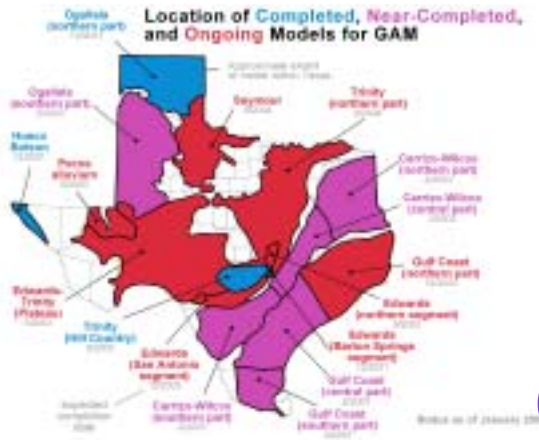
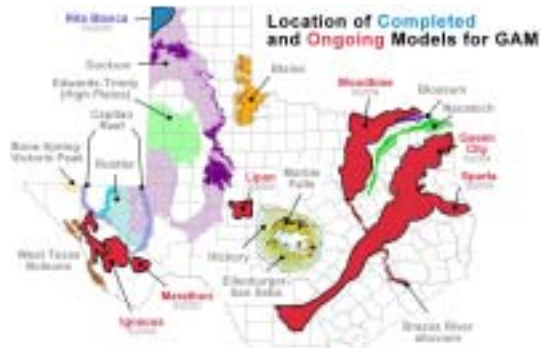
texas water development board

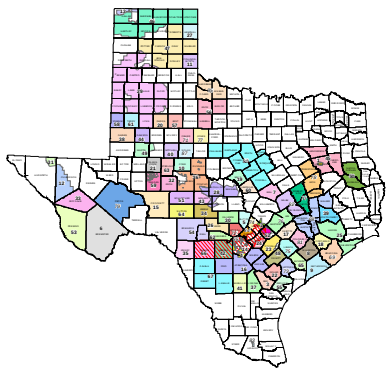
Groundwater Availability Modeling

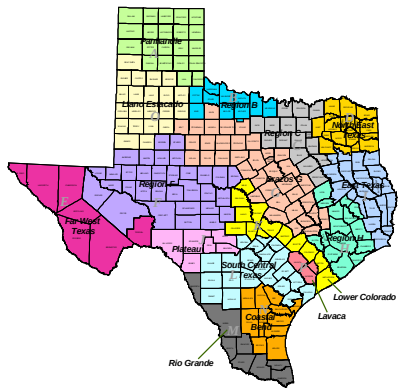




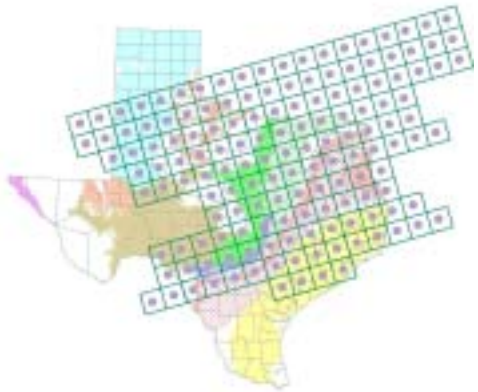
Cindy Ridgeway

Contract Manager



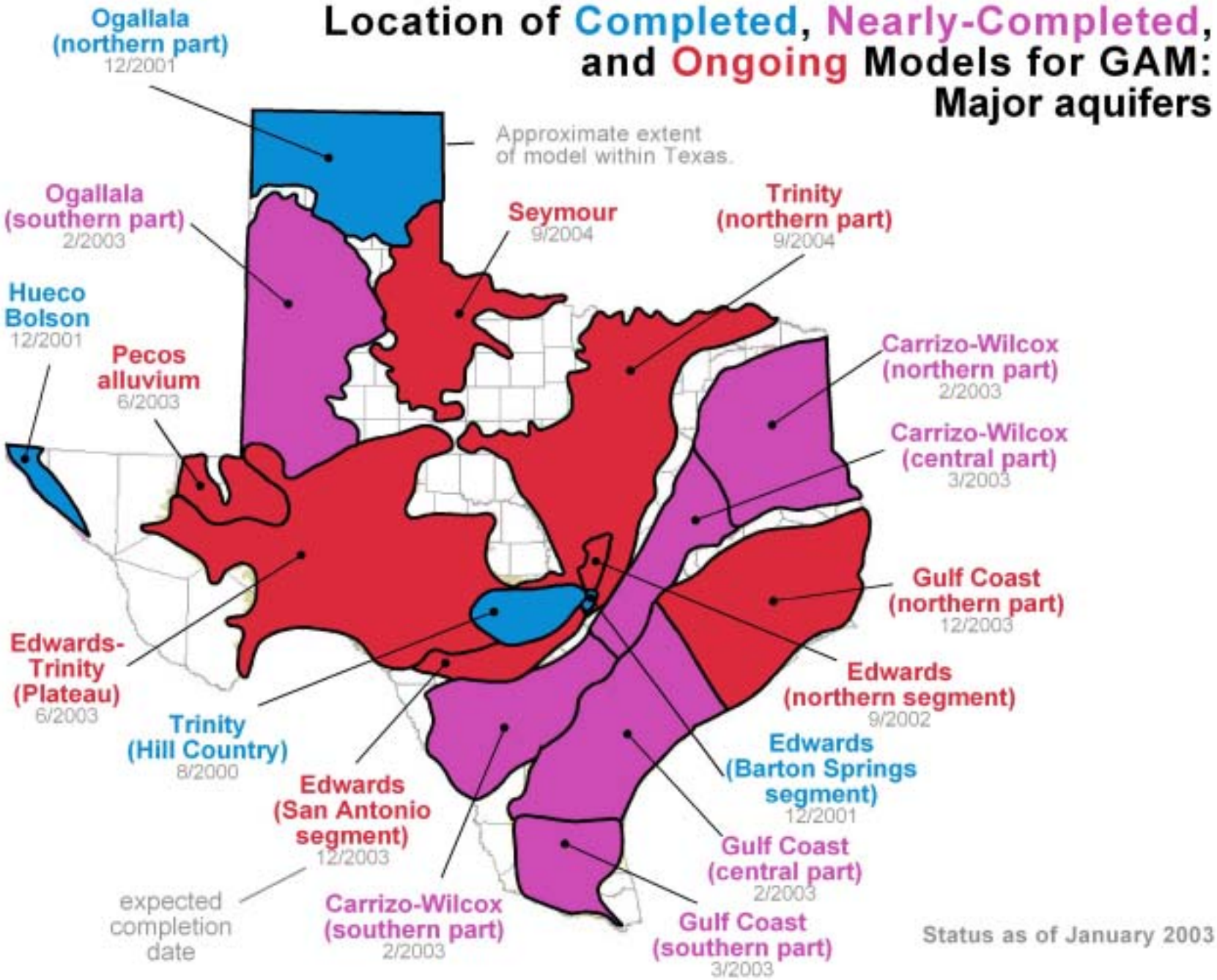


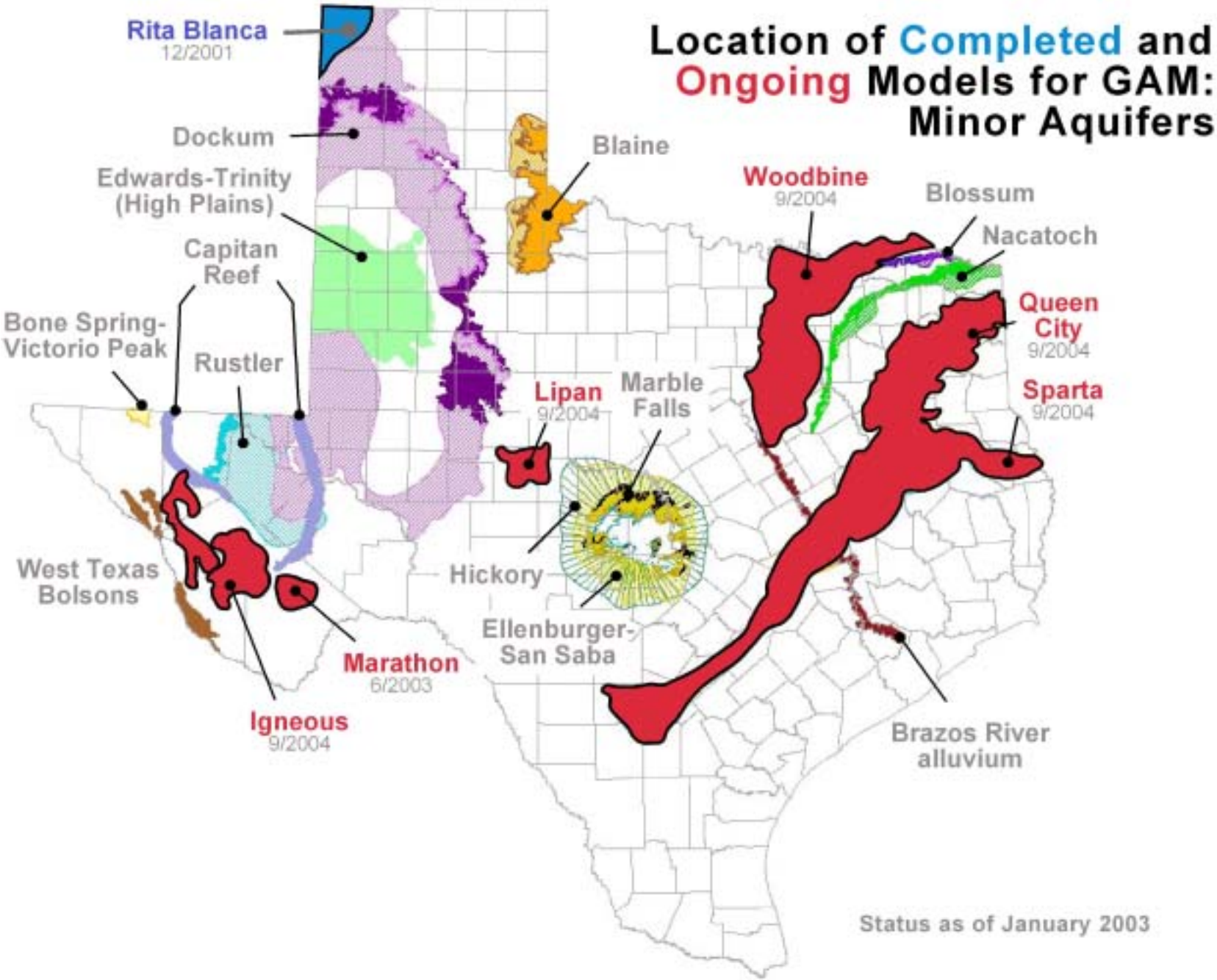
Texas Water Development Board

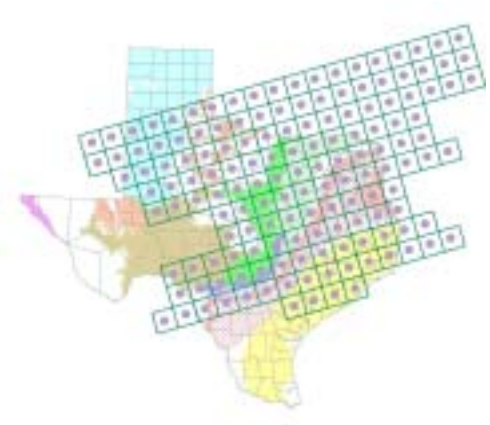


GAM

- Purpose: to develop the best possible groundwater availability model with the available time and money.
- Public process: you get to see how the model is put together.
- Freely available: standardized, thoroughly documented, and available over the internet.
- Living tools: periodically updated.

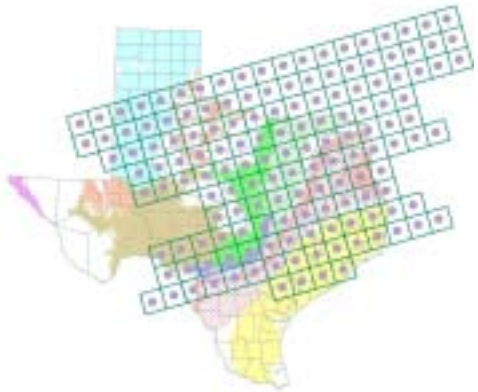

Location of Completed, Nearly-Completed, and Ongoing Models for GAM: Major aquifers
Ogallala (northern part) 12/2001
Approximate extent of model within Texas.
Ogallala (southern part) 2/2003
Seymour 9/2004
Trinity (northern part) 9/2004
Hueco Bolson 12/2001
Pecos alluvium 6/2003
Carrizo-Wilcox (northern part) 2/2003
Carrizo-Wilcox (central part) 3/2003
Gulf Coast (northern part) 12/2003
Edwards-Trinity (Plateau) 6/2003
Edwards (northern segment) 9/2002
Trinity (Hill Country) 8/2000
Edwards (Barton Springs segment) 12/2001
Edwards (San Antonio segment) 12/2003
Gulf Coast (central part) 2/2003
expected completion date
Carrizo-Wilcox (southern part) 2/2003
Gulf Coast (southern part) 3/2003
Status as of January 2003


Location of Completed and Ongoing Models for GAM: Minor Aquifers
Rita Blanca
12/2001
Dockum
Edwards-Trinity (High Plains)
Capitan Reef
Bone Spring-Victorio Peak
Rustler
Blaine
Woodbine
9/2004
Blossum
Nacatoch
Queen City
9/2004
Sparta
9/2004
Lipan
9/2004
Marble Falls
Hickory
Ellenburger-San Saba
West Texas Bolsons
Marathon
6/2003
Igneous
9/2004
Brazos River alluvium
Status as of January 2003



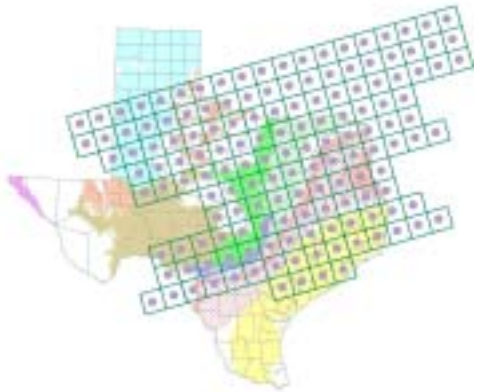
What is groundwater availability?

- …the amount of groundwater available for use.
- The State does not decide how much groundwater is available for use: GCDs and RWPGs decide.
- A GAM is a tool that can be used to assess groundwater availability once GCDs and RWPGs decide how to define groundwater availability.



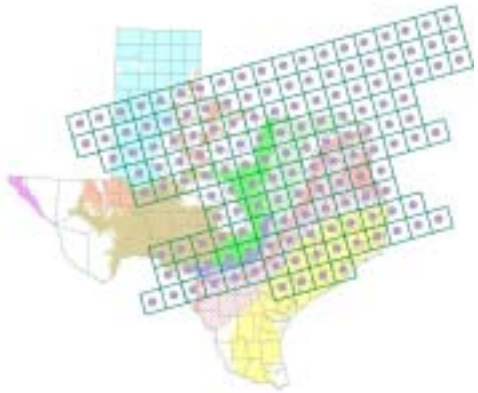
Do we have to use GAM?

- Water Code & TWDB rules require that GCDs use GAM information. Other information can be used in conjunction with GAM information.
- TWDB rules require that RWPGs use GAM information unless there is better site specific information available



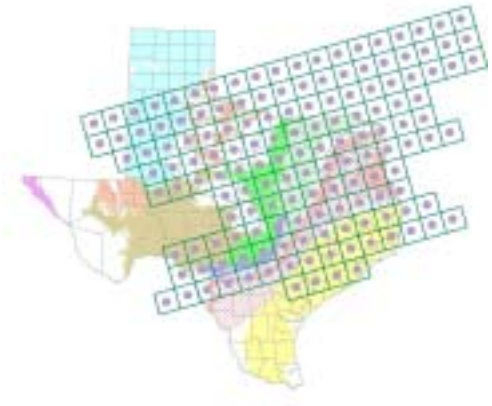
How do we use GAM?

- The model
  - predict water levels and flows in response to pumping and drought
  - effects of well fields
- Data in the model
  - water in storage
  - recharge estimates
  - hydraulic properties
- GCDs and RWPGs can request runs



Living tools

- GCDs, RWPGs, TWDB, and others collect new information on aquifer.
- This information can enhance the current GAMs.
- TWDB plans to update GAMs every five years with new information.
- Please share information and ideas with TWDB on aquifers and GAMs.



Participating in the GAM process

- SAF meetings
  - hear about progress on the model
  - comment on model assumptions
  - offer information (timing is important!)
- Report review
  - at end of project
- Contact TWDB
  - Robert Mace (512) 936-0861
  - Cindy Ridgeway (512) 936-2386

Comments:

Contract Manager

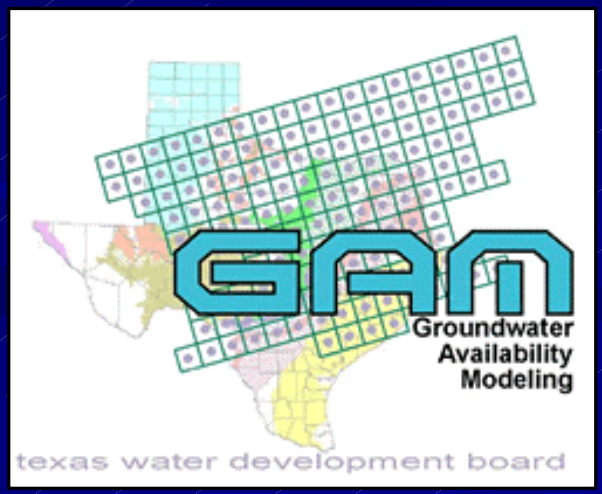
cindy.ridgeway@twdb.state.tx.us

(512)936-2386

www.twdb.state.tx.us/gam

Groundwater Availability Modeling (GAM) for the Seymour Aquifer

Stakeholder Advisory Forum (SAF#2)
Seymour, Texas
June 30, 2003



INTERA

WPRC

ENPROTEC

PARSONS

Outline

- SAFs
- Introduction to Seymour aquifer and GAM
- Preliminary approach to model implementation
  - Model design – layers & boundaries
  - Geology/structure
- Status of data source review & data base development
  - Hydraulic properties
  - Recharge
  - Streams
  - Water levels
  - Springs
  - Pumping
- GAM schedule
- Scope for next SAF

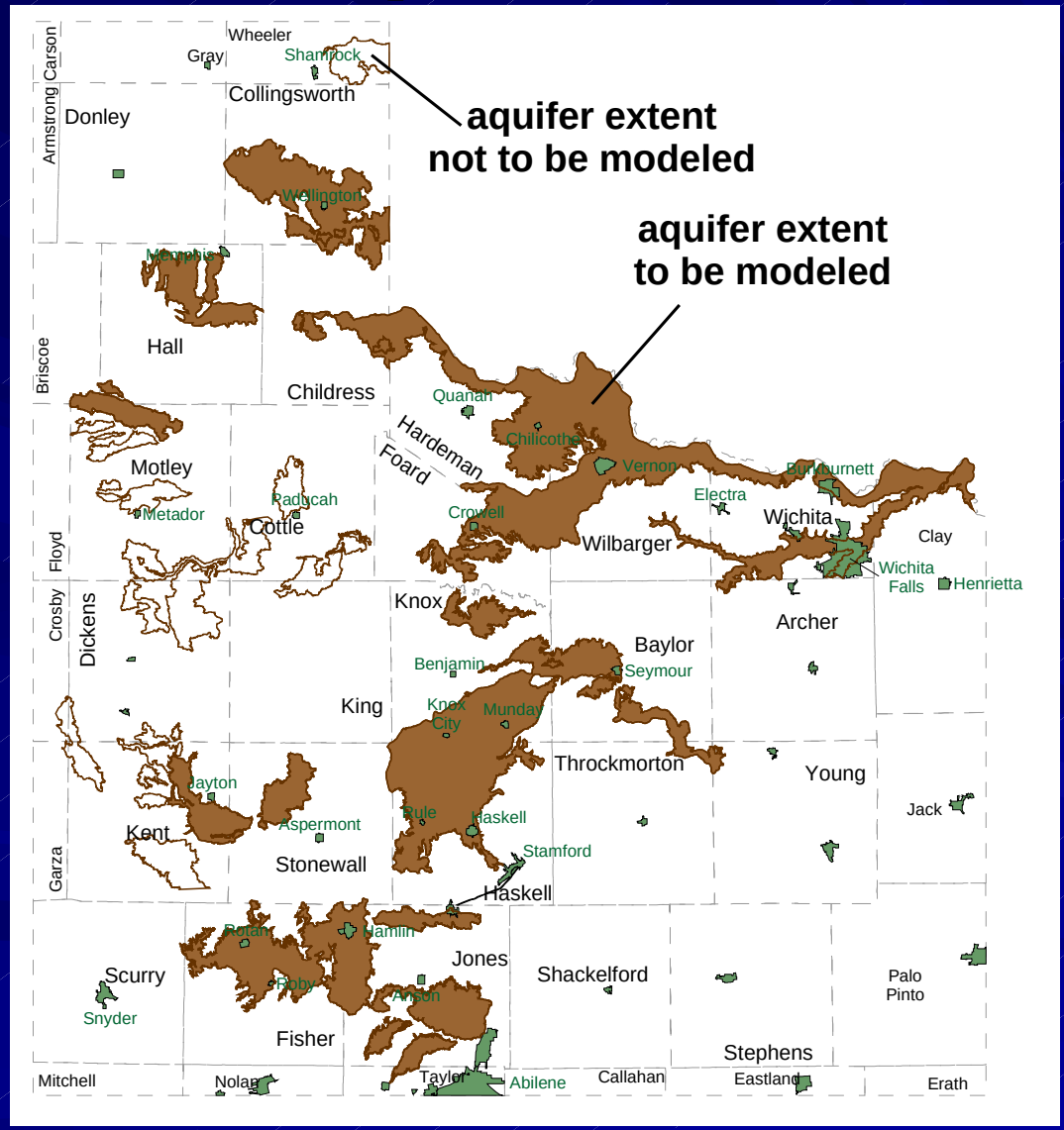
Stakeholder Advisory Forums - SAFs

- Held on 4 month schedule
- First SAF introduced basic information and requested data for the model
- Today's meeting and future meetings will:
  - provide updates on progress
  - provide an opportunity to offer feedback
- SAF presentations and questions & responses from meetings will be posted at http://www.twdb.state.tx.us/gam/symr/symr.htm

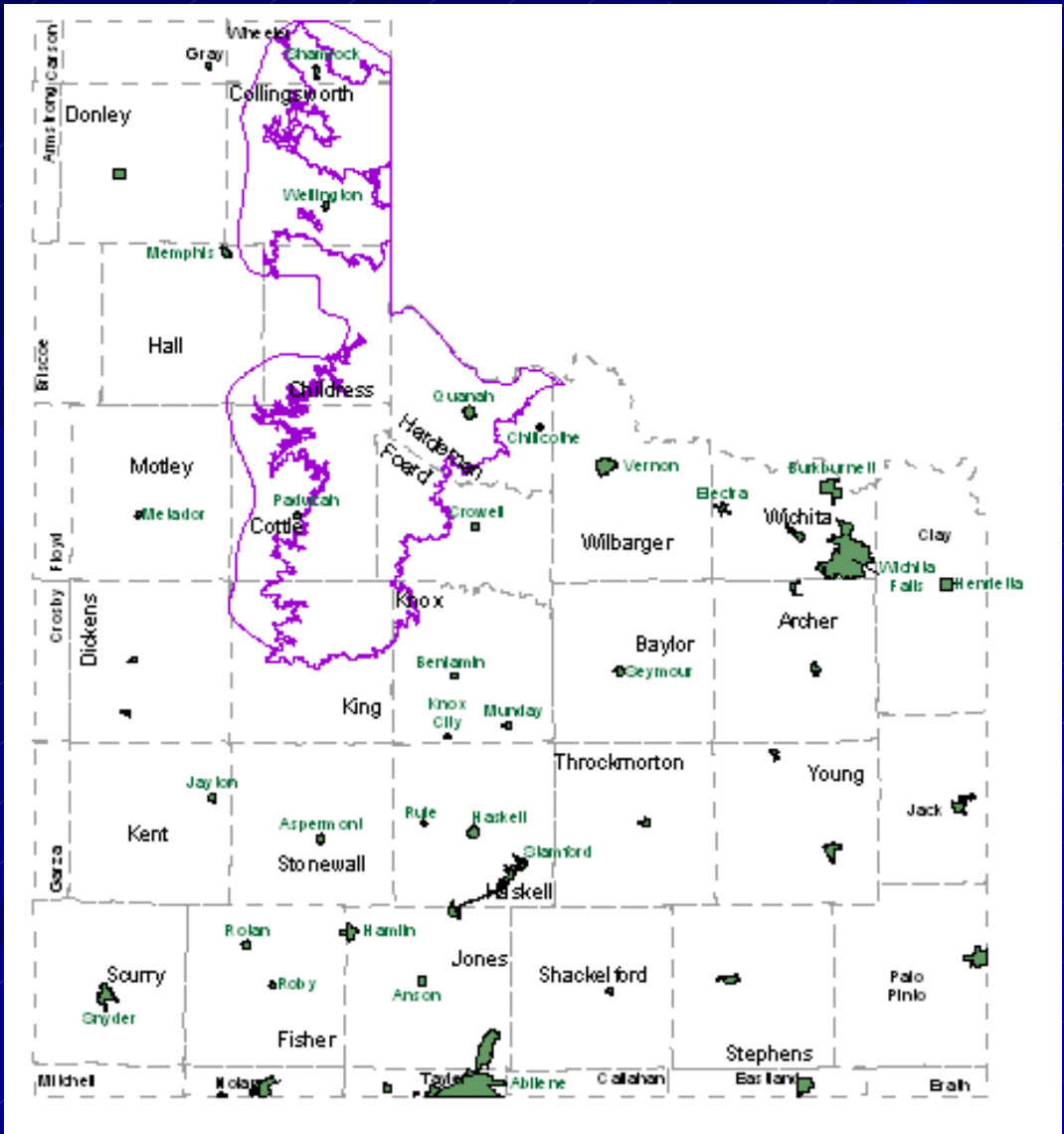
Seymour Aquifer

- Seymour aquifer is composed of clay, silt, sand, and gravel. Sands & gravels occur primarily at base.
- For some of the model areas, it includes alluvial deposits in the river valleys.
- Thickness of Seymour aquifer is up to 100 feet, with a saturated thickness typically less than 60 feet.
- Model will represent the Seymour and alluvium as a single layer.
- Blaine aquifer is modeled as a second layer.

