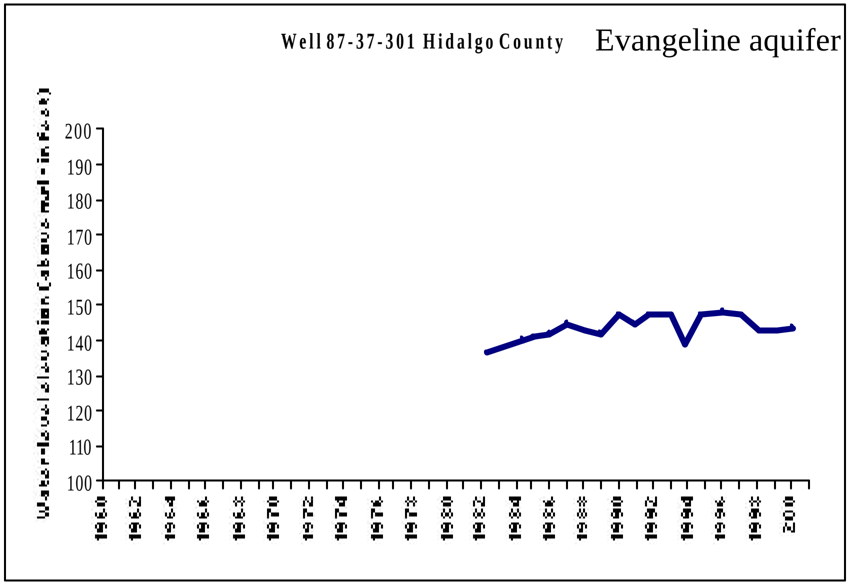


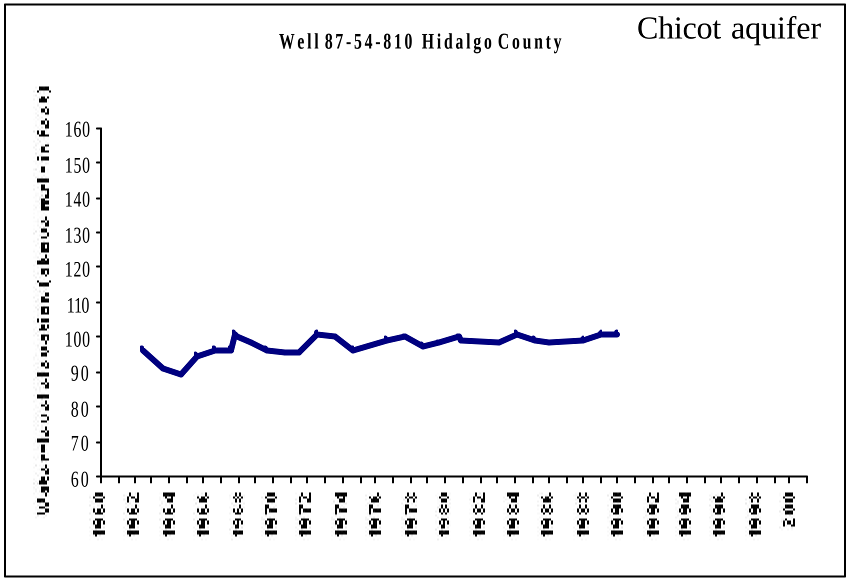


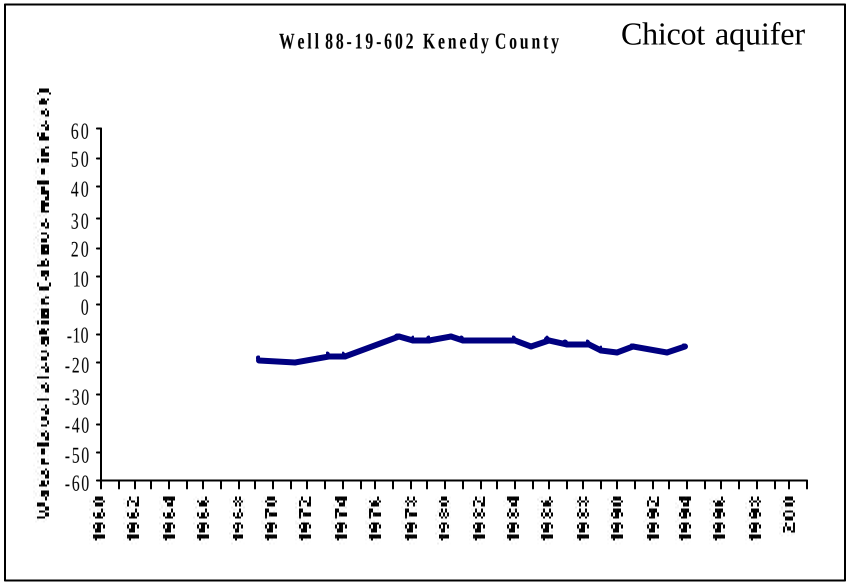
Distance between wells < 1,000 m

