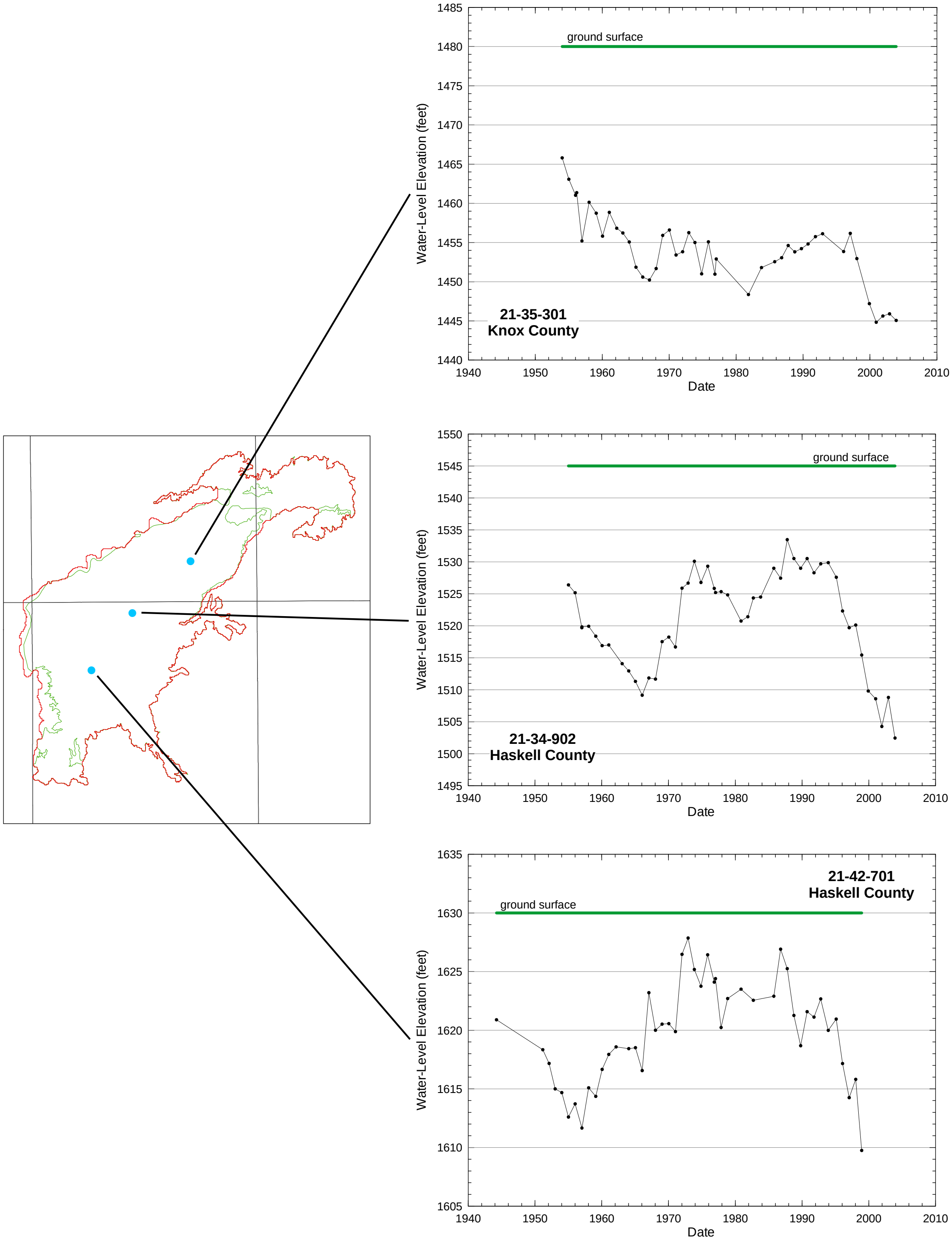

Figure 4.4.7 Long-term water-level data used to estimate recharge rates for the Seymour Aquifer using the water-table fluctuation method.

