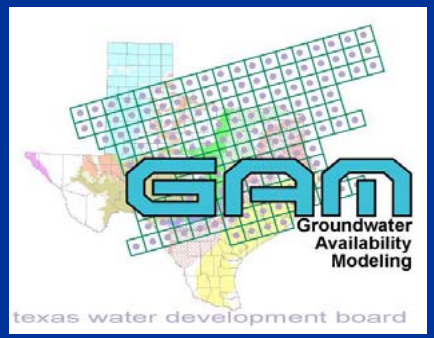
Hill Country Portion of the Trinity Aquifer System Groundwater Availability Model: Update



Ian C. Jones, Ph.D., P.G.

Texas Water Development Board

December 12, 2006

OUTLINE

- Introduction
- Overview of Trinity-Hill Country Aquifer
- Conceptual model GAM schedule
- Steady-state model
- Project schedule

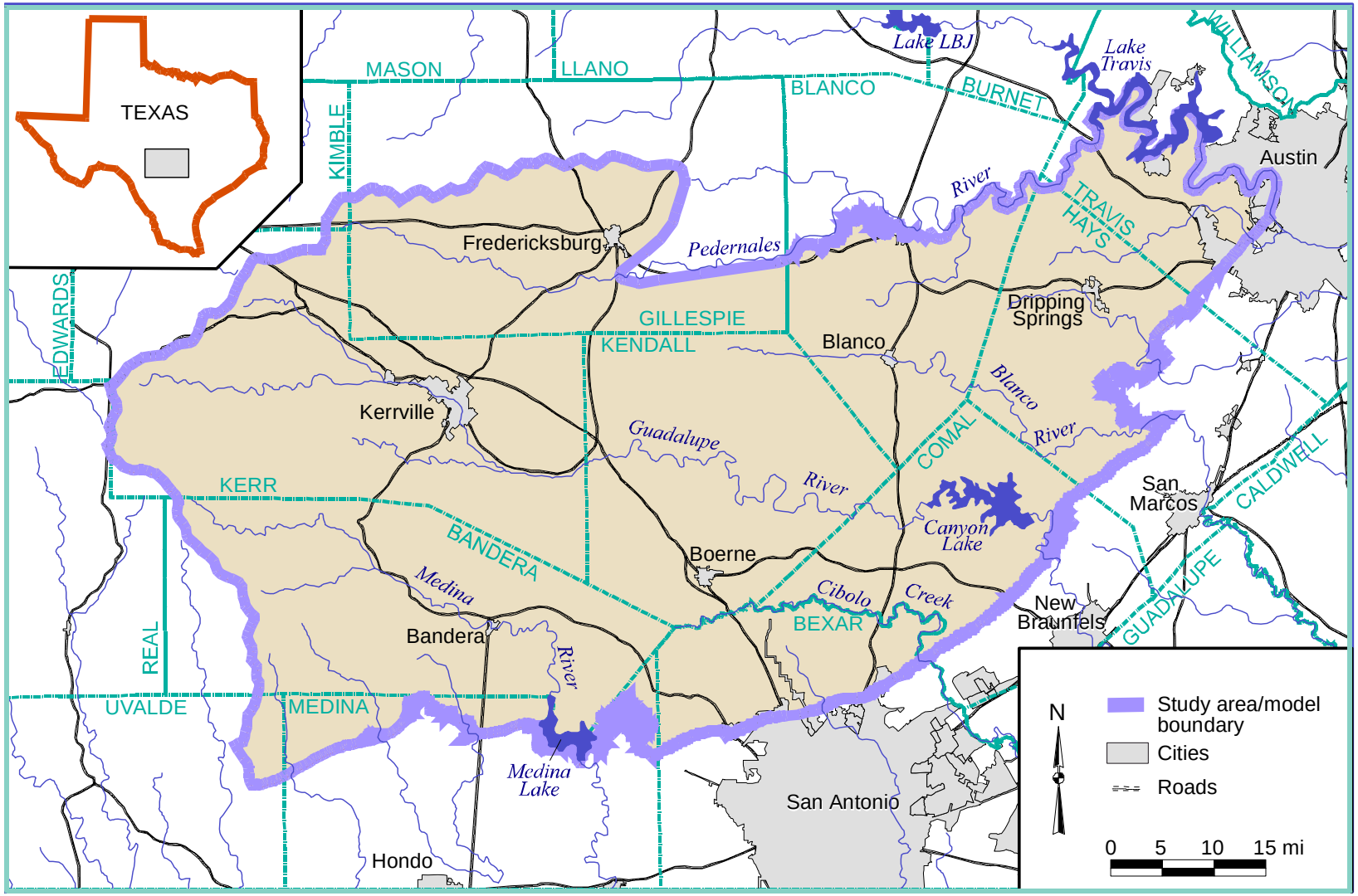
UPDATE ISSUES

- Meeting GAM standards
  - Map projection
  - Stress periods
- Adding Lower Trinity
- Adjust structure
- Redistribution of pumping
- Recharge distribution

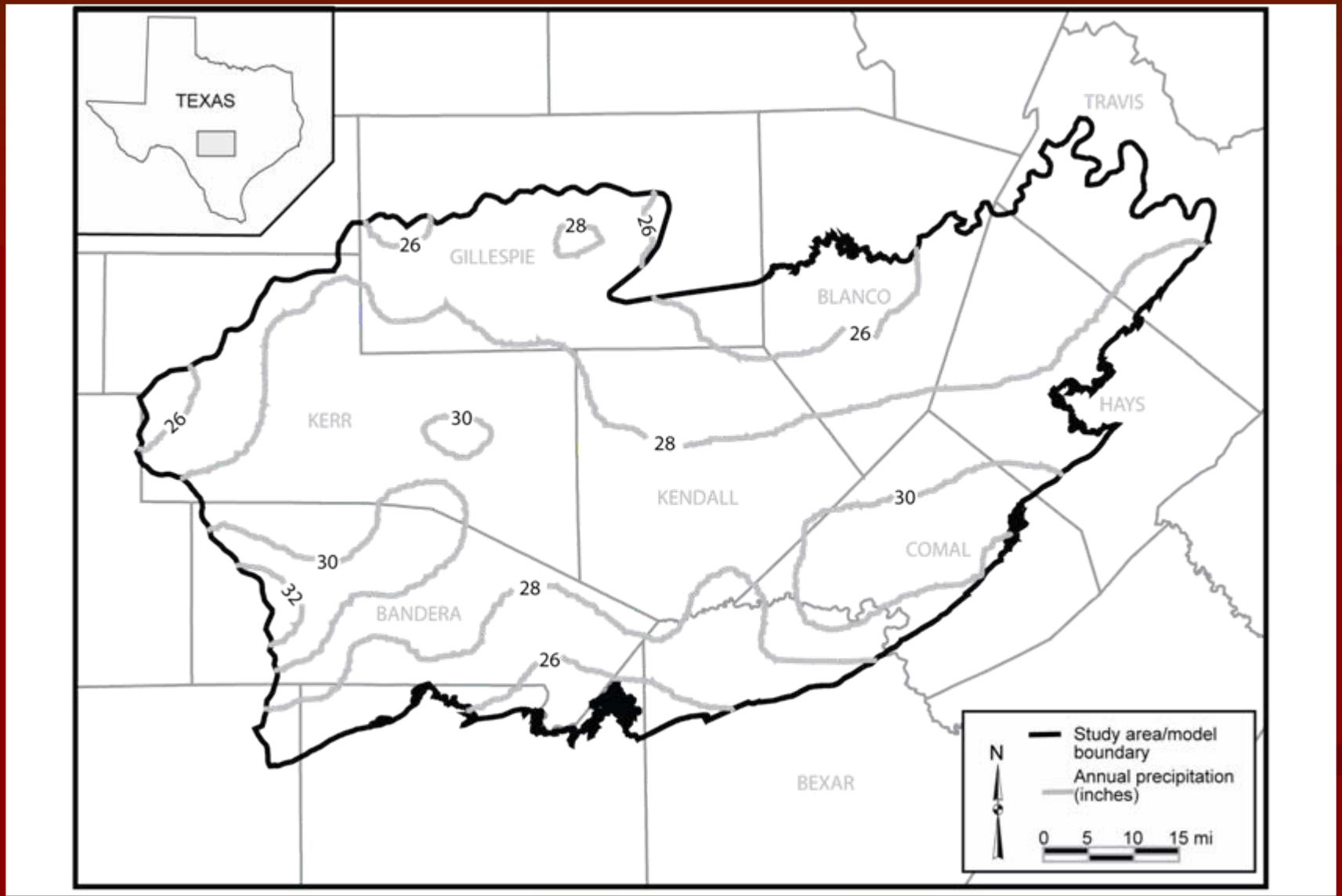
THE MODEL AT A GLANCE

- Hill Country area.
- Includes: (1) Edwards Group in plateau,
  (2) Upper Trinity aquifer,
  (3) Middle Trinity aquifer.
  (4) Lower Trinity aquifer.
- Considers geology, recharge, rivers, and pumping.

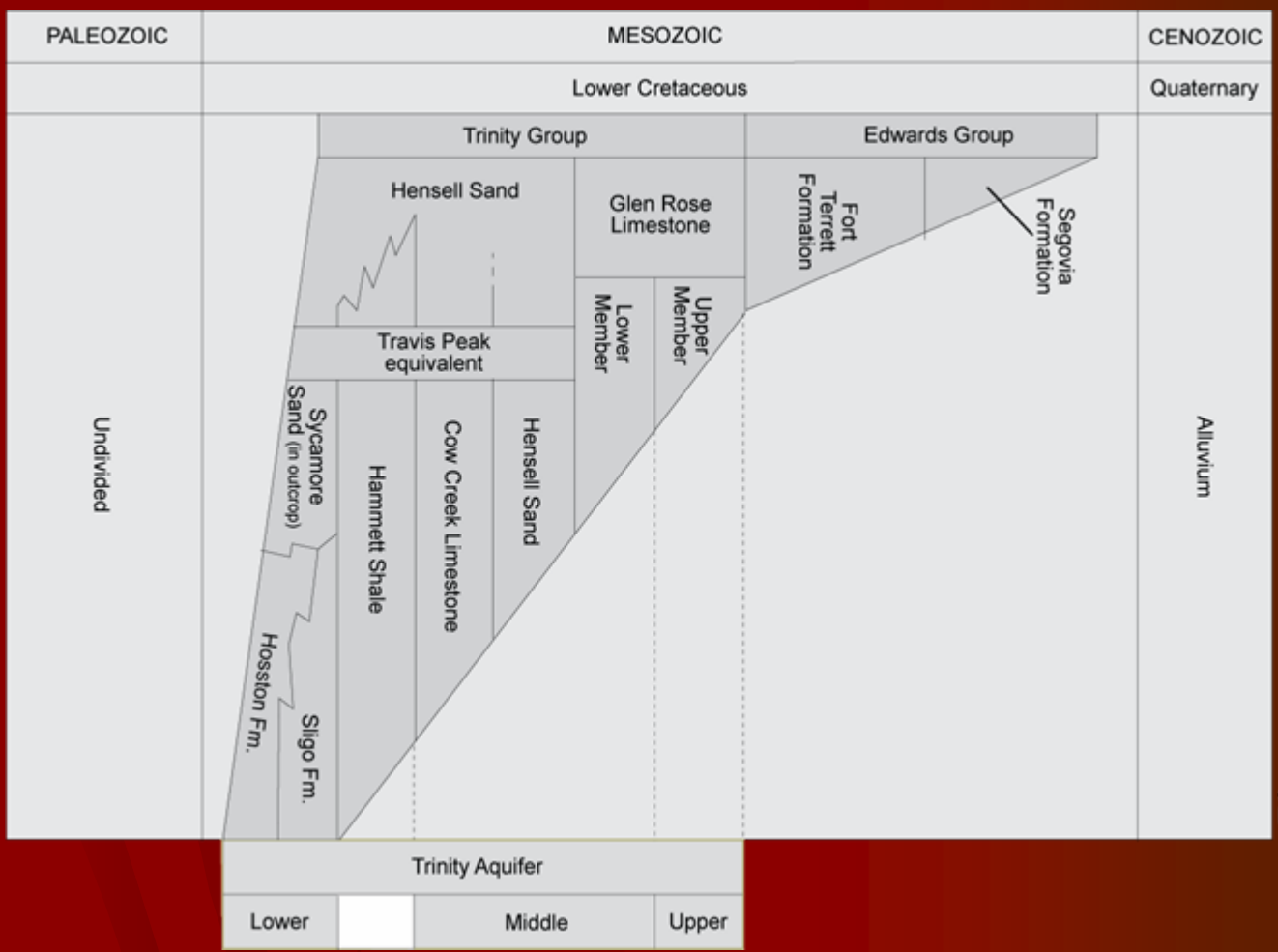
STUDY AREA


TEXAS
MASON
LLANO
BLANCO
BURNET
WILLIAMSON
KIMBLE
Lake LBJ
Lake Travis
Austin
River
TRAVIS
HAYS
Fredericksburg
Pedernales
EDWARDS
GILLESPIE
KENDALL
Blanco
Dripping Springs
Kerrville
Guadalupe
River
Blanco
River
COMAL
CALDWELL
KERR
San Marcos
Canyon Lake
BANDERA
Boerne
Medina
Cibolo
Creek
BEXAR
New Braunfels
GUADALUPE
REAL
Bandera
River
UVALDE
MEDINA
Medina Lake
San Antonio
Hondo
N
Study area/model boundary
Cities
Roads
0 5 10 15 mi