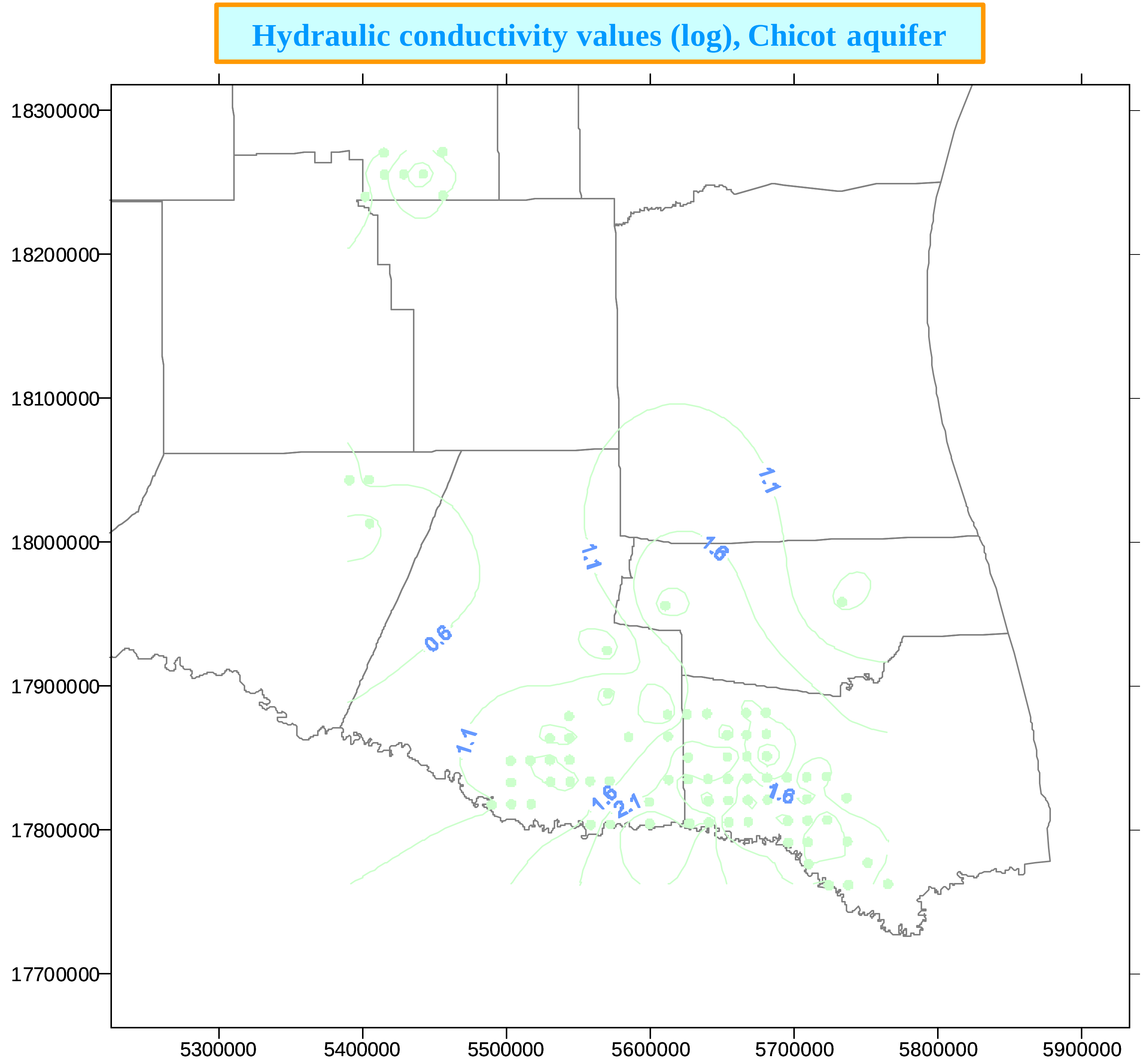
Hydrographs



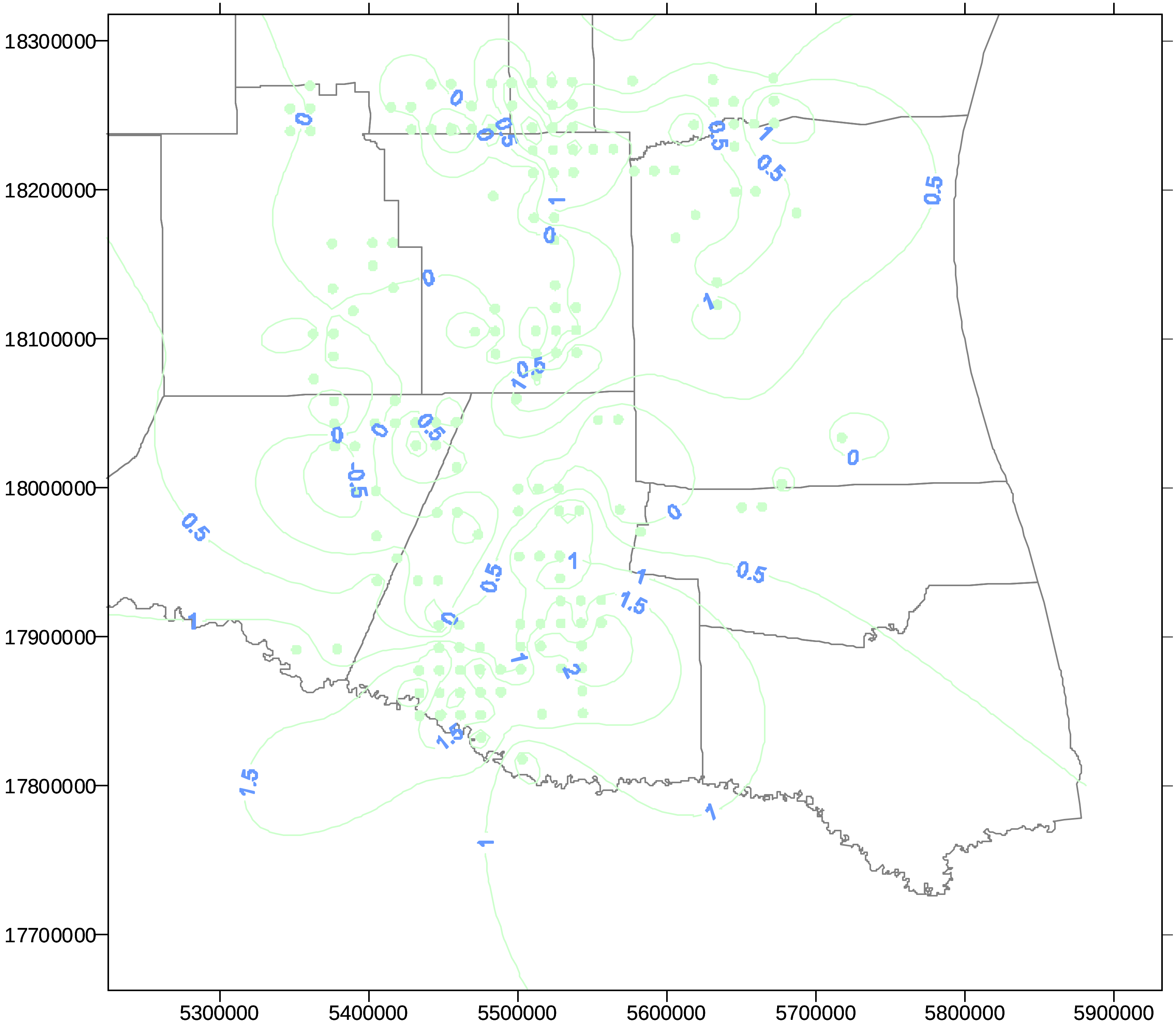




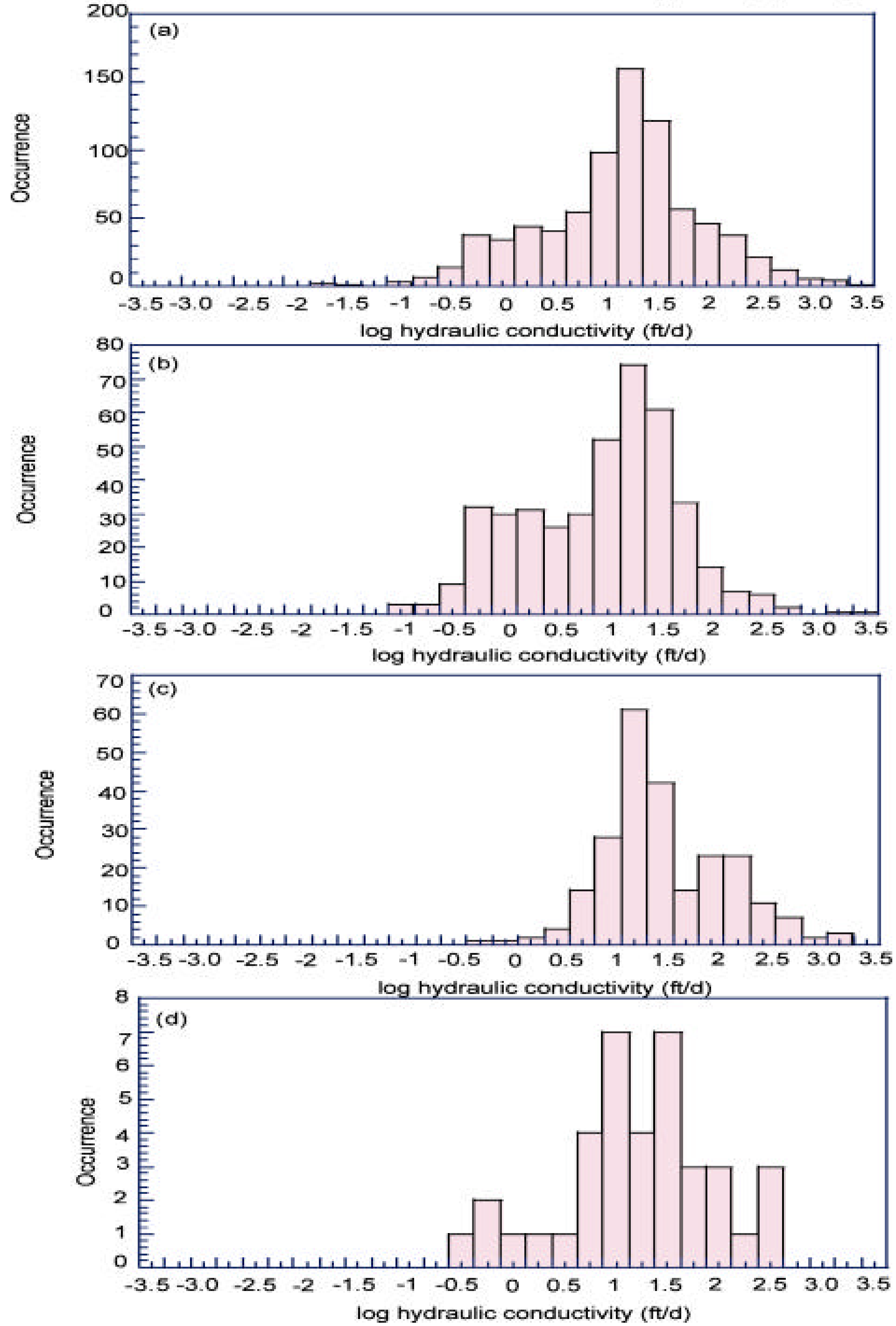