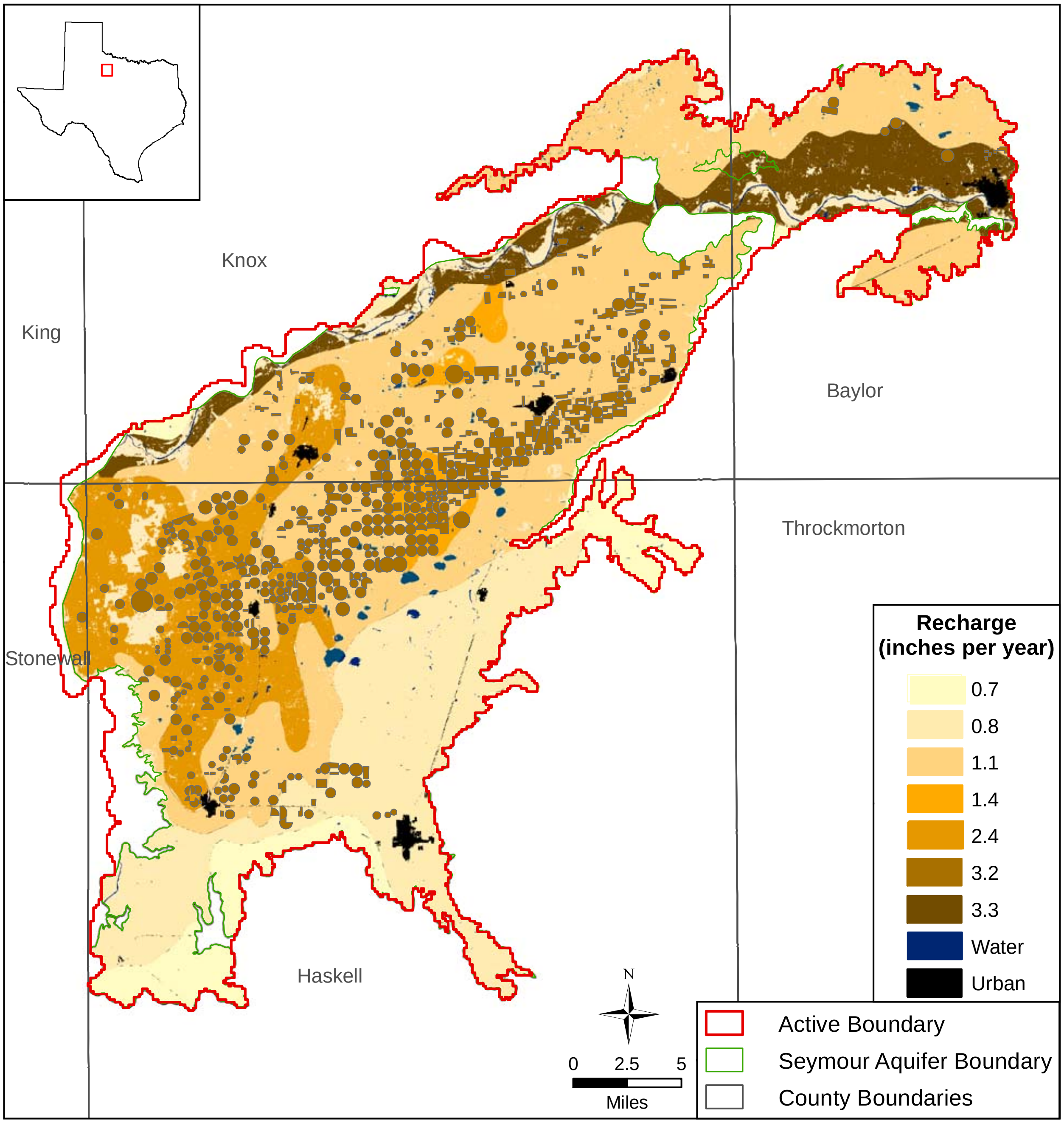

Figure 4.4.8 Estimated spatial distribution of modern recharge for the Seymour Aquifer.

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4.5 Rivers, Streams, Springs, and Lakes

Interaction between groundwater and surface water occurs at the location of rivers, streams, springs, and lakes. Rivers and streams can either lose water to the underlying aquifer, resulting in aquifer recharge, or gain water from the underlying aquifer, resulting in aquifer discharge. Discharge from an aquifer also occurs where the water table intersects the ground surface at springs or seeps. Lakes can provide a potential site of focused recharge.