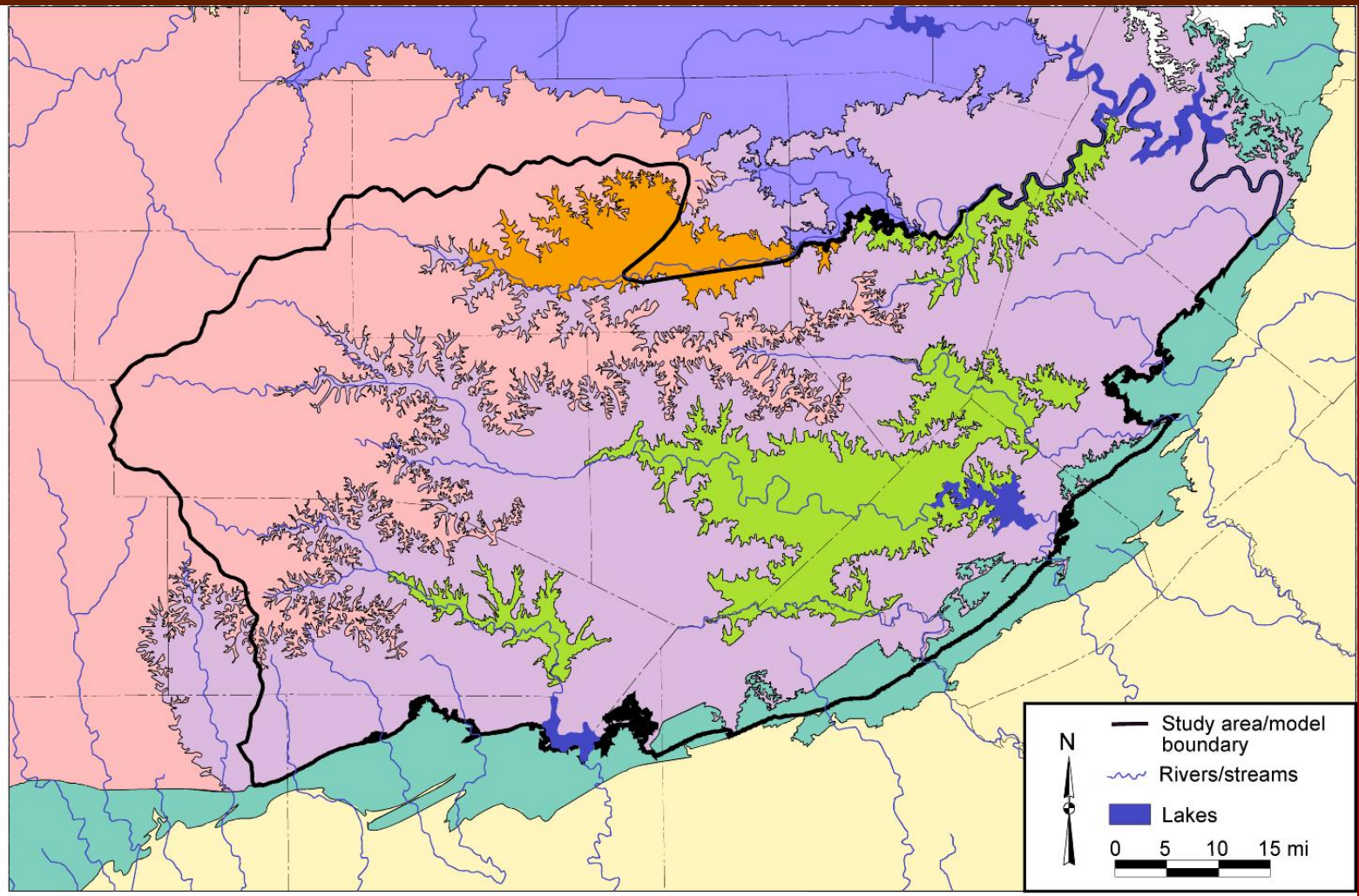
ANNUAL PRECIPITATION



STRATIGRAPHY/ HYDROSTRATIGRAPHY

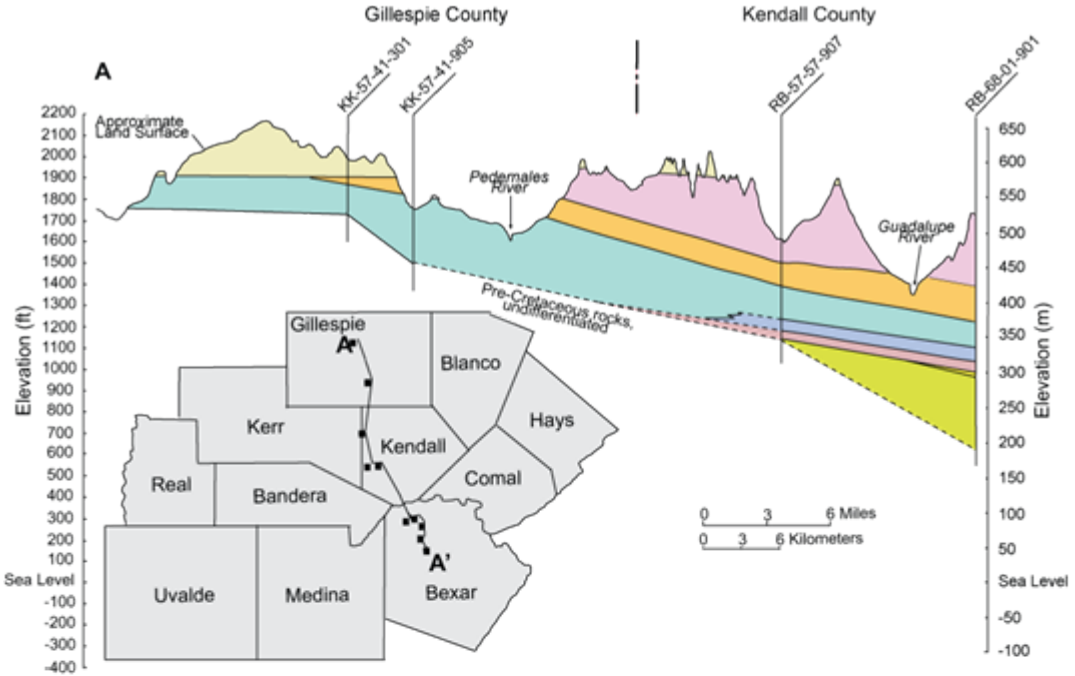


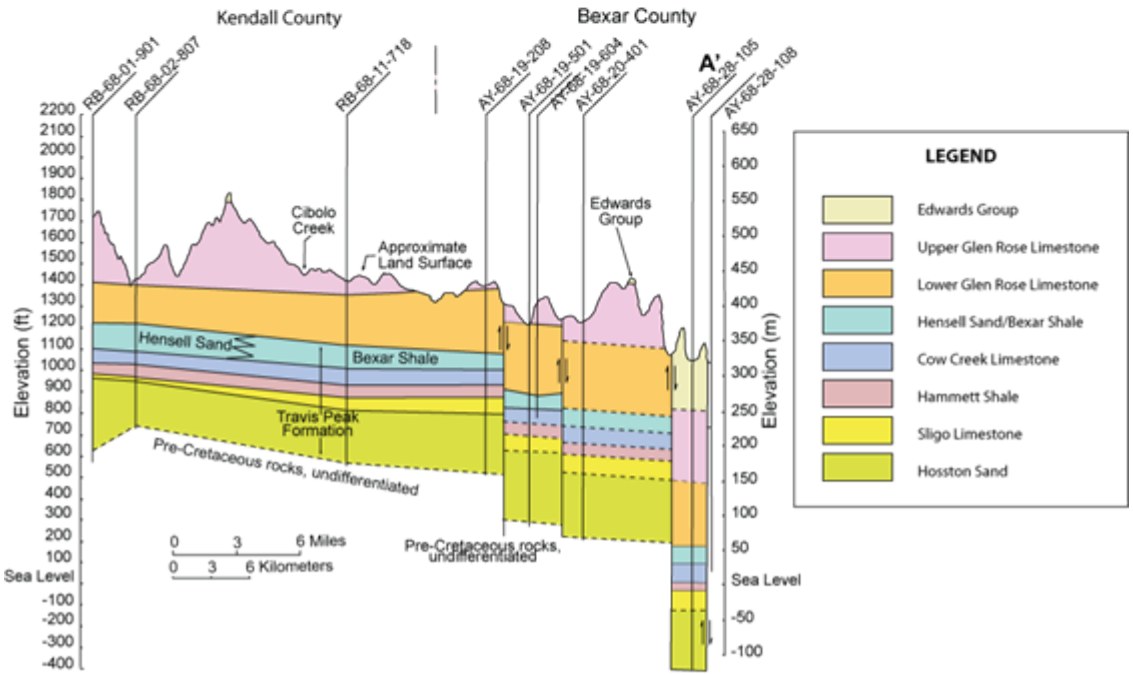
surface geology



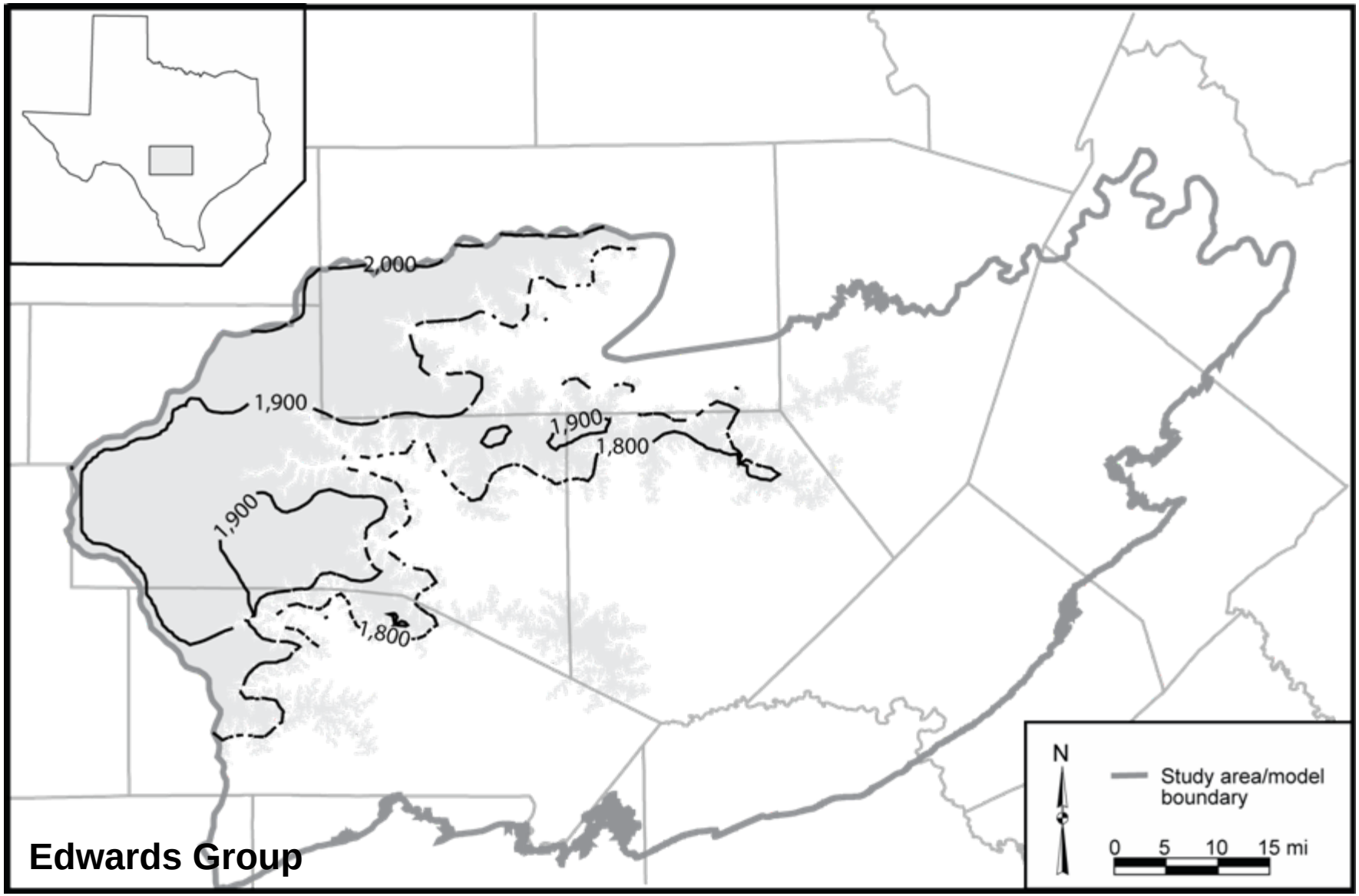
- Sediments younger than Edwards Group
- Edwards Group (BFZ)
- Edwards Group (Plateau)
- Upper member of the Glen Rose Limestone
- Lower member of the Glen Rose Limestone
- Hensel Sand
- Sediments older than the Hensel Sand