Hydraulic conductivity values (log), Chicot aquifer
18300000
18200000
18100000
18000000
17900000
17800000
17700000
5300000
5400000
5500000
5600000
5700000
5800000
5900000
1.1
1.1
1.6
0.6
1.1
1.6
2.1
1.6

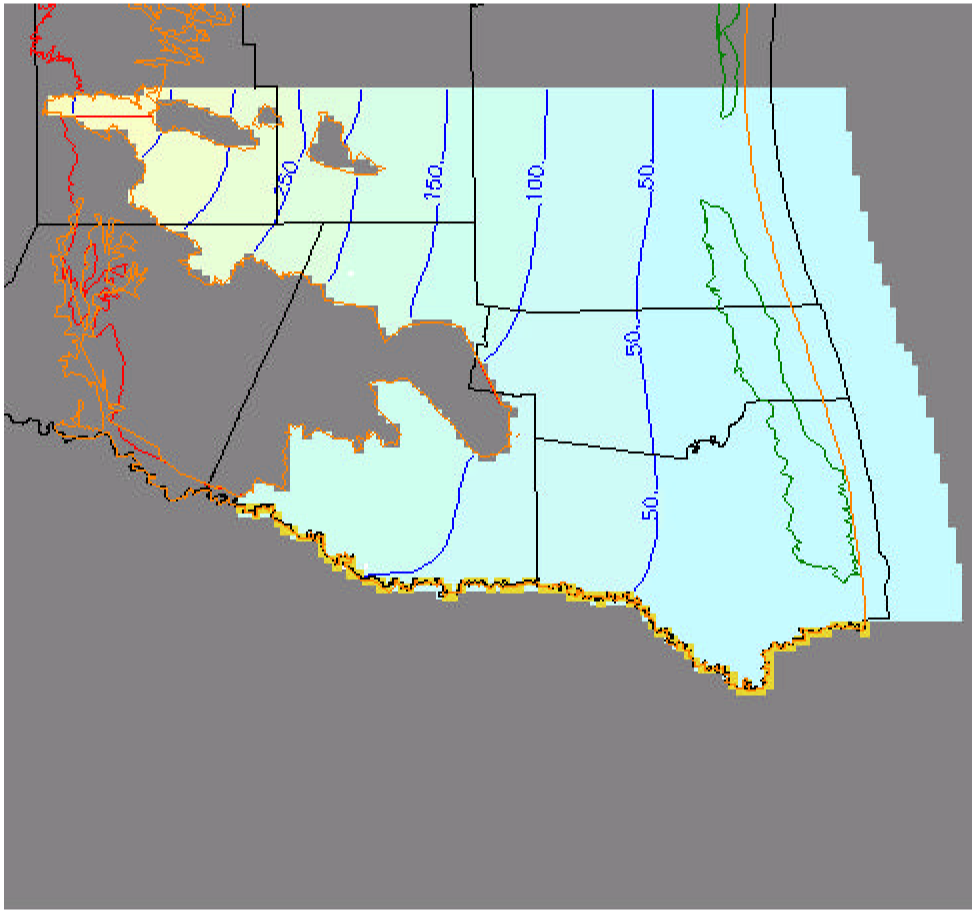
Hydraulic conductivity values (log), Evangeline aquifer