Seymour Aquifer Boundaries



Blaine Aquifer Boundaries



Key Data Sources

- TWDB website: Seymour/alluvium (approx. 5000 wells)
- County reports by TWDB & predecessors
- U.S. Geological Survey reports
- UT Bureau of Economic Geology reports
- Oklahoma WR Board & GS reports
- TCEQ drillers logs
- Brune (1975) spring locations & flows

Key Data Sources (cont'd)

- Additional websites:
  - U.S. Geological Survey
    - topography
    - stream flows
    - stream gain/loss studies
  - U.S. EPA
    - stream characteristics
    - land use / land cover
    - soil type
  - National Climatic Data Center - precipitation

General Stratigraphy

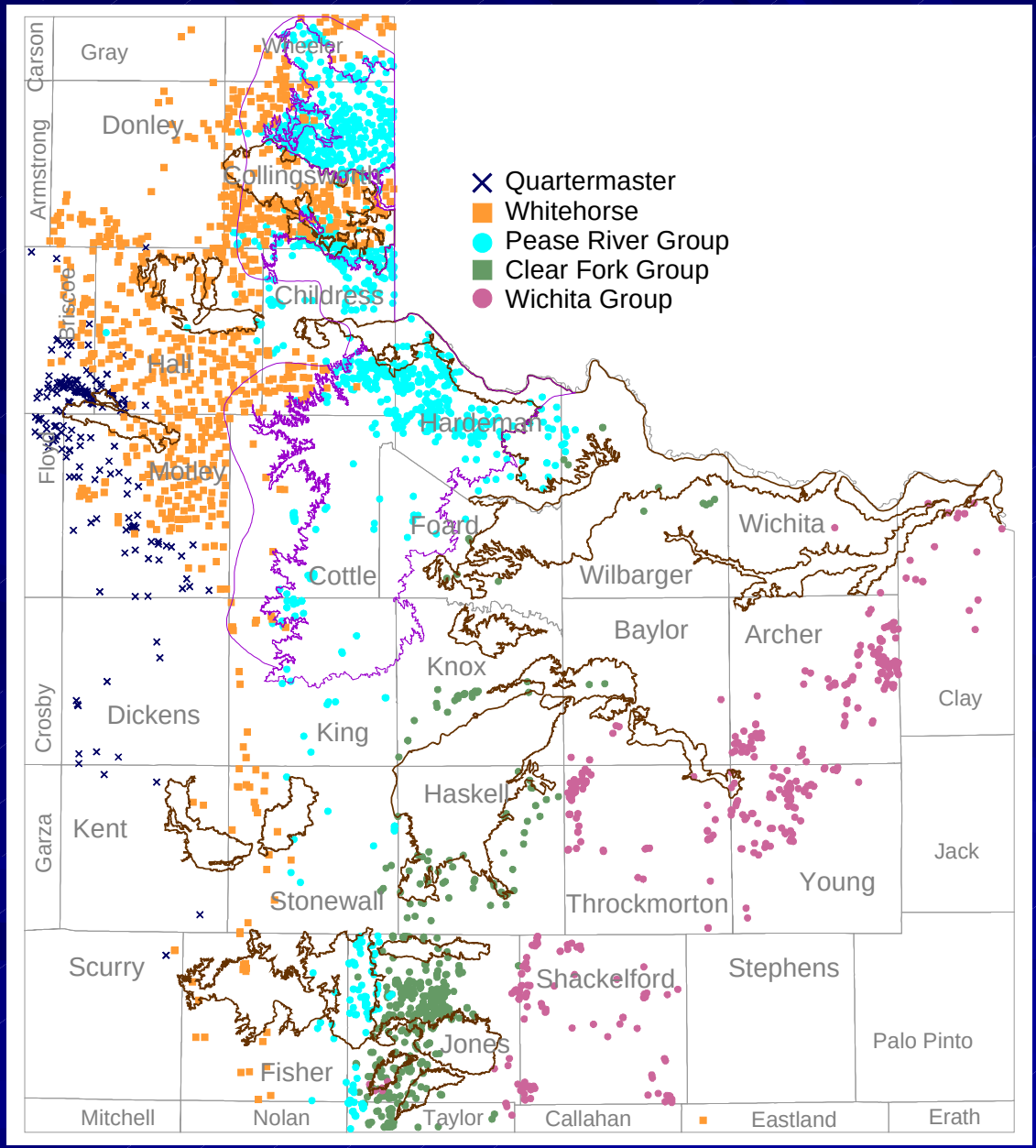
Seymour/Alluvium
Quarter Master – Ochoa Group
Whitehorse – Artesia Group

	Dog Creek Shale
Pease River	Blaine Formation
Group	Flowerpot Shale
	San Angelo Sandstone

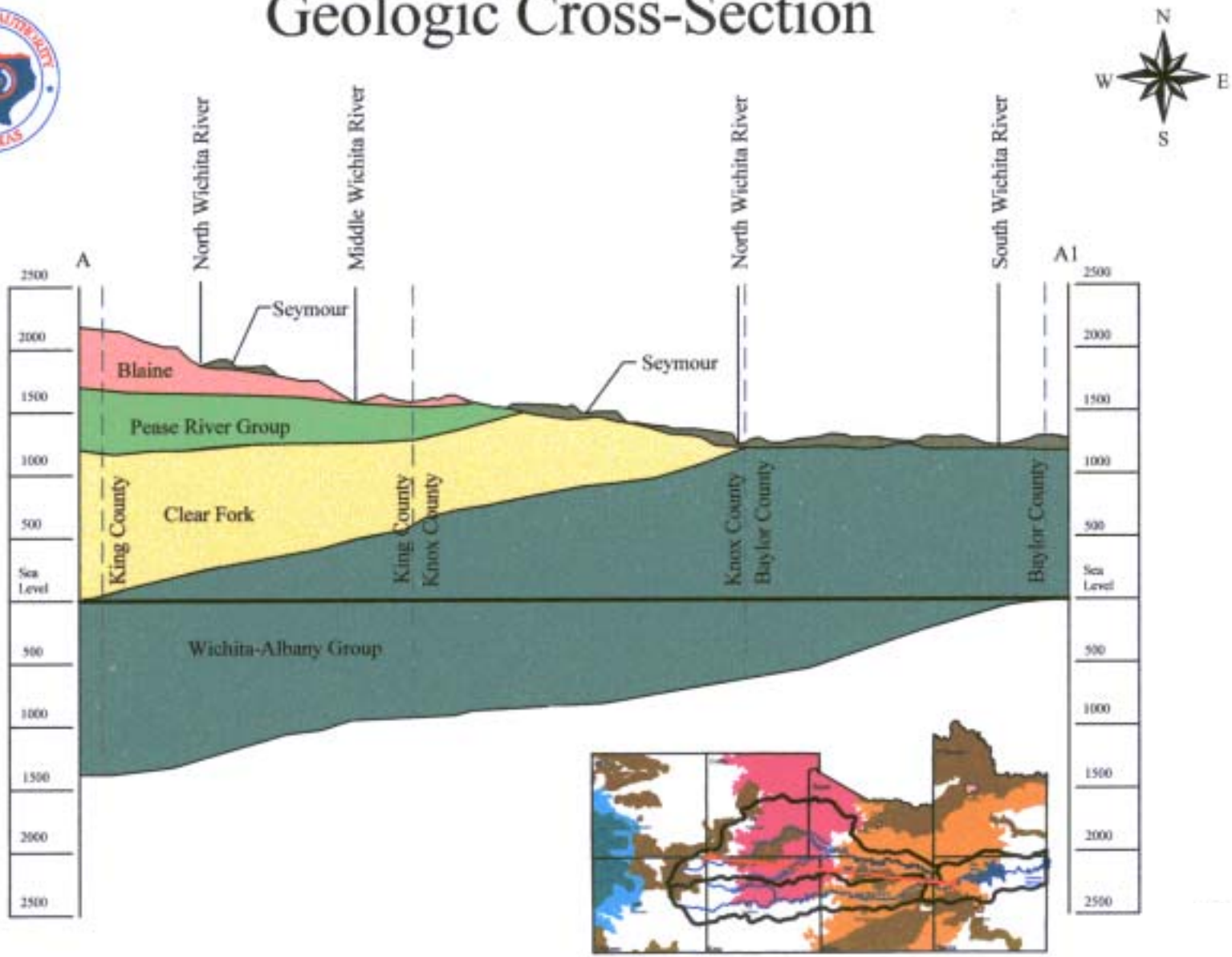
	Choza Formation
Clear Fork Grp	Vale Formation
	Arroyo Formation

Wichita Group

Stratigraphic Units Underlying Seymour Aquifer



Geologic Cross-Section



Taken from the website of the Red River Authority.

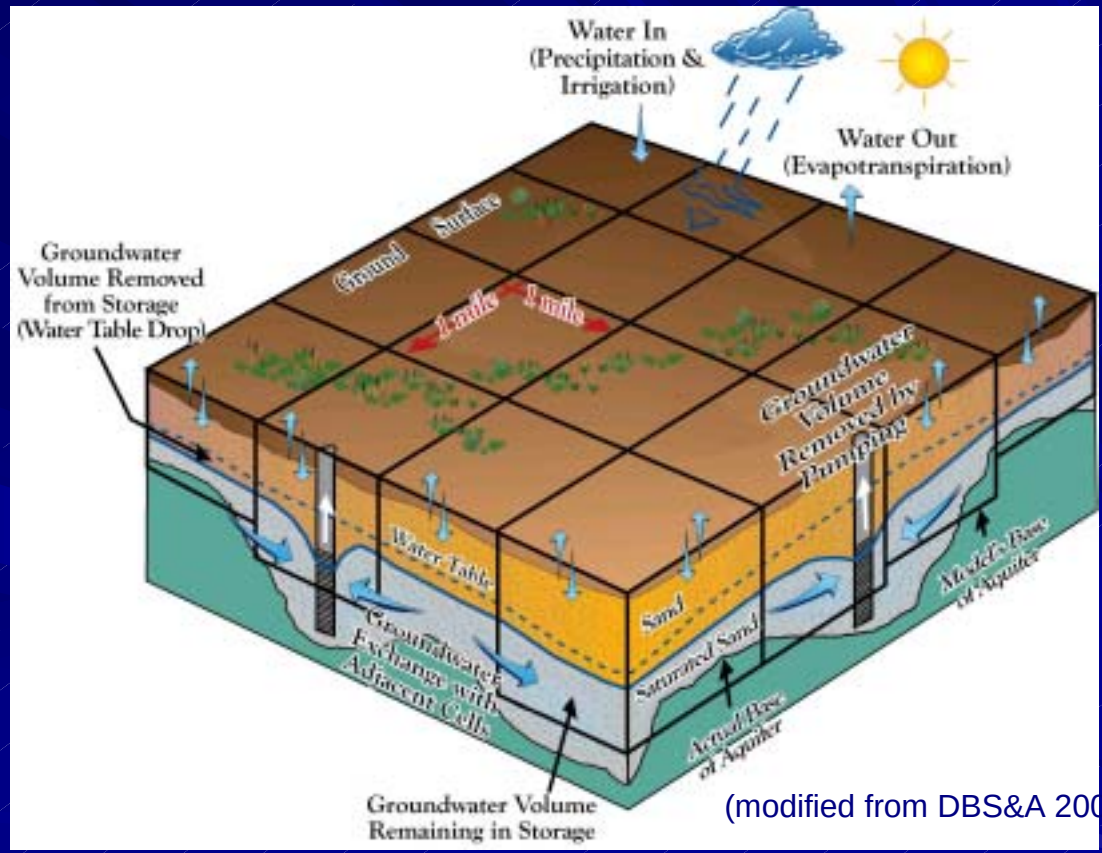
Definition of a Model

Domenico (1972) defined a model as a representation of reality that attempts to explain the behavior of some aspect of reality and is always less complex than the real system it represents.

Wang & Anderson (1982) defined a model as a tool designed to represent a simplified version of reality.

A Model is a Tool

- **Model heads are calculated based upon:**
  - Recharge
  - Aquifer properties
  - Pumping
  - Natural Discharge
- **Model heads are compared to observed water levels**
- **The tool is used to predict future water levels**



(modified from DBS&A 200

GAM Model Specifications

- **Three dimensional (MODFLOW-96)**
- **Regional scale (1000's of square miles)**
- **Grid spacing of 1 square mile**
- **Implement**
  - recharge
  - groundwater/surface water interaction
  - pumping
- **Calibration to observed water levels**

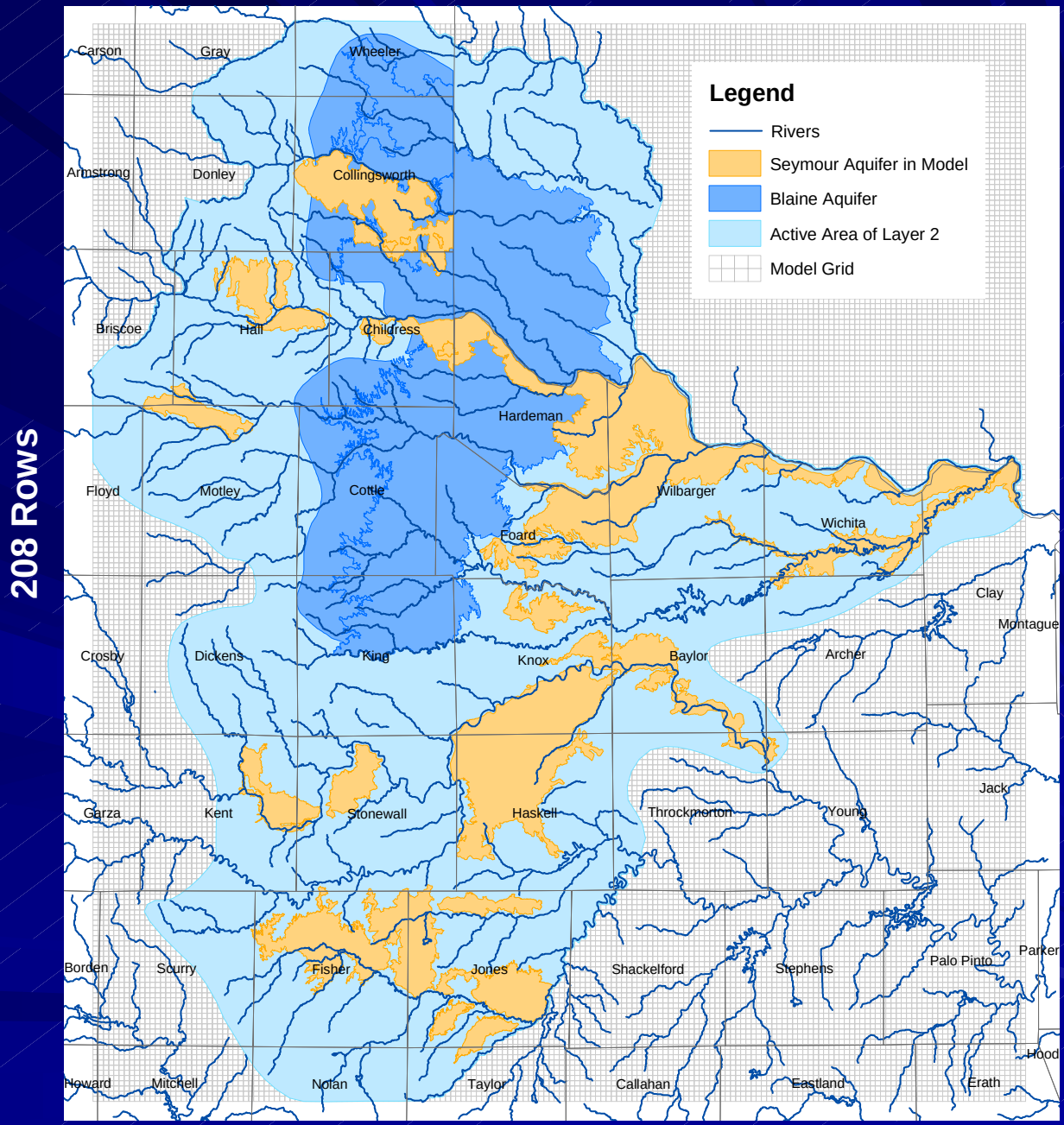
Hydrogeologic Setting

- Study area
- Hydrostratigraphy
- Hydraulic properties
- Regional groundwater flow
- Recharge
- Discharge
  - Pumping
- Streams

Model Grid Design

- No single directional trend in the Seymour aquifer segments
- General west-to-east topographical trend
- Model grid oriented orthogonal to north
- Model grid shifted in ¼-mile increments to determine best fit overall with Seymour outline

Model Domain and Model Grid

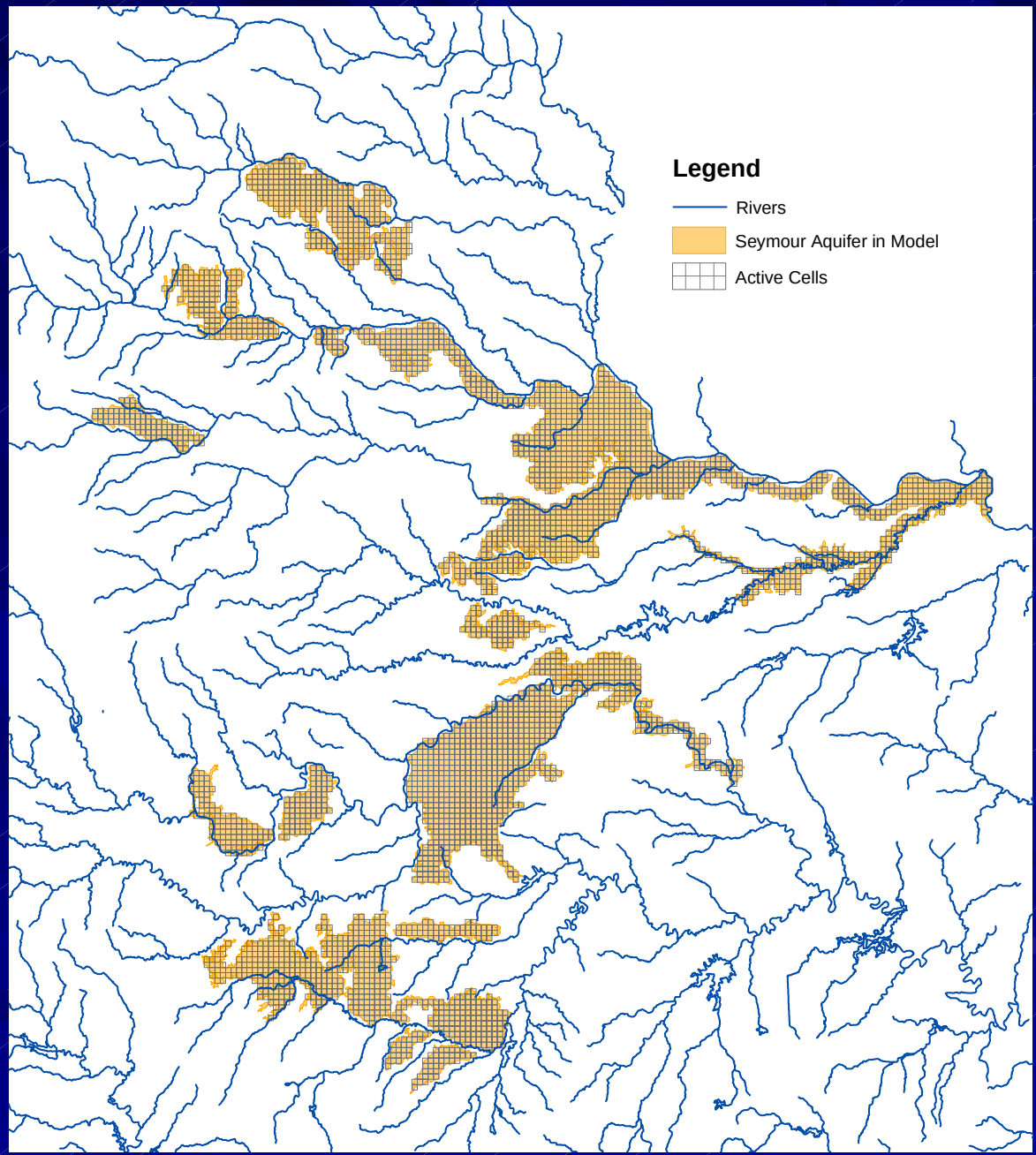


Active Cells in Layer 1

Seymour Aquifer
3391 mi²

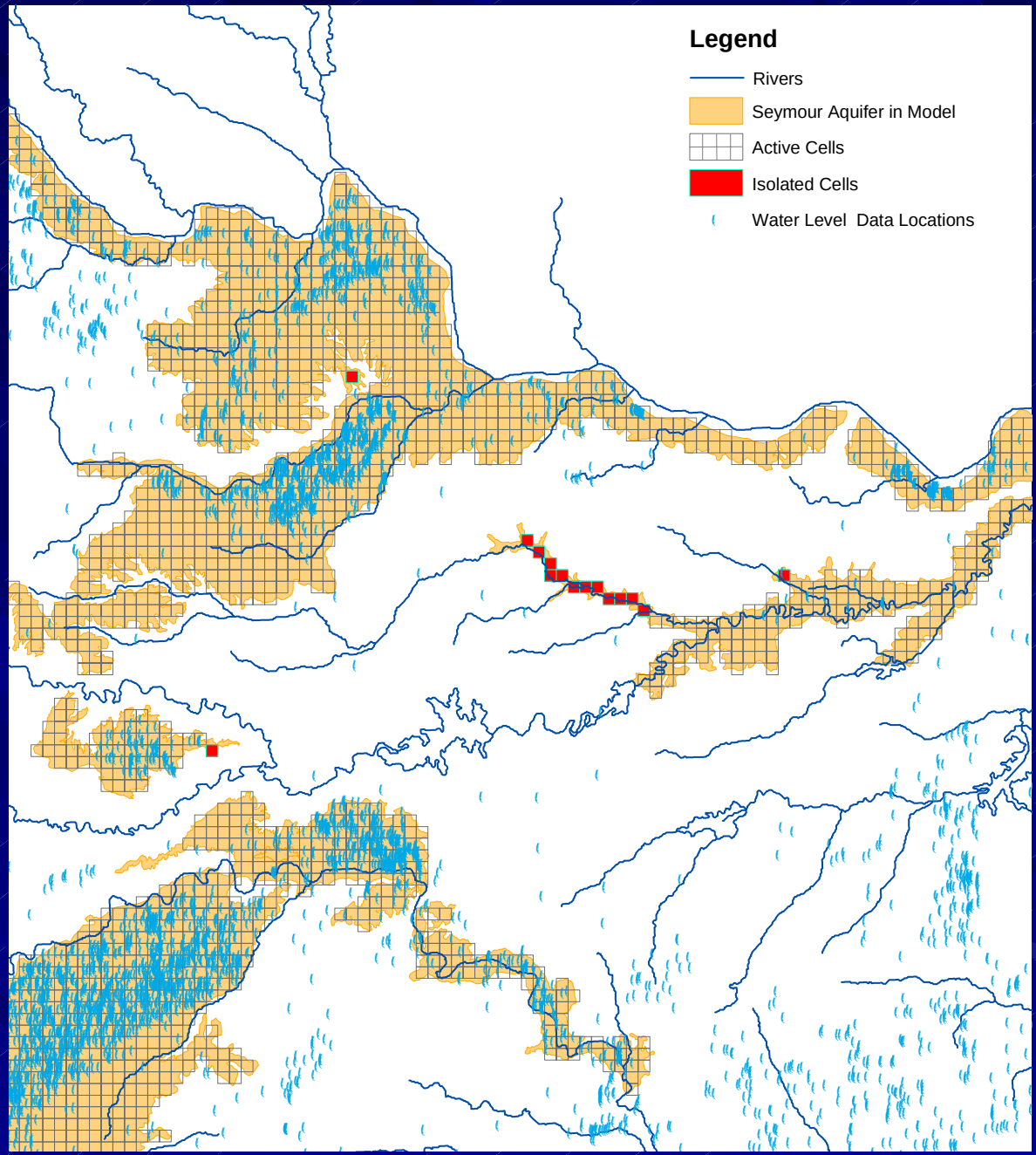
Active Cells with >50% coverage
3400 mi²