4.5.1 Rivers and Streams

Base flow in a river or stream is the contribution of groundwater to gaining reaches of a stream. After runoff from storm events has drained away, the natural surface-water flow that continues is predominately base flow from groundwater. Streams can have an intermittent base flow with flow during wet periods and low or no flow during dry periods. Larger streams and rivers might have a perennial base flow. Direct exchange between surface water and groundwater is limited to the outcrop.

One major river, two large creeks, and four small creeks intersect the study area (Figure 4.5.1). The locations of the major river and two large creeks were obtained from the United States Environmental Protection Agency reach file 1 for the conterminous United States (Alexander and others, 1999), clipped to the active model area, and the locations for the four small creeks were digitized from a scanned image of a United States Geological Survey topographic map obtained from the Texas Natural Resources Information System website (TWDB, 2005). The names for these four small creeks were taken from R.W. Harden and Associates (1978). Because the locations of the four small creeks were digitized from a figure, they are less certain than the locations of the major river and two large creeks.

Also shown on Figure 4.5.1 is the location of the one stream gage, where stream-flow data are collected, available for the river in the study area. This gage is located on the Brazos River in Baylor County. Figure 4.5.2 shows a hydrograph of the yearly average stream flow at this gage over the period of record from 1924 through 2008. This yearly average stream flow was calculated from daily stream flow data obtained from the United States Geological Survey website of surface water data for the nation (United States Geological Survey, 2009b). The yearly average has ranged from a low of 48 cubic feet per second in 1952 to a high of 1,786 cubic feet per second in 1941. During the transient model calibration period of 1980 through 1997, the yearly average ranged from a low of 92 cubic feet per second in 1984 to a high of 632 cubic feet per second in 1992. A pattern of relatively low stream flow for one or two years followed by significantly higher flow for the next two or three years occurs three times during the transient model calibration period of 1980 through 1997. However, stream flow was continually low from 1993 through 1997. Figure 4.5.3 shows the daily and monthly average stream flow at the gage during the transient model calibration period. The grid lines on the monthly average figure indicate the month of January in each year. A comparison of this grid line to the data does not show a consistent seasonal trend in the monthly average stream flow. Although the lowest stream flows occurred in the summer months of 1983, 1984, and 1996, several of the highest streams flows also occurred in summer months (i.e., 1982, 1990, 1991, and 1992).

Stream interaction with underlying aquifers can be quantified through stream gain/loss studies that determine the rate of water exchange between a stream and the adjacent aquifers. A low-flow gain/loss study was conducted in February 1970 on the Brazos River from the Knox-Baylor county line to the bridge over the river at the city of Seymour in Baylor County (Preston, 1978). Gains/losses in stream flow were measured at five sites along this portion of the river. The approximate locations of measurements sites 2, 3, 4, and 5 are shown in Figure 4.5.1. The location of measurement site 1 is not shown on this figure because it was not given in Preston (1978). Table 4.5.1 summarizes the stream flow measured at each site, the net gain, and the yearly discharge from the Seymour Aquifer represented by the gain. The study showed that this portion of the Brazos River is gaining, with the net gain ranging from 0.1 to 2.6 cubic feet per second (Table 4.5.1). The gains observed along the river indicate discharge from the Seymour Aquifer to the river. Preston (1978) calculated the magnitude of this discharge to range from 72.4 to 1,882.5 acre-feet per year (Table 4.5.1). Note that along this portion of the Brazos River, the Seymour Aquifer includes groundwater in the Seymour Formation as well as groundwater in the recent alluvium sediments located adjacent to the river. The majority of the groundwater discharging to the river comes from the Seymour Formation and travels through the recent alluvial deposits to the river (Preston, 1978). The Slade and others (2002) report on gains from and losses to major and minor aquifers in Texas does not include stream gain/loss study data for the Seymour Aquifer.