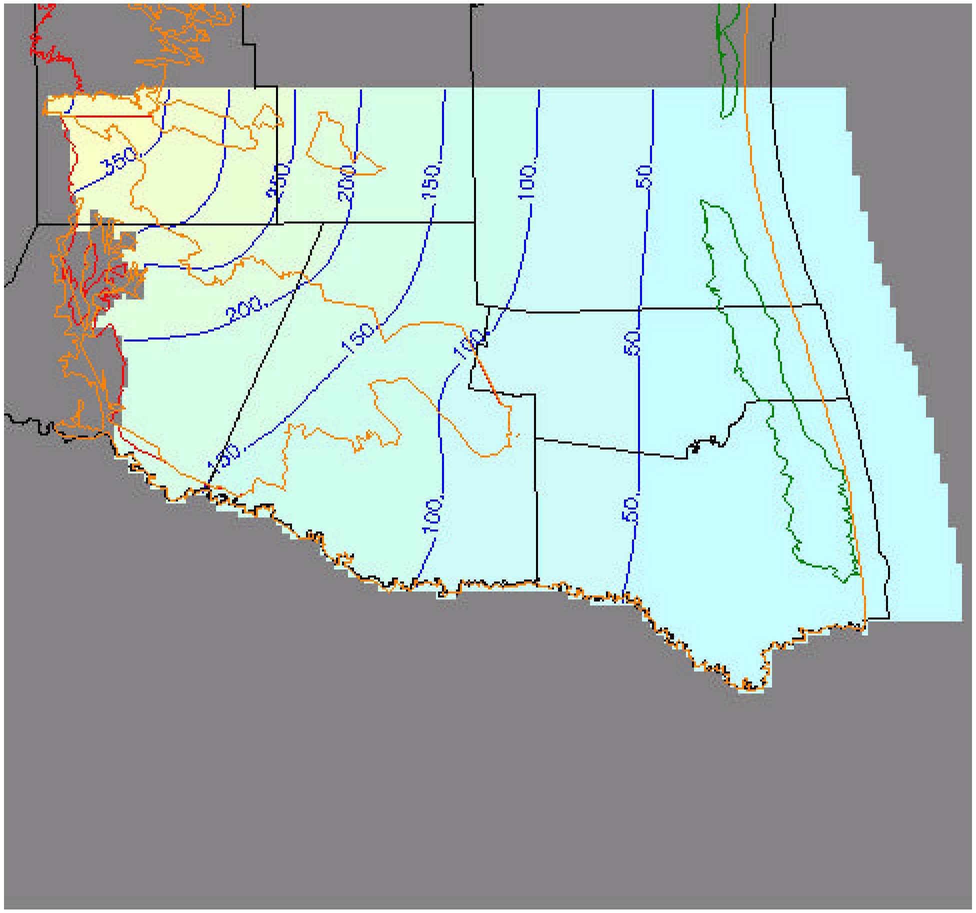
(a) total, (b) evangeline (c) chicot (d) chicot-evangeline