Error = 0.28%

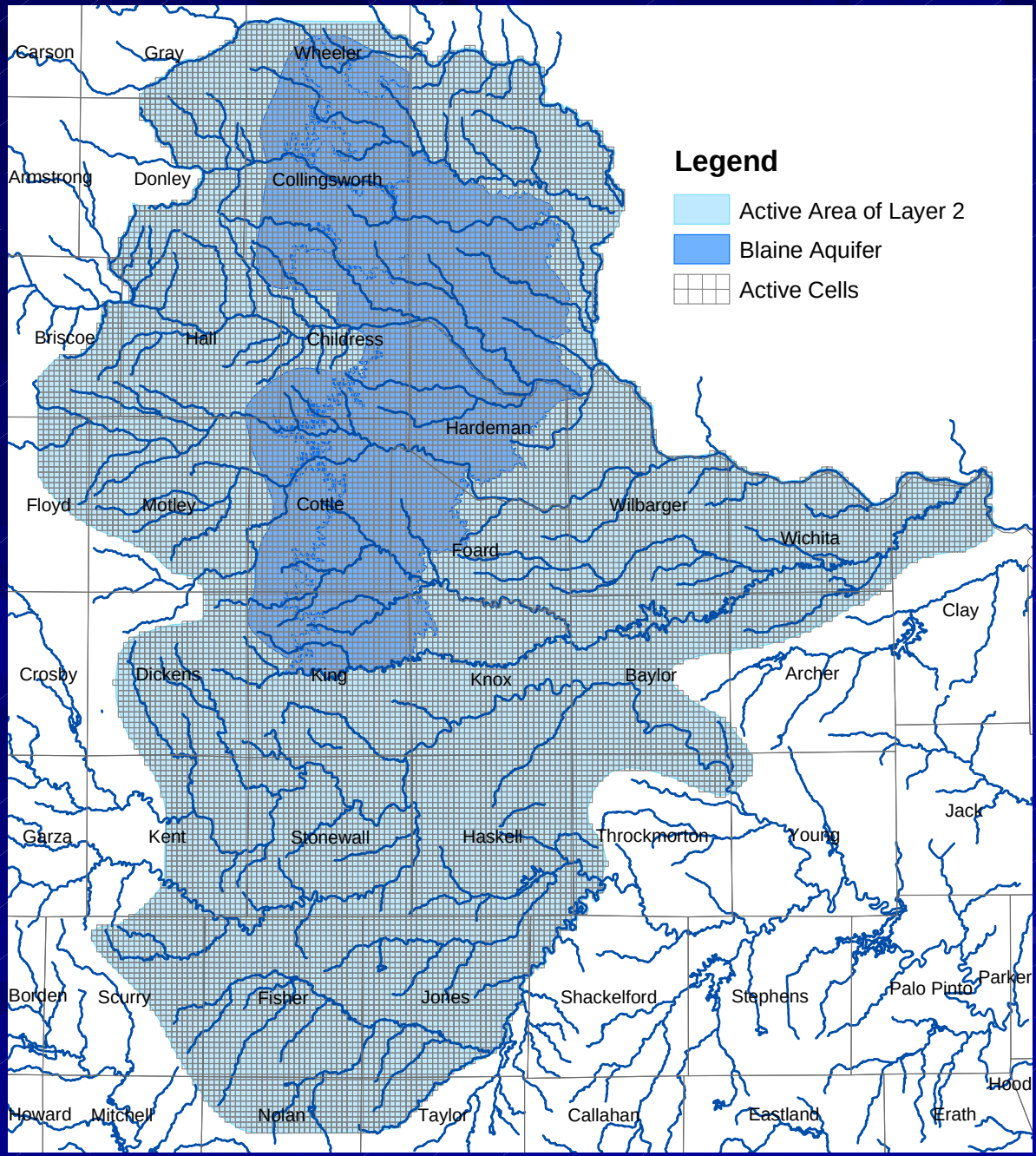


Examples of Isolated Cells of Layer 1

Finite-Difference Model where flow occurs only through cell faces



Active Cells in Layer 2



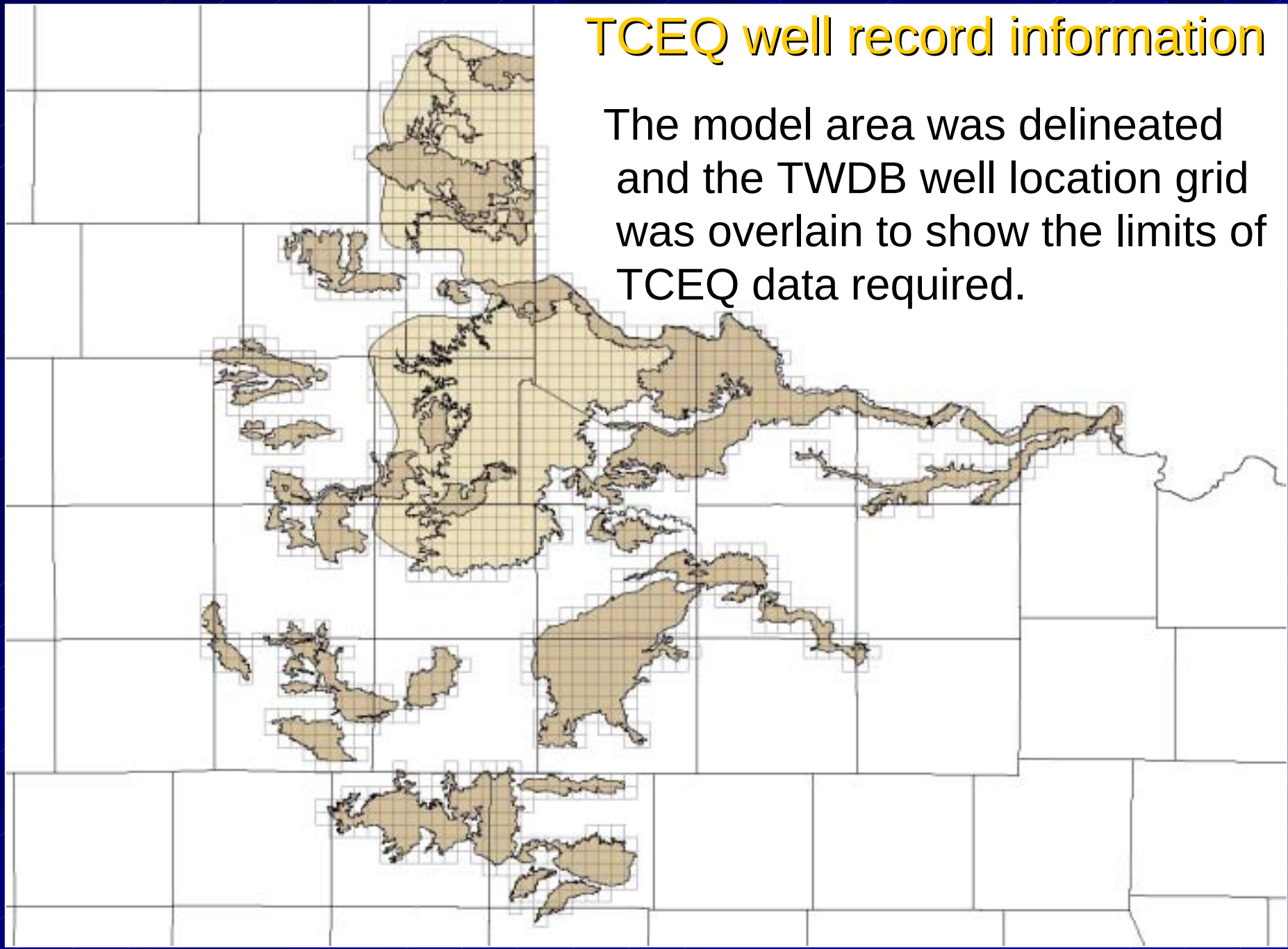
Well Record Information

The following data sources were evaluated:

- TWDB water well database
- TCEQ central records water well drilling files
- Existing Groundwater Conservation District files
- Agricultural Extension Service Files and communications
- Local Well Drillers personal communications
- Existing County and State reports

TCEQ well record information

The model area was delineated and the TWDB well location grid was overlain to show the limits of TCEQ data required.



TCEQ data

Identification		Well Information							Well Tests				Level	Geology	
Well ID (Owner)	TWDB ID.	Latitude	Longitude	Date Drilled	Diameter (in)	Depth (ft)	Screen (ft)	Estimated Elevation	GPM	Drawdown (ft)	Time (hrs)	Specific Capacity	Water Level	gravel / sand layer 1 base	gypsum top
H.P. Bradley	05-61-8			6/28/1983	12	40			5				31.0	26	
R.M. Standridge	12-04-3			11/5/1975	12	200	160-200							174	
W.H. Cooke	12-04-3	*		5/28/1984	9.875	70	38-58		20		0.5		18.0	60	
W.H. Cooke	12-04-3			5/28/1984	10	80	50-70		20		0.5		21.0	70	
Jim Cabbell	12-04-3			3/16/1989	26	150	70-150							150	
Jim Cabbell	12-04-3			3/28/2000	20	208	161-201		400	22	24	18	113.0	199	
Catherine Mary Ford	12-04-3	*		9/20/1991	9	100	80-100		16	0	1		86.0	97	
James Doneghy	12-04-6			10/14/1972	10	195			20	40	2	1		172	
W.R. Peggram	12-04-6			11/9/1979	12	200	180-200								
Jim Cabbell, Jr.	12-04-6			12/24/1984	8.375	175	75-110, 130-175						78.0	147	
Alfred McMurtry	12-05-1			5/23/1967	10	47	32-47		9	23	24	0	12.0		
Neil Davis	12-05-1			7/20/1968	10	135			20	10	2	2	96.0	134	
Neil Davis	12-05-1			4/3/1972	10	150			10	45		0	70.0	130	

- All the data files available within the Central Records, within the targeted areas, were recorded into the database. Over 3300 well files were compiled.
- The aim was to create as comprehensive a database as possible, with all the known well data from the area.
- Since the TCEQ block is a 2.5 minute by 2.5 minute area, the data becomes relatively coarse. However, the data is intended to be used by using averages of all the available data at the centroid location of each of the TCEQ grid blocks.

QA/QC and Structure Assessment

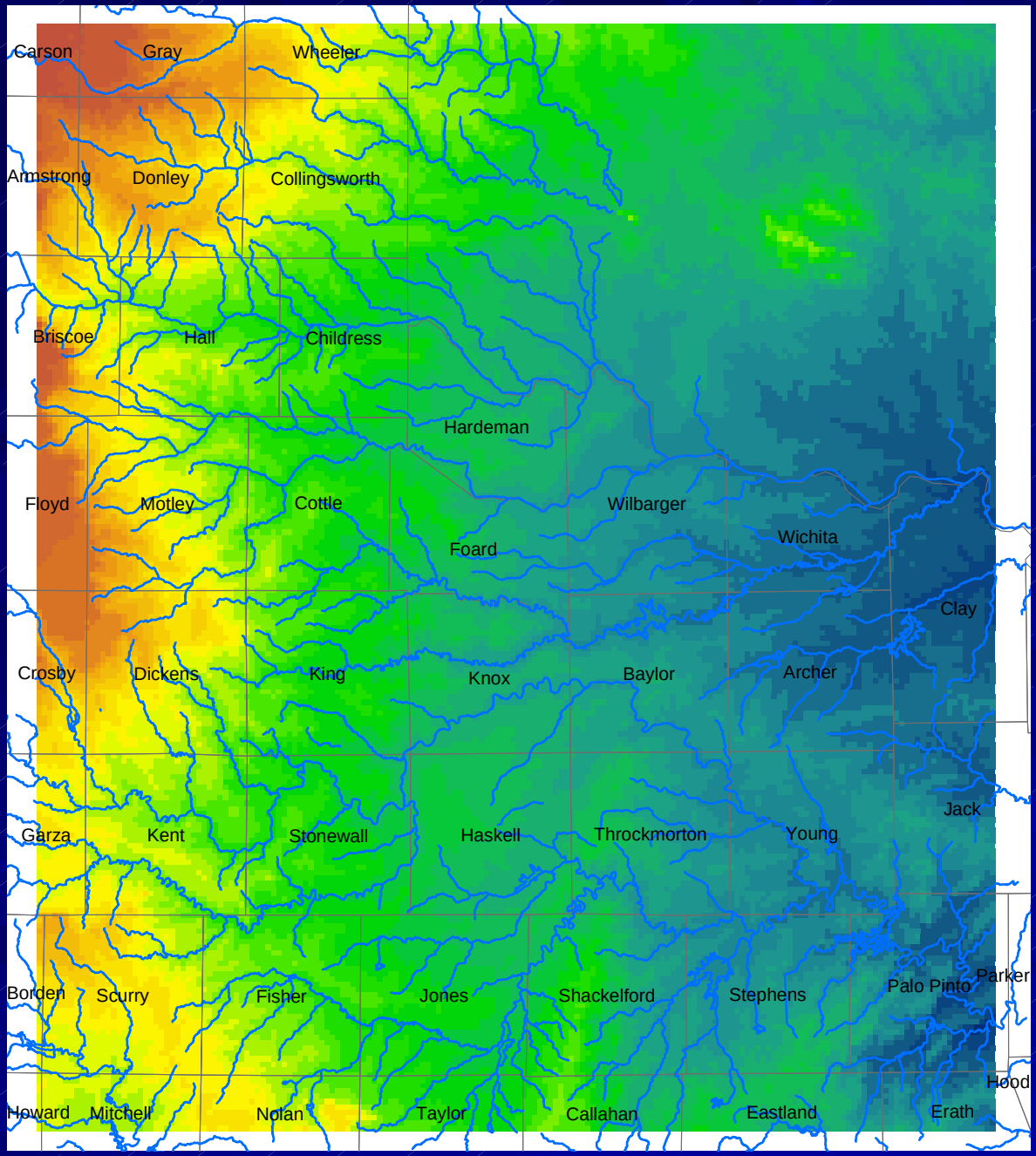
- QA/QC 1: Review of every data record for data accuracy
- QA/QC 2: Flag obvious anomalies in data
- QA/QC 3: Interpretation of geology

Structure Assessment				
Data assessment	Likely Surface Formation	Likely Aquifer Formation	Seymour	Blaine
1	Symr	Symr	26	
1	Symr	Symr	174	
0	Symr	Symr		
0	Symr	Symr		
1	Symr	Symr	15	
1	Symr	Symr	199	
0	Symr	Symr		
1	Symr	Symr	172	
0	Symr	Symr		
1	Symr	Symr	147	
0	Symr	Symr		
1	Symr	Symr	134	
1	Symr	Symr	13	

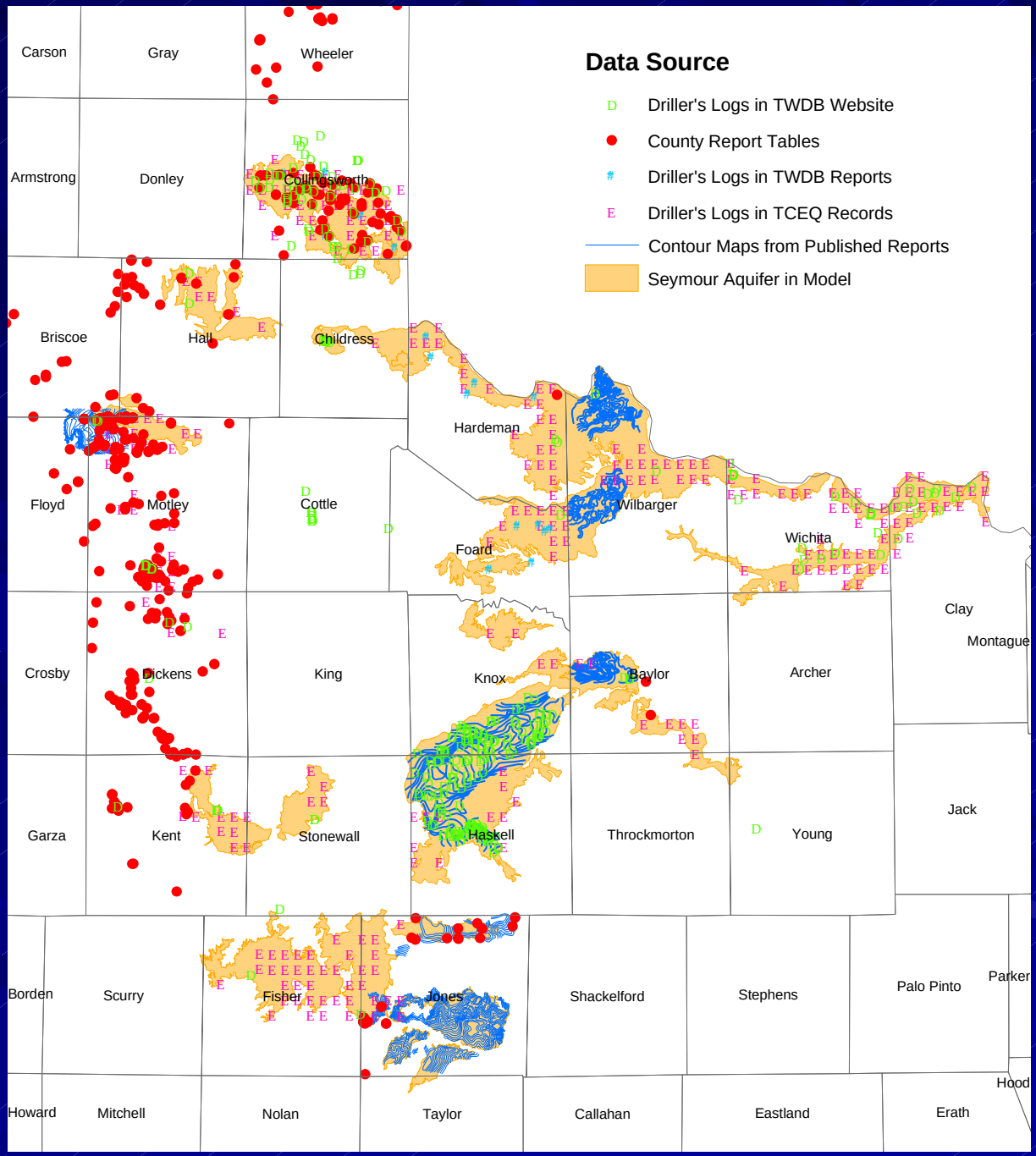
Structure

- Land surface from 30-meter DEM
- Data sources for Seymour aquifer (Layer 1)
  - Point data from TWDB and TCEQ driller's logs and county report tables
  - Contour maps from published reports
  - Water level data at wells without logs
  - Seymour outline
- Data sources for Blaine aquifer (Layer 2)
  - Limited point data from driller's logs
  - Contour map for Oklahoma
  - Blaine outcrop coverage
- Remainder of Layer 2
  - Assumed arbitrary thickness of 500 ft

Land Surface from DEM



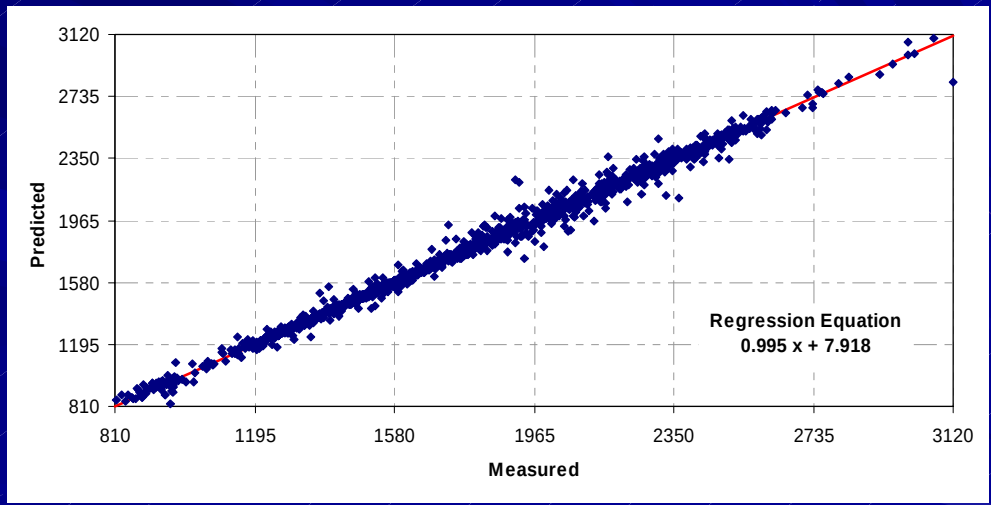
Data Sources for Base of Seymour



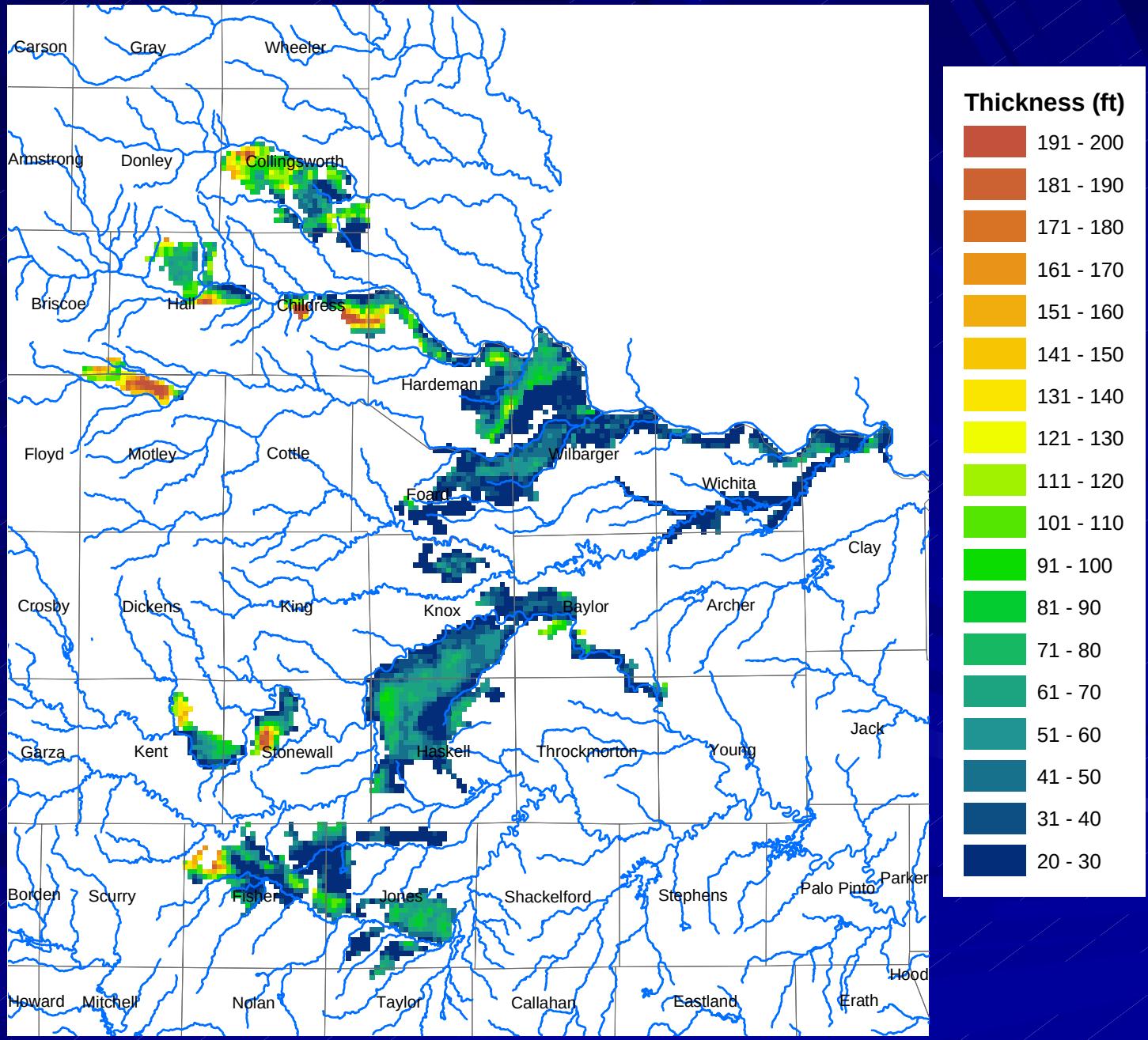
Seymour Basal Elevation

- Assumed Seymour basal elevation to be continuous prior to river incisement
- Kriged using all data over entire domain
- Used linear trend removal (50% global)
- Used zero nugget