CROSS-SECTION

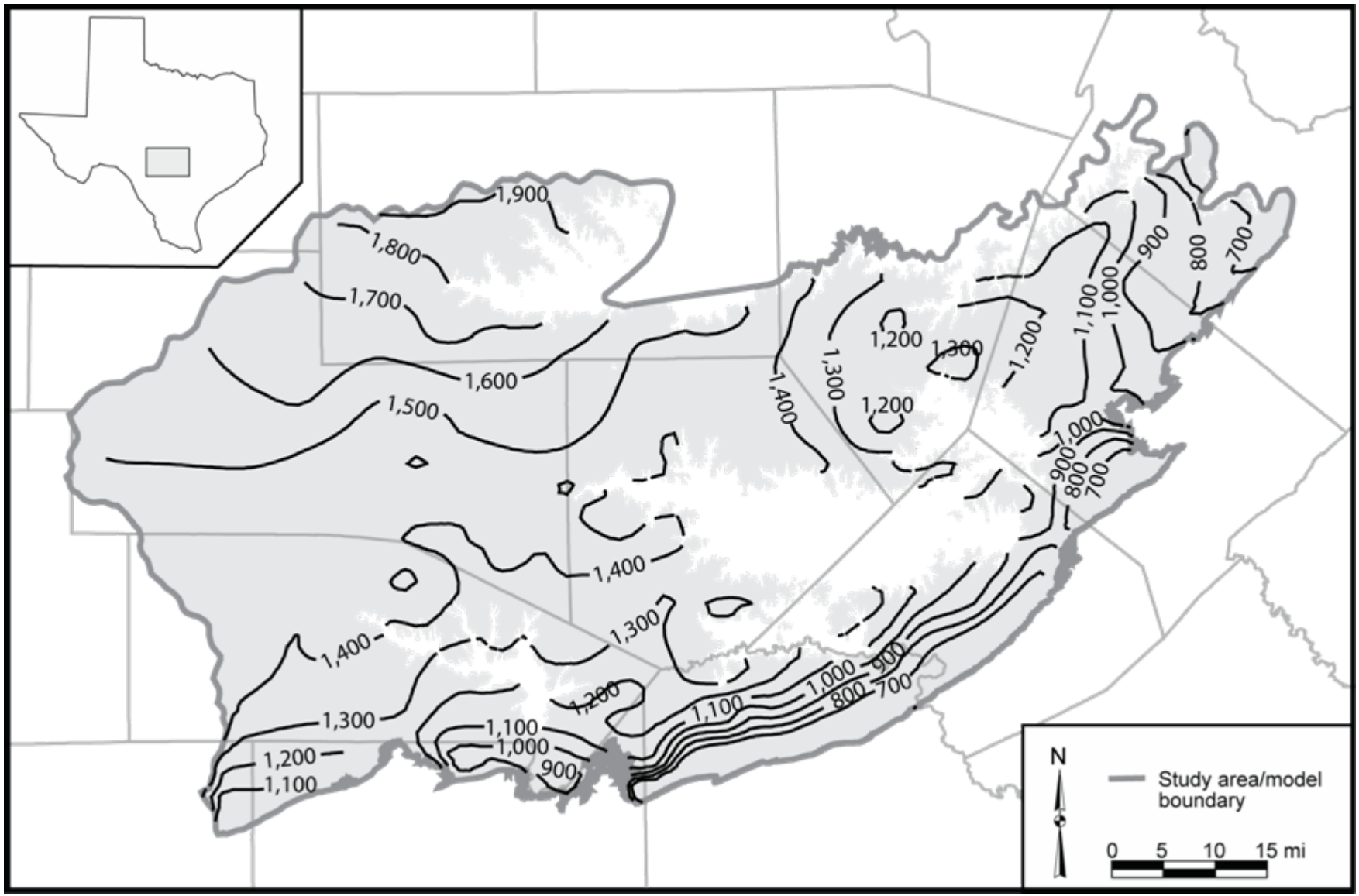




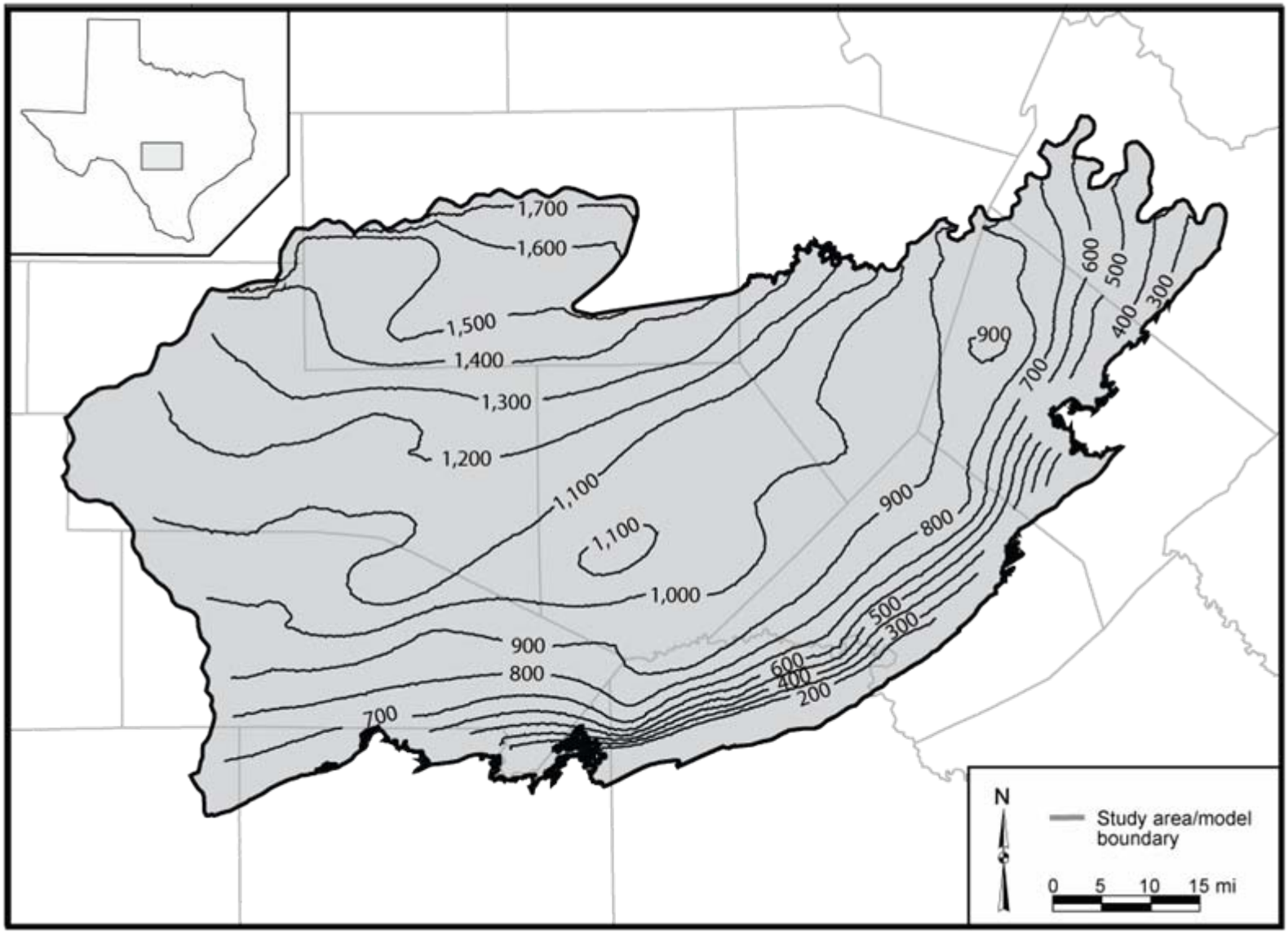
STRUCTURAL GEOLOGY



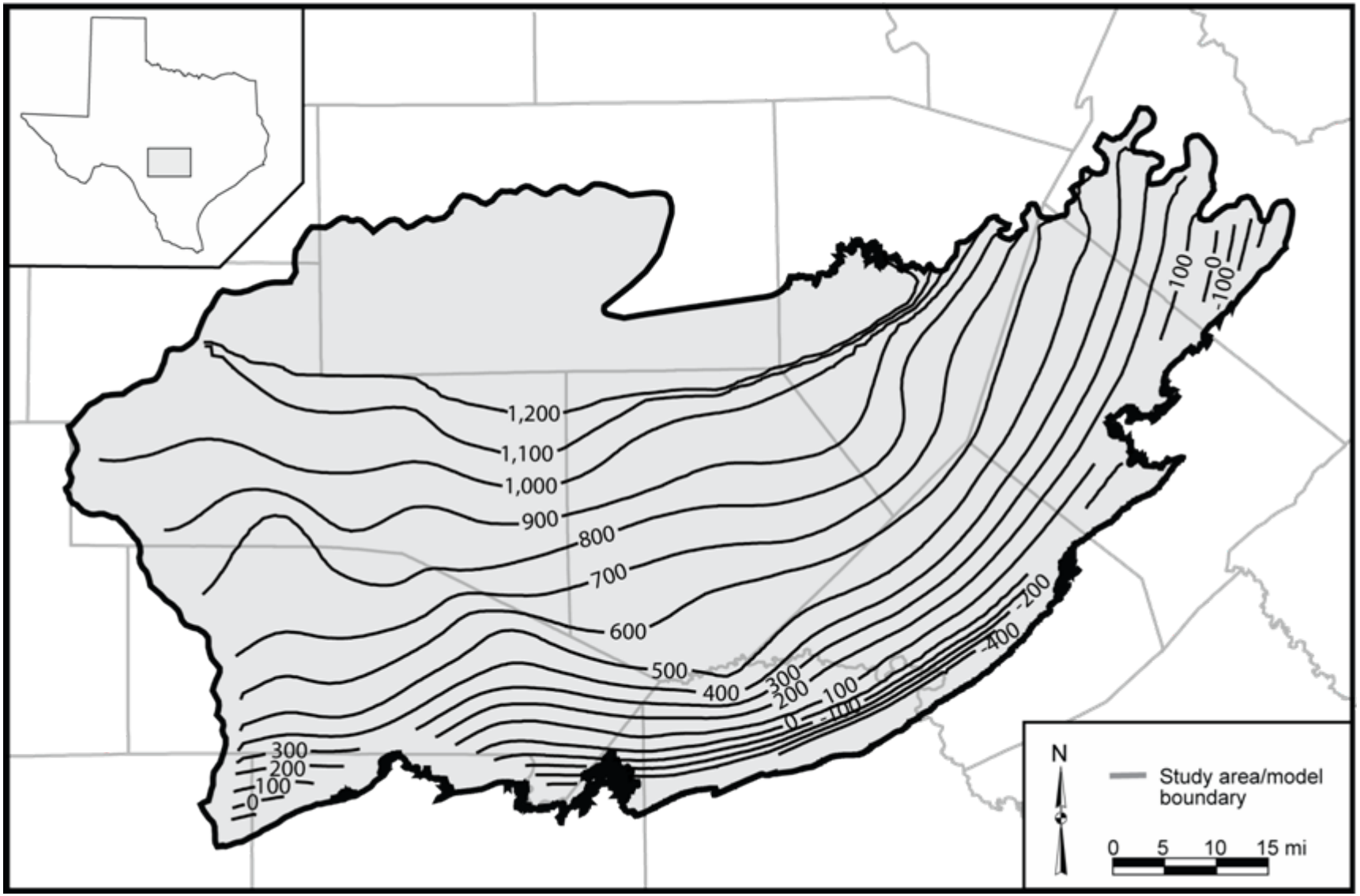
STRUCTURAL GEOLOGY



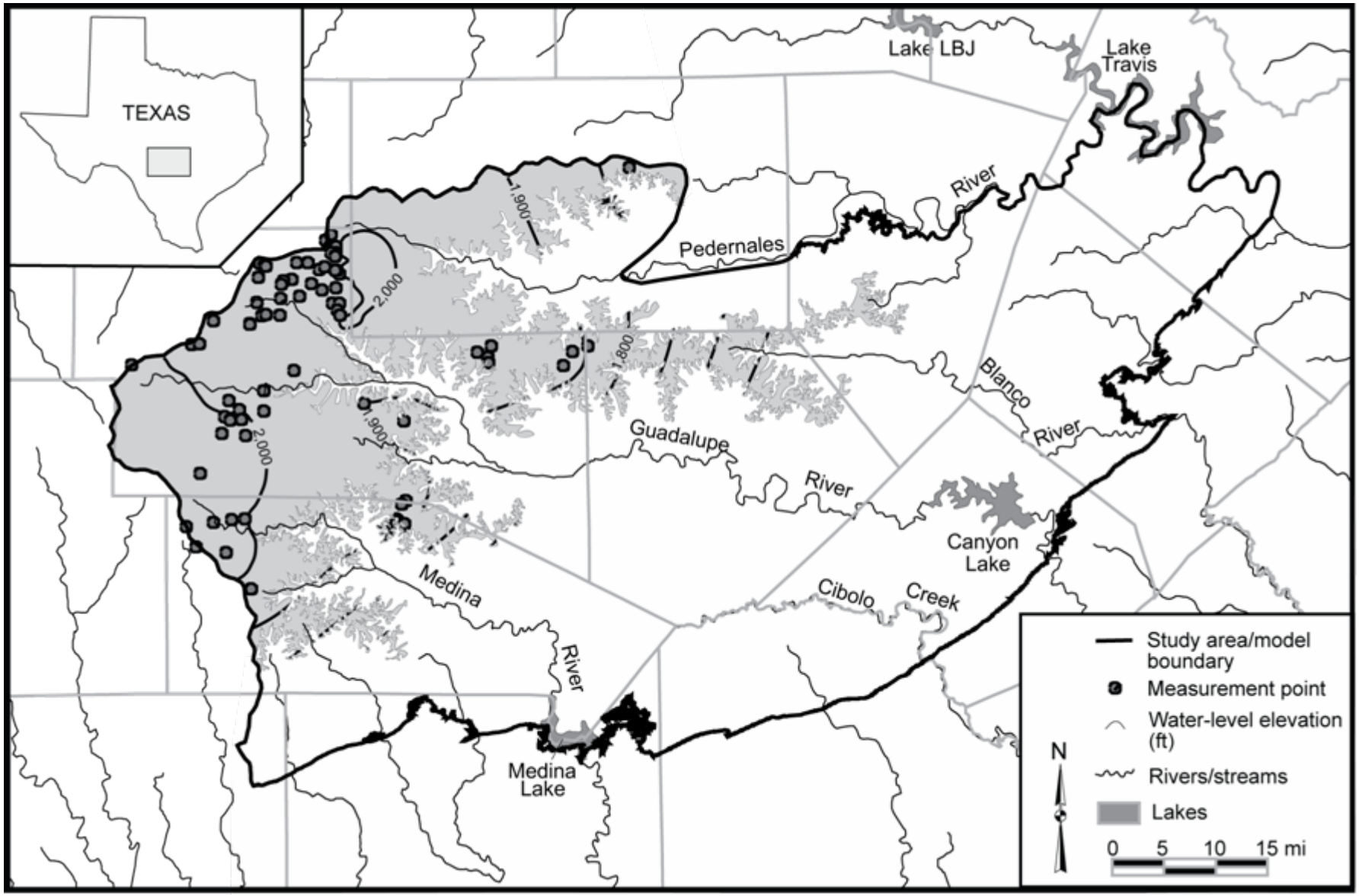
STRUCTURAL GEOLOGY



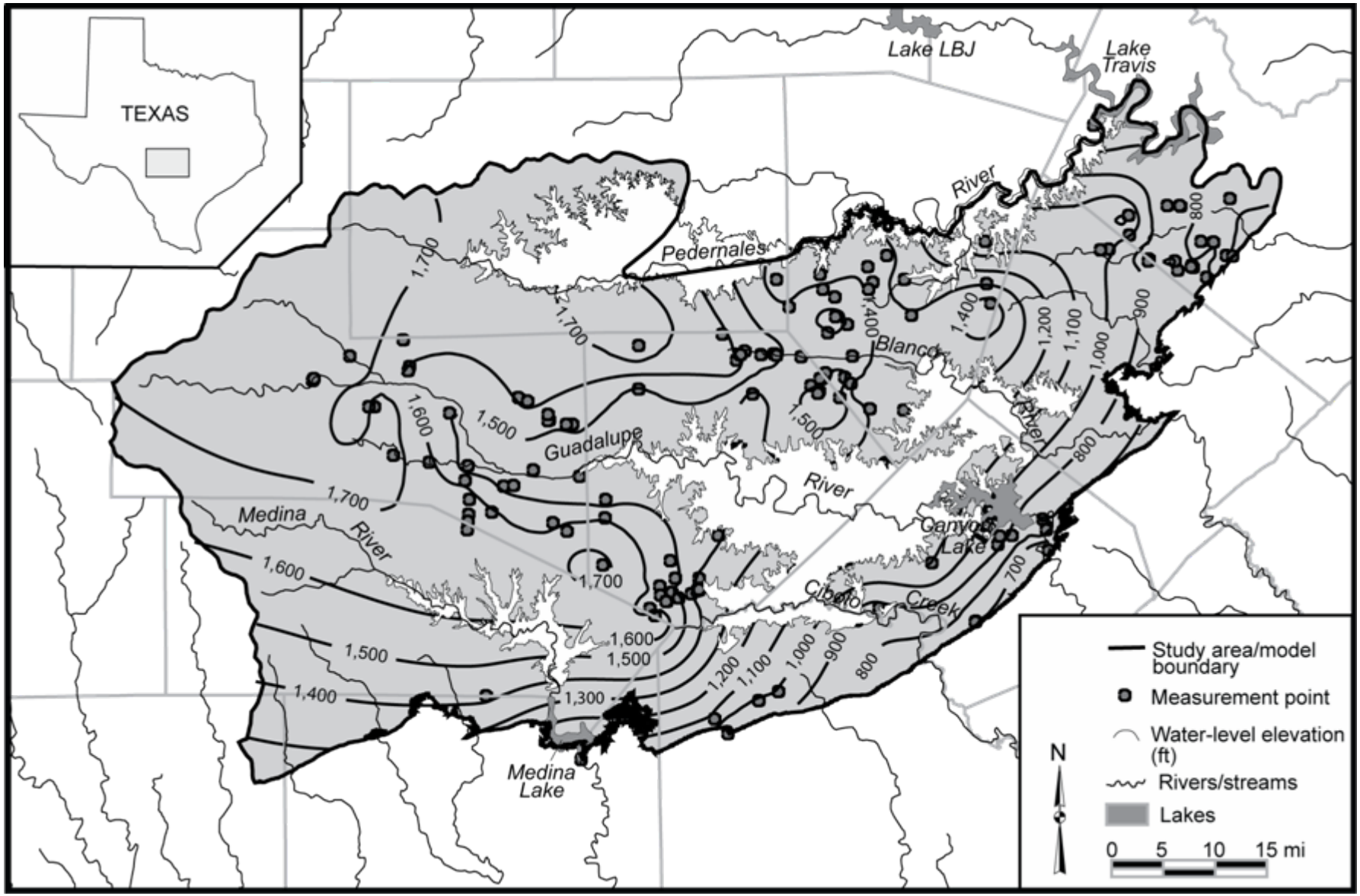
STRUCTURAL GEOLOGY



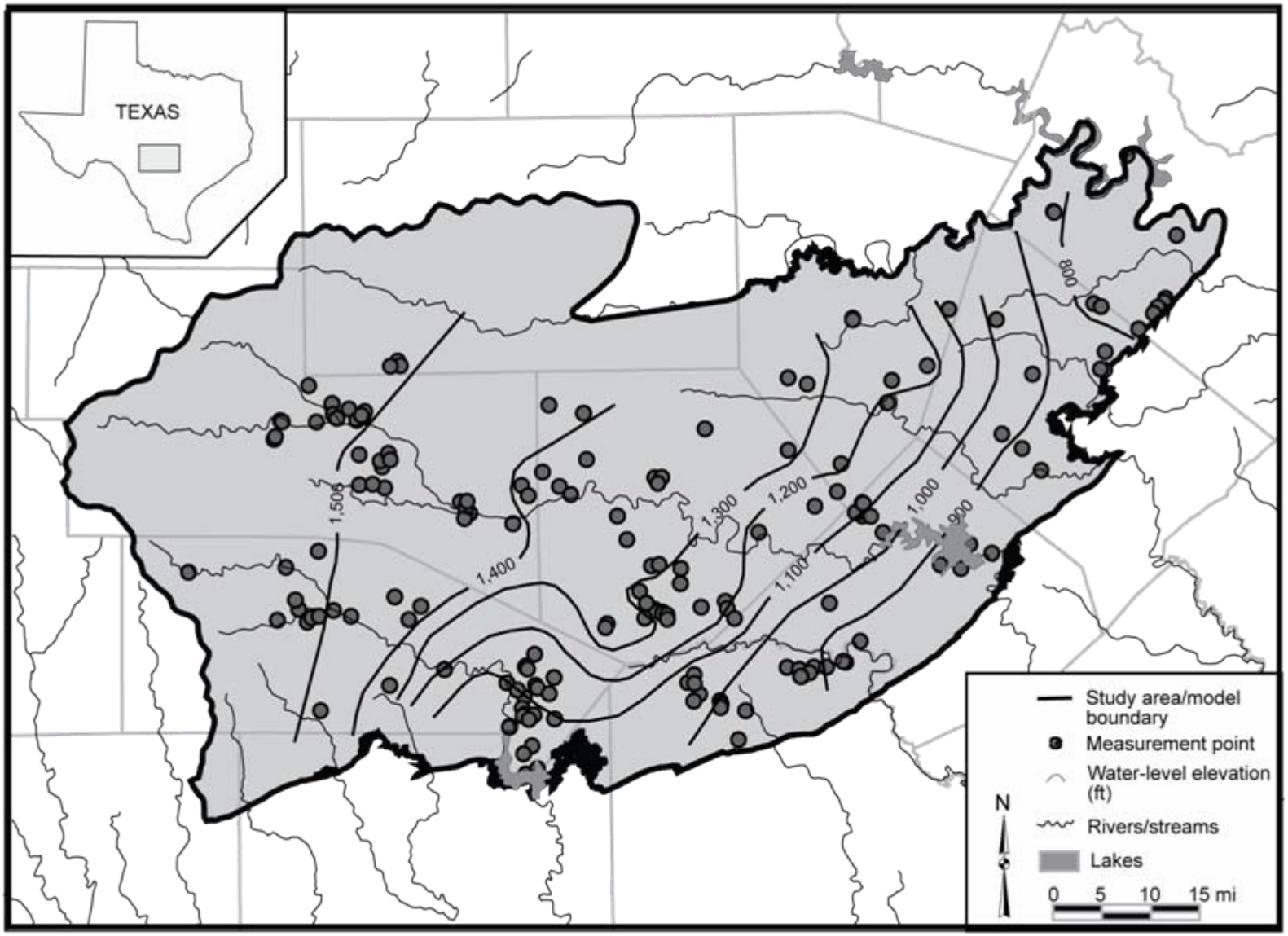
WATER LEVELS



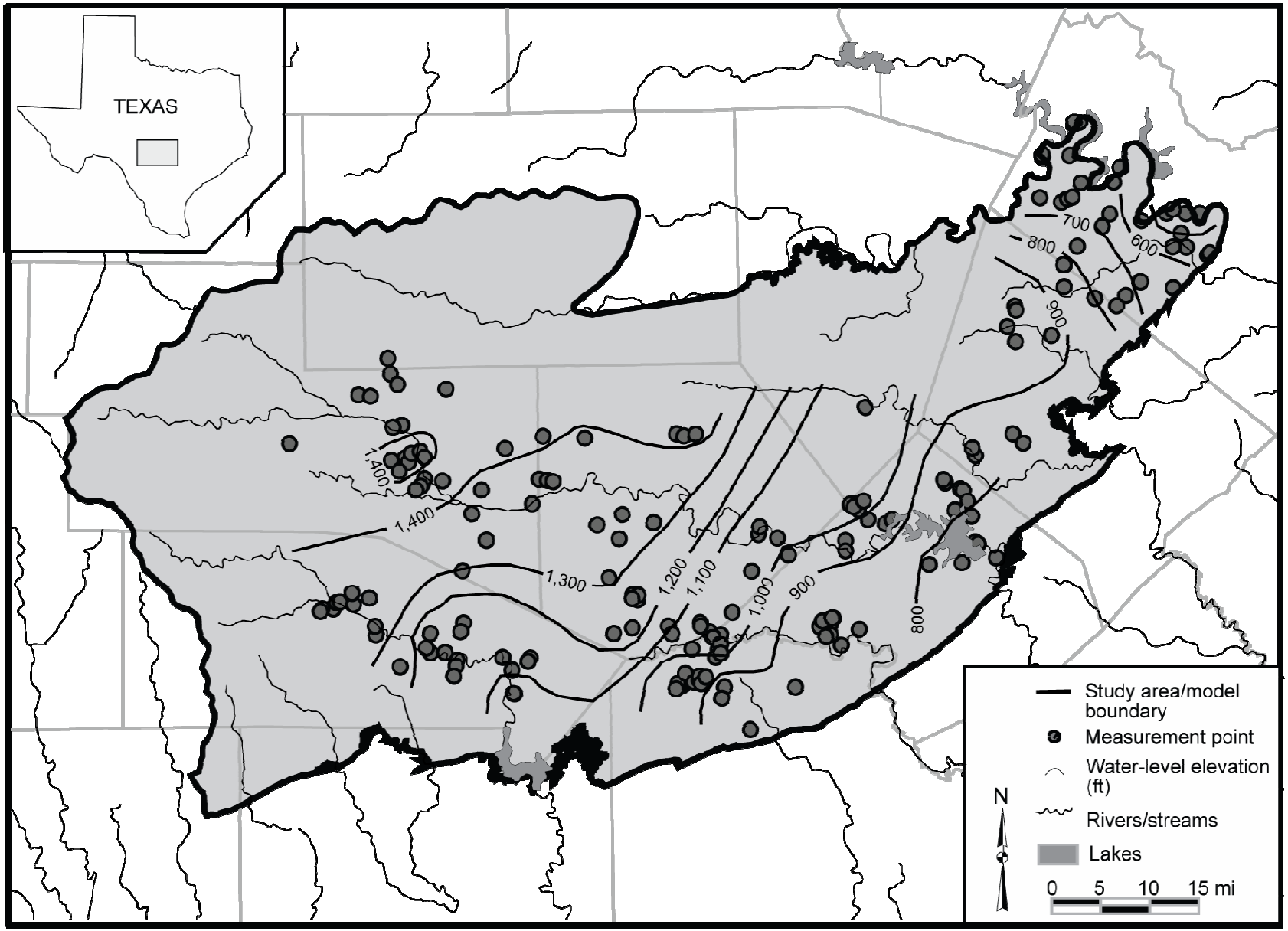