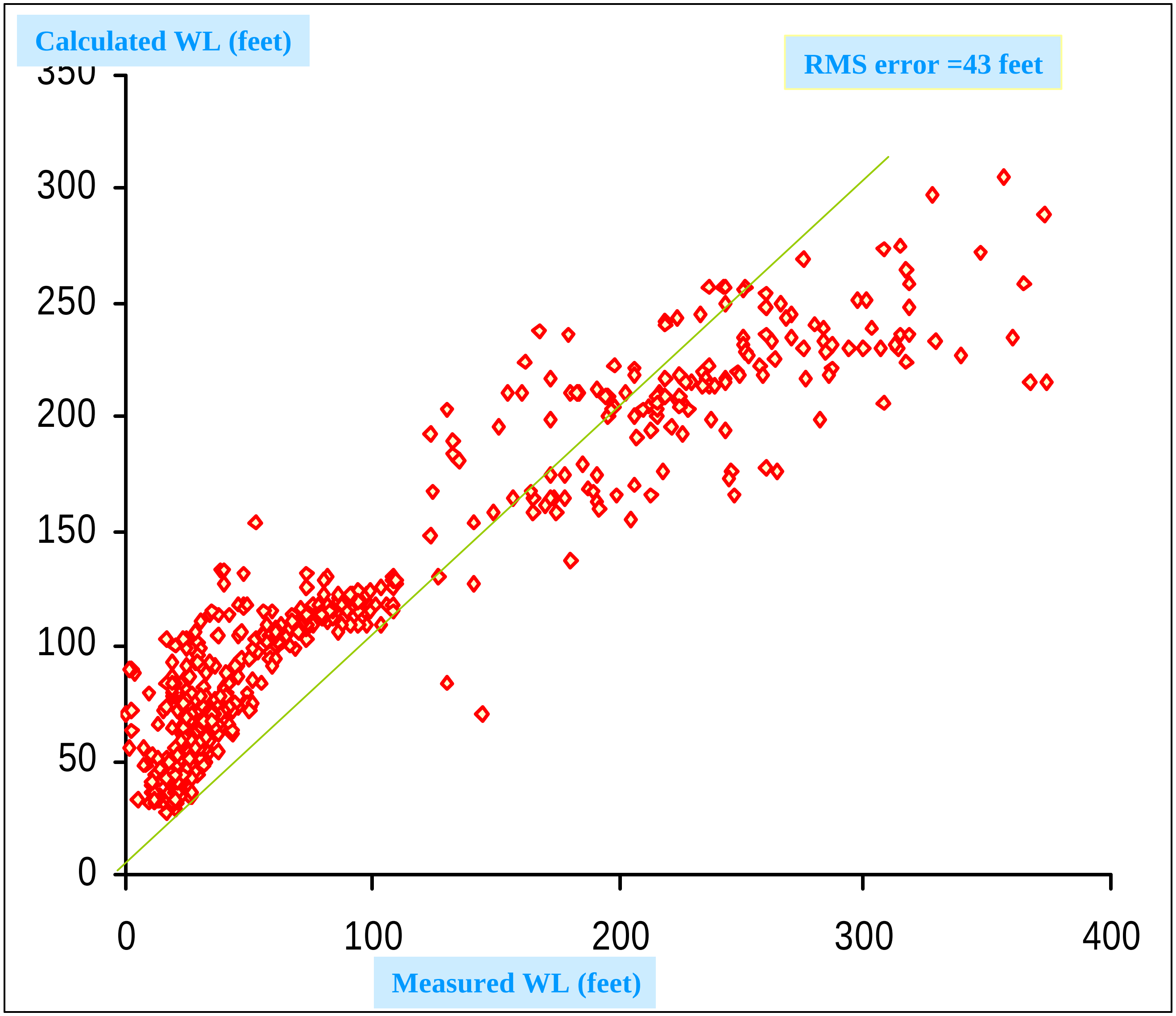
Initial results:Simulated water level in the Chicot aquifer