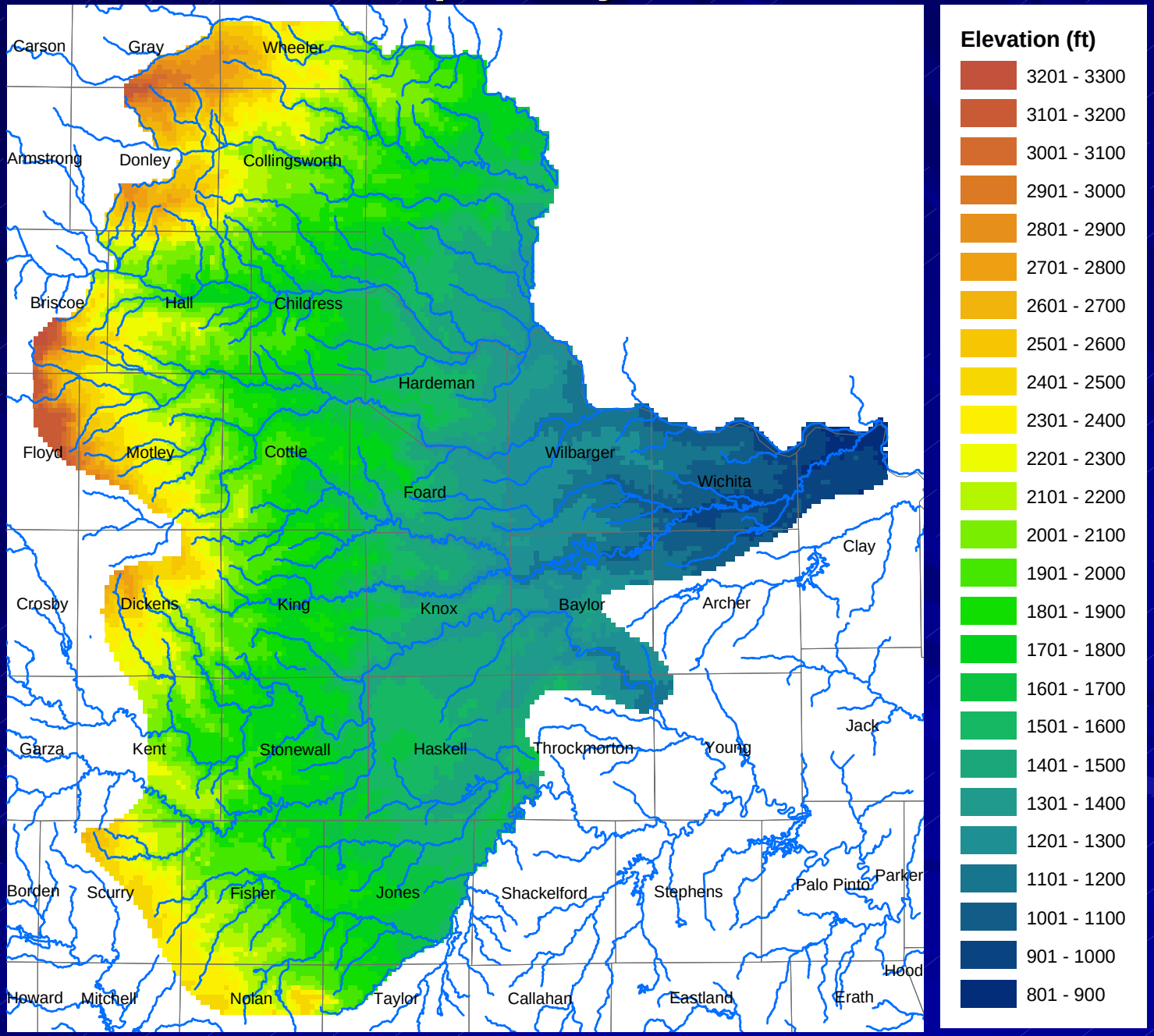
Cross-Validation



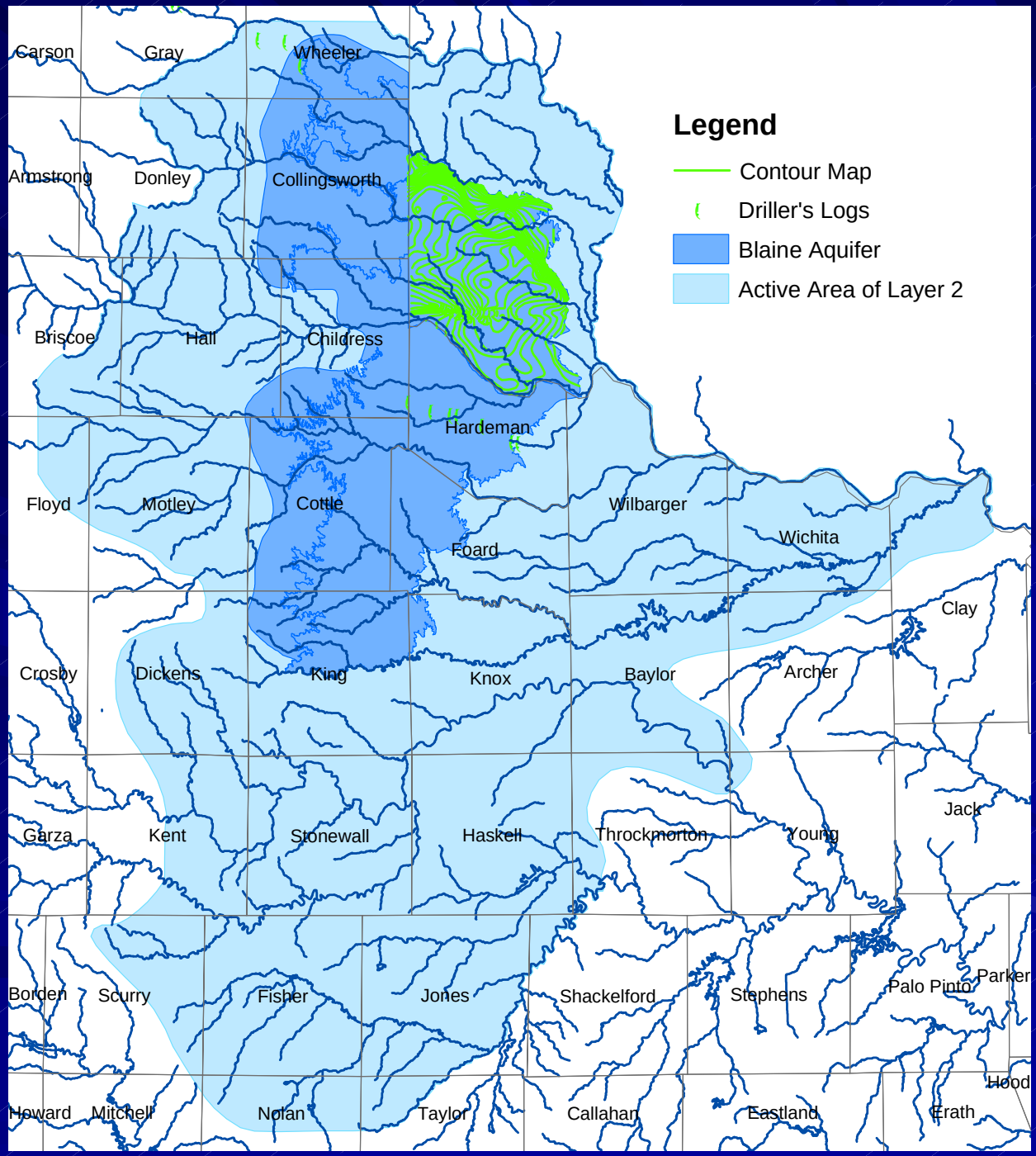
Layer 1 (Seymour) Isopach



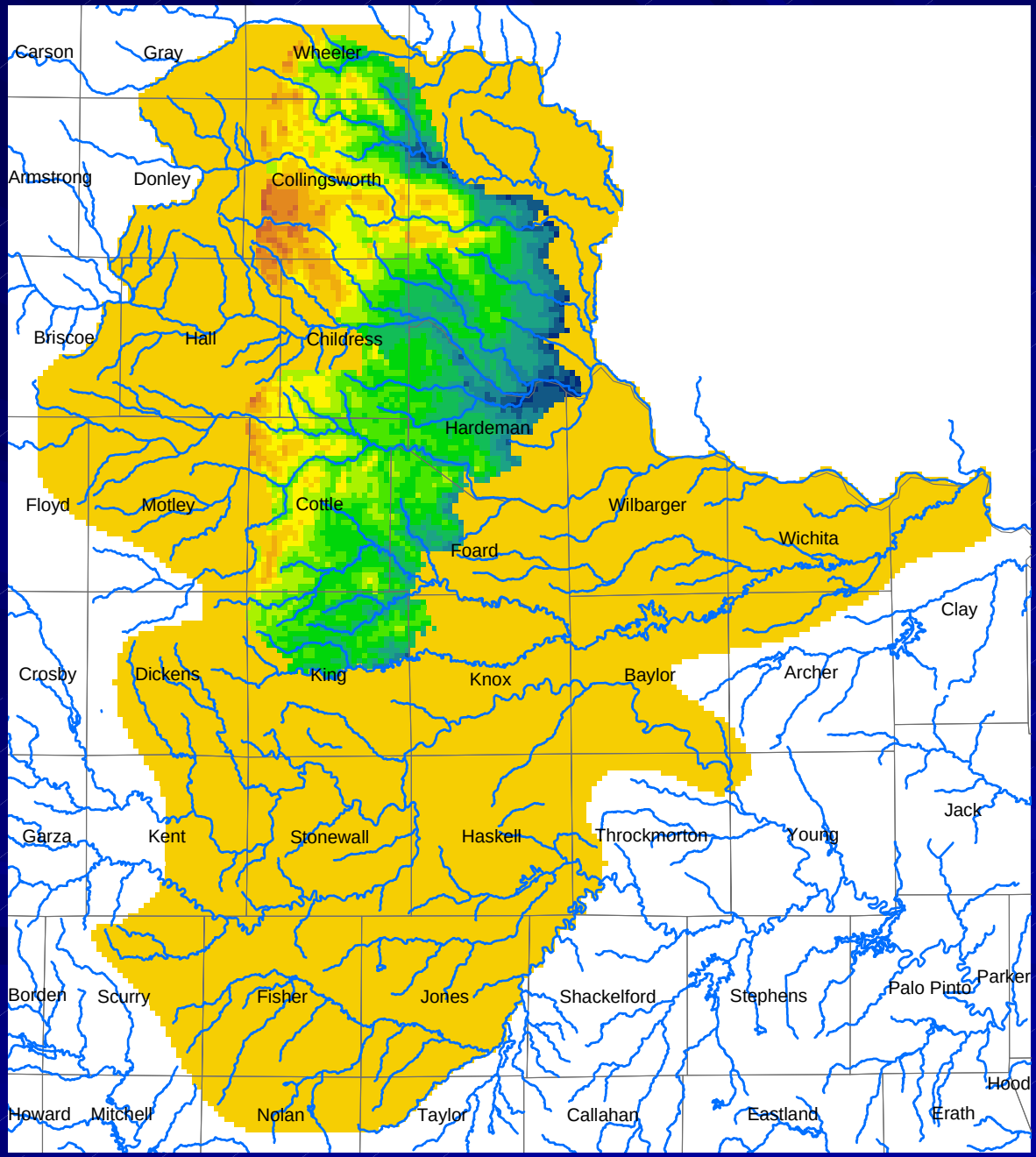
Top of Layer 2



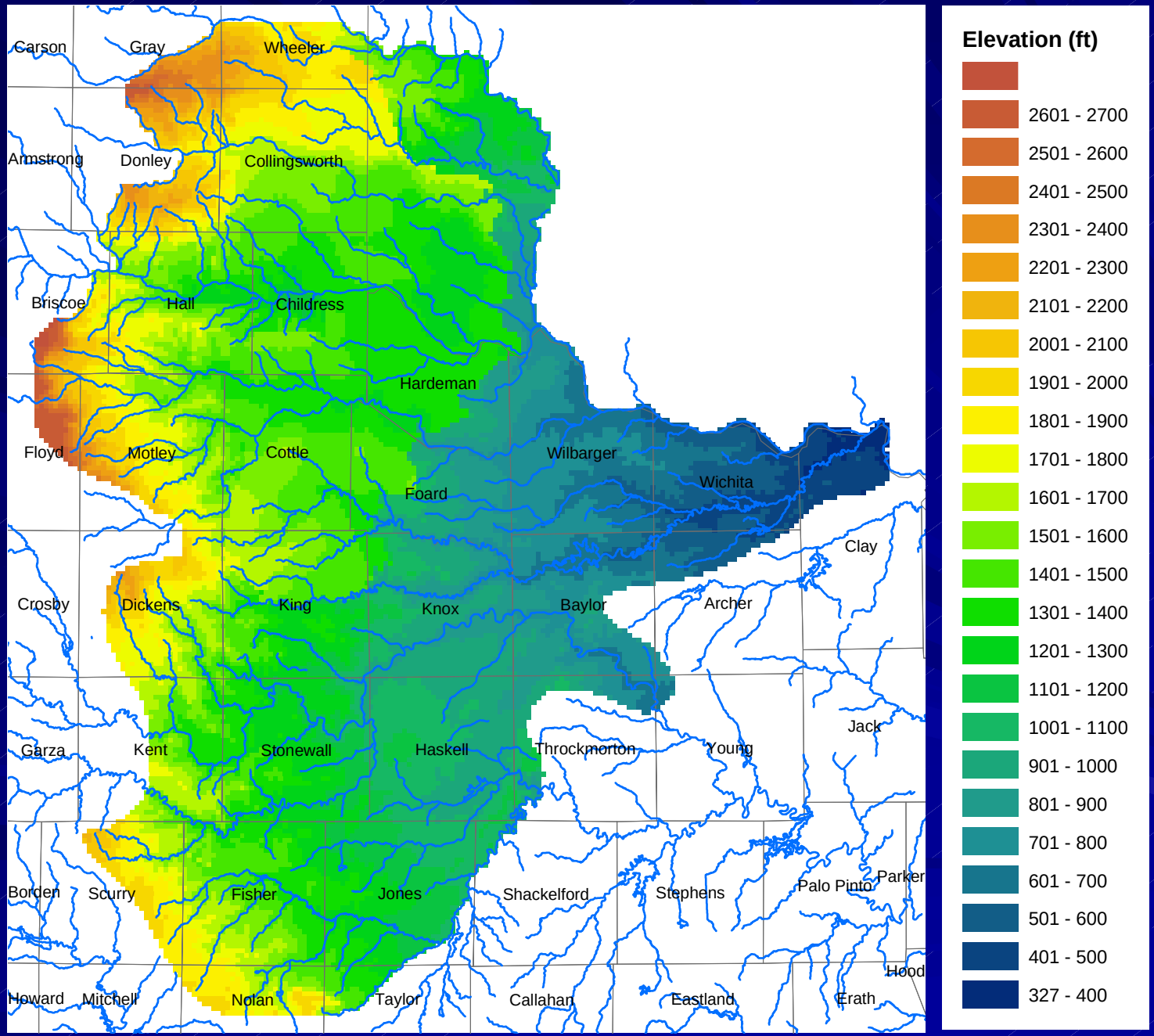
Data Sources for Base of Blaine



Layer 2 Isopach



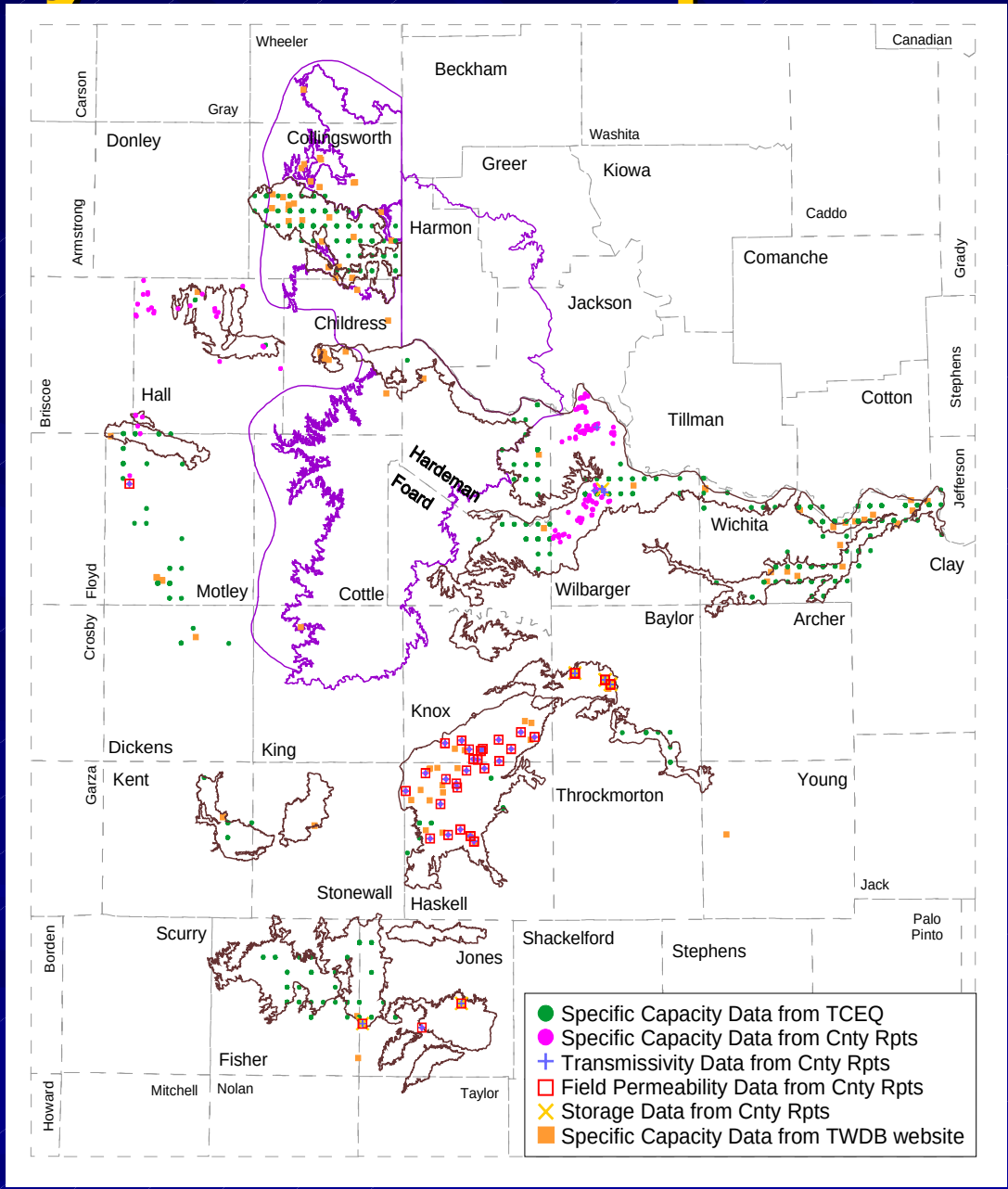
Base of Layer 2



Hydraulic Property Sources

- TCEQ Records
  - Specific capacity
- TWDB Website
  - Specific capacity
- TWDB County Reports
  - Specific capacity
  - Transmissivity
  - Field Permeability
  - Storage

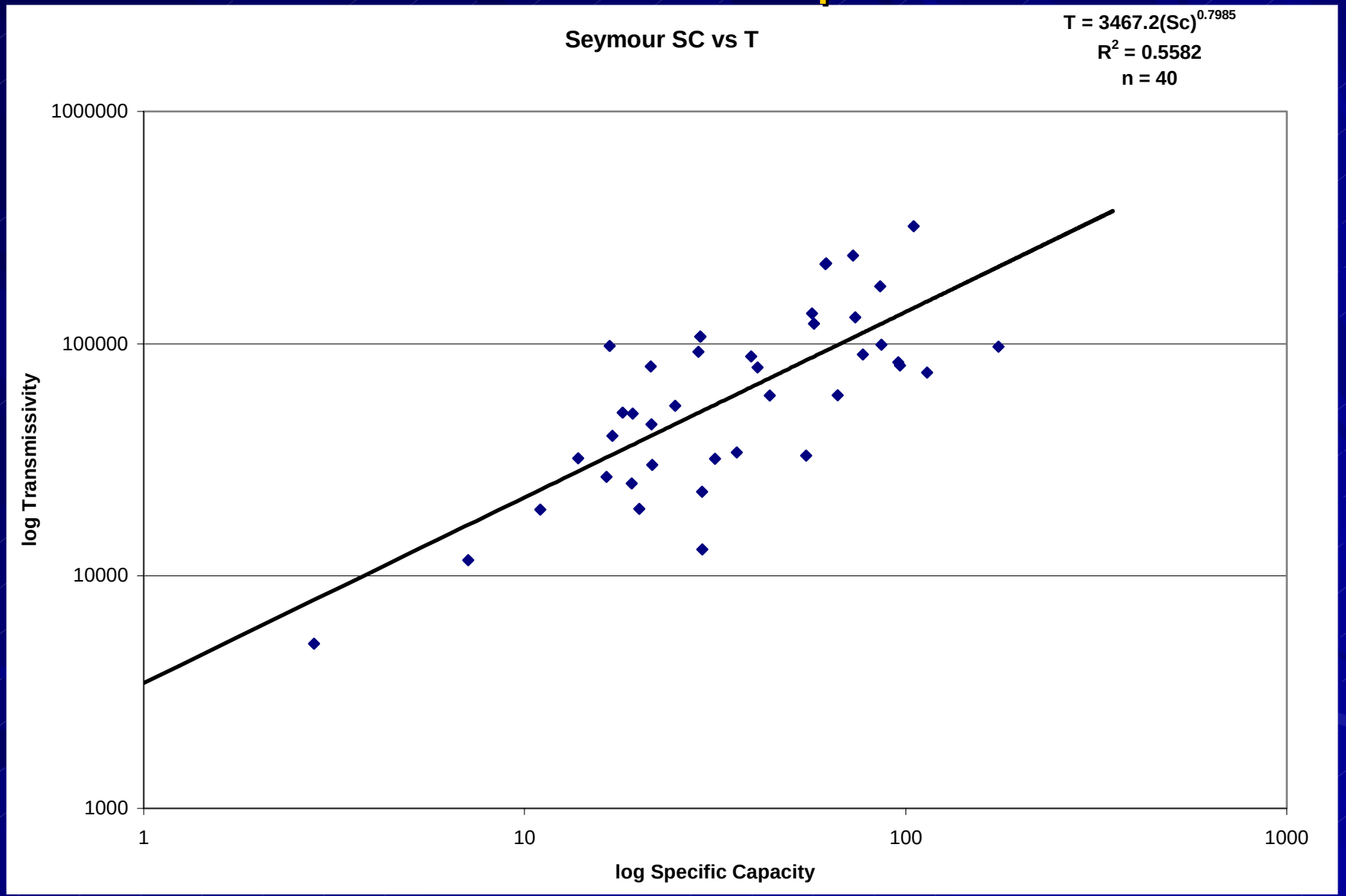
Hydraulic Properties



Hydraulic Properties

- Empirical relationship of Sc and T
- Calculation of T for all relevant TCEQ wells
- 6 methods of calculation used
- Use saturated thickness to calculate K from T

Seymour Aquifer Empirical Sc to T Relationship



Well Data Compilation

Seymour GAM

County: **All Seymour**

Data Input by: WPRC

Norm SC 7.27
=0.6904*14-2.3938

Method 1 Chastain-Howley (Empirical calculation with small Diameter Correction)
Method 2 Chastain-Howley (empirical)
Method 3 Razack and Huntley (1991) T=33.6(Q/s)*0.67
Method 4 Theis (1963) Max S =.3 Min S =.014
Method 5 Logan 1960 T=2.43Qb/(s(2b-s))
Method 6 Mott MacDonald (Pakistan Indus Valley) T=1.32 Q/s

Sc to T calculation

Identification		Transmissivity Calculations											
Well ID (Owner)	TWDB ID.	Normalize multiplier	Normalized SC	Method 1	Method 2	Method 3	Method 4	Method 5	Method 6	Average	Maximum	Minimum	Max without <1 hr	Min without <1 hr
H.P. Bradley	05-61-8													
R.M. Standridge	12-04-3													
W.H. Cooke	12-04-3													
W.H. Cooke	12-04-3													
Jim Cabbell	12-04-3													
Jim Cabbell	12-04-3	1.00	18.18	35139.80	35139.8	30647.79	34864.42	35976.62	34560	33215.75	35976.62	26181.82	35976.62	
Catherine Mary Ford	12-04-3													
James Doneghy	12-04-6	1.61	0.81	2919.12	1993.455	2759.002	687.2633	974.7771	950.4	1567.33	2919.12	687.26	2919.12	
W.R. Peggram	12-04-6													
Jim Cabbell, Jr.	12-04-6													
Alfred McMurtry	12-05-1	1.61	0.63	2400.20	1639.086	2341.138	640.3771	1019.656	743.7913	1335.39	2400.20	563.48	2400.20	
Neil Davis	12-05-1	1.61	3.22	8830.74	6030.473	6984.451	3077.433	4013.788	3801.6	5088.35	8830.74	2880.00	8830.74	
Neil Davis	12-05-1	1.61	0.36	1527.69	1043.251	1602.469		540.9391	422.4	909.46	1602.47	320.00		
Keith Davis	12-05-1													
Pat O'Hare	12-05-1	1.40	0.70	2605.31	1993.455	2759.002	679.0077	1421.55	950.4	1589.82	2759.00	679.01	2759.00	
Fred Bourland	12-05-1	1.00	10.00	21801.12	21801.12	20532.51	17696.07	23529.1	19008	19823.99	23529.10	14400.00	23529.10	
Jim Cubbell	12-05-1													
Jim Cubbell	12-05-1													
Delbert White	12-05-2													
Lewis Morris	12-05-2													
James Stavenhagen	12-05-2	1.00	16.25	32125.16	32125.16	28425.88	32241.63	33795.34	30888	30428.74	33795.34	23400.00	33795.34	
Reed Souder	12-05-2													
Wilbur DePauw	12-05-3	1.00	10.00	21801.12	21801.12	20532.51	17719.23	25748.83	19008	20144.40	25748.83	14400.00	25748.83	
Wilbur DePauw	12-05-3													
Paul Bell	12-05-3	1.61	2.15	6388.34	4362.571	5322.934	1989.672	3110.4	2534.4	3661.19	6388.34	1920.00	6388.34	
George Shadid	12-05-3													