WATER LEVELS



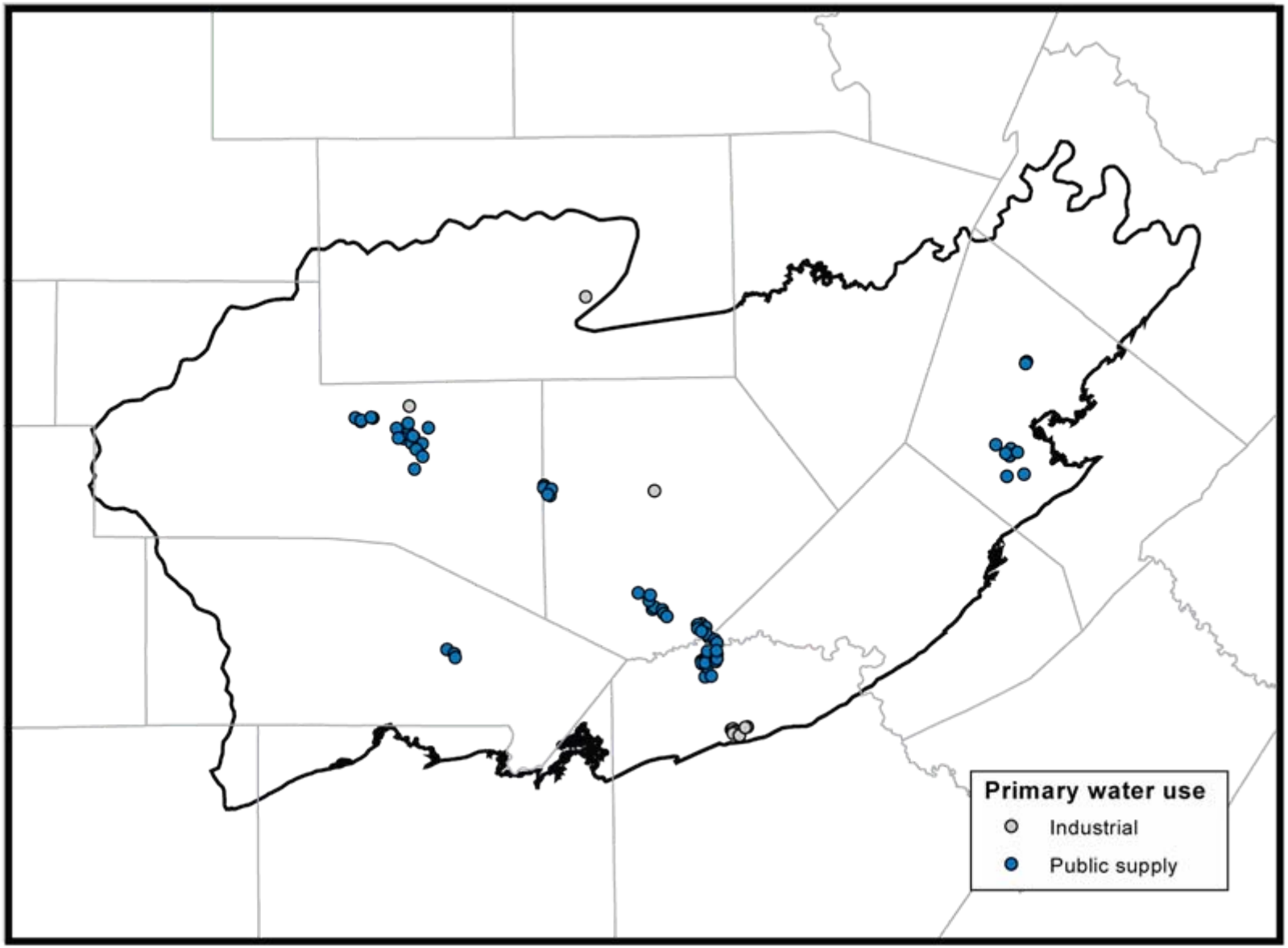
WATER LEVELS



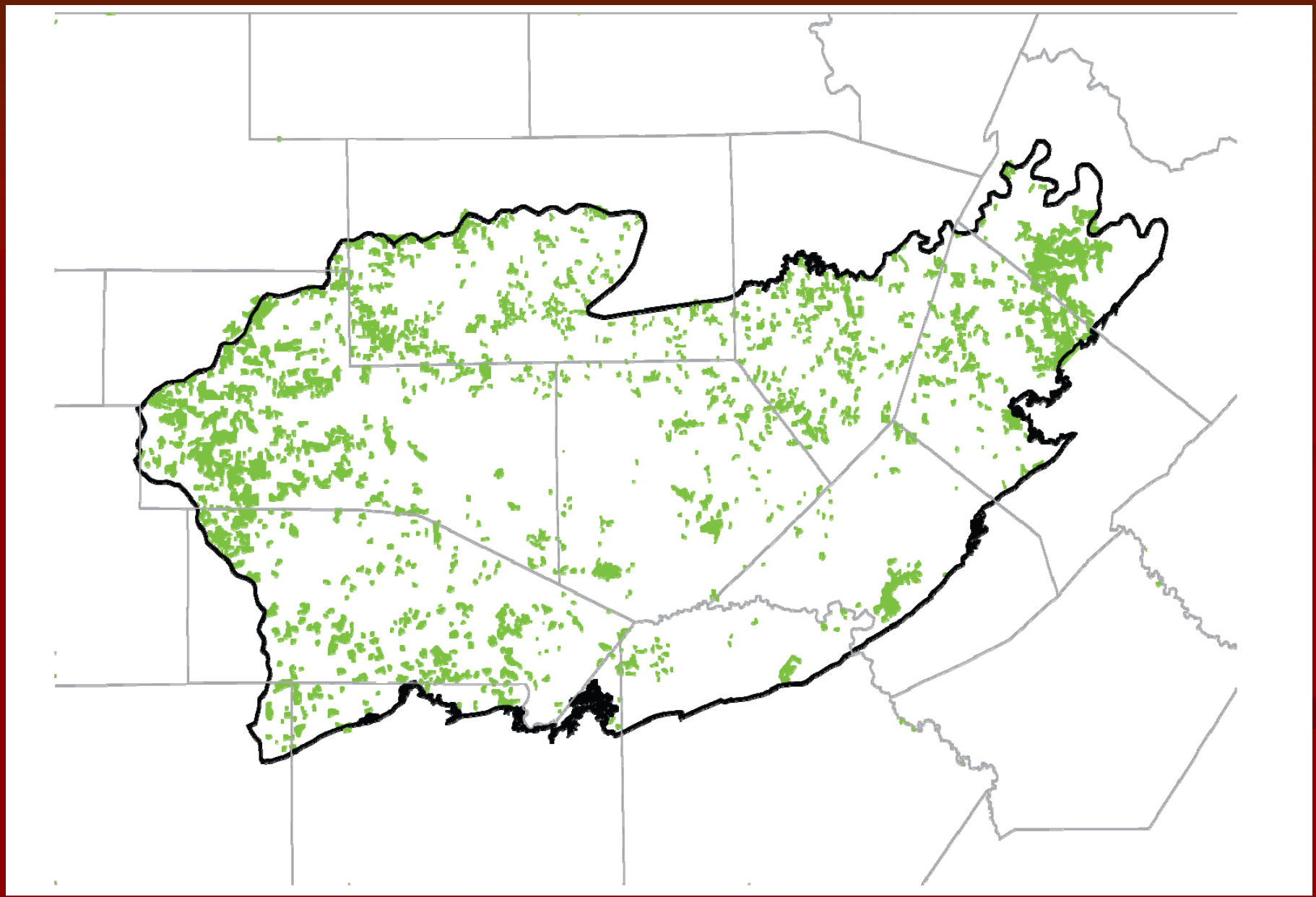
WATER LEVELS



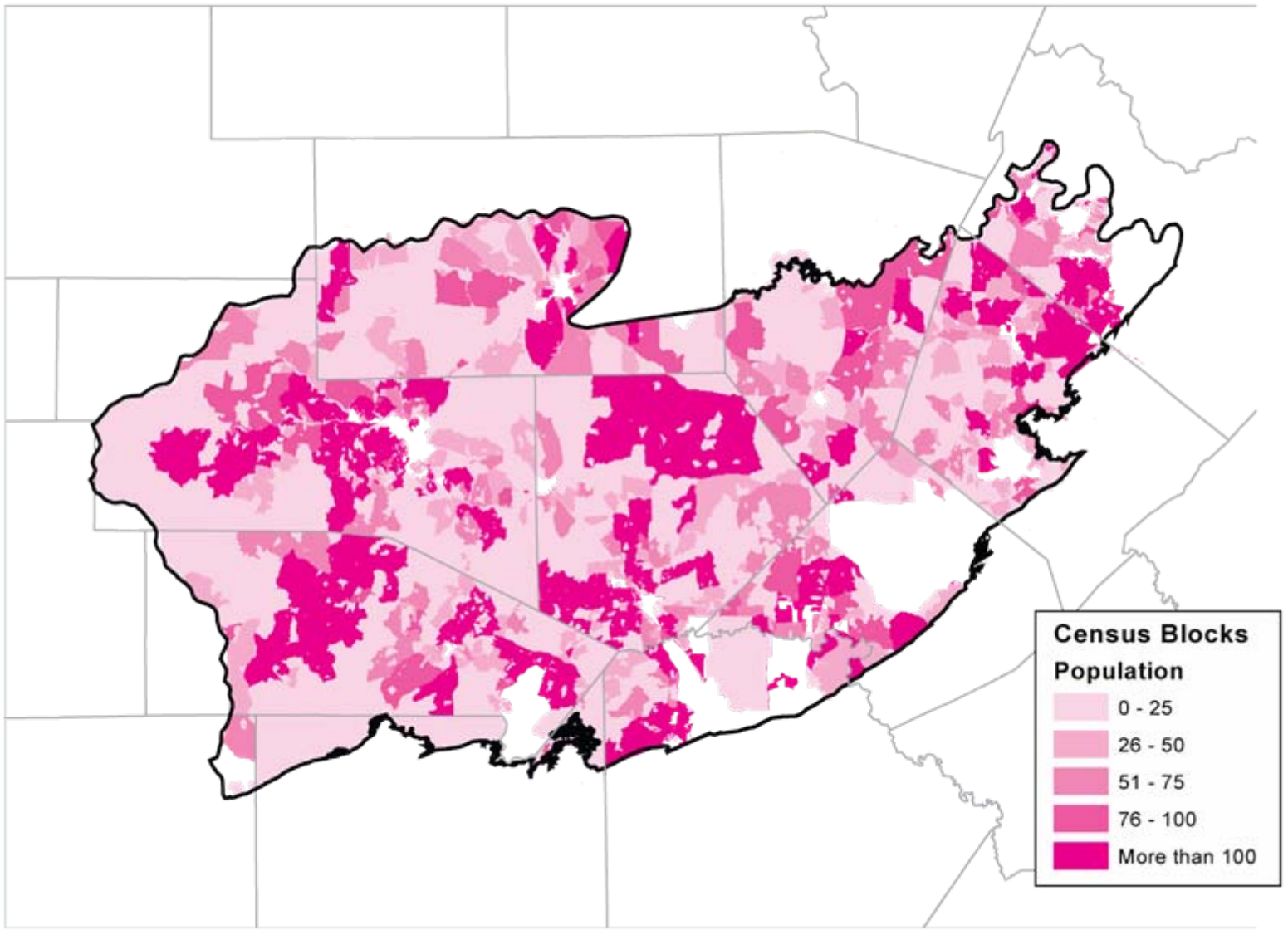
INDUSTRIAL AND PUBLIC SUPPLY



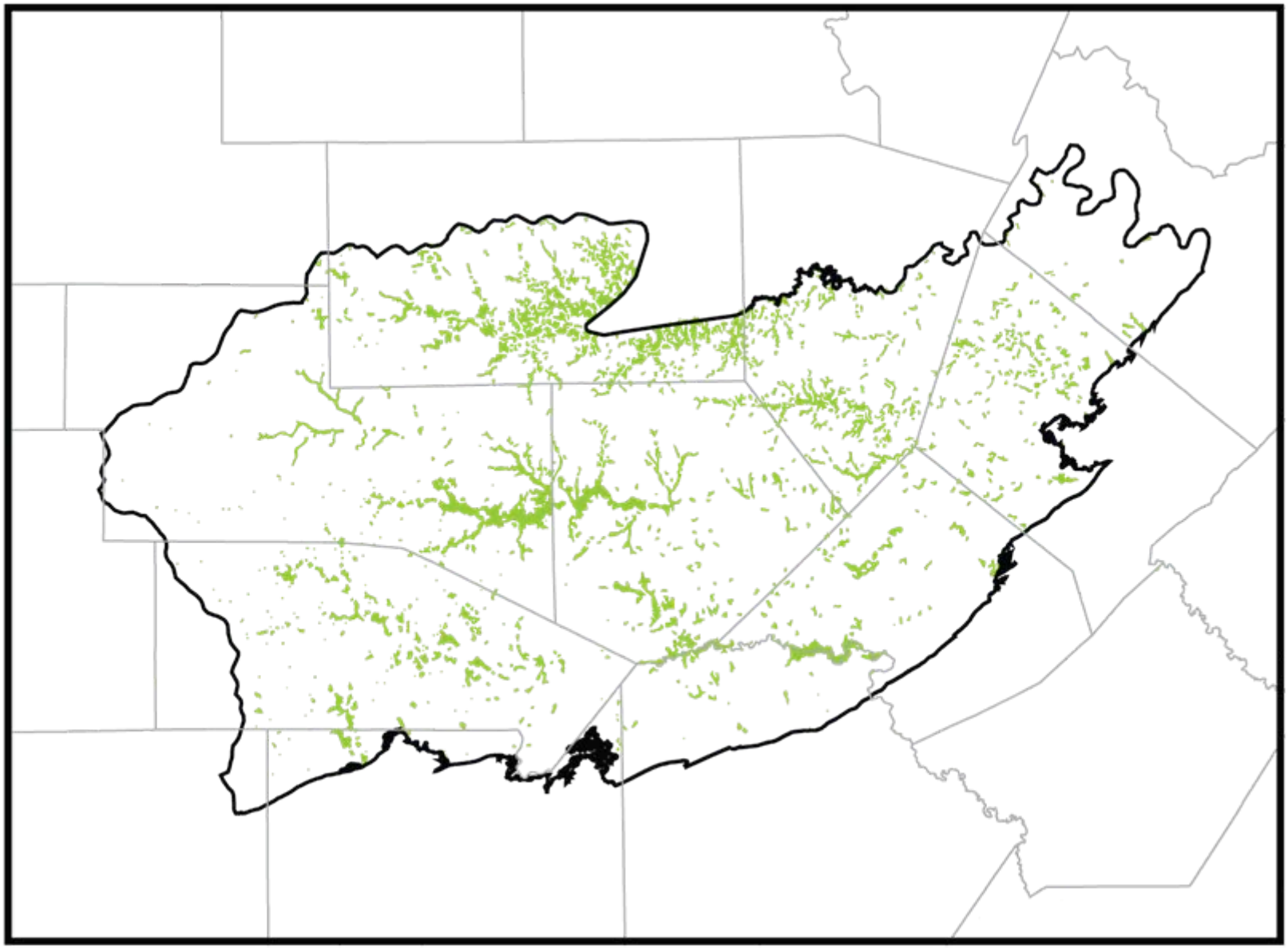
RANGELAND



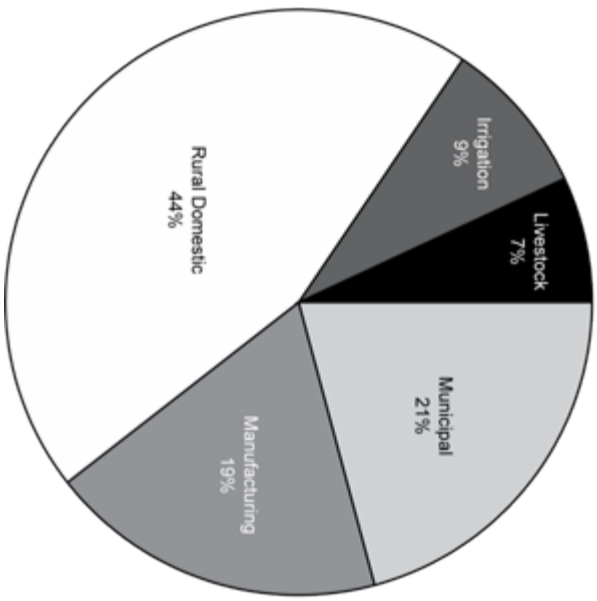
RURAL POPULATION

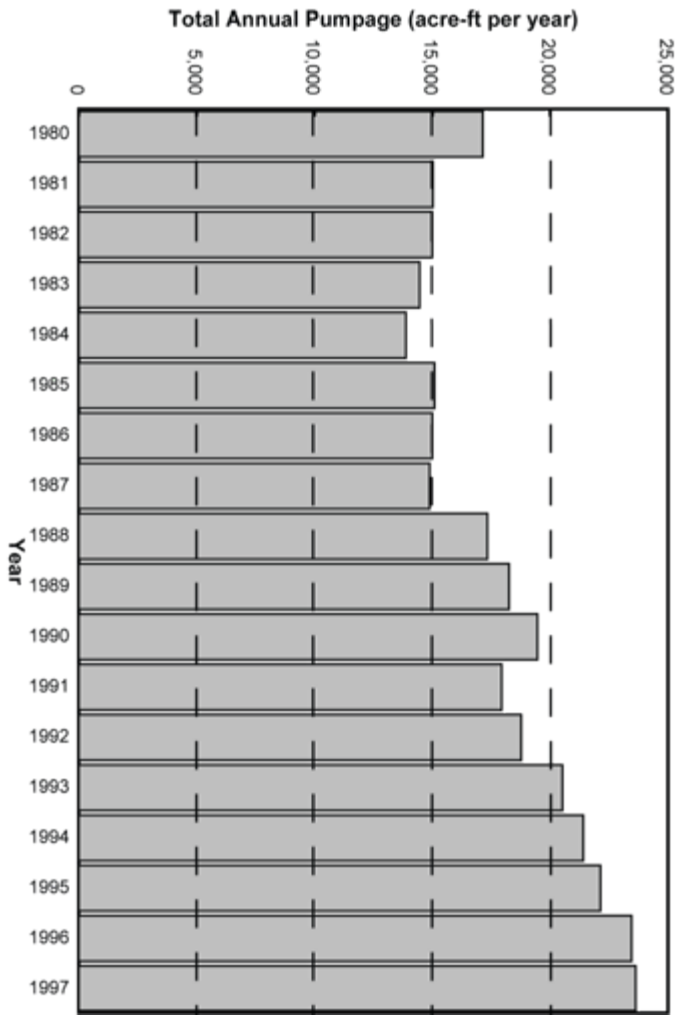


IRRIGATED FARMLAND