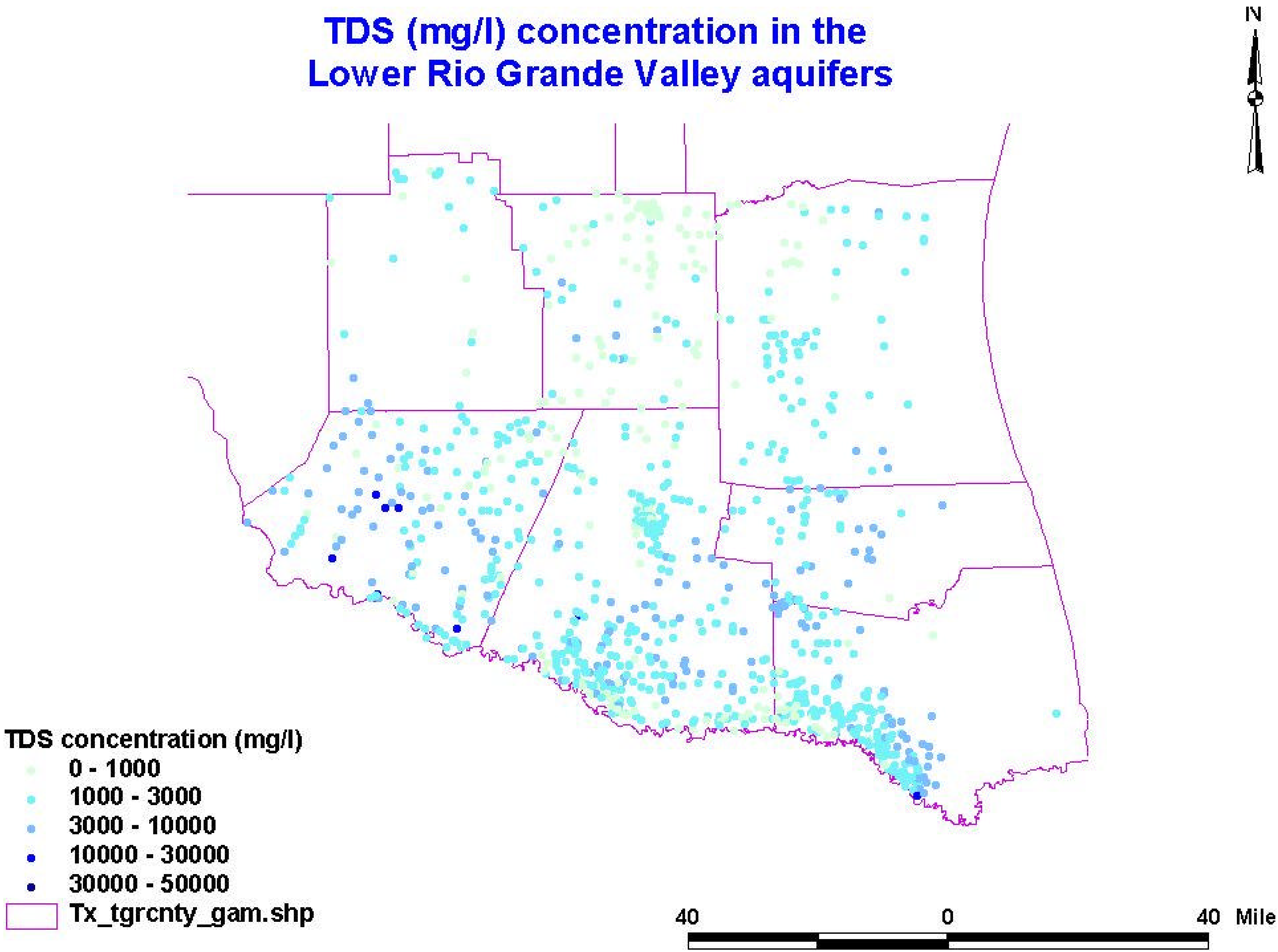


Initial results:Simulated water level in the Evangeline aquifer

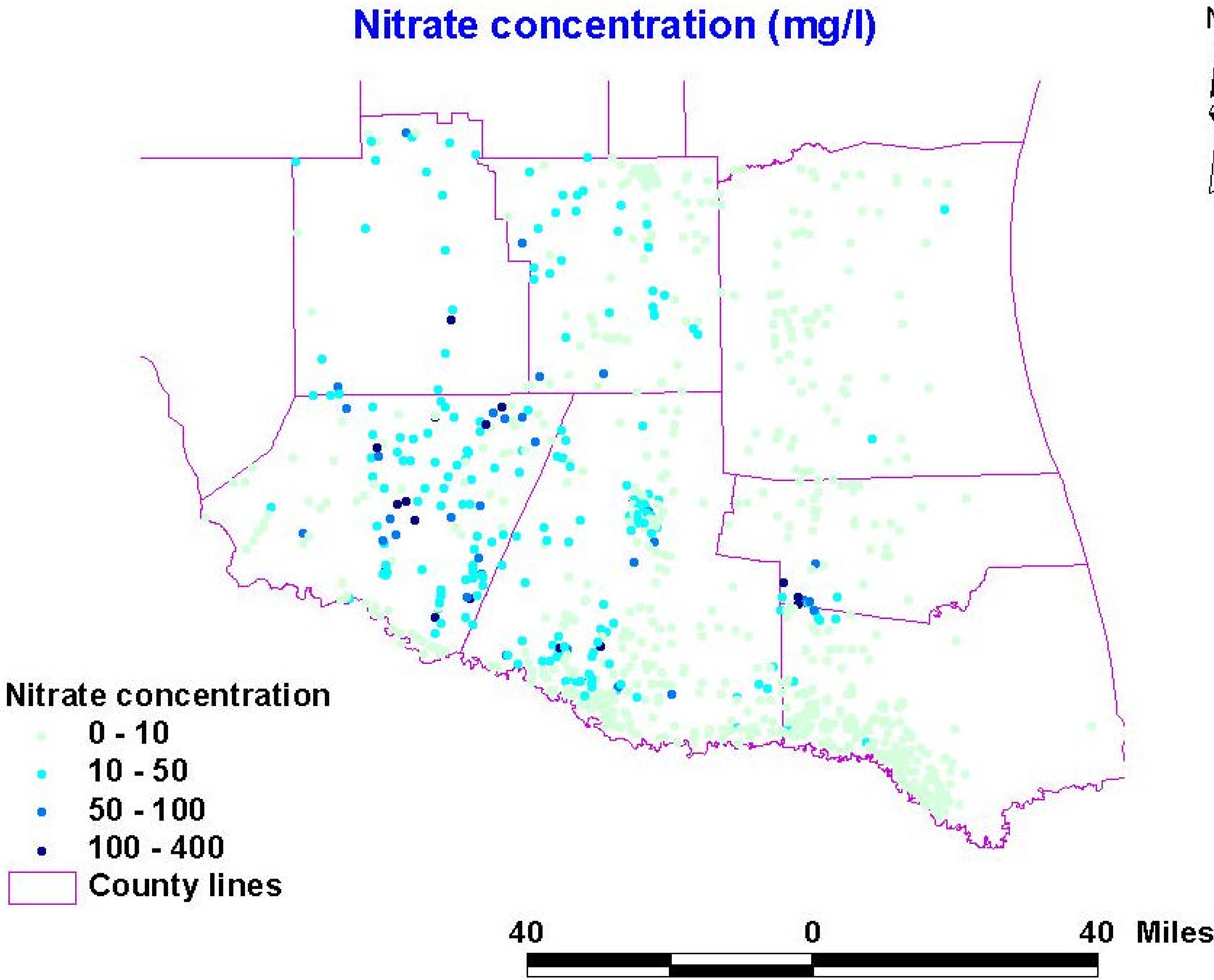


Cross plot of measured vs. simulated heads





TDS (mg/l) concentration in the
Lower Rio Grande Valley aquifers
N
TDS concentration (mg/l)
0 - 1000
1000 - 3000
3000 - 10000
10000 - 30000
30000 - 50000
Tx_tgrcnty_gam.shp
40
0
40 Mile


Nitrate concentration (mg/l)
N
Nitrate concentration
0 - 10
10 - 50
50 - 100
100 - 400
County lines
40
0
40 Miles

TEXAS WATER DEVELOPMENT BOARD

Southern Gulf Coast Stakeholder Attendance list
August 30, 2001

Name	**Affiliation**
Roberto Gonzalez	City of Eagle Pass
Lee Kirkpatrick	Region M/ Texas State Bank
Robert Fulbright	Executive Committee
Mary Lou Campbell	Sierra Club, Lone Star Chapter
Ray Prewett	Texas Citrus Mutual
Charles Browning	North Alamo Water Supply Corporation
Richard Preston	Texas Water Development Board
Ali Chowdhury	Texas Water Development Board
Robert Flores	Texas Water Development Board
G. Carlos Garza	Public
Gordon B. Hill	Bayview Irrigation District
Tomas M. Rodriguez	Webb County Engineering
Ignacio Diaz	El Diario
Xavier Tavy Williamson	Zapata County
Sonny Hinojosa	Hidalgo County irrigation District #2
John Bruciak	
Felipe Chaleas	CILA
Rick Reyes	US IBWC
Randy Blankmanship	TPWD
Roberto Rames	IBWC-Laredo Office
Jaime Gomez	Central Power and Light
Adrian Montemoyer	
Richard Peace	US IBWC
Paul Garza Valdez	Jad de Matamoros Tam/Comada N. Laredo
Patricio Salinas	KVTV-Ch13
Marisa R. Limon	KLDO27
Bill Norris	NRS
Stephanie Mata	
Ken Rakestraw	
Glenn Jarvis	Law Offices of Glenn Jarvis
M. Martinez	Webb County Judge
Jack Nelson	Rio Grande Valley Sugar Growers
Donald McGhee	Hydro Systems Inc.
Jorge Trevino	
Oscar Garza	Hidalgo County

<u>Discussion at the Stakeholder Advisory Forum for the southern Gulf Coast aquifer Groundwater Availability Model, August 30, 2001</u>