Recharge

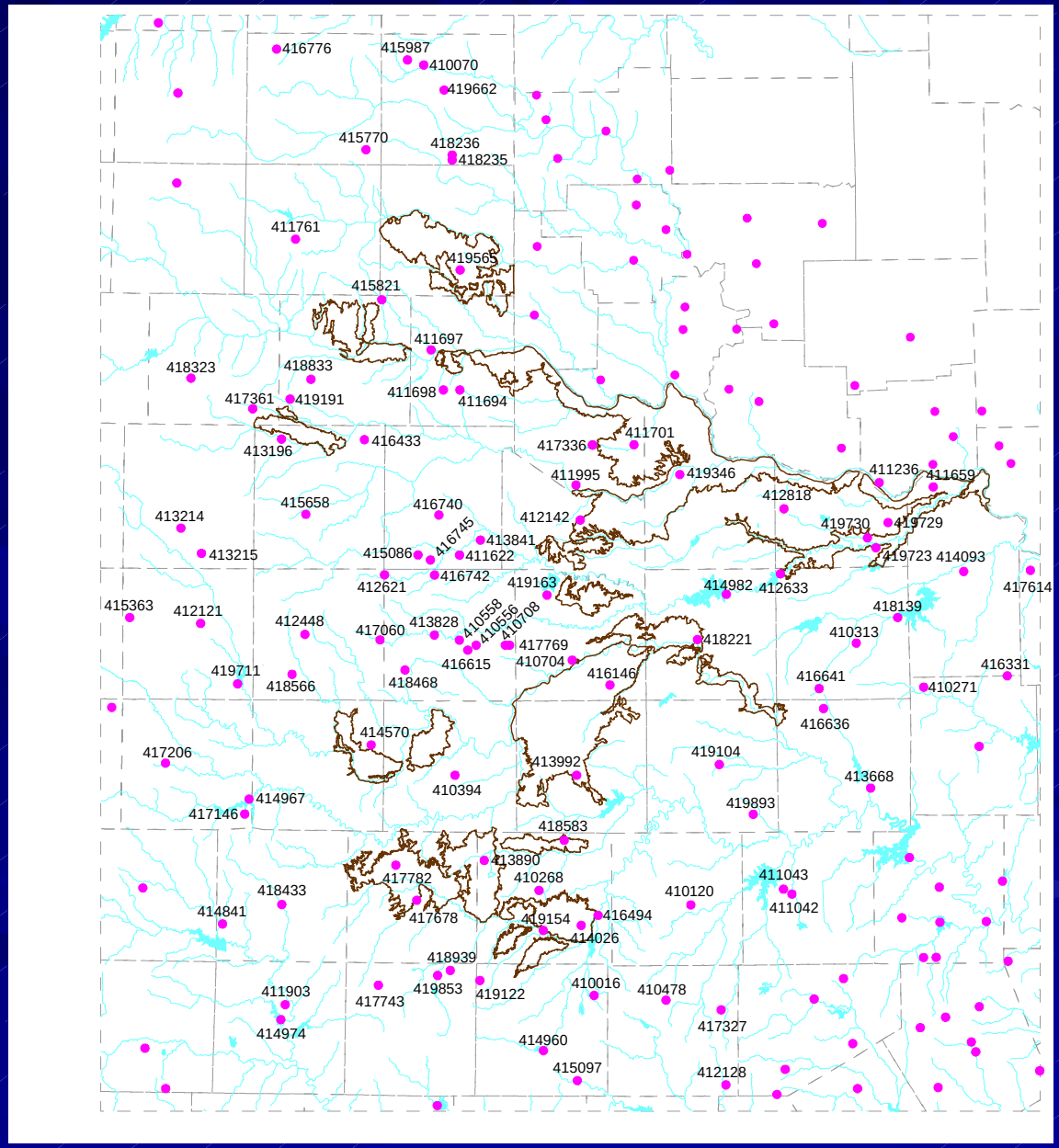
- Recharge – The addition of water to the water table. Recharge equals water inputs at ground surface (precipitation + irrigation + stream loss) minus water losses (runoff + evapotranspiration)
- Recharge is a complex function of
  - Precipitation (rate, volume, distribution),
  - Evapotranspiration (ET)
  - Runoff
  - Soil moisture, soil type
  - Runoff
  - Depth to water
- **Recharge is not directly measurable on a model scale**
- **Recharge varies as a function of time and location**

Recharge - Implementation

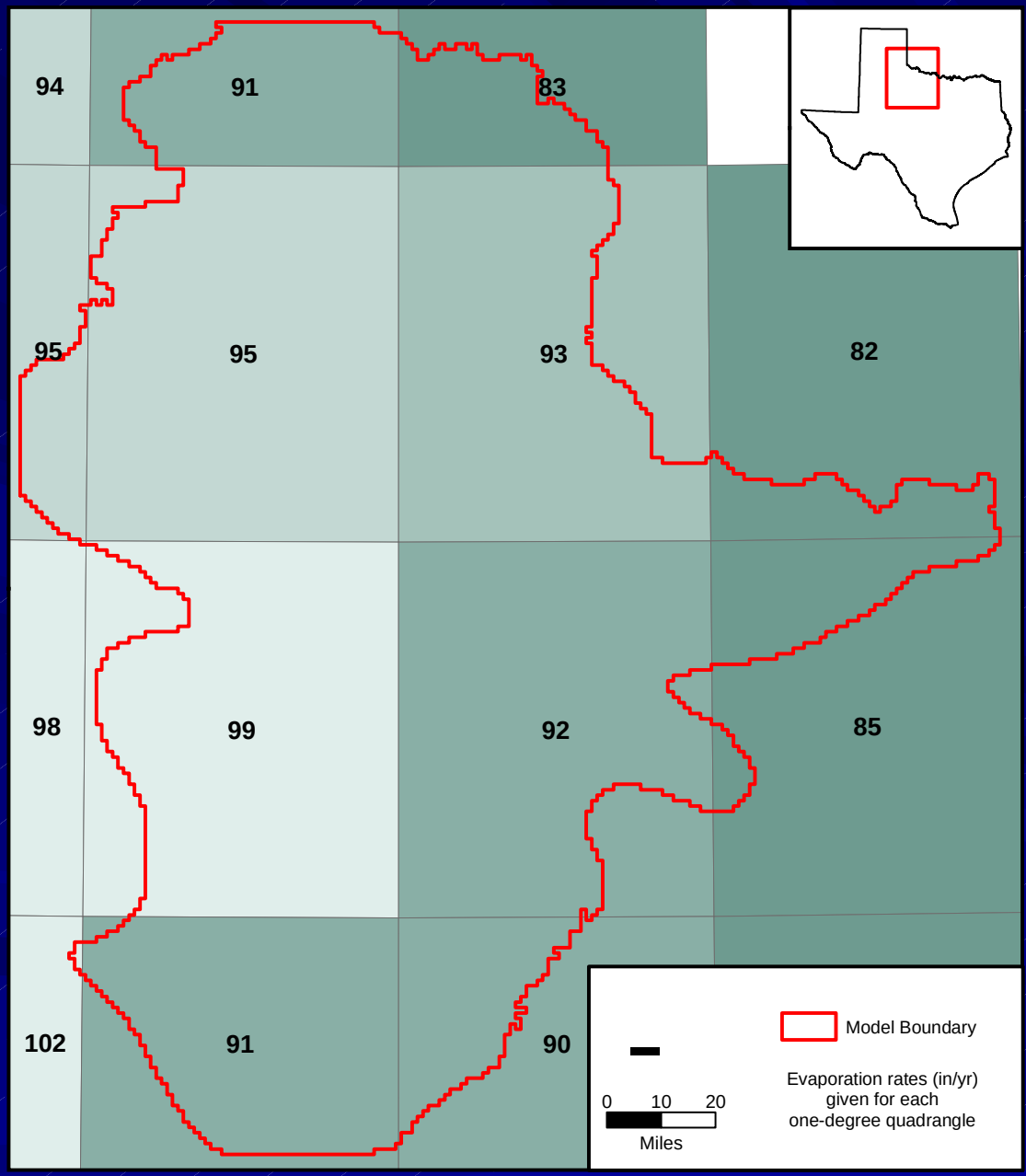
- **Proposed Approach:**
  - Complete SWAT simulations
  - Analyze what is driving SWAT results
  - Develop calibration methodology based on our analyses and previous estimates
  - Compare results to BEG field study estimates

Precipitation Gage Station Locations

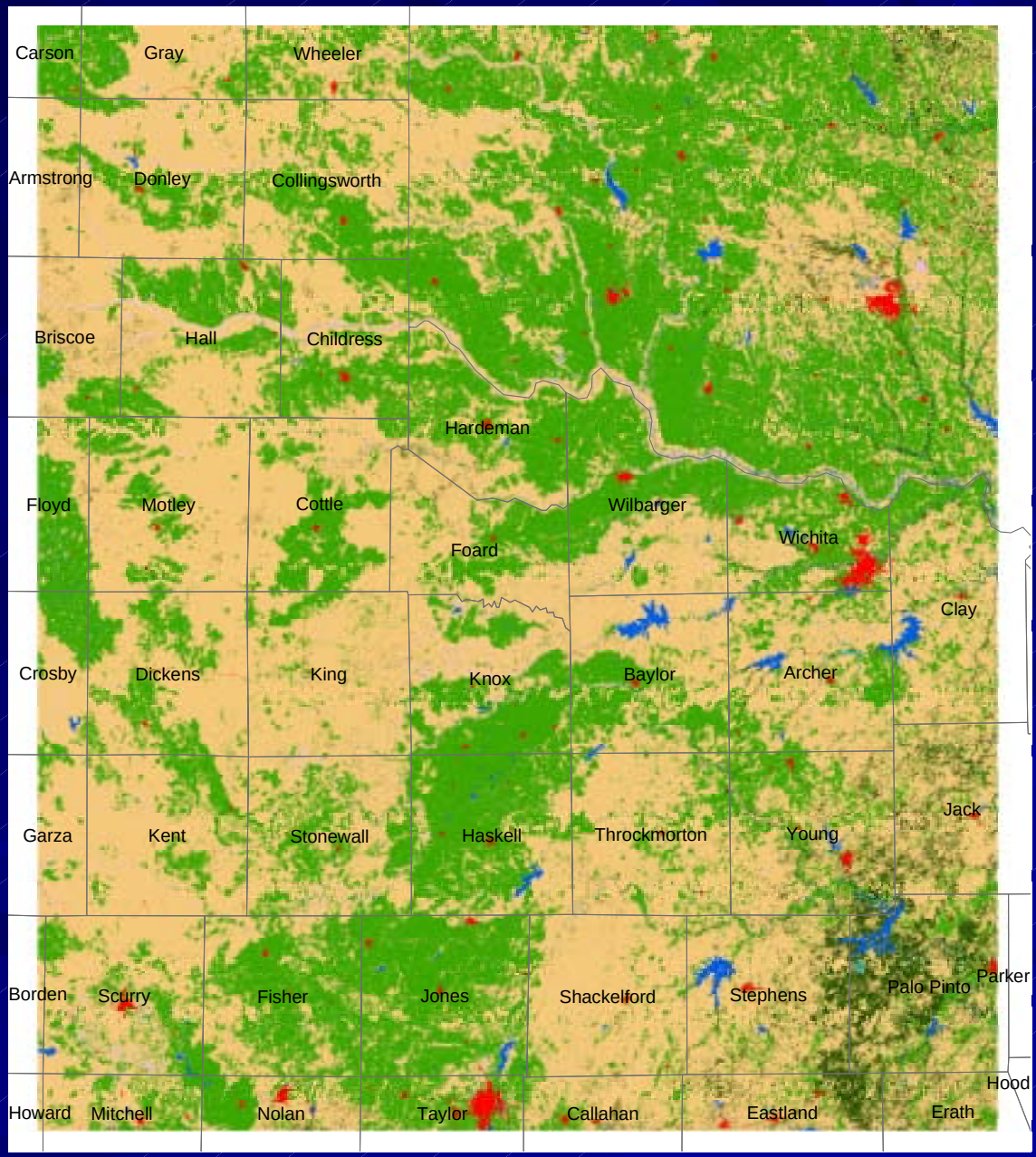
Average annual precipitation ranges from 18 in/yr in the western portion of the model to 30 in/yr in the eastern portion



Average Pan Evaporation Rates (in/yr)

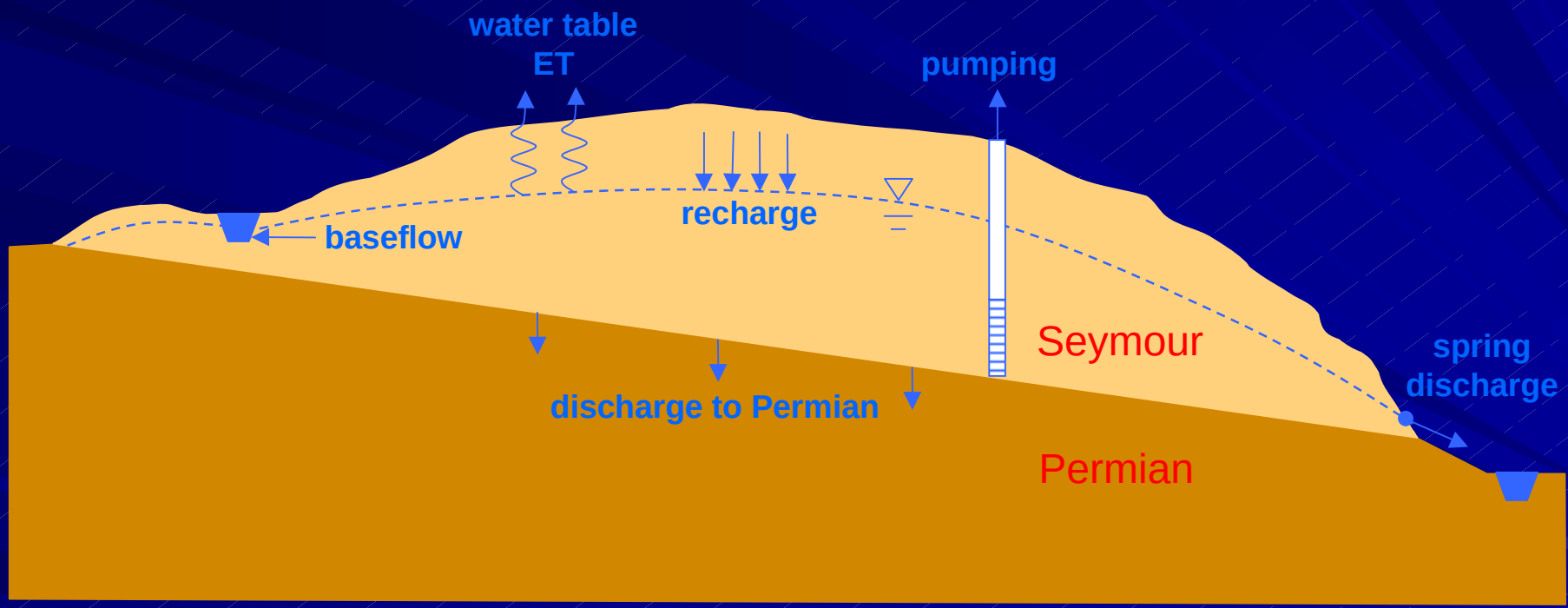


Land Use/Land Cover



- Urban
- Agriculture
- Rangeland
- Forest
- Water
- Wetland
- Barren Land

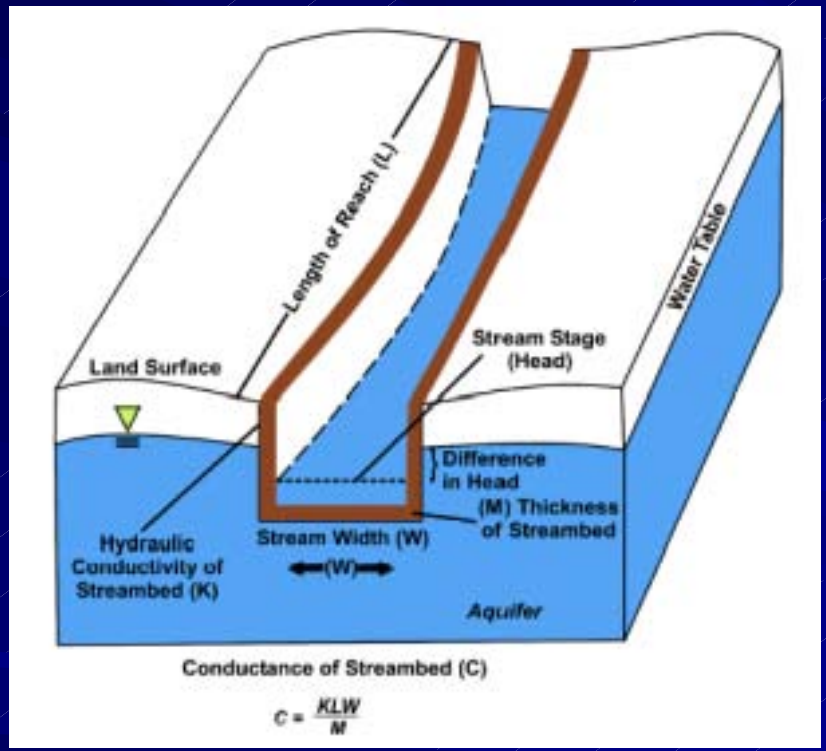
Where does recharge go?



MODFLOW Implementation

- Stream package to handle baseflow
- ET package to handle water table ET
- Well package to handle pumping
- Drain package to handle springs and seeps

Streams – Prudic (1991)

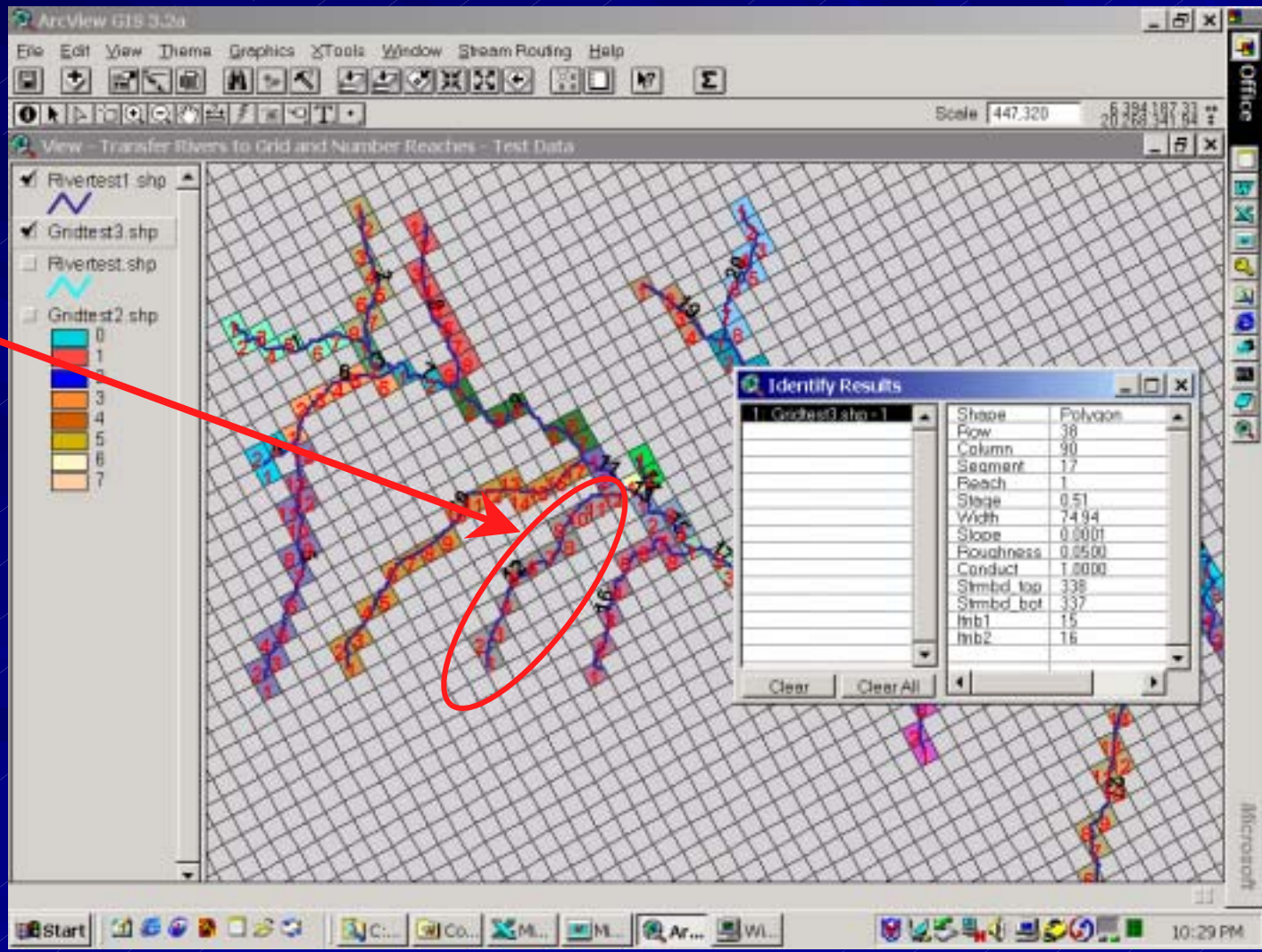


- Stream length (1 mile)
- Stream width
- Streambed thickness
- Streambed hyd. K
- Streambed elevation
- Streambed slope
- Manning's roughness
- Headwater reach Q for every stress period
- Segment connections

Streams

Queen City Sparta GAMs will require the addition of very few new reaches

- Each cell is a reach
- Reaches make up segments



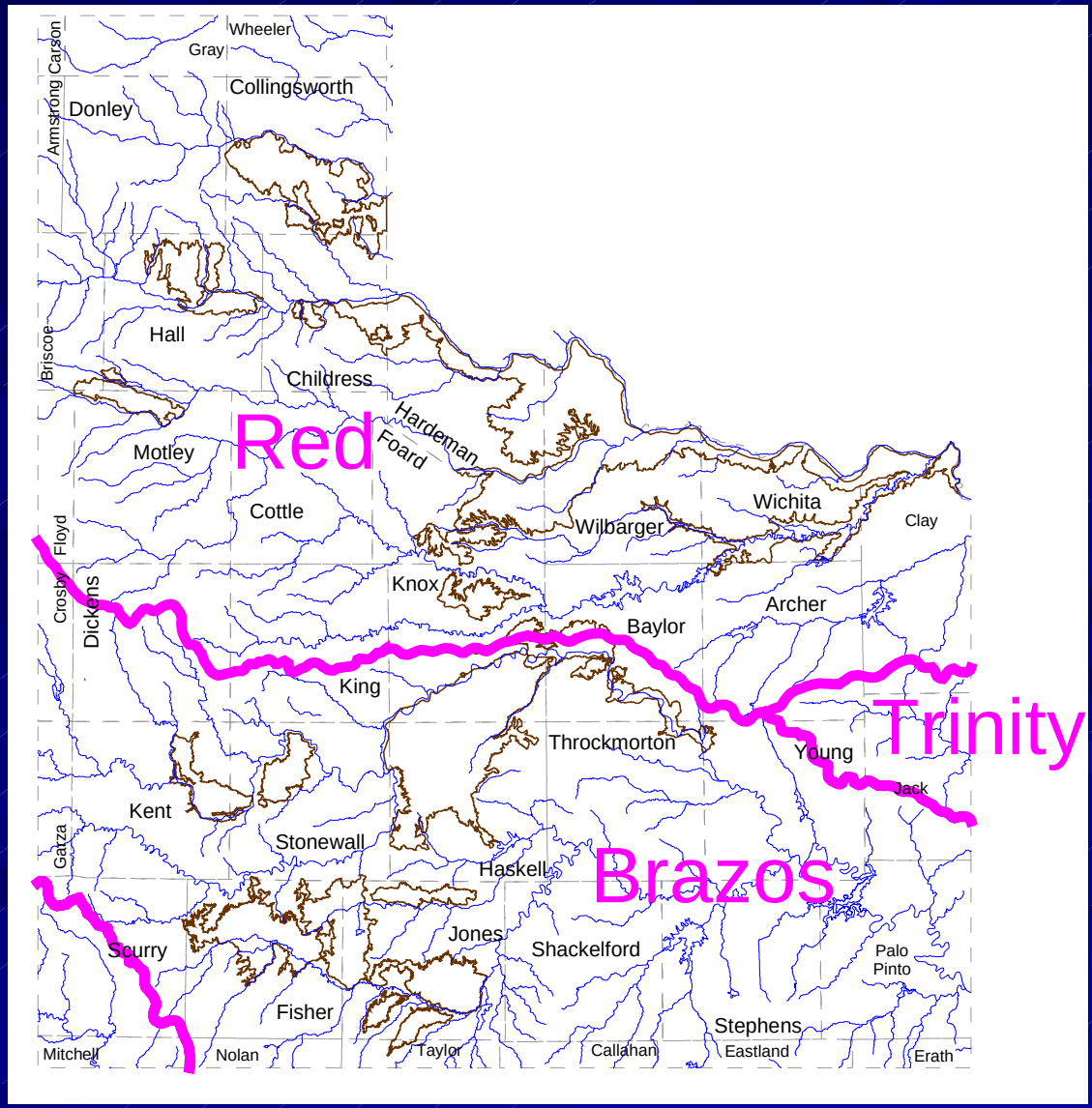
Streams – Calibration

- Calibrate streambed conductivities to match losses/gains
- Calibration targets:
  - Stream Gage Analysis (base flow)
  - Stream gage data – upper bound