4.5.2 Springs

In unconfined aquifers, springs are locations where the water table intersects the ground surface. Springs typically occur in topographically low areas in river valleys or in areas of the outcrop where hydrogeologic conditions preferentially reject recharge. Four sources were used to find spring data for the Seymour Aquifer; the TWDB website (TWDB, 2008c), a database of Texas springs compiled by the United States Geological Survey and reported in Heitmuller and Reece (2003), a report on the springs of Texas by Brune (2002), and the R.W. Harden and Associates (1978) report on the availability and quality of groundwater in the Seymour Aquifer in Haskell and Knox counties. Note that all of the springs identified in the report in the occurrence and quality of groundwater in Baylor County by Preston (1978) are included in TWDB (2008c). All of the springs found in Heitmuller and Reece (2003) were also found on the TWDB website (TWDB, 2008c).

The TWDB website and Heitmuller and Reece (2003) provide coordinates for springs but Brune (2002) does not. An exercise was conducted to try to determine the locations of the springs given in Brune (2002) by first looking at the discharge rates from the springs. If the rate was low, those springs were considered to be unimportant and not evaluated further. For springs with high discharge rates, an attempt was made to match the spring with a spring found in TWDB (2008c). For three springs this was easily done because the name of the spring in Brune (2002) matched the name of the spring in TWDB (2008c) and/or Heitmuller and Reece (2003). Several other springs were matched to a spring in TWDB (2008c) based on the description of the spring location given in Brune (2002) and/or based on the flow measurements given in Brune (2002) and TWDB (2008c). The certainty of this match is high for some springs but low for others. Six of the springs in Brune (2002) had a high discharge rate but could not be matched to a spring in TWDB (2008c). For those springs, an approximate location was estimated based on the location description given in Brune (2002).

Figure 4.5.4 shows the locations of springs flowing from the Seymour Aquifer obtained from the TWDB website (TWDB, 2008c), Heitmuller and Reece (2003), and Brune (2002). The springs are predominately located along the Brazos River in Baylor County and along the western edge of the Seymour Aquifer in Knox and Haskell counties. Table 4.5.2 provides a summary of flow from Seymour Aquifer springs. A flow rate is not available for several of the springs and only one flow rate is available for many of the springs. For the springs with more than one measurement, spring discharge has generally declined over time. Brune (2002) attributes this decline primarily to pumping of the Seymour Aquifer for irrigation purposes. More than two discharge measurements are available for only three of the springs. A plot of discharge for those three springs is provided in Figure 4.5.5.

R.W. Harden and Associates (1978) provide a figure showing areas of natural discharge from the Seymour Aquifer. That figure, reproduced as Figure 4.5.6, shows the locations of springs and zones of springs and seeps in creeks. A comparison of Figures 4.5.4 and 4.5.6 shows that the location for some, but not all, of the springs on the R.W. Harden and Associates (1978) figure match locations for springs found in TWDB (2008c). Volume II of the R.W. Harden and Associates (1978) report also contains a table with a record of wells, which includes springs. All of the springs in that table are included in TWDB (2008c). Coordinate and discharge data for springs shown on their figure but not included in their record of wells table are not provided by R.W. Harden and Associates (1978).

Brune (2002) reports that buffalo bones and Indian artifacts were found at several Seymour Aquifer springs in Baylor, Haskell, and Knox counties. He also found evidence of camp sites for buffalo hunters and Indians near several springs. Brune (2002) states that Rice Springs near the city of Haskell was flowing in 1867, 1875, and 1881 and that a spring in Baylor County fed a pool used for baptisms in the 1880s. This information indicates that that the Seymour Aquifer contained some water in the steady-state period prior to about 1880.

4.5.3 Lakes and Reservoirs

Figure 4.5.7 shows reservoirs located within the study area. None of these reservoirs lie on the Seymour Aquifer. Although it is difficult to see in Figure 4.5.7, a portion of Lake Davis falls within the active model area, but the boundary of the Seymour Aquifer does not include the lake. Figure 4.5.7 also shows the locations of several playas on the Seymour Aquifer. These playas contain water intermittently based on rainfall (McGuire, 2009). Most of the playas are located over the portion of the aquifer that is dry. The playas on the portion of the aquifer that contains water may be a source of focused recharge. However, their impact is expected to be insignificant.

Table 4.5.1 Summary of the February 1970 gain/loss study on the Brazos River in Baylor County (after Preston, 1978).