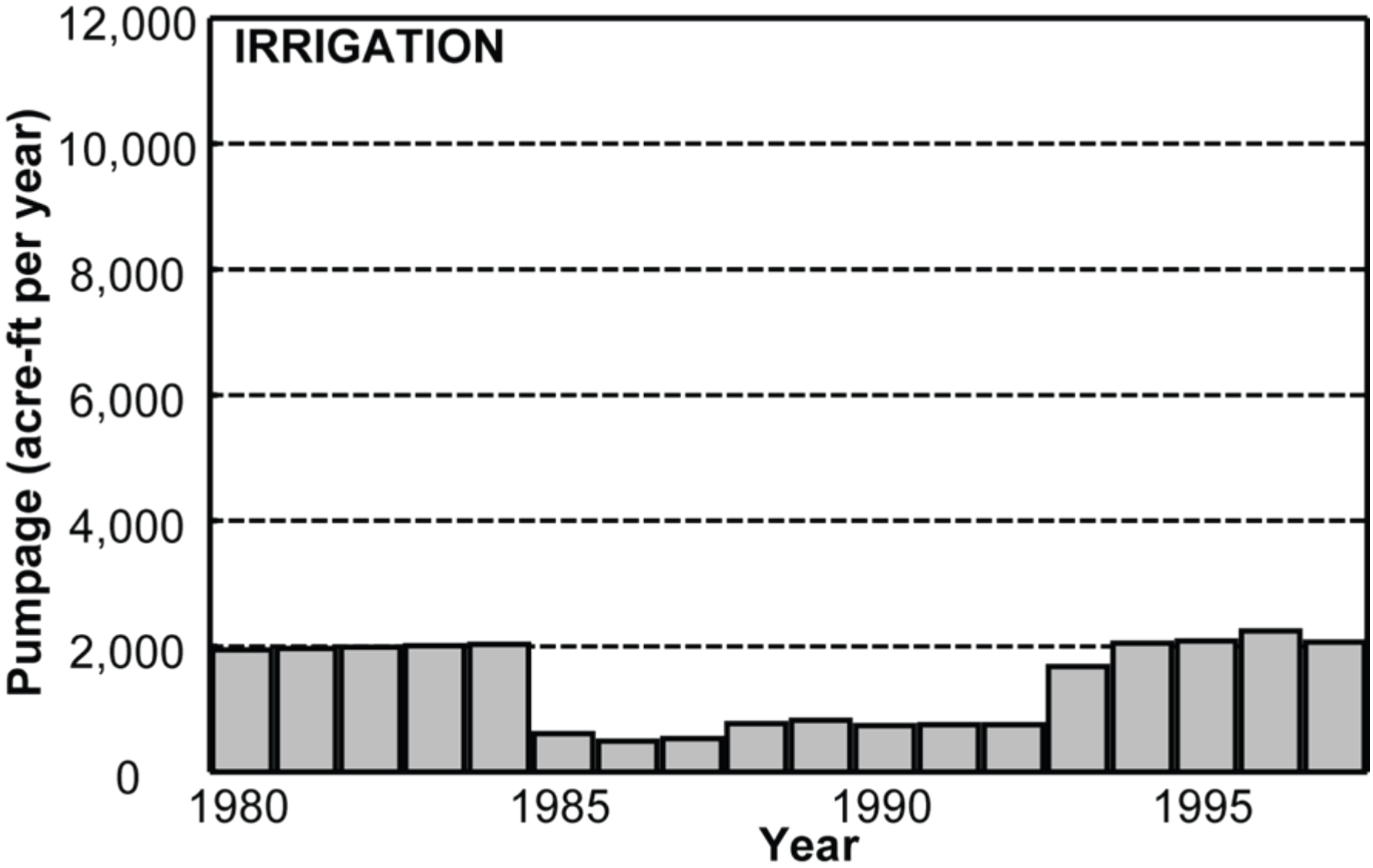


PUMPING BY USE CATEGORIES

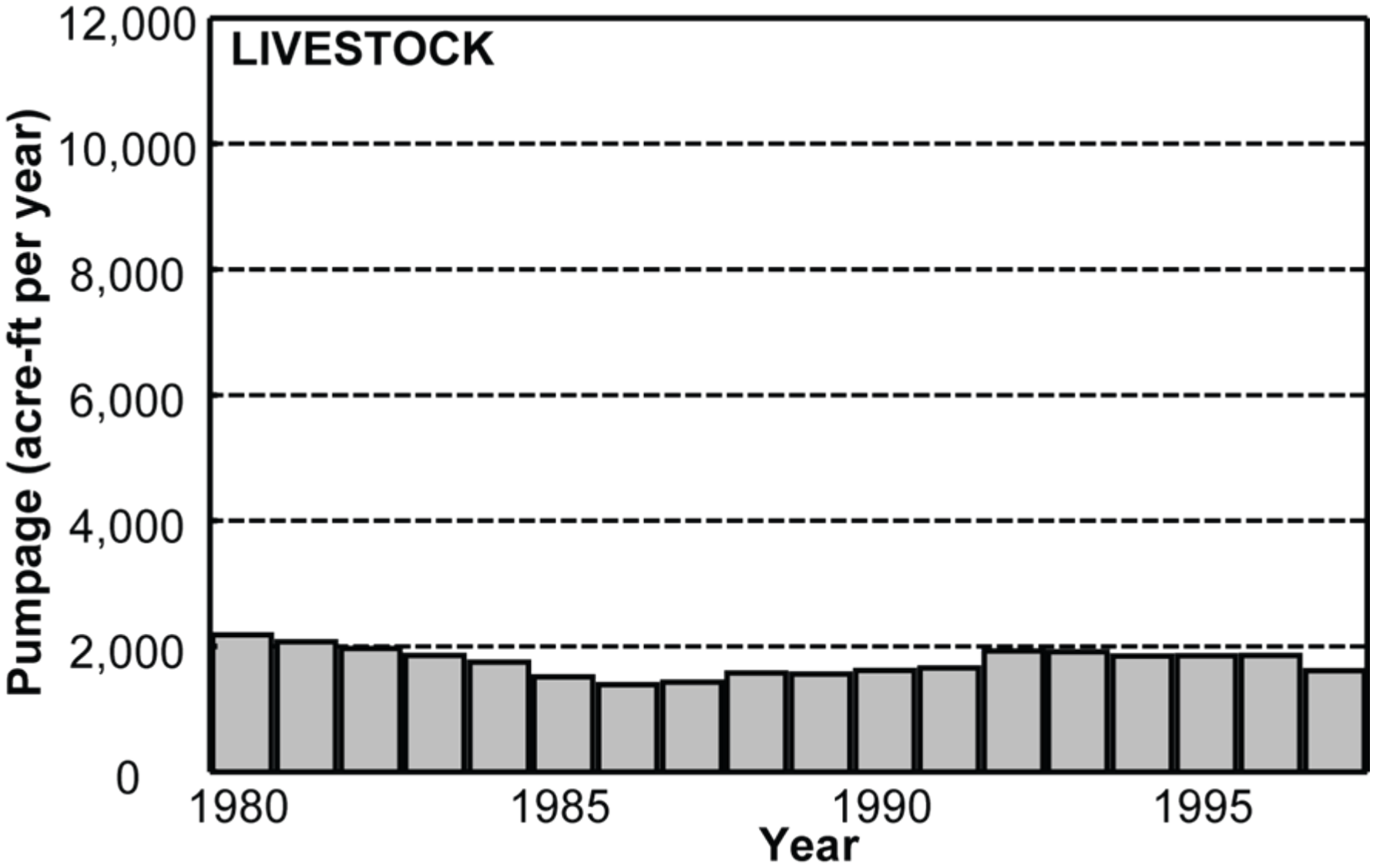




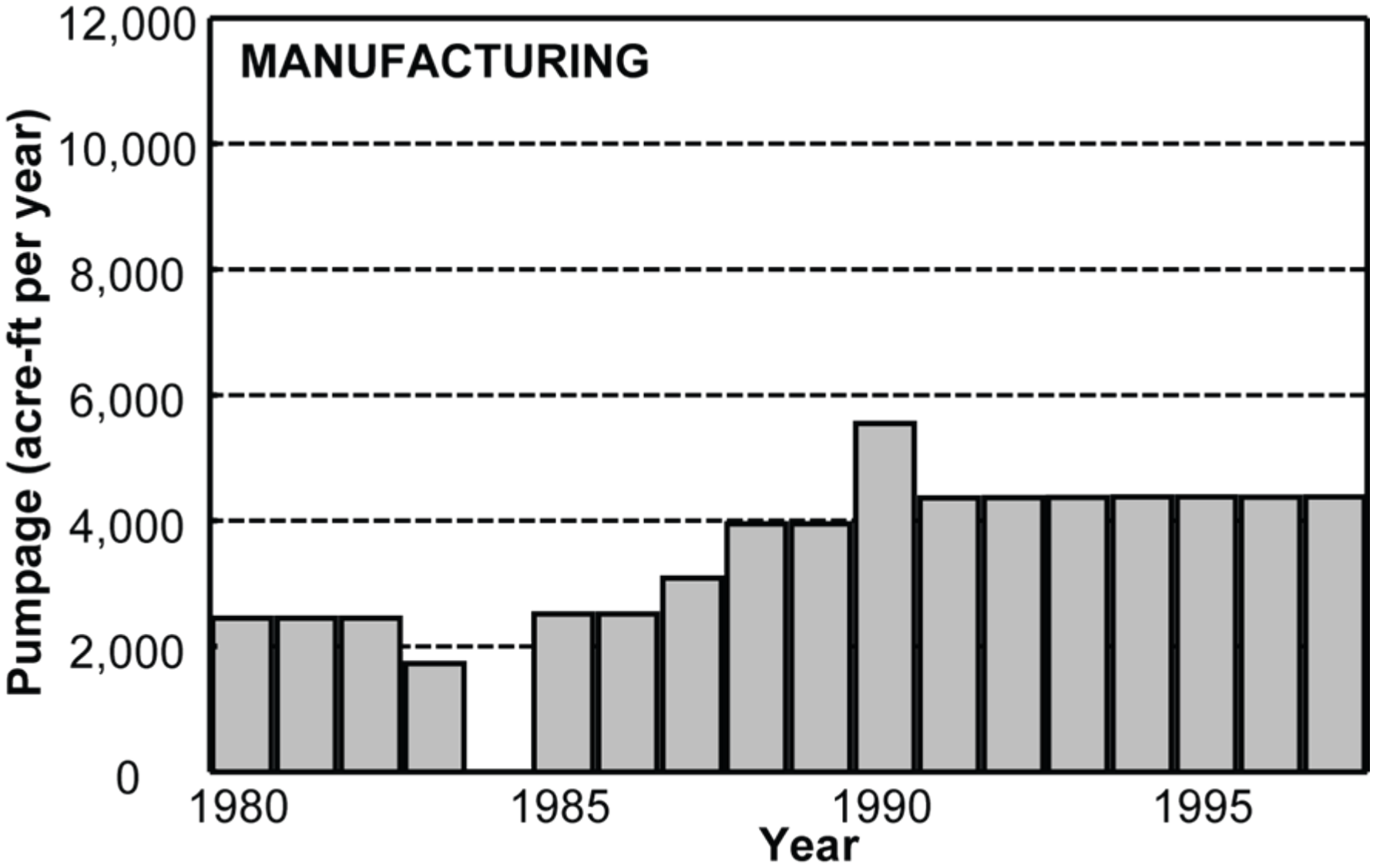
PUMPING


IRRIGATION
12,000
10,000
8,000
6,000
4,000
2,000
0
Pumpage (acre-ft per year)
1980
1985
1990
1995
Year

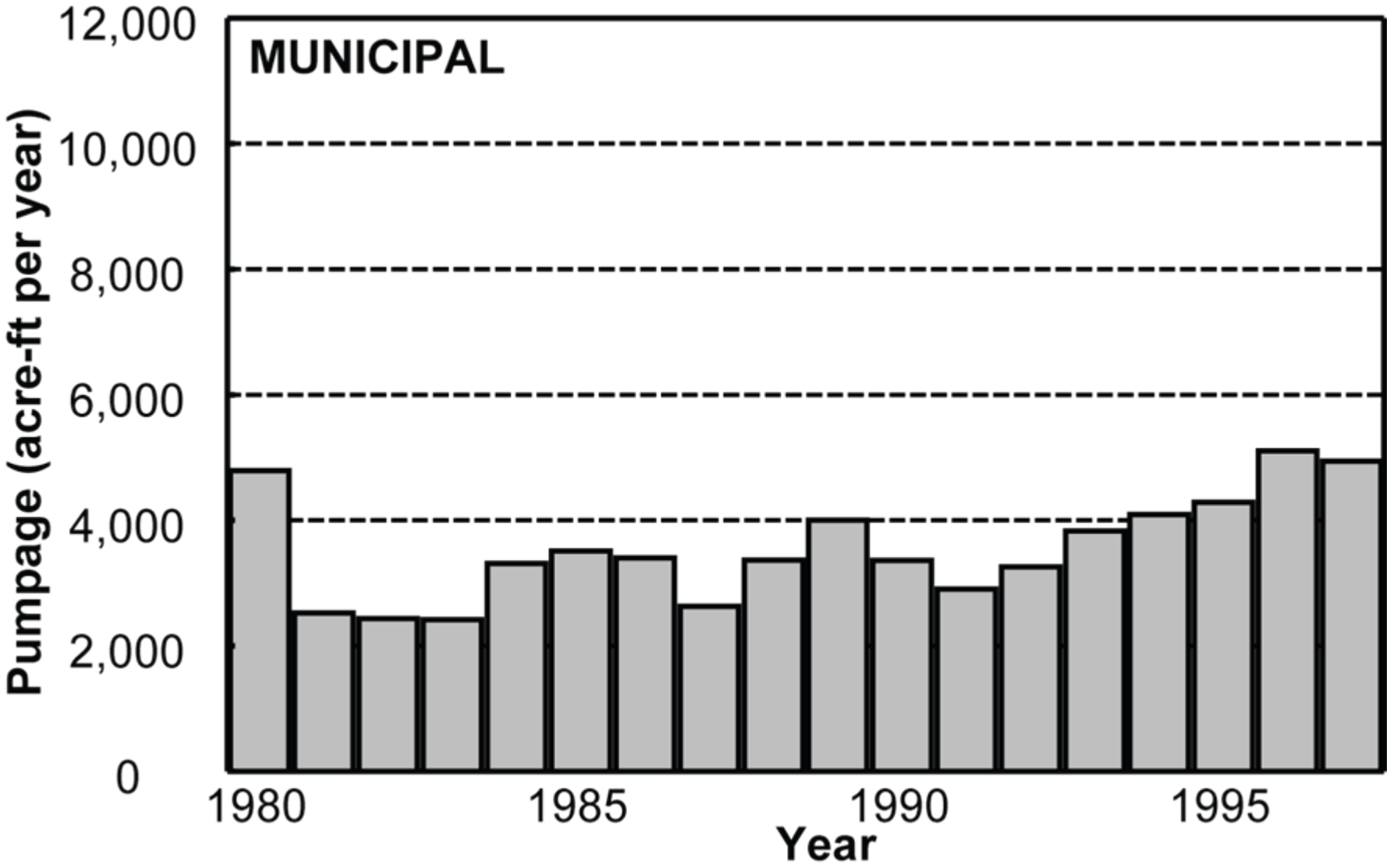
PUMPING


LIVESTOCK
12,000
10,000
8,000
6,000
4,000
2,000
0
Pumpage (acre-ft per year)
1980
1985
1990
1995
Year