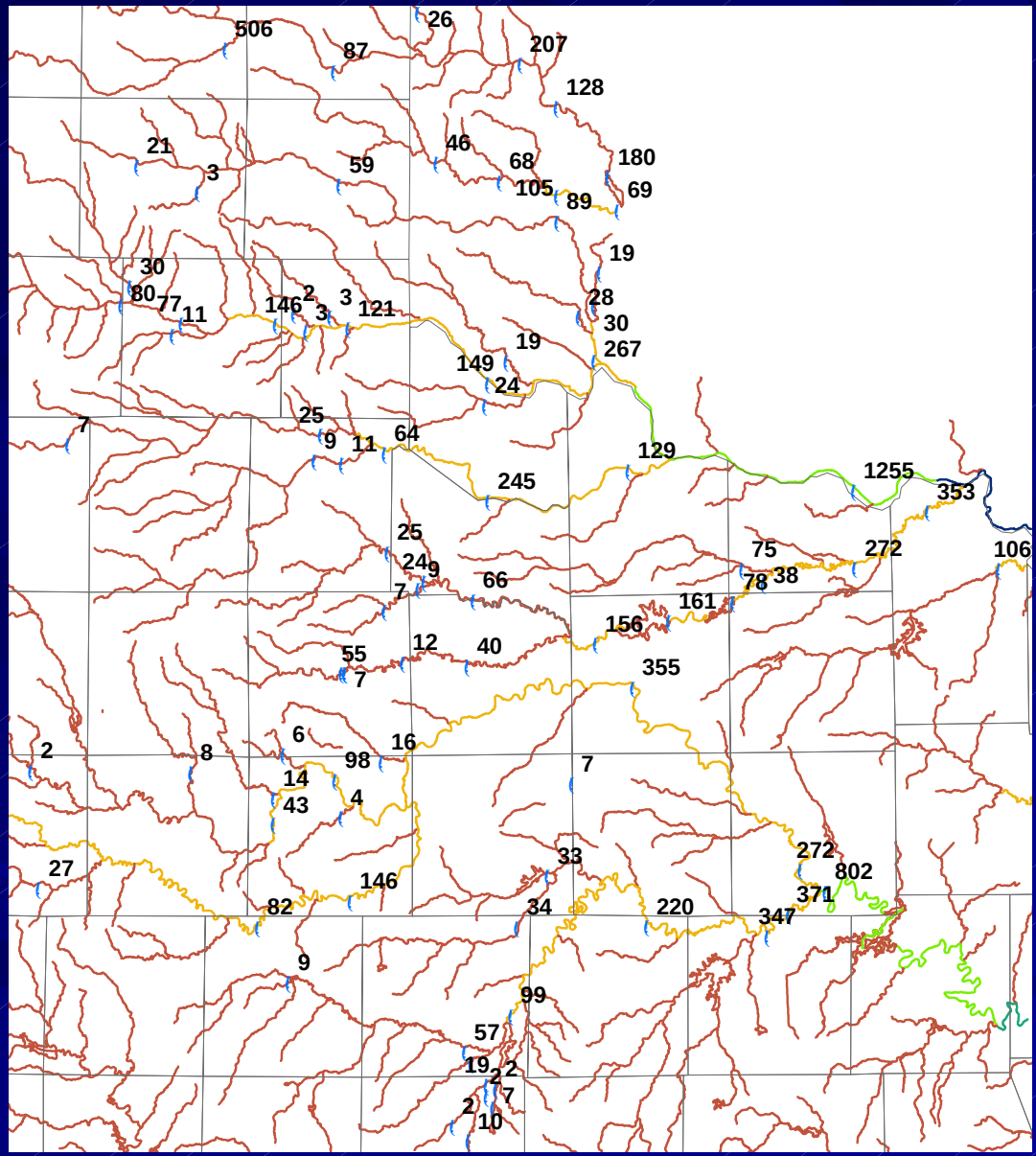
Ongoing Efforts – Stream Routing

- Review the method(s) used to assign stream flow rates to ungaged headwaters and provide recommendations for improvement.
- Review of the calibration targets used to characterize stream/aquifer interaction.
- Development of additional gain/loss estimates (surface water calibration targets).
- Review and provide recommendations regarding approach for initialization and calibration of stream bed conductance

River Basins



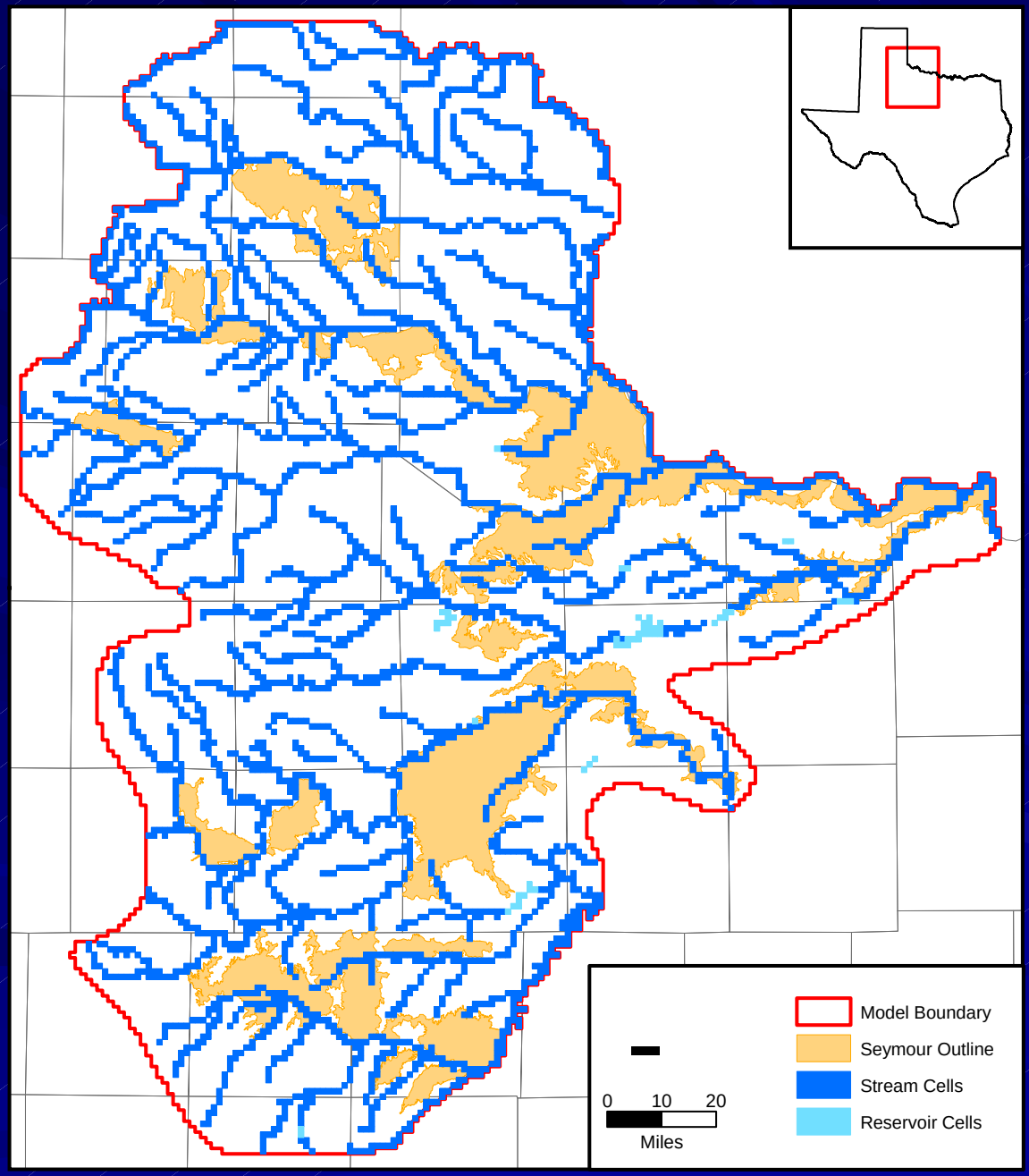
Streamflows



Mean Streamflow (cfs)

- 0 - 100
- 101 - 500
- 501 - 1000
- 1001 - 1500
- 1501 - 2000

Stream and Reservoir Cells in Model



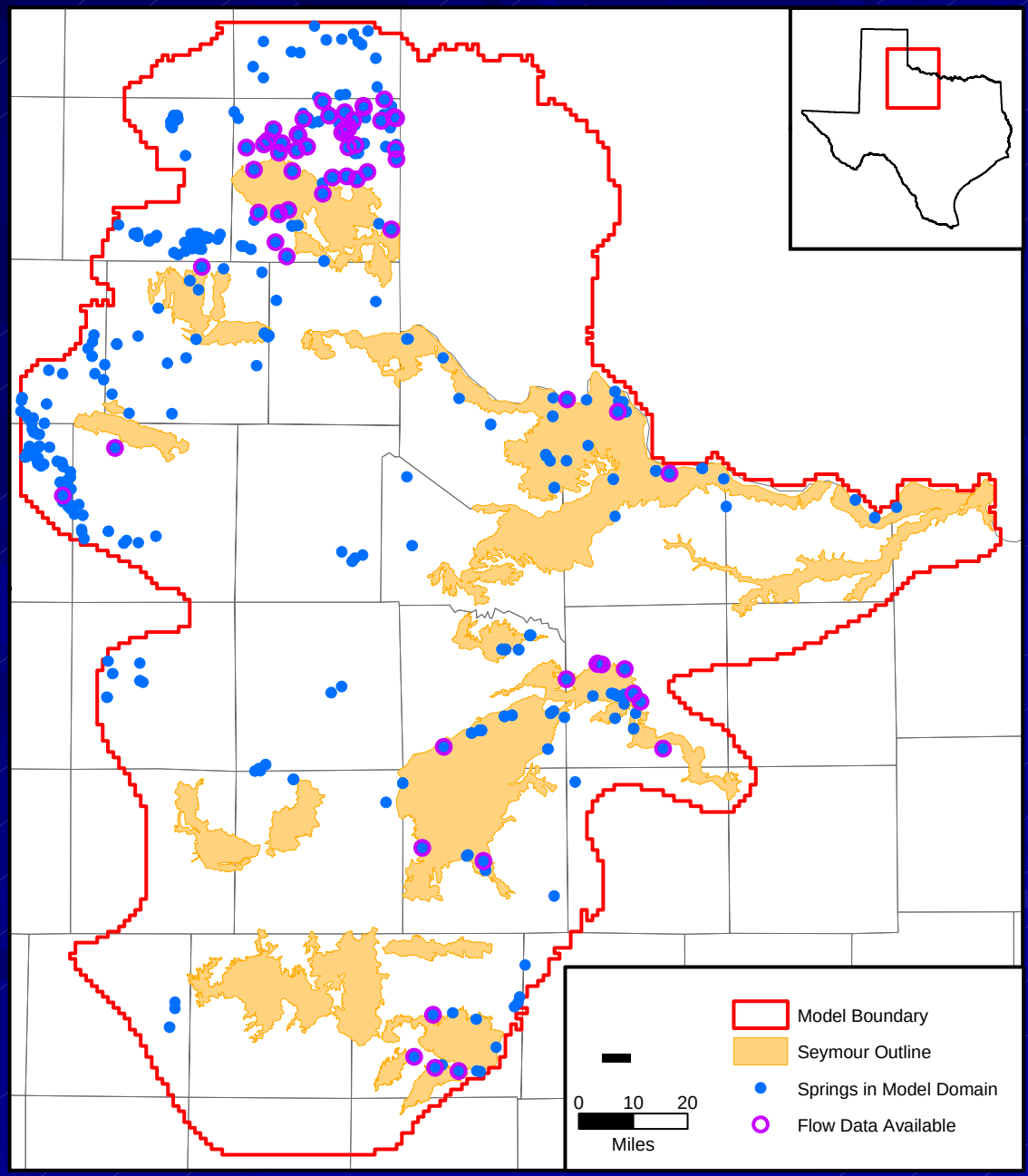
Springs

- Sources
  - TWDB County Reports
  - Brune (1975)
  - USGS Database
- Some flow data for calibration

Springs

66 springs with flow rates available and not intersecting stream cell

5 springs with flows greater than 0.5 cfs



Regional Groundwater Flow

- Each patch of Seymour aquifer acts as an individual flow system
- Too few data are present in some patches (such as in Kent and Stonewall counties) to determine regional flow

Water Levels

- Objectives
  - Develop water-level elevation contours of predevelopment conditions
  - Develop water-level elevation contours for
    - The start of model calibration (1980)
    - The end of model calibration (1990)
    - The end of model verification (1999)
  - Evaluate transient water-level conditions and select hydrographs for use as calibration targets
  - Evaluate cross-formational flow

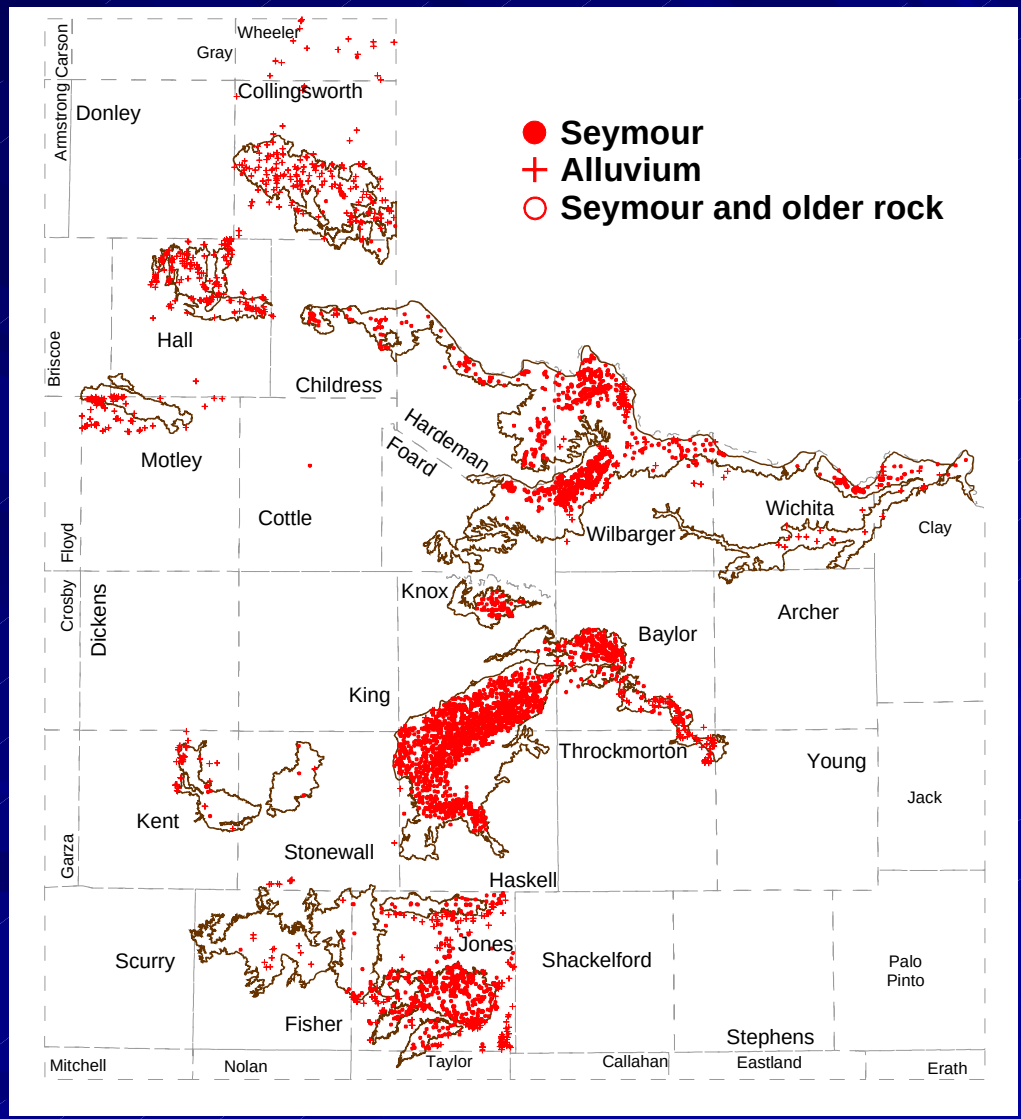
Water Levels (cont'd)

- Challenges
  - Identification of predevelopment conditions
    - In many locations, Seymour was dry in early 1900s (e.g., Haskell and Knox counties)
    - Clearing of phreatophytes and development of land for cultivation resulted in increased recharge and the aquifer began to fill up
    - Assumed predevelopment corresponds to maximum water-level elevation regardless of time

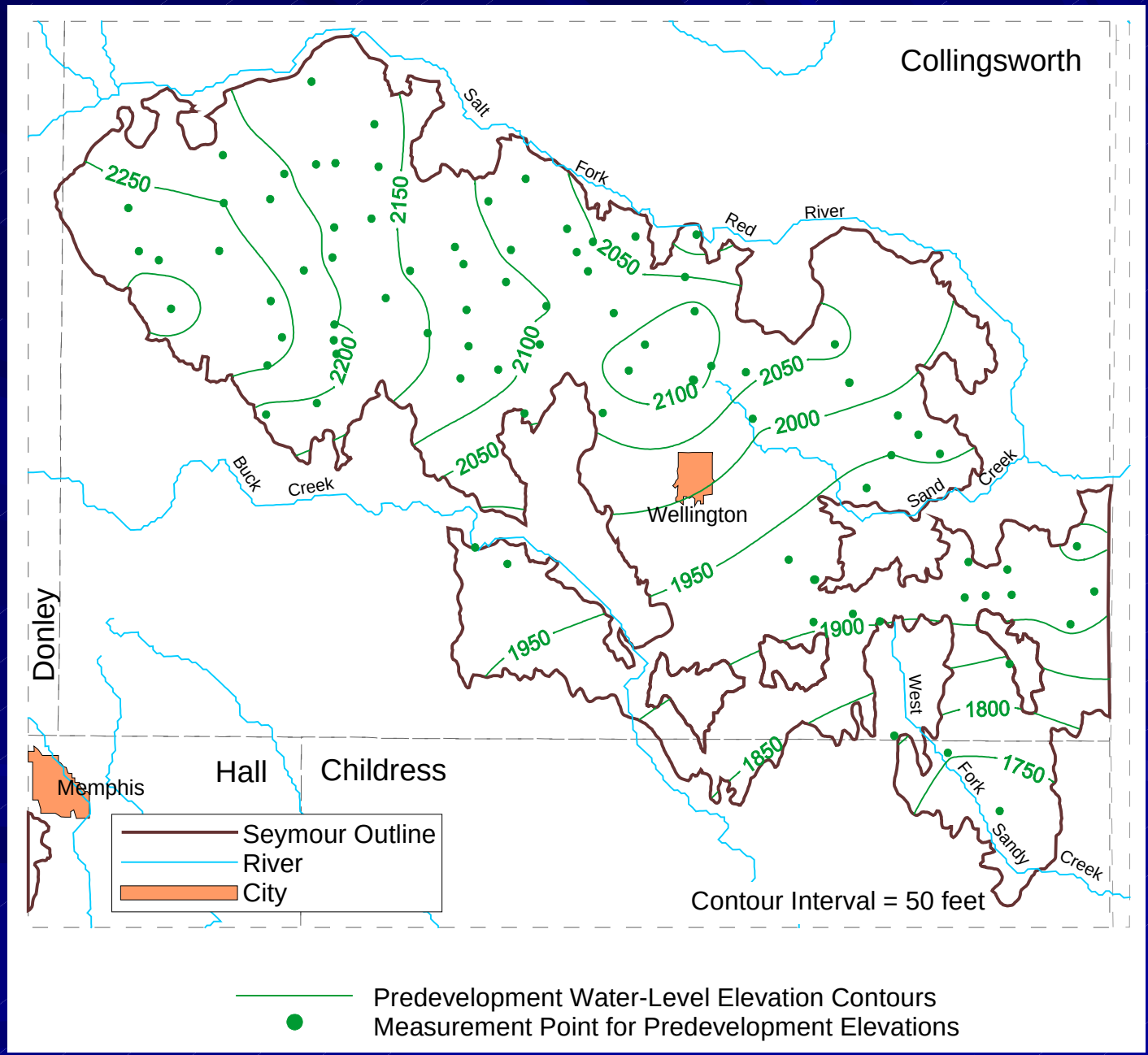
Water Levels (cont'd)

- Challenges (continued)
  - Inconsistent data coverage from year to year and county to county
  - The Seymour is not a continuous aquifer but rather a series of hydraulically isolated patches

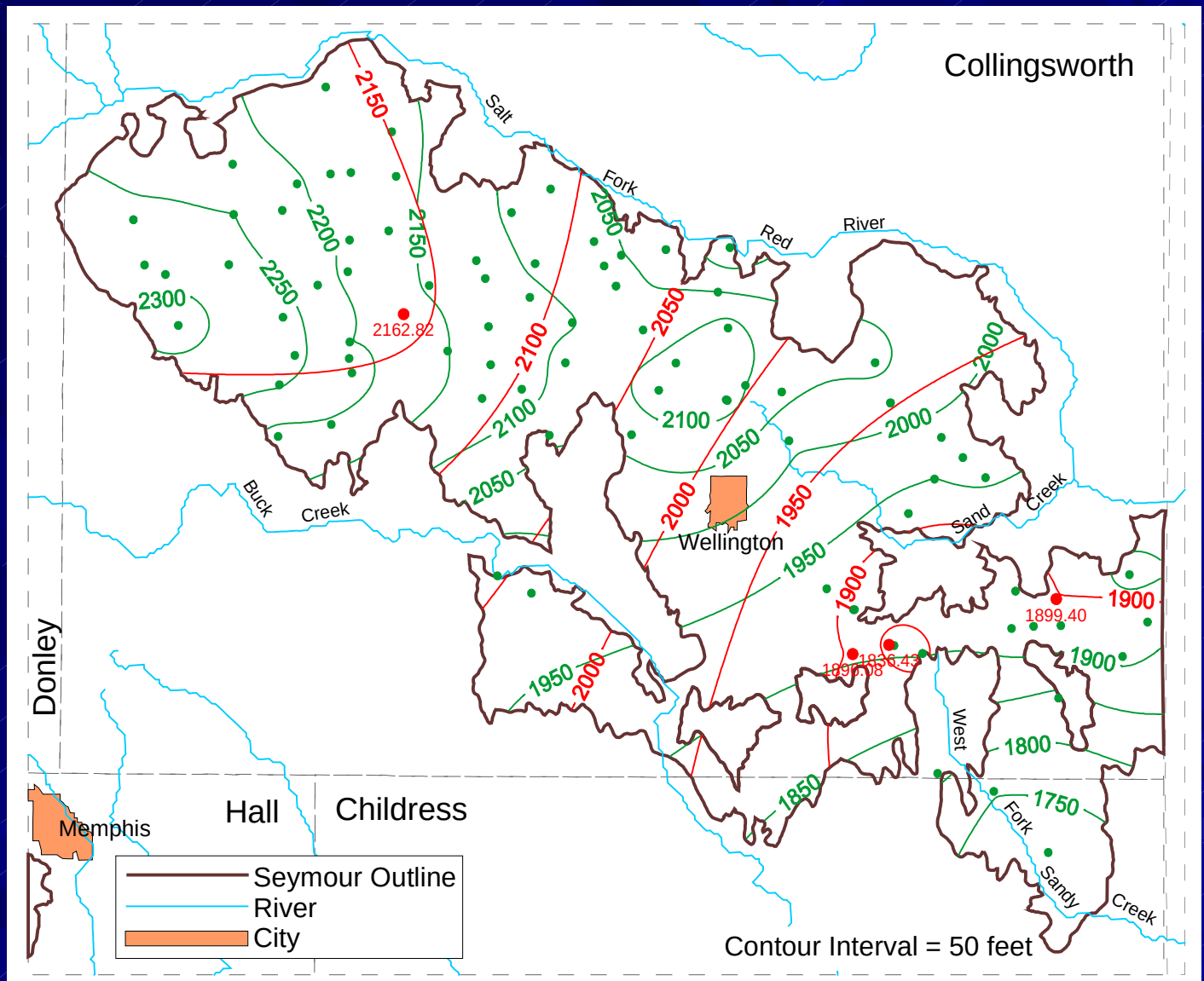
Seymour – Water-Level Locations



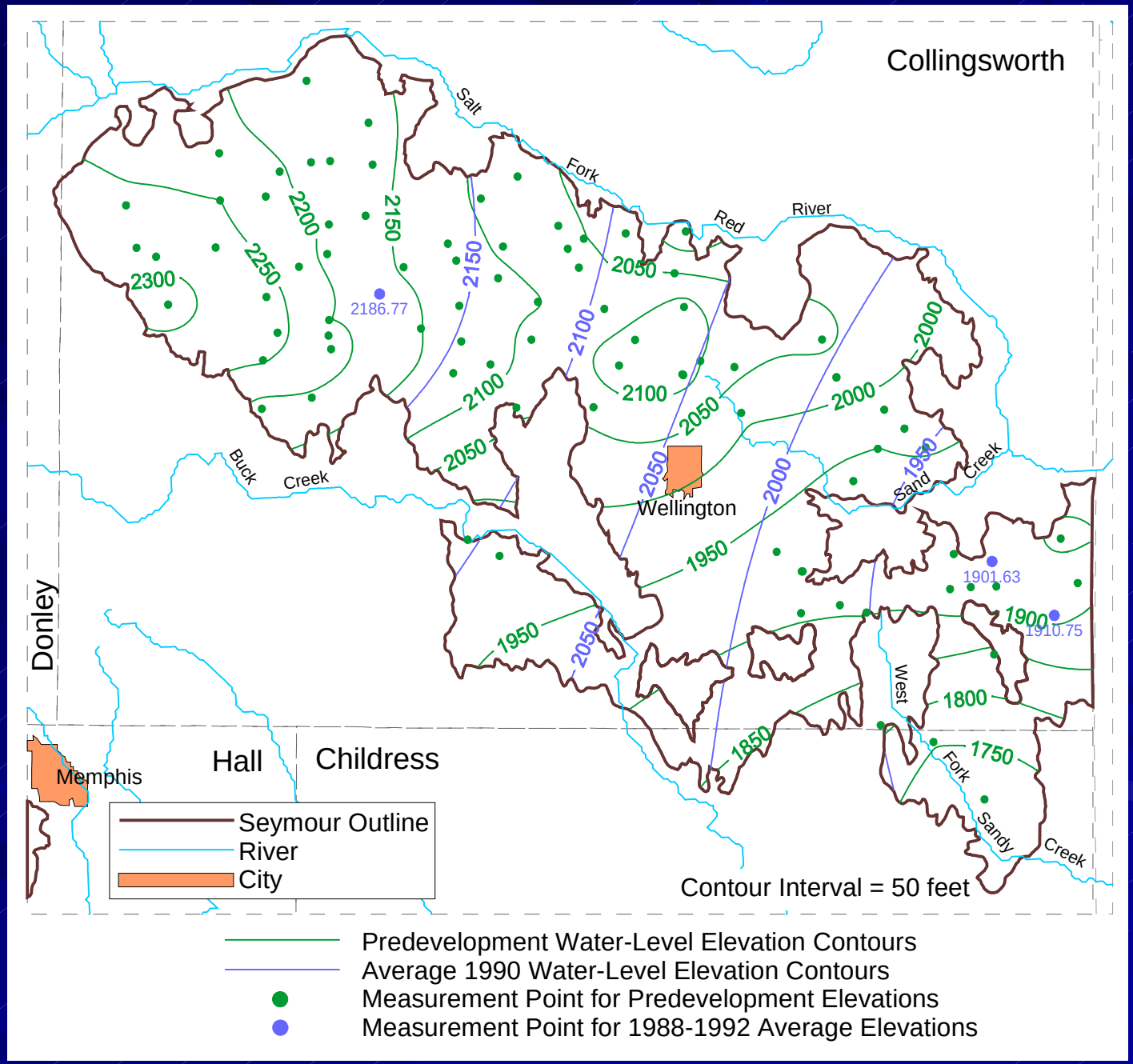
Collingsworth County – Predevelopment Water-Level Elevations