Measurement Site	Flow (cubic feet per second)	Net Gain (cubic feet per second)	Yearly Discharge Represented by Net Gain (acre-feet)
1	34.6	-	-
2	34.7	0.1	72.4
3	35.2	0.5	362.5
4	37.8	2.6	1,882.5
5	38.7	0.9	651.6

Table 4.5.2 Summary of springs flowing from the Seymour Aquifer in the study area.

Spring Number/ Name	Possible Spring in Brune (2002)	County	Elevation (feet)	Max Flow (gpm)	Max Flow (lps)	Date of Max	Min Flow (gpm)	Min Flow (lps)	Date of Min	Number of Measure-ments	Source
21-21-703	Soap Springs	Baylor	1388	30	**1.9**	10/1969	16	**1.0**	7/21/1979	3	TWDB (2008c), Brune (2002)
21-22-406	Dead Man Springs	Baylor	1280	10	**0.63**	10/1969	5.5	**0.35**	7/21/1979	2	TWDB (2008c), Brune (2002)
21-22-407		Baylor	1285	**15**	0.95	nr				1	TWDB (2008c)
21-22-408		Baylor	1285	**15**	0.95	nr				1	TWDB (2008c)
21-22-910		Baylor	1346	**2**	0.1	nr				1	TWDB (2008c), Heitmuller and Reece (2003)
21-29-317		Baylor	1300	**5**	0.3	nr				1	TWDB (2008c)
21-29-701		Baylor	1385							0	TWDB (2008c)
21-30-201		Baylor	1290	**10-15**	0.63-0.95	nr				1	TWDB (2008c)
21-30-214/ Buffalo Springs	Buffalo Springs	Baylor	1268	44	**2.8**	8/7/1925	12	**0.75**	1/22/1969	3	TWDB (2008c), Heitmuller and Reece (2003), Brune (2002)
21-30-262		Baylor	1267	**15**	0.95	nr				1	TWDB (2008c)
21-30-263		Baylor	1290	**15**	0.95	nr				1	TWDB (2008c)
21-30-383		Baylor	1303	**10**	0.63	nr				1	TWDB (2008c)
21-30-384		Baylor	1280	**5**	0.3	nr				1	TWDB (2008c)
21-30-603		Baylor	1332							0	TWDB (2008c)
21-39-604		Baylor	1260	**15**	0.95					1	TWDB (2008c)
21-30-393		Baylor		**67.32**	4.247	8/7/1925				1	TWDB (2008c), Heitmuller and Reece (2003)
Cottonwood Holes		Baylor		12	**0.75**	7/21/1979				1	Brune (2002)

Table 4.5.2, continued

Spring Number/ Name	Possible Spring in Brune (2002)	County	Elevation (feet)	Max Flow (gpm)	Max Flow (lps)	Date of Max	Min Flow (gpm)	Min Flow (lps)	Date of Min	Number of Measure-ments	Source
21-41-131	McGregor Springs	Haskell	1495	27	**1.7**	9/9/1979				1	TWDB (2008c), Heitmuller and Reece (2003), Brune (2002)
21-49-505	nr	Haskell	1650	**25**	1.6	3/20/1944	10	**0.61**	9/8/1979	2	TWDB (2008c), Heitmuller and Reece (2003), Brune (2002)
21-50-639		Haskell	1582							0	TWDB (2008c), Heitmuller and Reece (2003)
21-51-717/ Rice Spring	Rice Springs	Haskell	1560	55	**3.5**	9/7/1979	**dry**		8/6/1975	4	TWDB (2008c), Heitmuller and Reece (2003), Brune (2002)
Cook Springs		Haskell		41	**2.6**	9/9/1979				1	Brune (2002)
21-27-921	Redder Springs	Knox	1375	8.7	**0.55**	9/2/1979				1	TWDB (2008c), Heitmuller and Reece (2003), Brune (2002)
21-27-922		Knox	1365							0	TWDB (2008c), Heitmuller and Reece (2003)
21-28-601		Knox	1390	**1**	0.1	11/5/1975				1	TWDB (2008c), Heitmuller and Reece (2003)
21-28-602		Knox	1400							0	TWDB (2008c), Heitmuller and Reece (2003)
21-34-323	Mansfield Springs	Knox	1405	**100**	6.31	2/10/1957	**seeps**		9/1/1979	2	TWDB (2008c), Heitmuller and Reece (2003), Brune (2002)