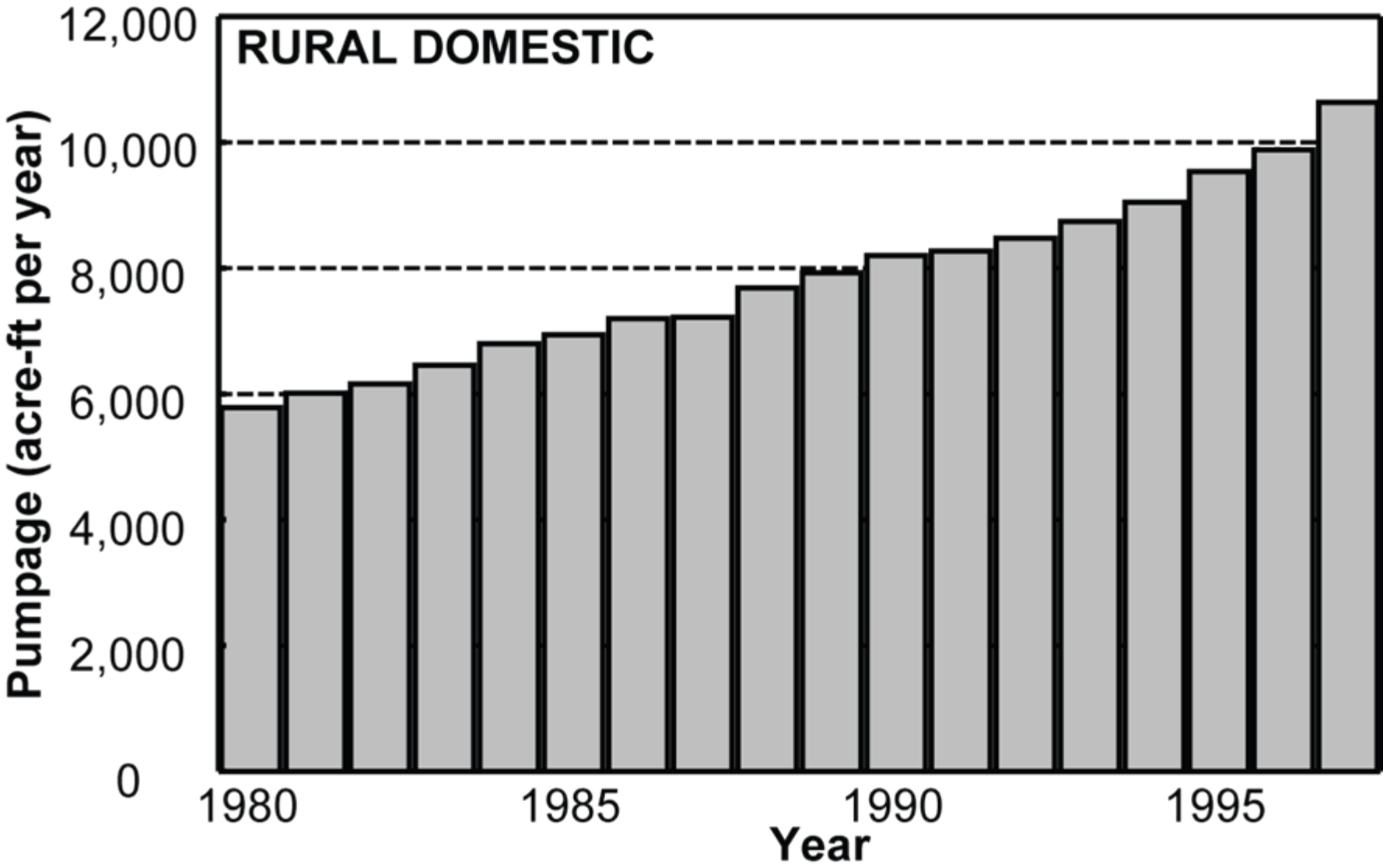
PUMPING


MANUFACTURING
Pumpage (acre-ft per year)
12,000
10,000
8,000
6,000
4,000
2,000
0
1980
1985
1990
1995
Year

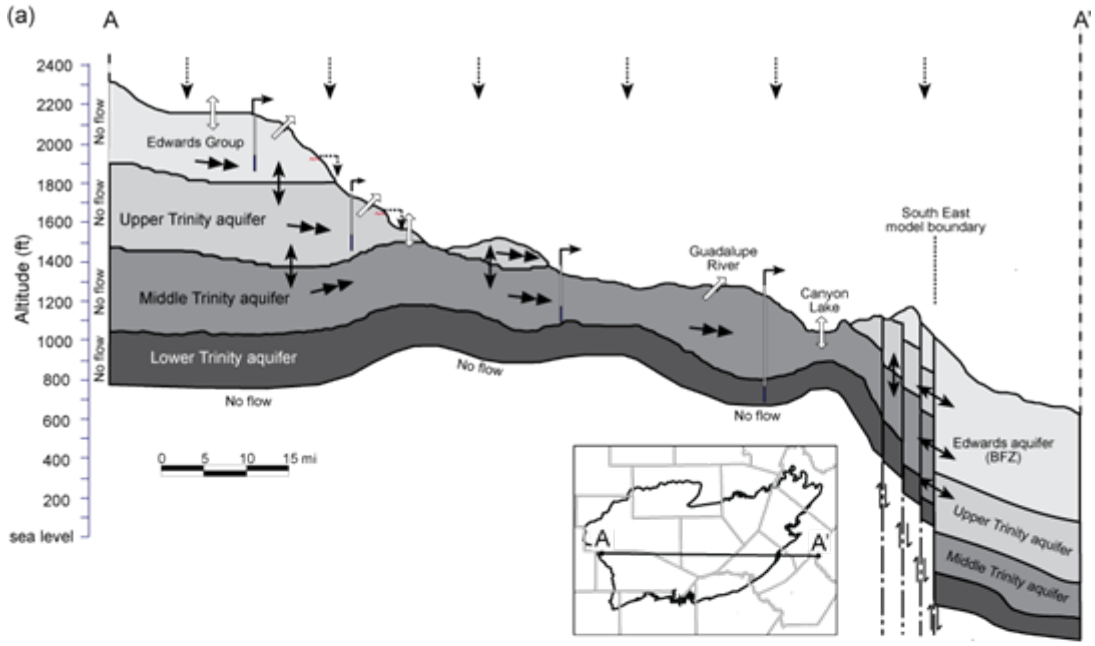
PUMPING

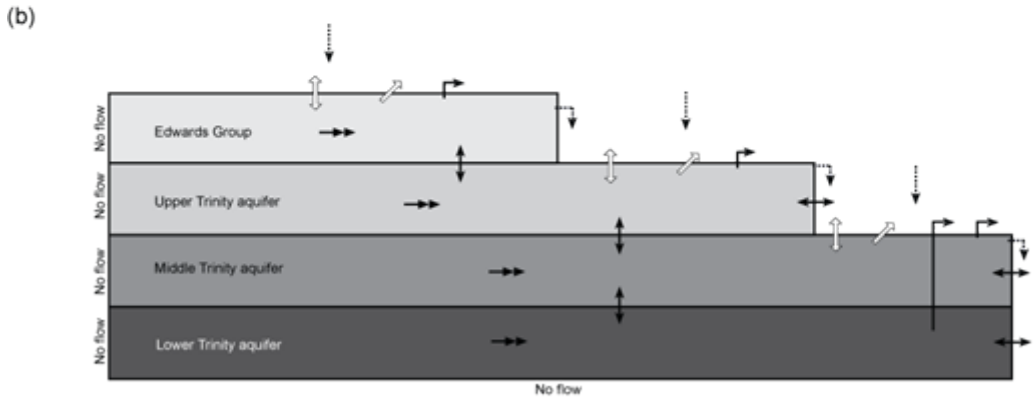

MUNICIPAL
Pumpage (acre-ft per year)
12,000
10,000
8,000
6,000
4,000
2,000
0
1980
1985
1990
1995
Year

PUMPING

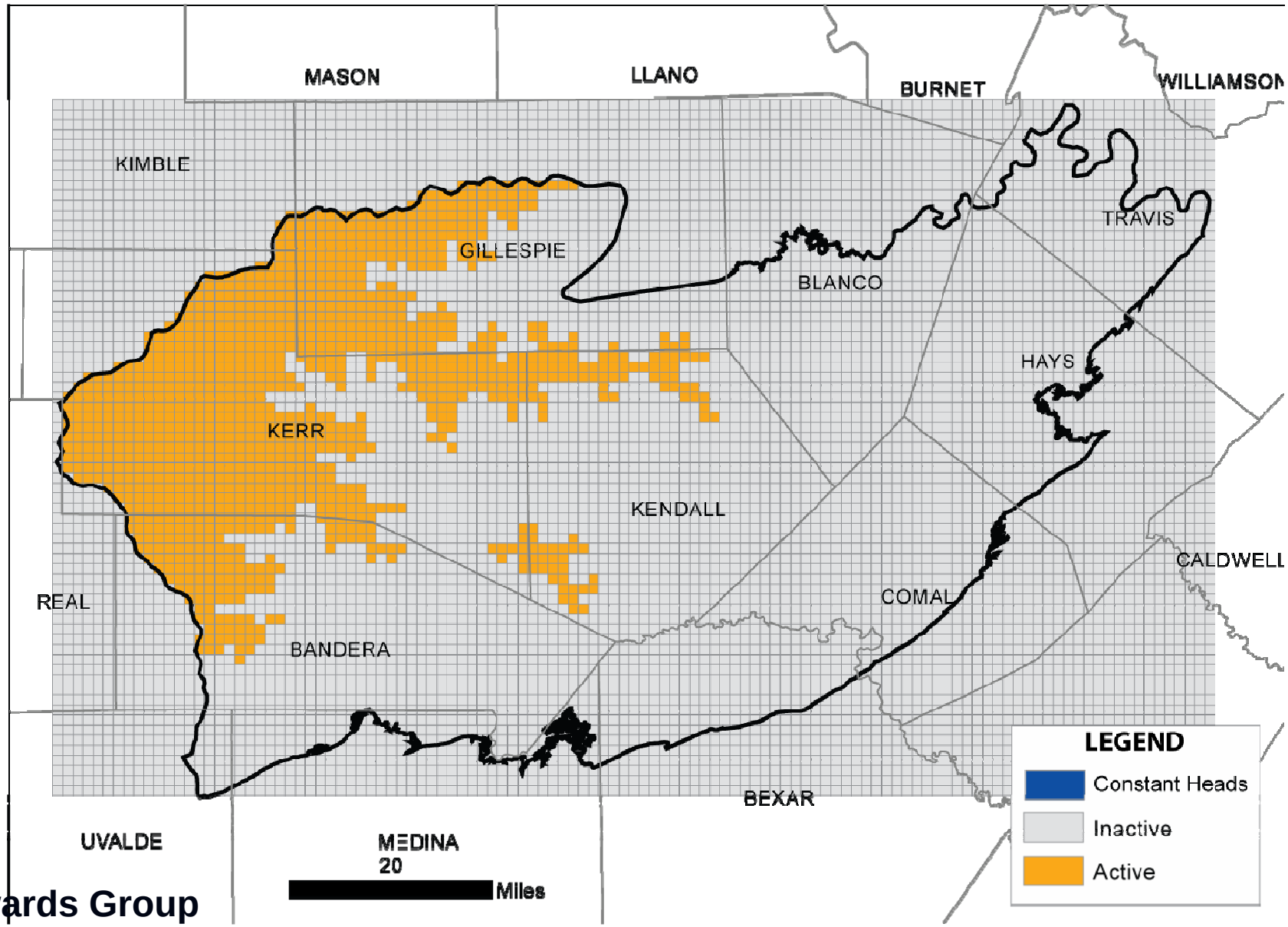

RURAL DOMESTIC
12,000
10,000
8,000
6,000
4,000
2,000
0
Pumpage (acre-ft per year)
1980
1985
1990
1995
Year