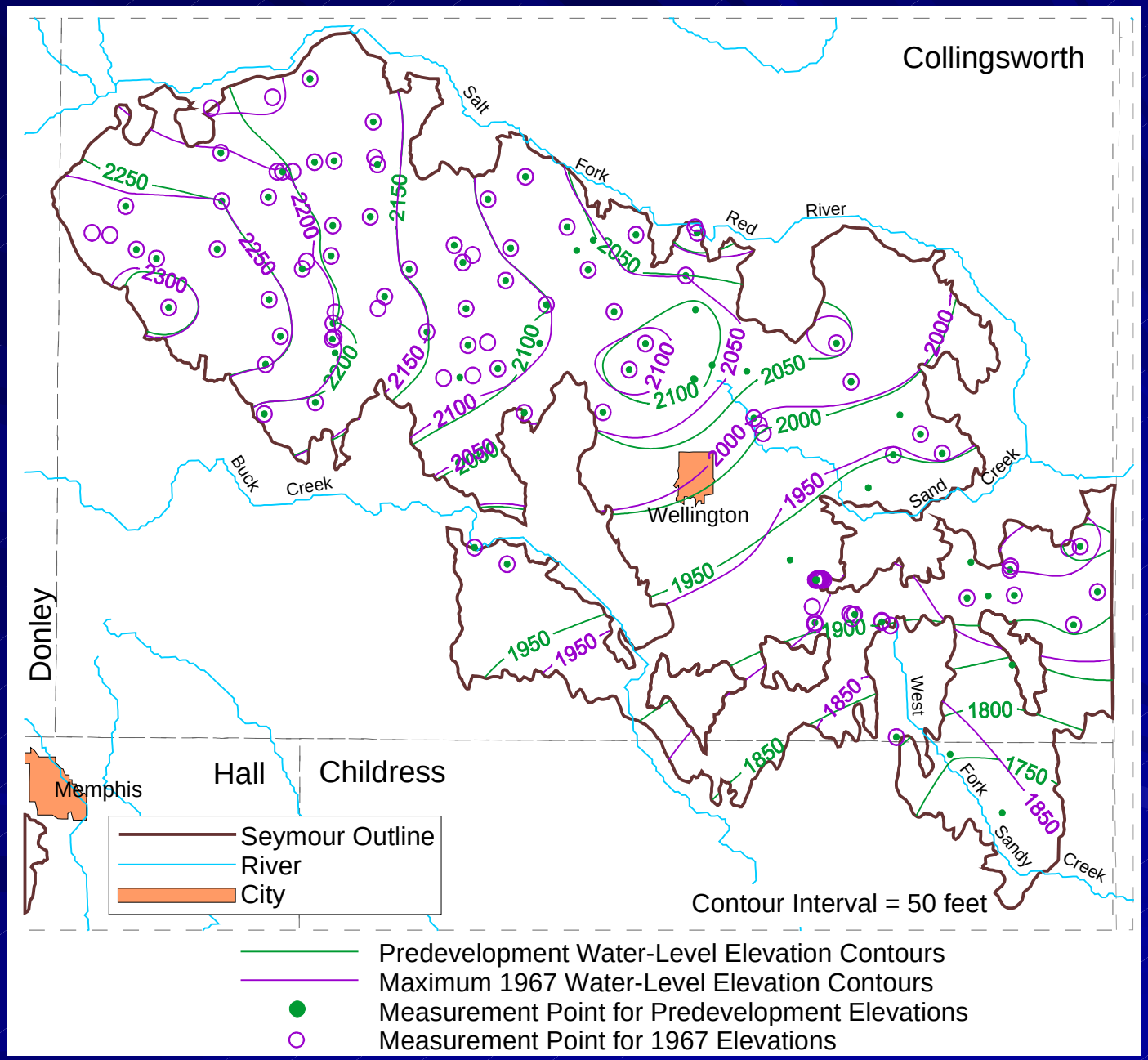
Predevelopment & 1978-1982 Average Water-Level Elevations



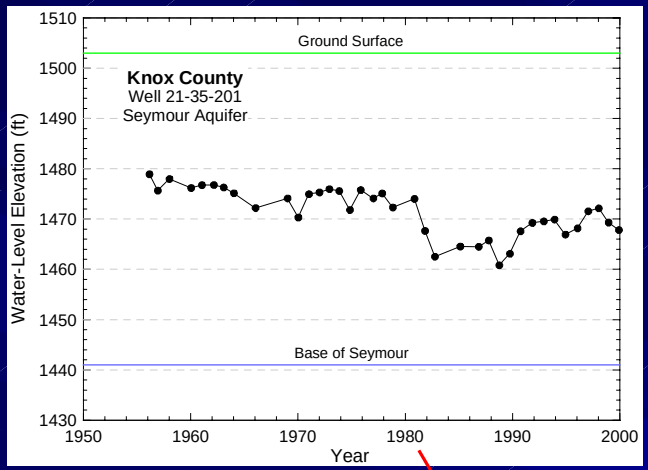
Predevelopment & 1988-1992 Average Water-Level Elevations

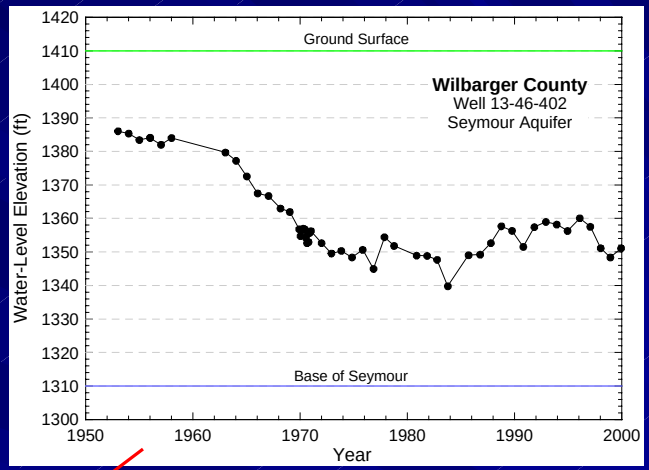


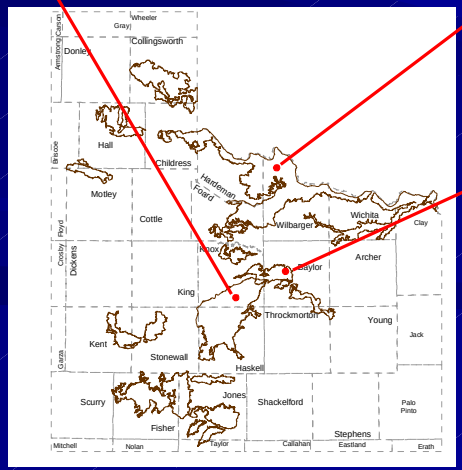
Predevelopment & 1967 Water-Level Elevations

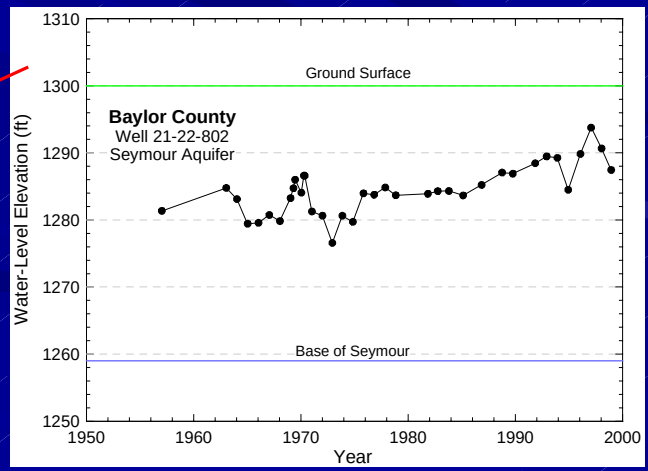


Seymour Wells – Hydrograph Examples

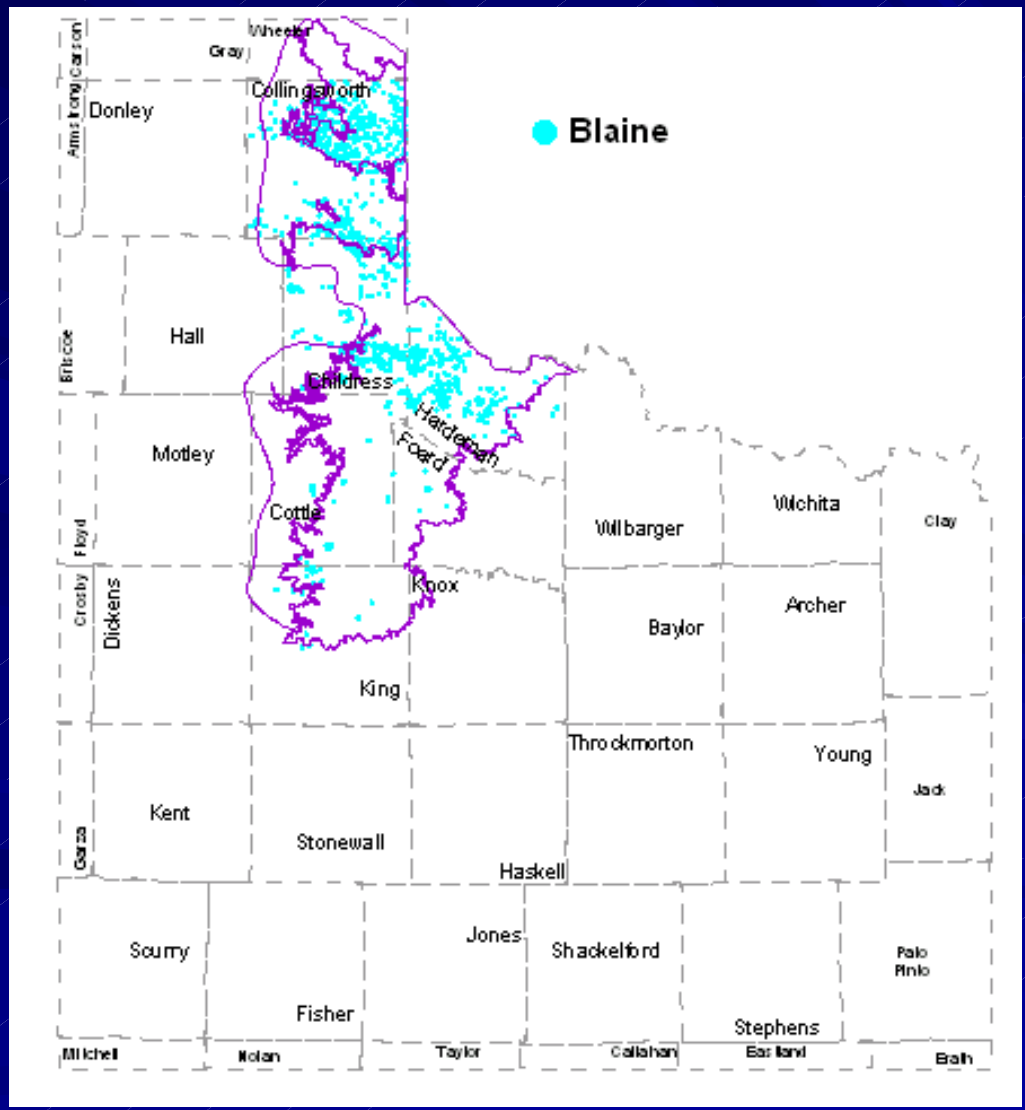








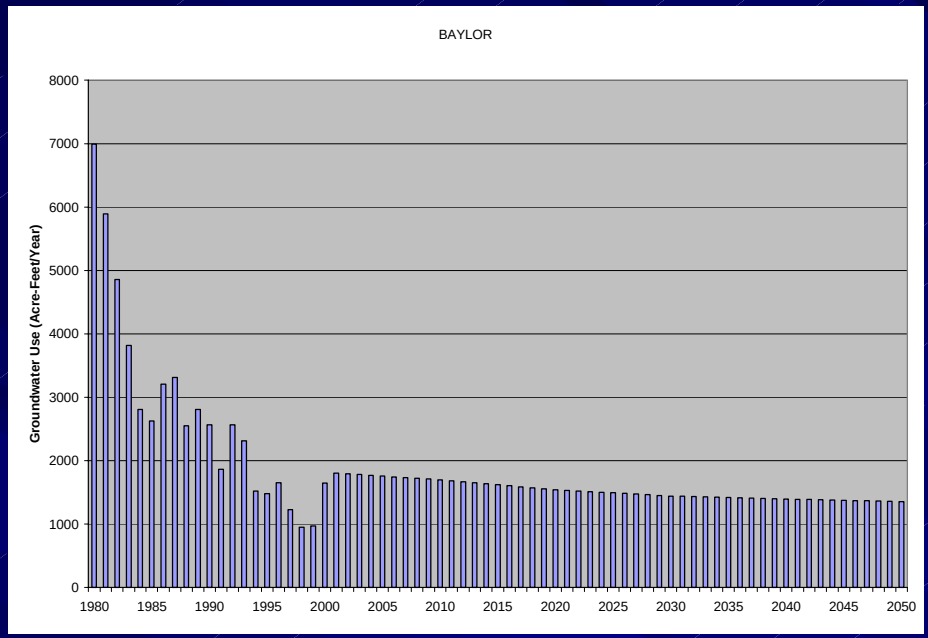
Blaine – Water-Level Locations

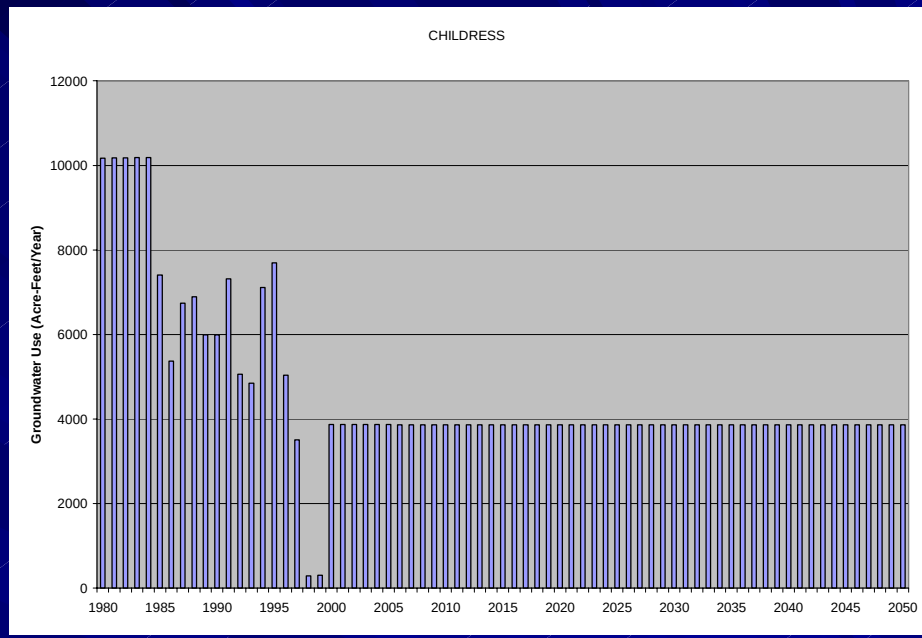


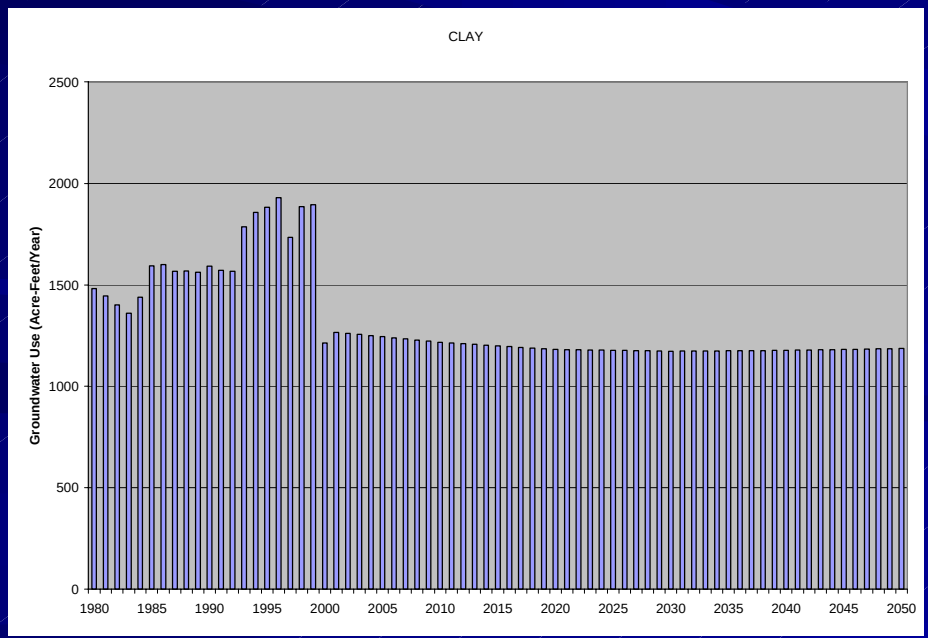
Pumping

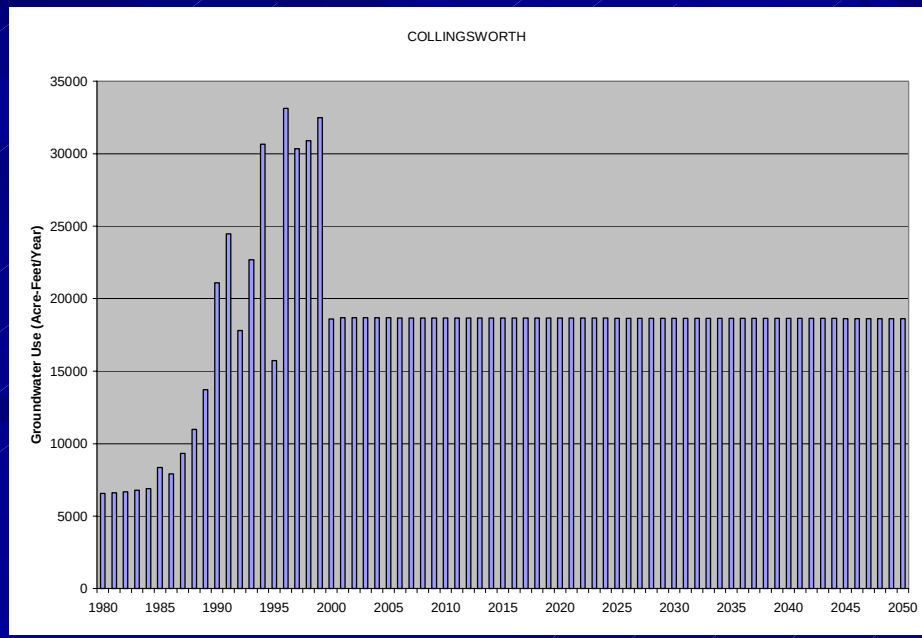
- Technical Memorandum 02-02 posted on TWDB website
- Historical groundwater pumpage (1980 – 2000)
- Predictive groundwater pumpage (2000 – 2050)

Historical & Predictive Groundwater Pumpage (by County)

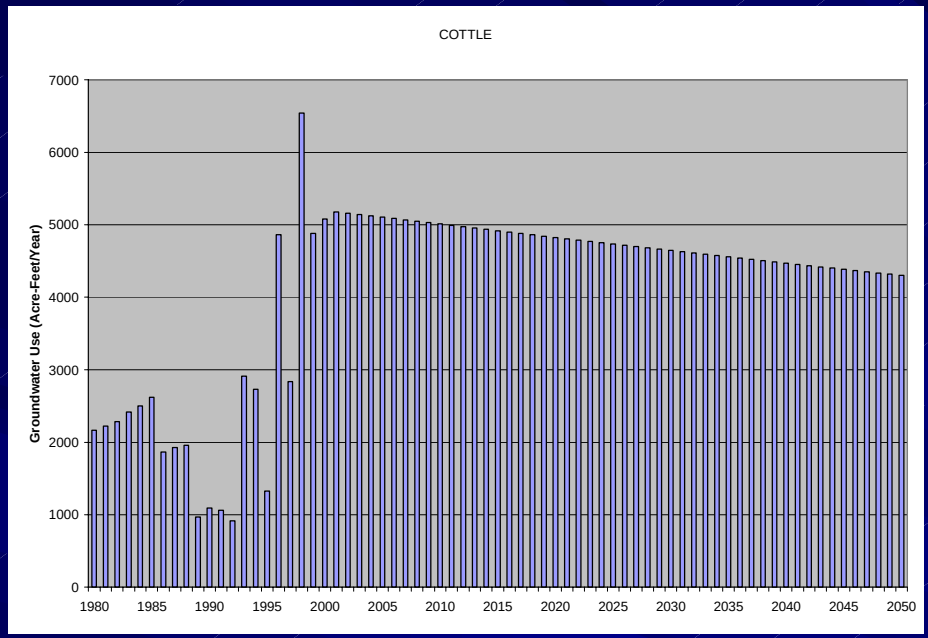


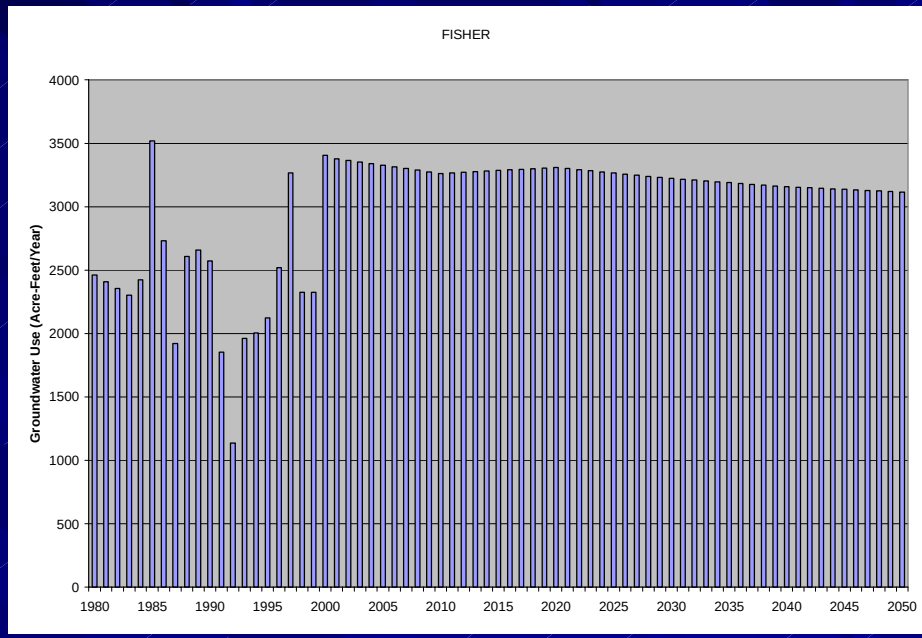


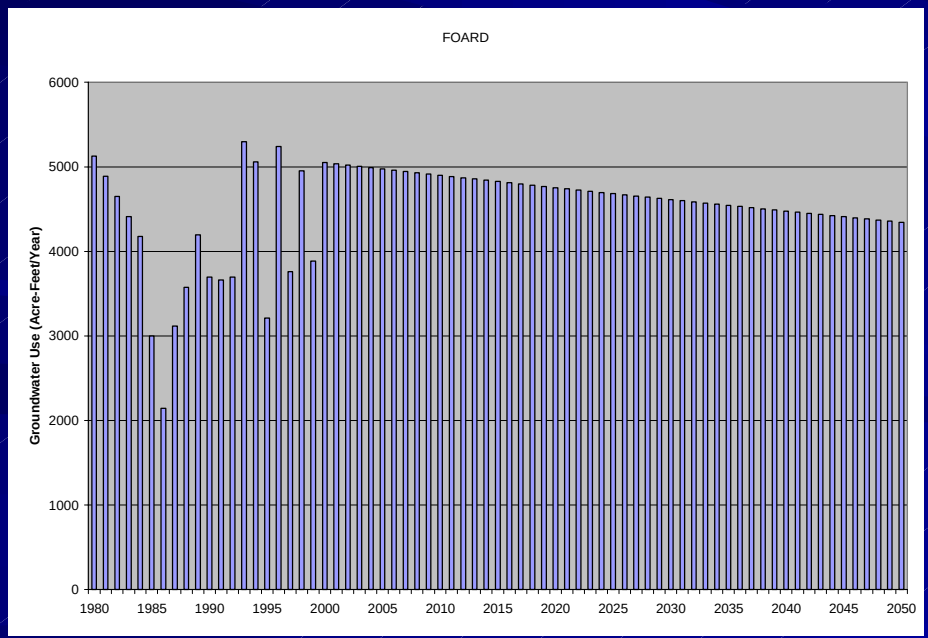


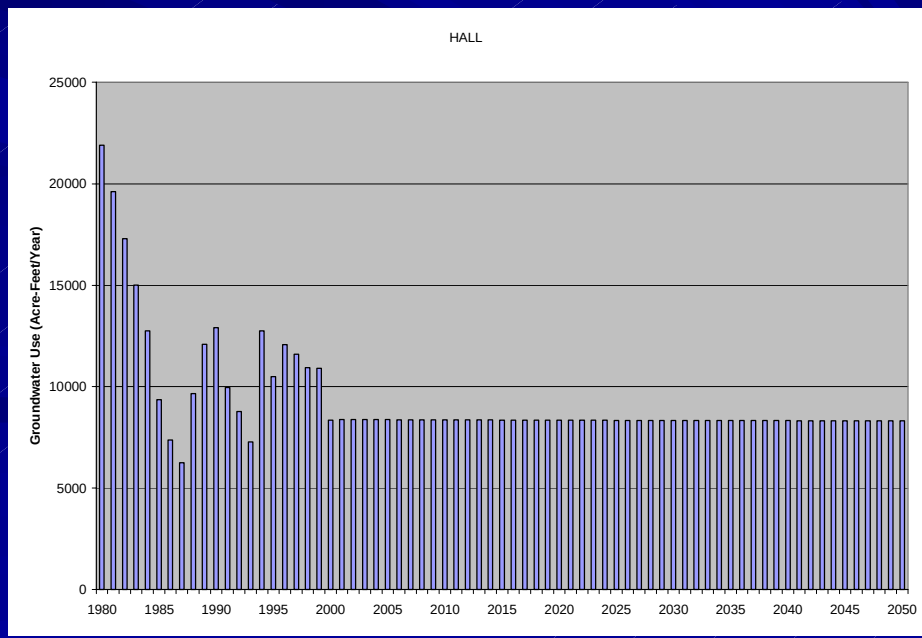


Historical & Predictive Groundwater Pumpage (by County)