Table 4.5.2, continued

Spring Number/ Name	Possible Spring in Brune (2002)	County	Elevation (feet)	Max Flow (gpm)	Max Flow (lps)	Date of Max	Min Flow (gpm)	Min Flow (lps)	Date of Min	Number of Measure-ments	Source
21-34-445/ Chalk Springs	Chalk springs	Knox	1445	**75**	4.73	3/1957	15	**0.95**	8/31/1979	3	TWDB (2008c), Heitmuller and Reece (2003), Brune (2002)
21-35-105		Knox	1405							0	TWDB (2008c), Heitmuller and Reece (2003)
21-35-106		Knox	1415							0	TWDB (2008c), Heitmuller and Reece (2003)
21-36-602		Knox	1412	**0.125**	0.008	11/6/1975				1	TWDB (2008c), Heitmuller and Reece (2003)
Bluff Springs		Knox		9.8	**0.62**	9/1/1979				1	Brune (2002)
Mockingbird Springs		Knox		21	**1.3**	9/3/1979				1	Brune (2002)
W Cross Springs		Knox		5.5	**0.35**	9/3/1979				1	Brune (2002)
Wild Horse Springs		Knox		81	**5.1**	9/3/1979				1	Brune (2002)

Note: Bold information reflects values and text given in the data source.
gpm = gallons per minute
lps = liters per second
TWDB = Texas Water Development Board