CONCEPTUAL MODEL



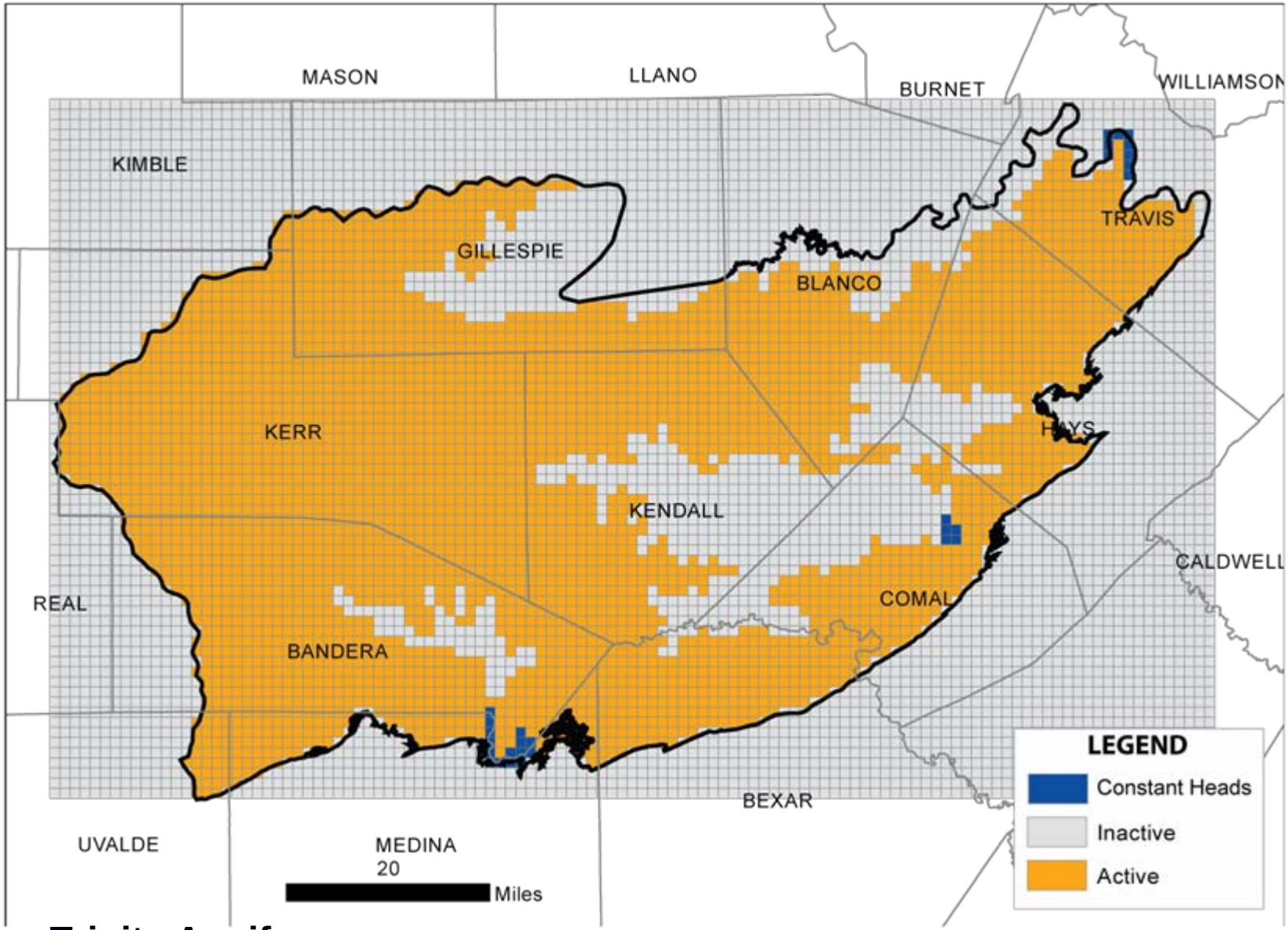


MODEL GRID



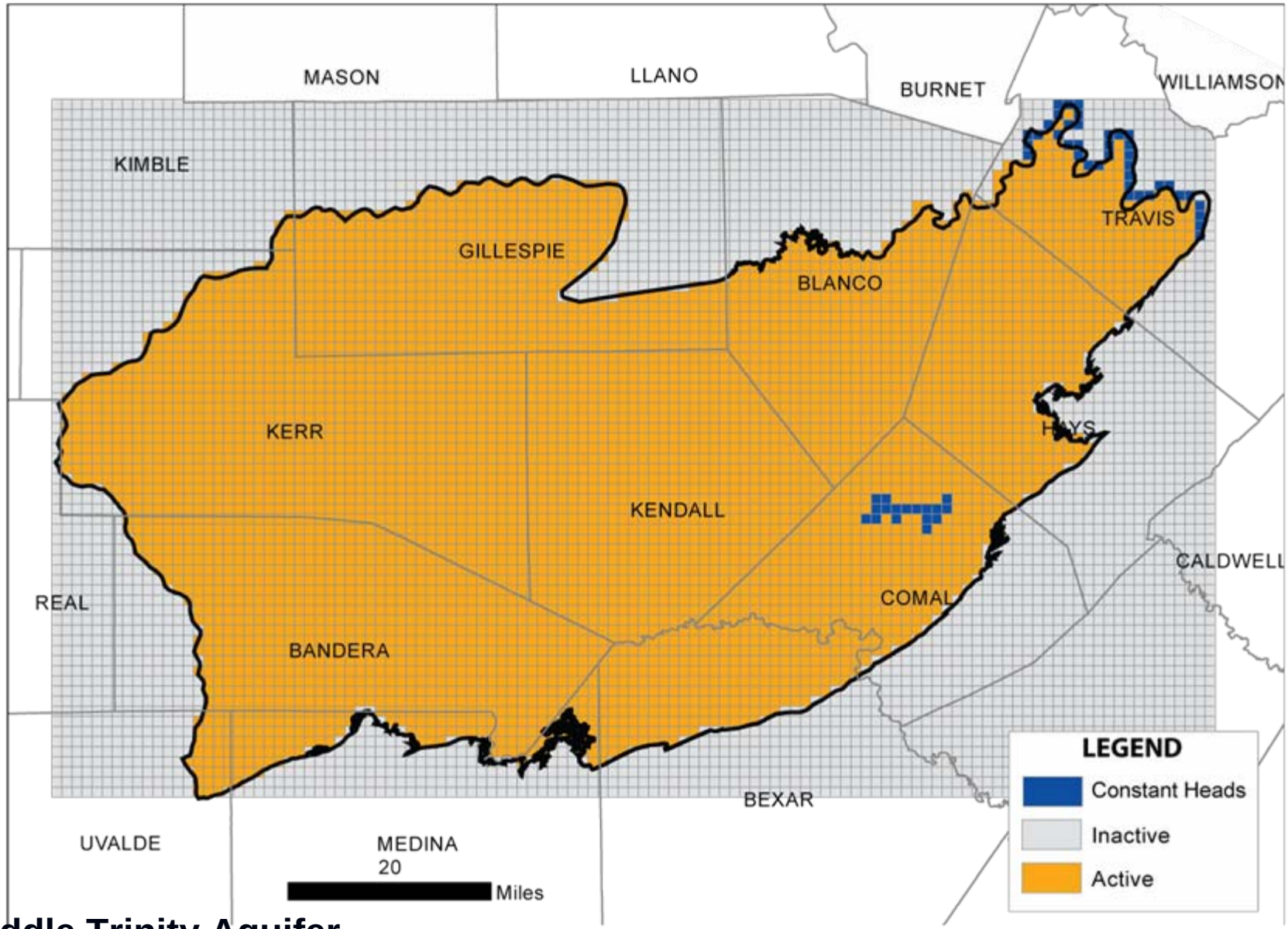
Edwards Group

MODEL GRID



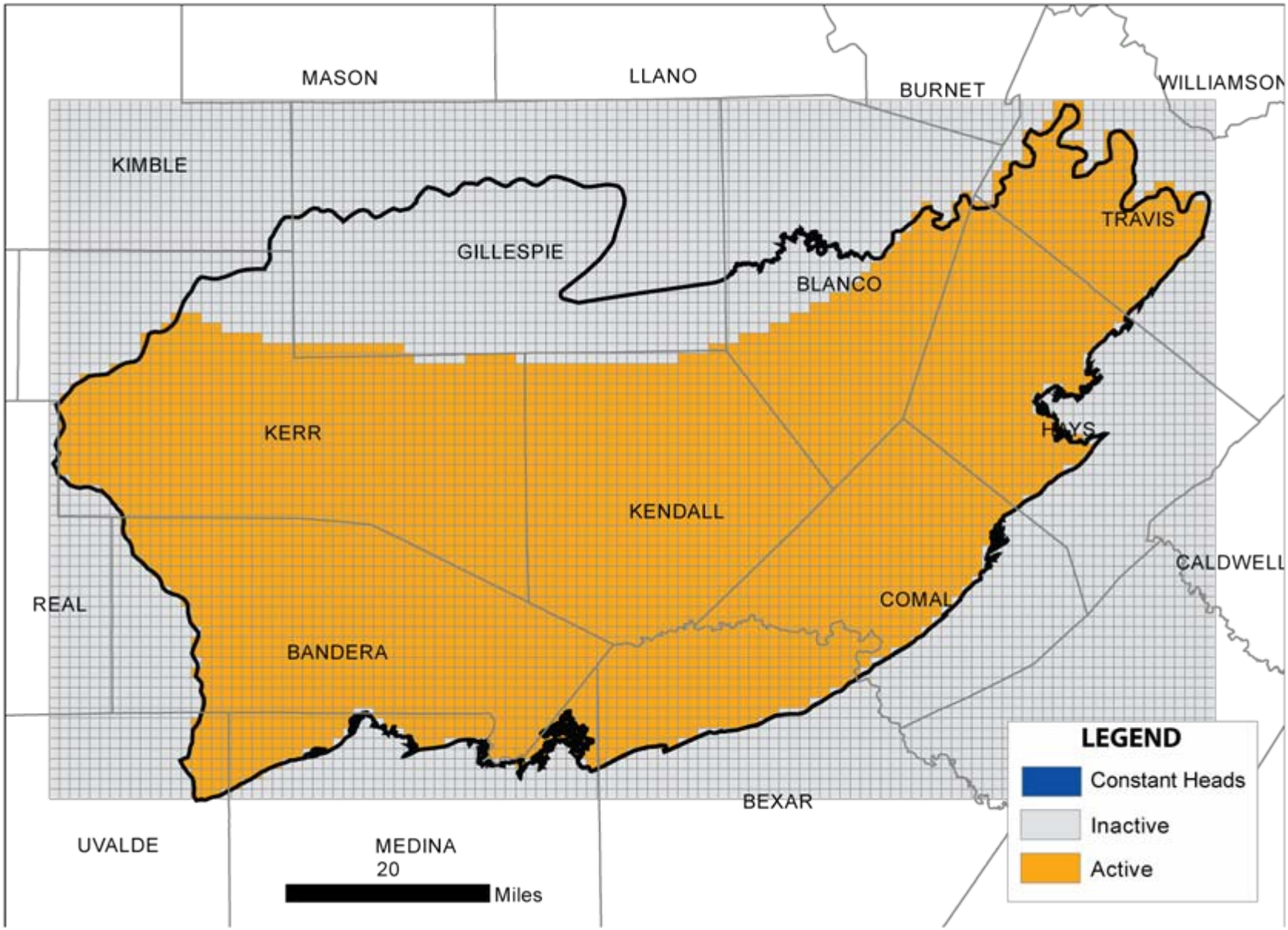
Upper Trinity Aquifer

MODEL GRID



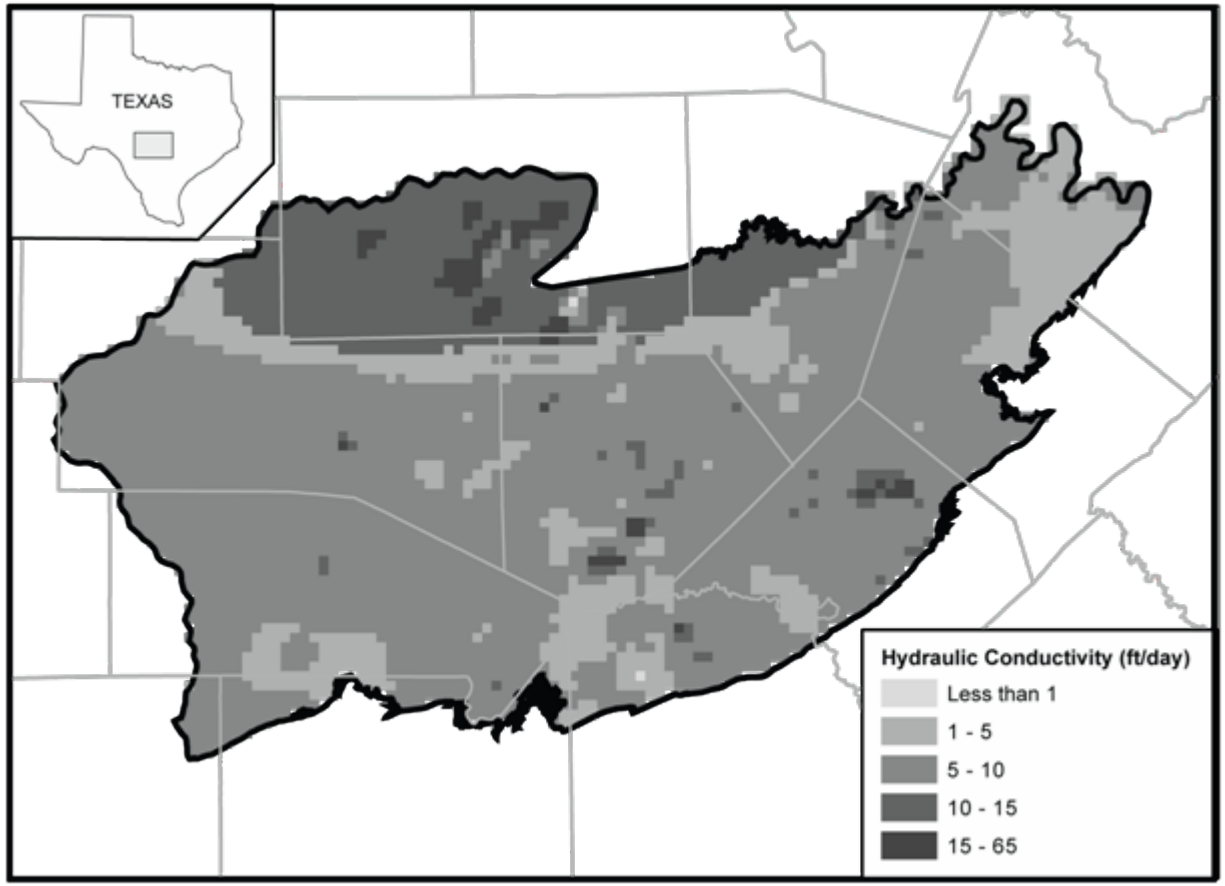
Middle Trinity Aquifer

MODEL GRID

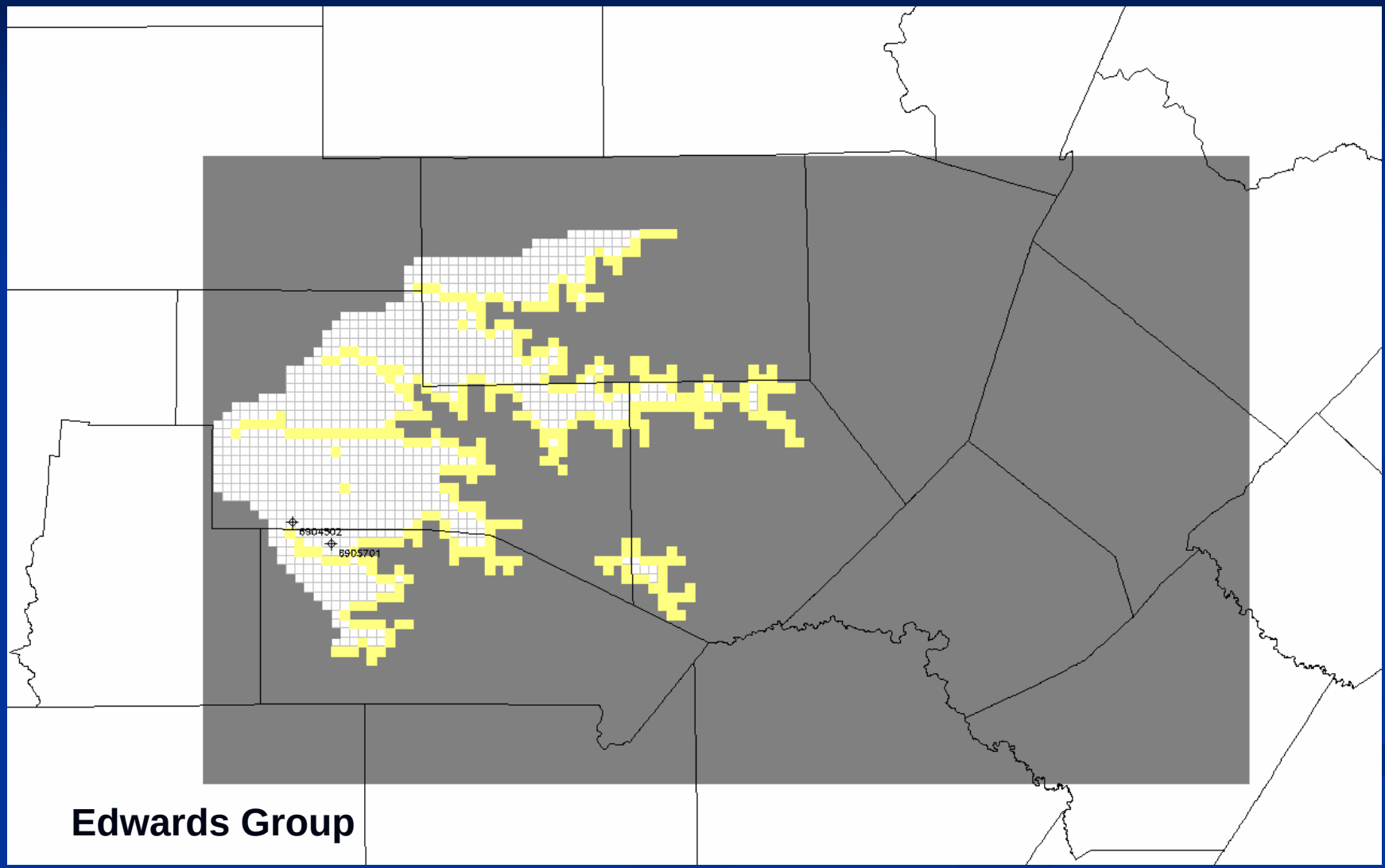


Lower Trinity Aquifer

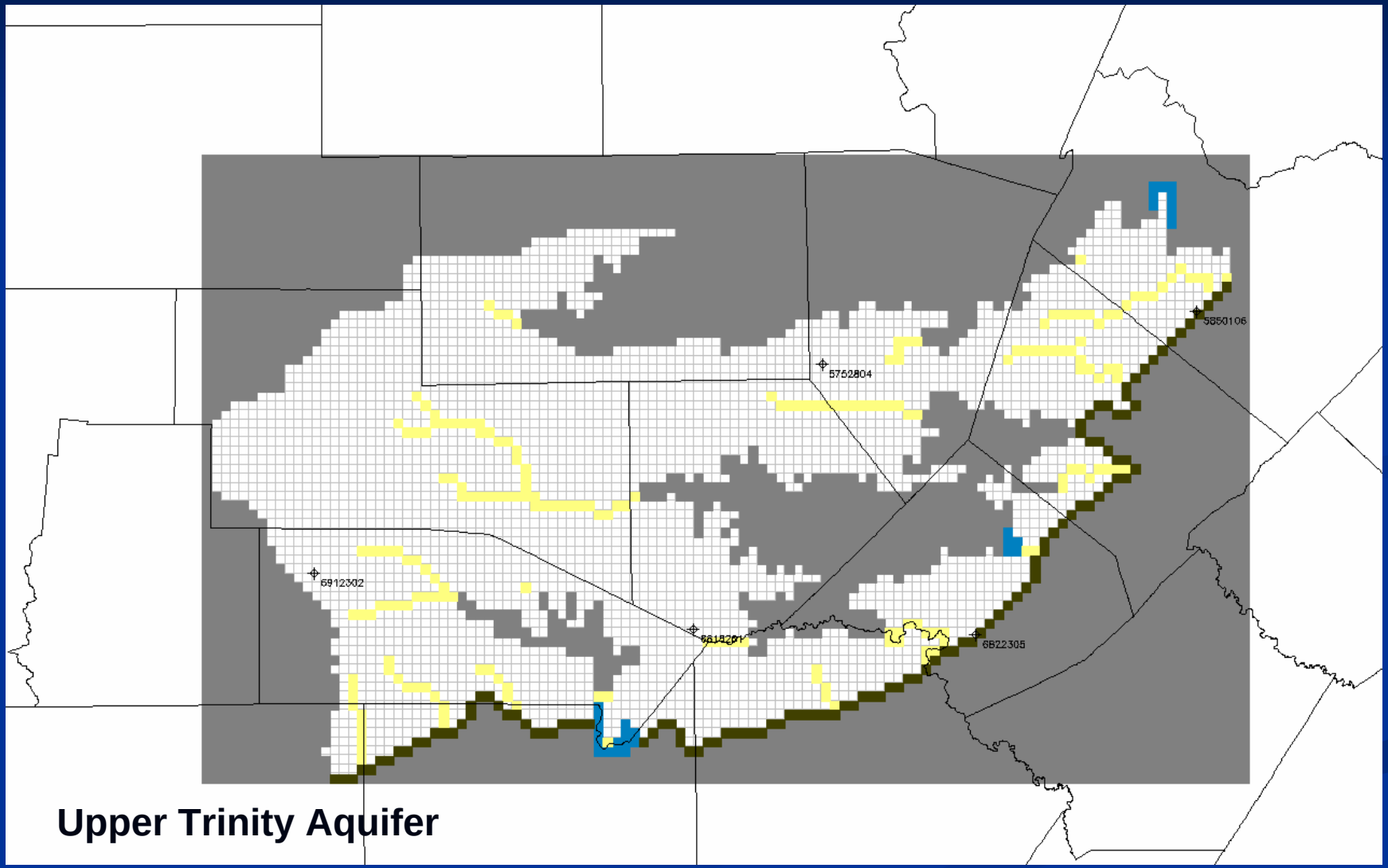
HYDRAULIC CONDUCTIVITY



DRAINS

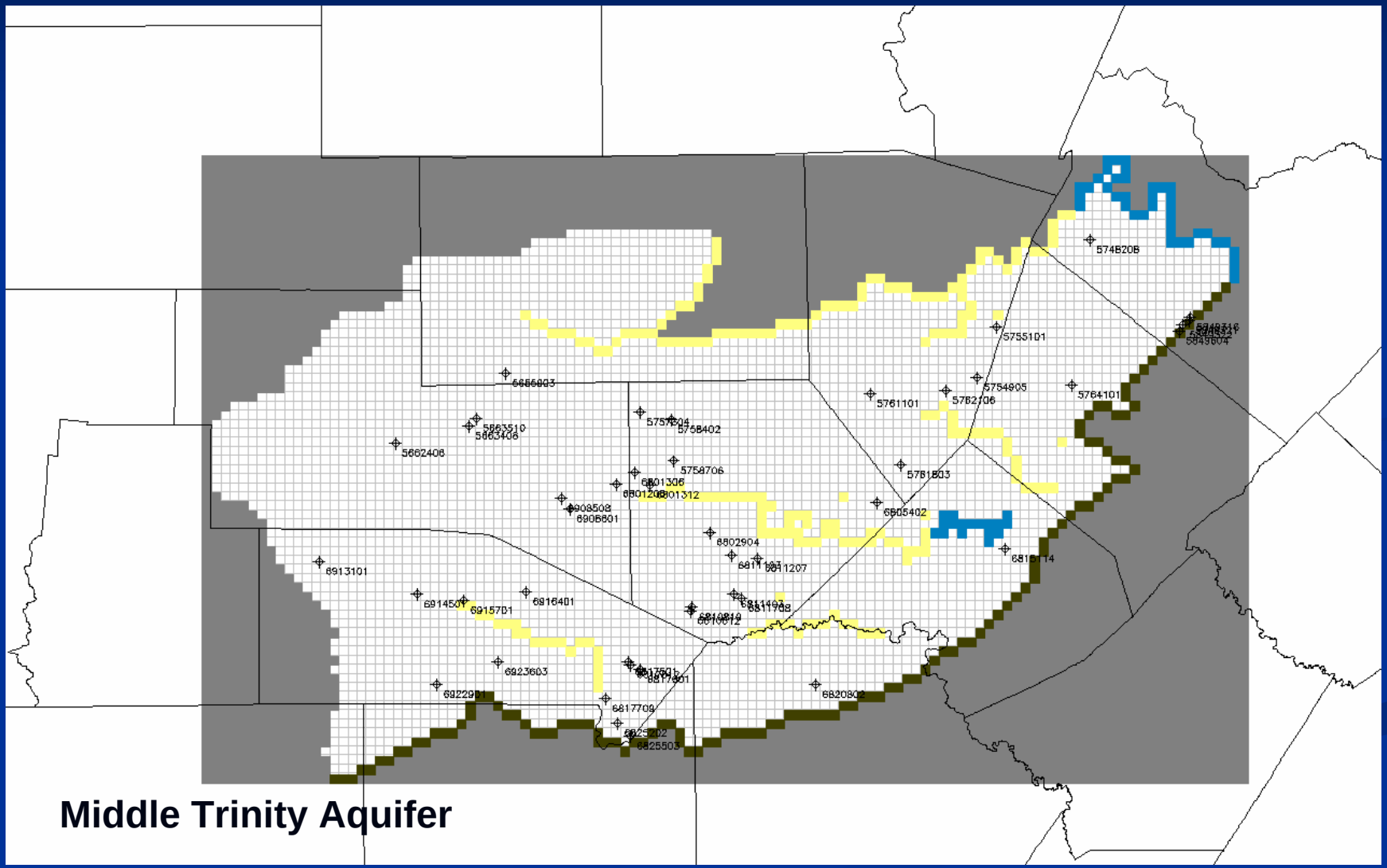


DRAINS

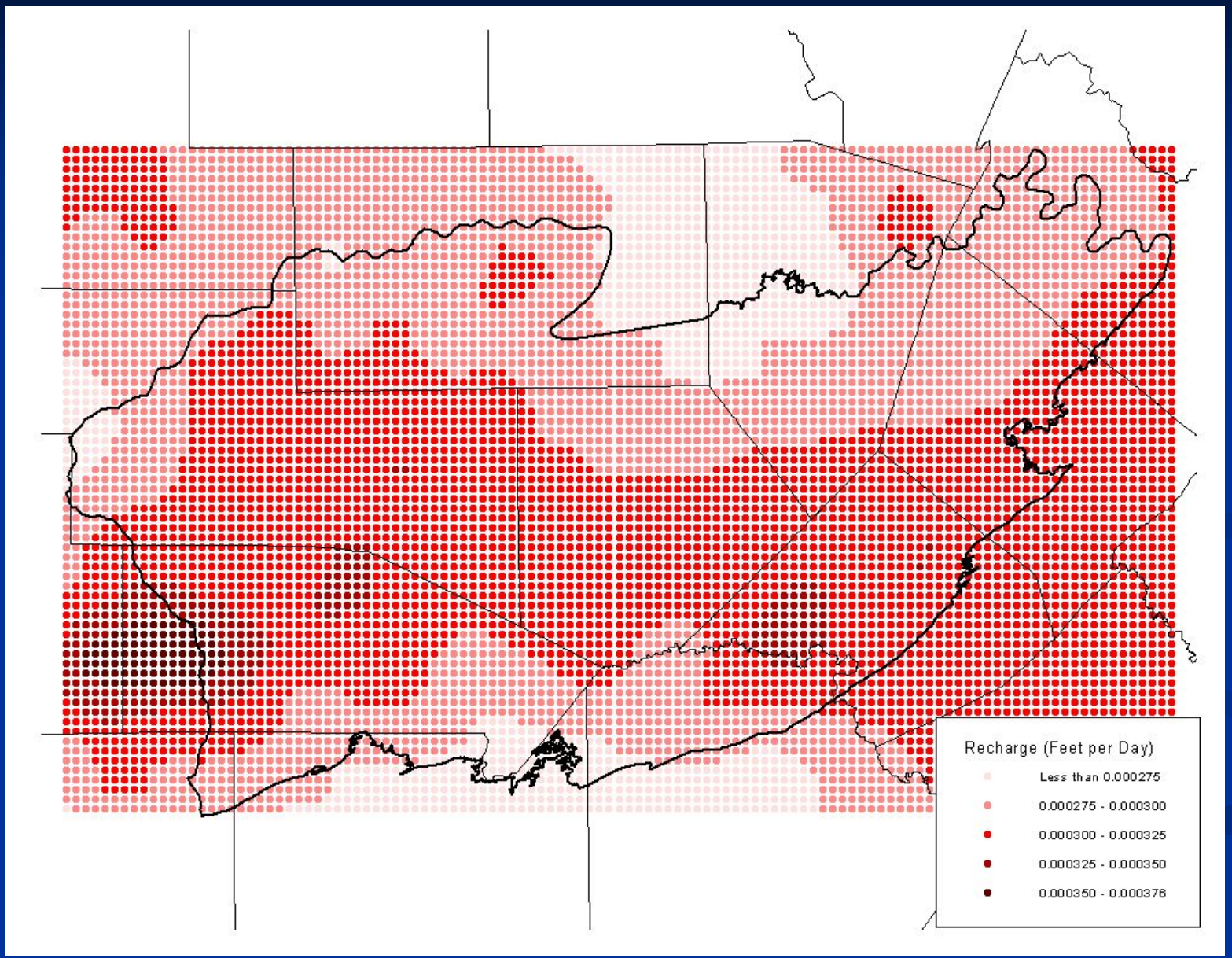


Upper Trinity Aquifer

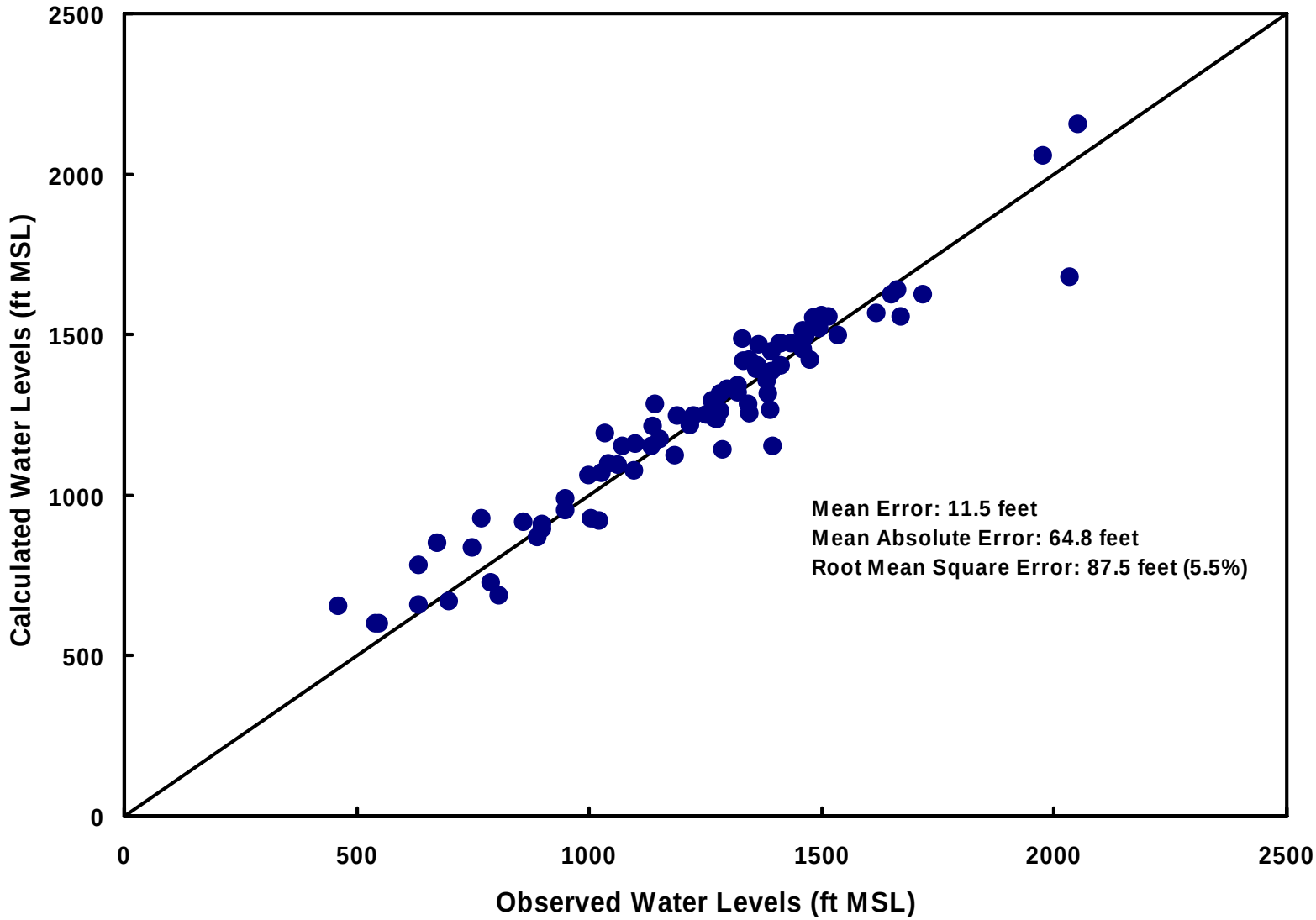
DRAINS



RECHARGE


Recharge (Feet per Day)
Less than 0.000275
0.000275 - 0.000300
0.000300 - 0.000325
0.000325 - 0.000350
0.000350 - 0.000376

PRELIMINARY MODEL RESULTS



WHAT'S NEXT?

- Steady-State Model
  - Sensitivity Analysis
  - Water Budget Analysis
- Transient Model
  - Calibration
  - Sensitivity Analysis
- Report
  - Internal/external review
  - Finalization

SCHEDULE

SAF Meeting 1 — Conceptual model

— Model design

SAF Meeting 2 — Dec. 2006 — Calibrate steady-state model

Mar. 2007 — Calibrate transient model

SAF Meeting 3 — Jun. 2007 — Prepare draft report

Aug. 2007 — Present SAF Model Seminar

Deliver Final Product


TEXAS WATER DEVELOPMENT BOARD

Second Stakeholder Advisory Forum for the updated Trinity Hill Country GAM
Held at Blanco-Pedernales GCD, Johnson City, December 12, 2006
List of Attendees

	Name	Affiliation
1	Micah Voulagis	Cow Creek GCD
2	Tommy Mathews	Cow Creek GCD
3	Ronald Zuncker	
4	Mary Ellen Summerlin	Headwaters GCD
5	Andrew Backus	Hays Trinity GCD
6	Thomas Boehme	
7	George Wissmann	Trinity Glen Rose GCD
8	Jim Hannah	
9	Bob Moore	Travis County
10	Jasmine Beitz	
11	Ian Jones	TWDB
12	Ali Chowdhury	TWDB
13	Rima Petrossian	TWDB
14	Ron Fieseler	Blanco-Pedernales GCD
15	Paul Babb	
16	Abiy Berehe	TCEQ
17	John Elliott	
18	Gene Williams	Headwaters GCD
19	Diane McMahon	
20	Mary K. Binford	
21	Don Dietzmann	Cow Creek GCD
22	John Kight	Cow Creek GCD
23	Christy Muse	Hill Country Alliance
24	Doug Wierman	Hays Trinity GCD
25	Jack Hollon	
26	Laura Marbury	Environmental Defense
27	Rebecca Lambert	USGS
28	George Ozuna	USGS
29	Jack Sharp	UT
30	William Feathergail Wilson	Strata Geological
31	David Eaton	UT
32	Sarah Davidson	UT
33	Peggy Null	UT
34	Michael Cialreghi	UT
35	Manami Suga	UT
36	Suzanne Schartz	UT
37	Richard A. Connors	BCRAGD
38	Paul Tybor	Hill Country UWCD
39	Jules Vieau	UT
40	Stan Meyer	
41	Bobby Wilson	

Texas Water Development Board
Groundwater Resources Division

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1. **Purpose of meeting**: Stakeholder Advisory Forum for the Groundwater Availability Model of the Hill Country portion of the Trinity Aquifer System
2. **Date and location of meeting**: December 12, 2006
3. **TWDB staff in attendance**: Ian Jones, Ali Chowdhury, Rima Petrossian
4. **Senators/Representatives/other VIPs in attendance**: Bob Moore for Travis Co. Comm. Gerald Daugherty
5. **Who was in attendance (non-TWDB staff):** See below
6. **Meeting report filed by:** Ian Jones
7. **Date of meeting report filing:** December 12, 2006
8. **Agenda/Outcomes/Comments:**

The second Stakeholder Advisory Forum for the updated Groundwater Availability Model of the Hill Country portion of the Trinity Aquifer System was held at the offices of the Blanco-Pedernales Groundwater Conservation District in Johnson City, Texas, on December 12, 2006. This stakeholder advisory forum was held in conjunction with a meeting of Groundwater Management Area 9. Topics covered during the meeting included the work to be done to update the model, the hydrogeology of the Hill Country portion of the Trinity Aquifer System, preliminary results of steady-state modeling, and the work schedule. The model is being updated to meet Texas Water Development Board Groundwater Availability Model standards, add the Lower Trinity aquifer to the model, make adjustments to the structure of the existing layers, and redistribute recharge and pumping. According to the present work schedule, work to update the model, including the report, may be completed by the end of August 2006.