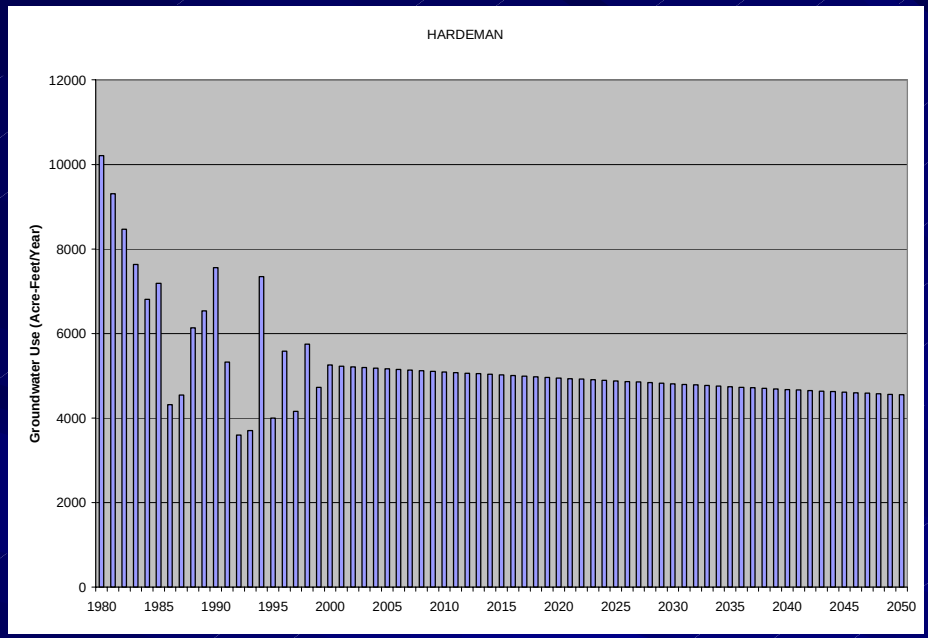


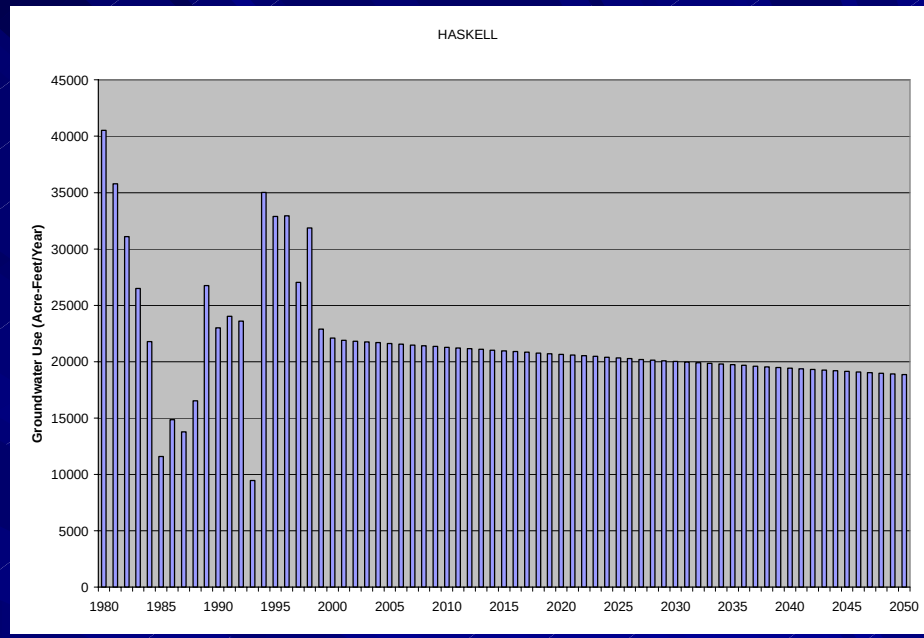


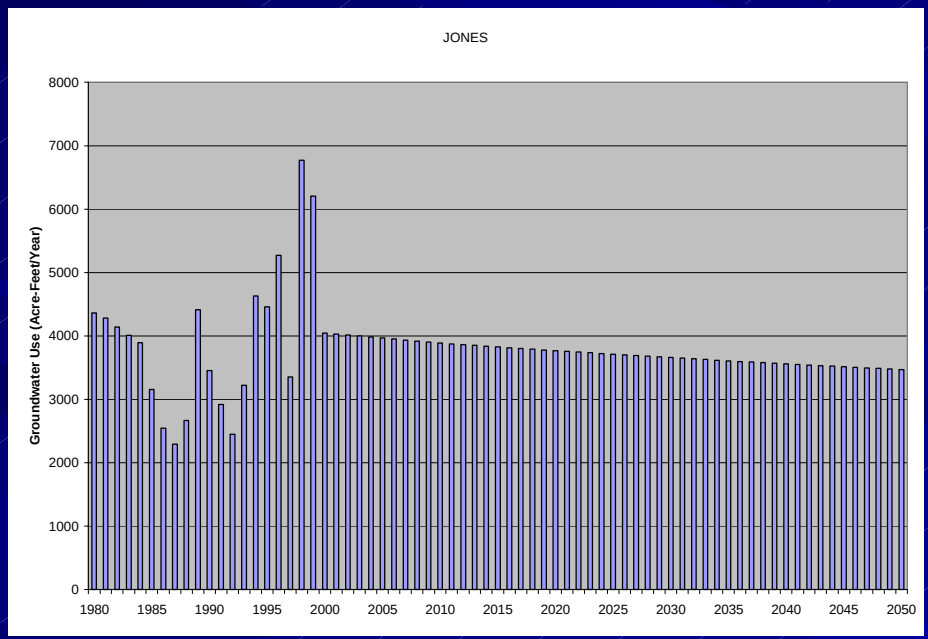


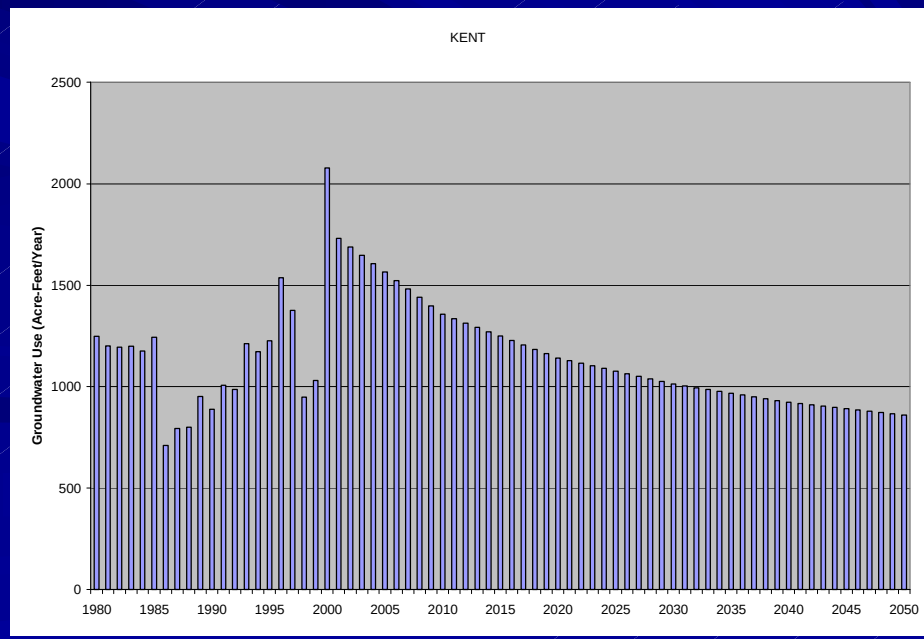


Historical & Predictive Groundwater Pumpage (by County)

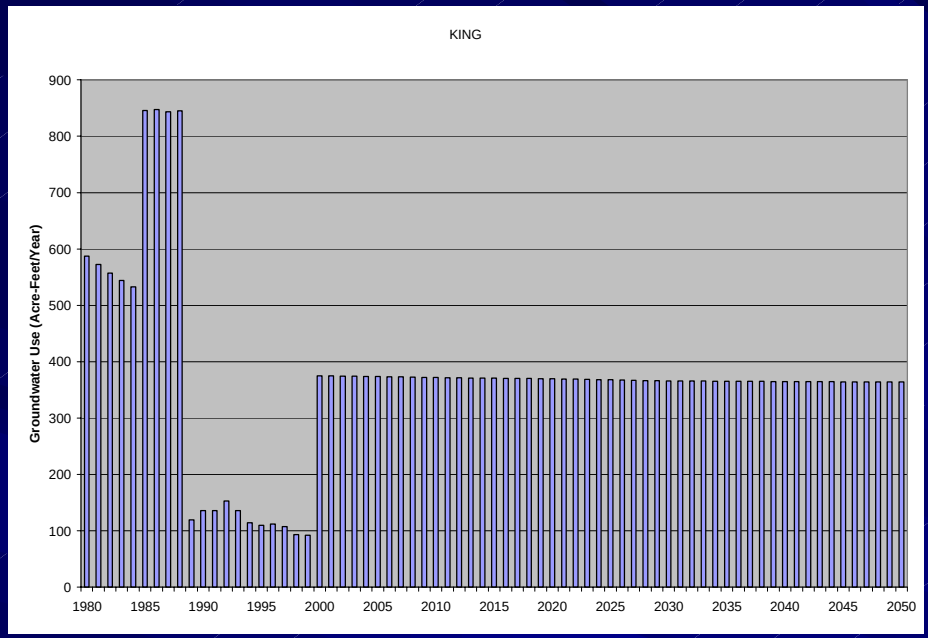


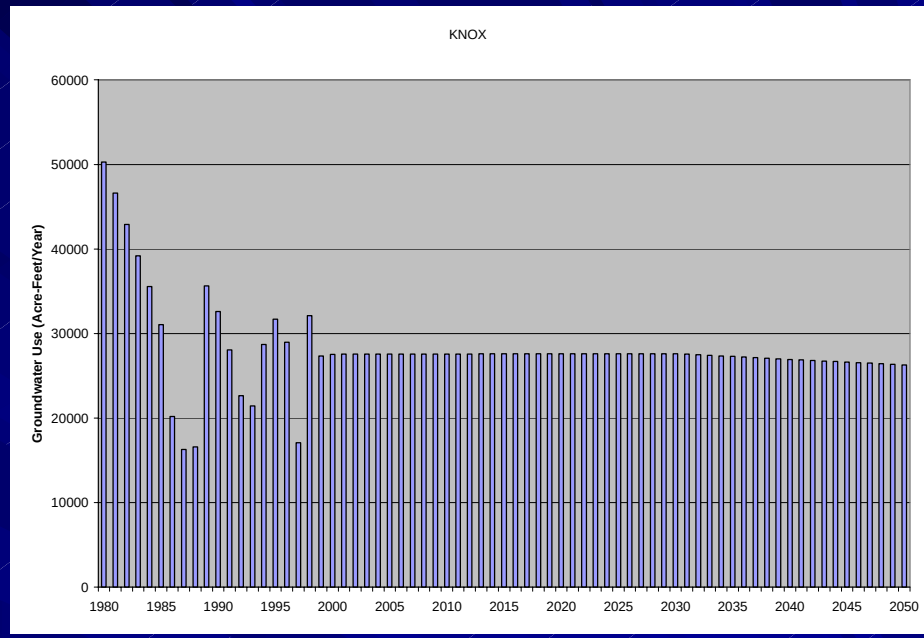


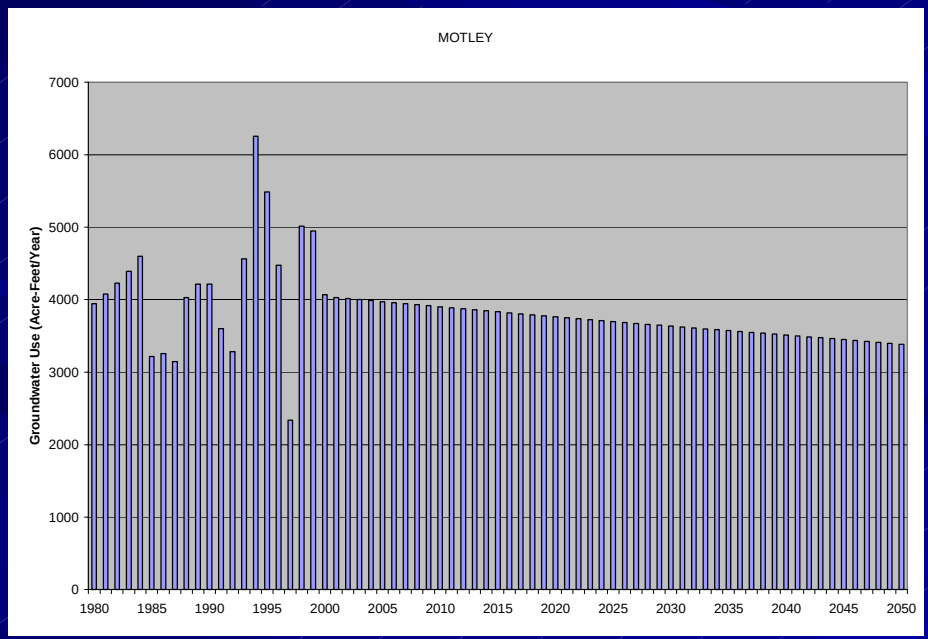


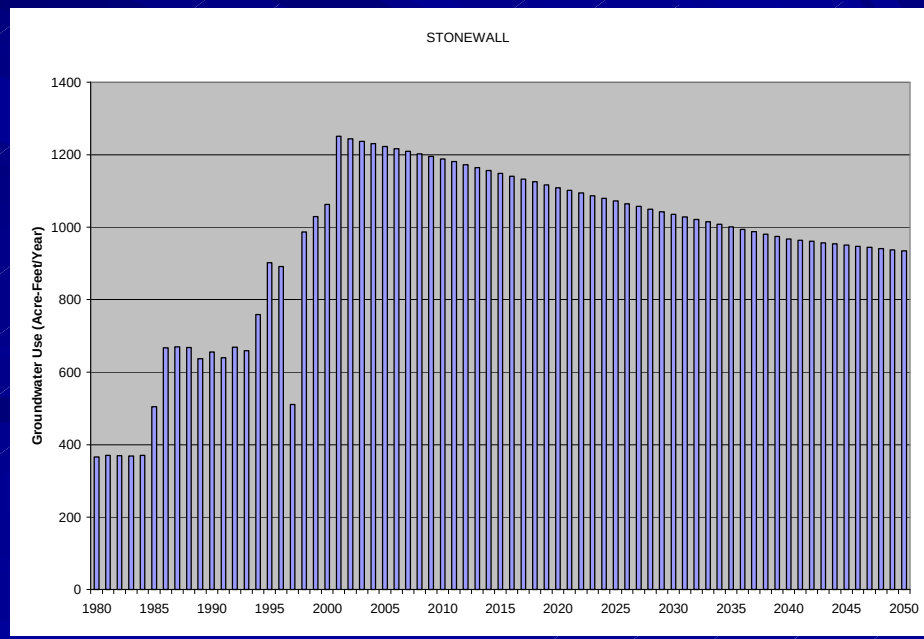


Historical & Predictive Groundwater Pumpage (by County)

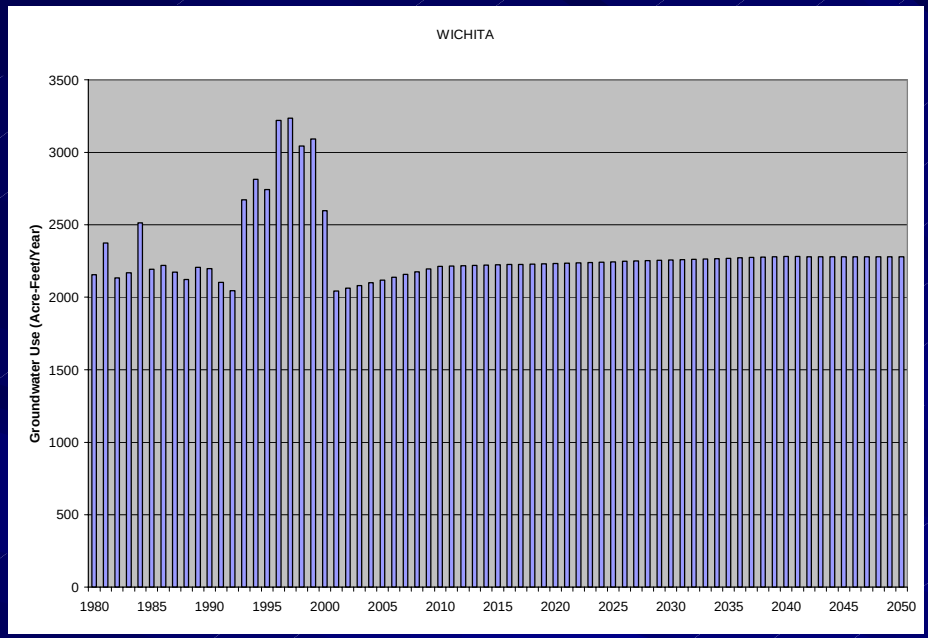


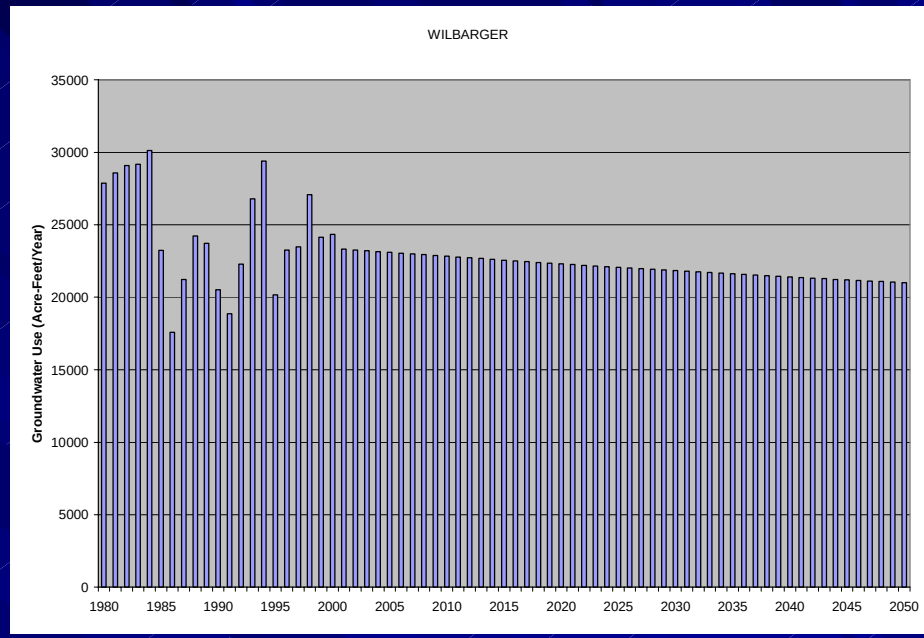






Historical & Predictive Groundwater Pumpage (by County)





GAM Schedule

- Project start – Nov. 2002
- Draft concept. model – July 31, 2003*
- Draft conceptual model report – Aug. 31, 2003
- Steady-state model calibration – Nov. 2003*
- Transient calibration & verification – Jan. 2004*
- Predictions – Feb. 2004*
- Draft Model Report to TWDB – Mar. 1, 2004
- TWDB feedback on Draft Report – April 2004*
- Model Training Seminar – Apr. 2004
- Final Model Report to TWDB – Jun. 30, 2004
- Note: SAFs are scheduled at about 4 month intervals

Note: * means technical review meeting scheduled with the TWDB

Feedback

- Comments/discussion

Scope for Next SAF

- Next meeting – October/November
  - Final conceptual model review
  - Model implementation
  - Pumping distribution
  - Water quality
  - Draft steady-state model calibration

Who to Contact?

- John Pickens
  INTERA Inc.
  9111A Research Blvd
  Austin, TX 78758
  (512) 425-2030
  jpickens@intera.com
- Cindy Ridgeway
  Texas Water Development Board
  P.O. Box 13231
  Austin, TX 78711
  (512) 936-2386
  cindy.ridgeway@twdb.state.tx.us

SEYMOUR GAM STAKEHOLDERS ATTENDANCE LIST
Stakeholders Advisory Forum
Held
June 30, 2003 in Seymour, Texas

NAME	AFFILIATION
Cindy Ridgeway	TWDB
John Ewing	Intera
Andrew Chastain-Howley	WPRC
Dan C. Choate	Enprotec
Thomas Powell	Collingsworth UWCD
Glenn Ray Howell	Rolling Plains Water District
Brenda Miller	Private
Joe Shephard	City of Seymour
J. Colthon	Baylor County
Mike McGuire	Rolling Plains GCD
Cynthia Laney	City of Seymour

Summary Memorandum Report
Seymour Aquifer GAM
SAF Meeting #2, Seymour, Texas
June 30, 2003

PRESENTATION

The second Stakeholder Advisory Forum was held on Monday June 30, 2003 at 1.30 p.m. at the Portwood Arts and Civic Center, 800 East Morris Street, Seymour, Texas.

The presentation topics for this forum included:

(1) GAM objectives, expectations, and schedule
(2) Using GAM and participating in the GAM process
(3) Seymour aquifer location and stratigraphy
(4) Model grid design
(5) Well record information and structure assessment
(6) Hydraulic properties
(7) Recharge
(8) Streams and streamflows
(9) Water levels
(10) Pumping (by County)

A summary of questions, answers, and other discussion is listed below.

QUESTIONS AND ANSWERS

Q: Will there be any costs associated with requesting model runs?
A: Cindy Ridgeway: There will be no charge to water planning groups or groundwater conservation districts. All the model runs are currently being conducted in-house (within the TWDB) and so there may come a time when there is a backlog of requests, however this is not foreseen in the near future.
Info: Andrew Chastain-Howley and Cindy Ridgeway: There will be a training workshop held at the end of the modeling contract to teach stakeholders how to run the models at a basic level.

Q: Mike McGuire: What dates will be used for input into the model?
A: John Ewing: Pre-development, 1980, 1990 and 1999-2000.

Q: Mike McGuire: There have been significant changes in water levels from 1999 to present, at least in the Knox, Haskell, Baylor County area. Will these be put into the model?
A: Cindy Ridgeway, John Ewing, Andrew Chastain-Howley: The new data will probably not be directly put into the model. However, the model should be able to predict these reductions in water levels depending upon the accuracy of the input data. These models should be updated on approximately a five-year cycle, so this new data can be

incorporated at this time and the model re-calibrated if necessary. This is the first stage of a continuing GAM process.

Info: Mike McGuire reported that he had acquired 30 rain gauges for use around the Rolling Plains GCD. This would over time improve the level of detail used for recharge calculations in this tri-county area. Mr. McGuire also reported that the BEG has started a monitoring program in Knox and Haskell Counties to analyze the water levels and quality in the main recharge zone.

Q: Joe Shephard: Have there been any discussion of aquifer recharge of reuse water in rural areas?
A: Dan Choate, Andrew Chastain-Howley, Cindy Ridgeway: Work was conducted in 2001, in Jones County near Abilene. This was a basic feasibility for aquifer storage and recovery (ASR). Reuse is a very hot topic around the state and especially in the Dallas-Fort Worth area where over 30% of the new water sources for the next 50 years are slated to be from reuse. This appears to be viable but local study would be needed.

Info: Cindy Ridgeway: It was also mentioned that grants are available for this research (from the TWDB), but that the money is hard to find at this time.

Q: County Judge: Will there be any water quality modeling with this GAM process?
A: Water quality will be reviewed, but only at a basic level and it will not be modeled at this stage. The most important thing is to get a working flow model (which is required for a water quality model anyway).

Info: Dan Choate reported that he had worked on the Jones County ASR project. He reported that it had not as yet been proven to be a viable alternative using excess water from Lake Possum Kingdom.

Info: Mike McGuire stated that he had developed a new list of contact names and numbers for the Seymour area groundwater conservation districts. He provided details for the Tri-County district and will furnish updated details for the other GCD's at a later date.

Prepared by: Andrew Chastain-Howley
Date: July 7, 2003