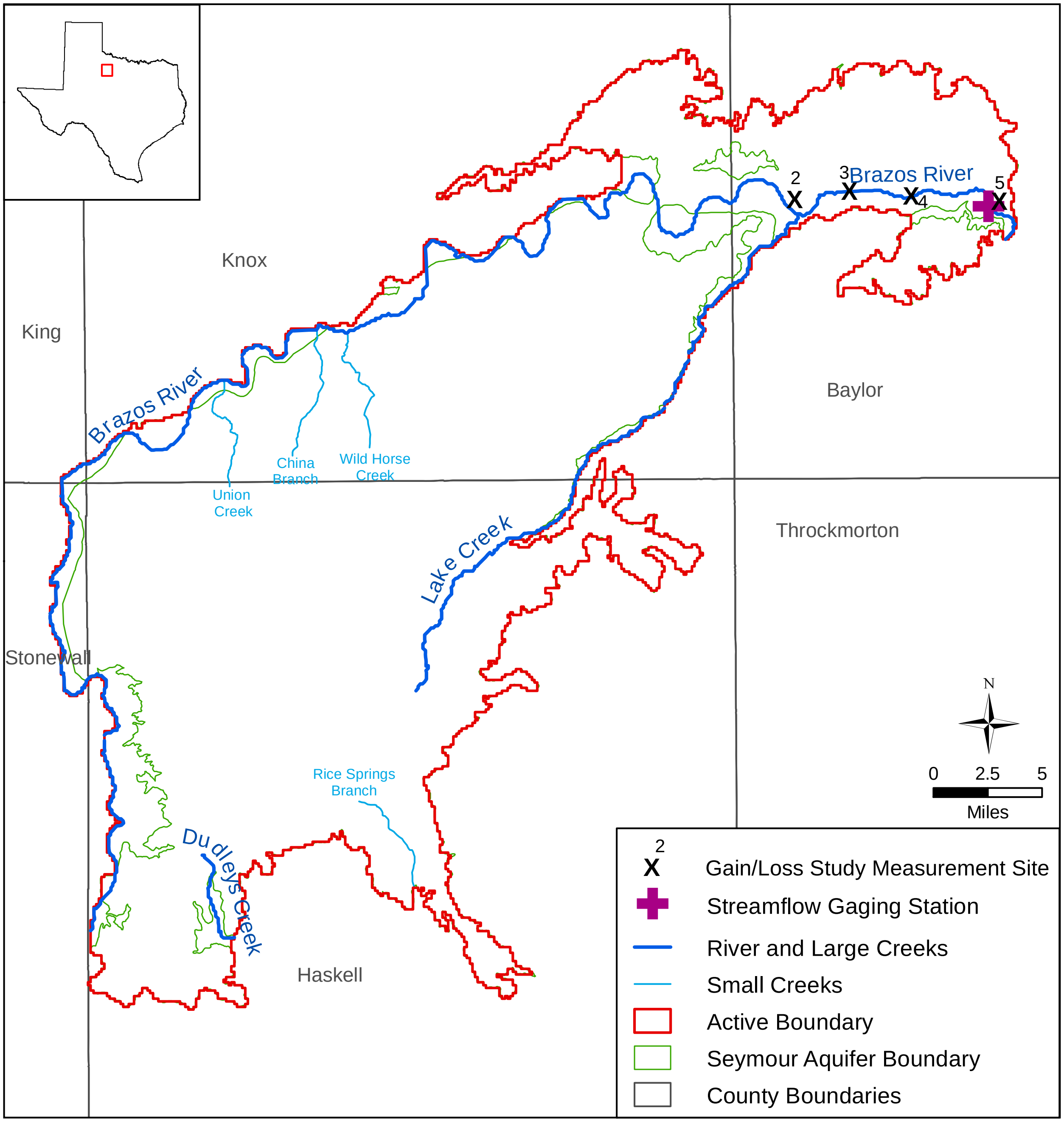


Figure 4.5.1 **Locations of major river, large creeks, and small creeks in the model area.**

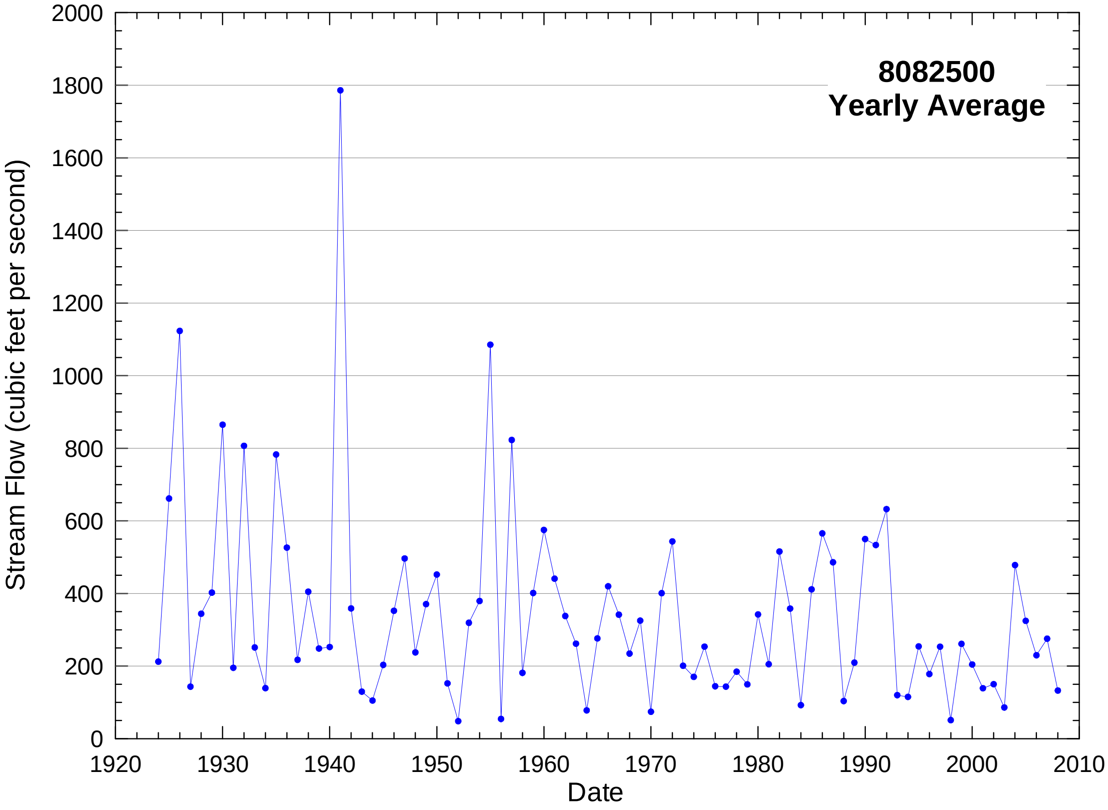


Figure 4.5.2 **Hydrograph of yearly average stream flow for the gage on the Brazos River in Baylor County.**