Question: How much water is lost through lined vs. unlined canals?

Response: More water is lost through the lined canals than the unlined canals because of cracks in the joints. This is not very intuitive but is the case. The unlined canals probably accumulate fines at the bottom reducing infiltration into the groundwater. Referred to investigation results by Dr. Fipps from Texas A&M.

Comments: It was suggested by one stakeholder that the Canal loss data as presented in Texas A&M report should not be included as is due to large variability of seepage across the irrigated areas.

Question: When the drilling investigation will be carried out to verify results of the UT-BEG geophysical investigation?

Response: A plan is in place to drill a number of boreholes in Faysville and Stockholm area. These boreholes should test the water quality in the favored target areas. The boreholes will probably be drilled with assistance from the federal Bureau of Reclamation in early 2002.

Question: More water flow through areas of high hydraulic conductivity?

Response: Yes. Hydraulic conductivity in part determines transmission capability of the aquifer media.

Question: If we plant additional mesquite, will it compete for more of our groundwater resources?

Response: Additional mesquites will definitely compete for the existing groundwater. Mesquite has deep root system sometimes reaching up to 80 feet. Essentially they are acting as groundwater wells. Mesquite can extract up to 95% of the precipitation in riparian and in lesser amounts in upland areas.

Comments: Some stakeholders suggested that the Evapo-Transpiration (ET) rates for mesquite (3-8 ft/yr) may be realistic adding that they observe similar ET rates for some other crops in the valley.