During the meeting, stakeholders asked several questions pertaining to various aspects of the model. The following is a synopsis of stakeholder questions and comments (**bold**) and our responses (*italics*).

- **Will the model be calibrated to simulate discharge to springs and streams?** *The model only simulates selected springs and rivers and we will only calibrate discharge where data is available. Springs included in the previous version of the model will be included in the current version.*
- **Does the model account for facies changes?** *Only in some cases, by varying hydraulic conductivity. Small variations in facies changes cannot be incorporated in the model due to regional nature of the model. Where there is no hydraulic conductivity information available, hydraulic conductivity values are interpolated between measured points.*

- **How is rural domestic pumping in each cell calculated?** *Based on the census block data and pumping estimates for each watershed within each county. Pumping is applied based on the fraction of the total population within the watershed in the model cell based on census block population densities.*
- **Is recharge applied everywhere in the model?** *Recharge is only applied to the uppermost active cells within the model.*

- **Some of groundwater has groundwater ages of more than 25,000 years in parts of the aquifer. How does this relate to recharge assigned to the model?** *Although groundwater at depth may locally have old groundwater ages, modern recharge may be occurring in the shallower portions of the aquifer. A geochemical and isotopic investigation was conducted to better conceptualize the flow system prior to construction of the groundwater model. This report on conceptualization of the flow system based on isotopic and geochemical analyses will become available soon.*

- **How does interaction occur between the shallower and deeper parts of the aquifer and between model layers?** *Vertical hydraulic conductance values assigned in the model layers largely determines degree of connection between them.*

- **Can the model be scaled down for use at the local level for approving subdivisions?** *There is a need for lot more additional data to develop a local scale model.*

- **Why doesn't the model simulate the missing years between the 1980-1997 calibration period and the present?** *The model does not have to be calibrated to the present. The aim of model calibration is calibrate the model such that it responds in the same way as the aquifer. Once this is achieved, you have confidence that it will respond in same way the aquifer would for any given set of hydraulic conditions.*

List of meeting attendees

	Name	Affiliation
1	Micah Voulagis	Cow Creek GCD
2	Tommy Mathews	Cow Creek GCD
3	Ronald Zuncker	
4	Mary Ellen Summerlin	Headwaters GCD
5	Andrew Backus	Hays Trinity GCD
6	Thomas Boehme	
7	George Wissmann	Trinity Glen Rose GCD
8	Jim Hannah	
9	Bob Moore	Travis County
10	Jasmine Beitz	
11	Ian Jones	TWDB
12	Ali Chowdhury	TWDB
13	Rima Petrossian	TWDB
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16	Abiy Berehe	TCEQ
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21	Don Dietzmann	Cow Creek GCD
22	John Kight	Cow Creek GCD
23	Christy Muse	Hill Country Alliance
24	Doug Wierman	Hays Trinity GCD
25	Jack Hollon	
26	Laura Marbury	Environmental Defense
27	Rebecca Lambert	USGS
28	George Ozuna	USGS
29	Jack Sharp	UT
30	William Feathergail Wilson	Strata Geological
31	David Eaton	UT
32	Sarah Davidson	UT
33	Peggy Null	UT
34	Michael Cialreghi	UT
35	Manami Suga	UT
36	Suzanne Schartz	UT
37	Richard A. Connors	BCRAGD
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39	Jules Vieau	UT
40	Stan Meyer	
41	Bobby Wilson	