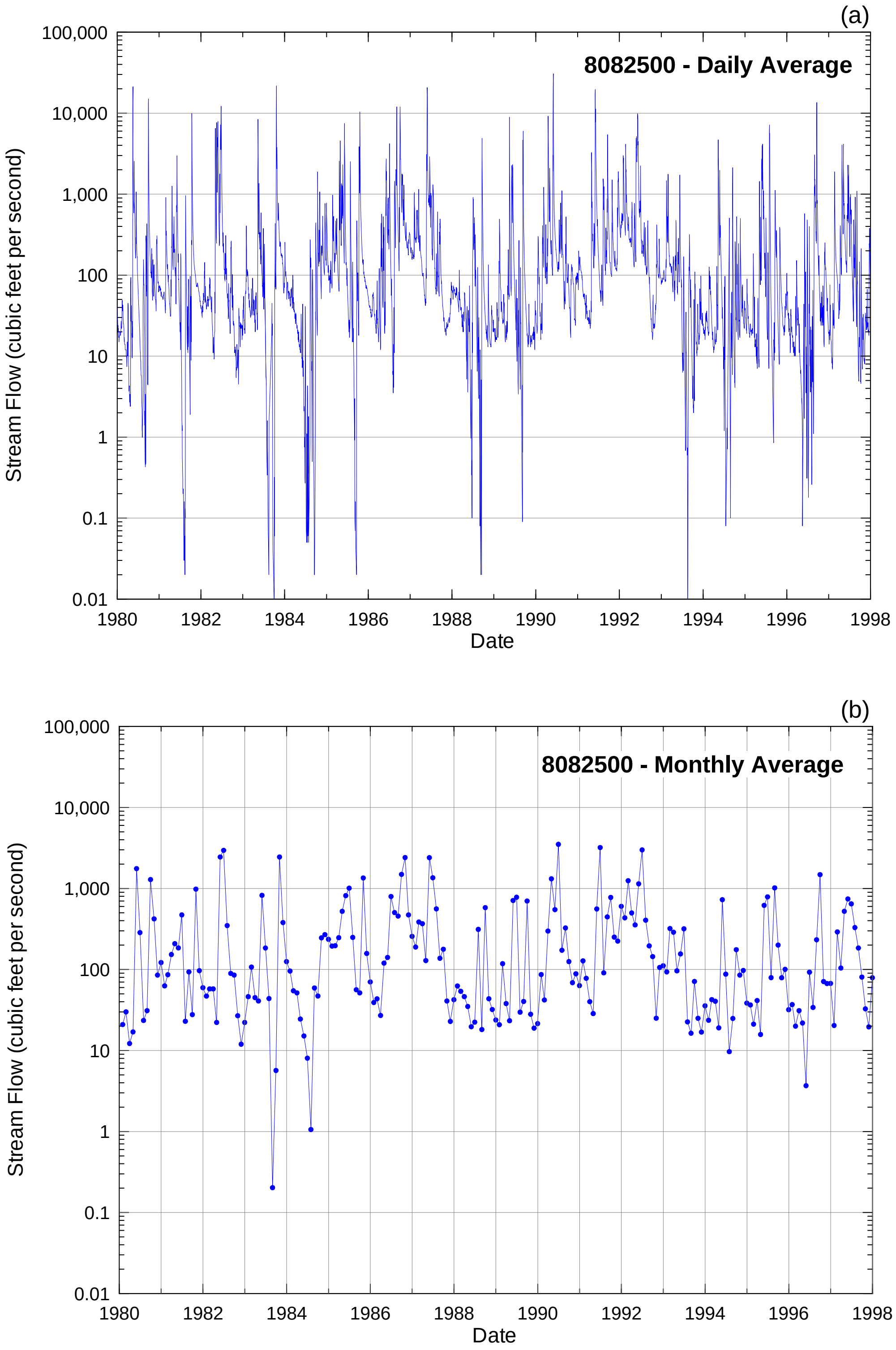


Figure 4.5.3 Hydrograph of (a) daily and (b) monthly average stream flow for the gage on the Brazos River in Baylor County during the calibration period (1980 to 1997).

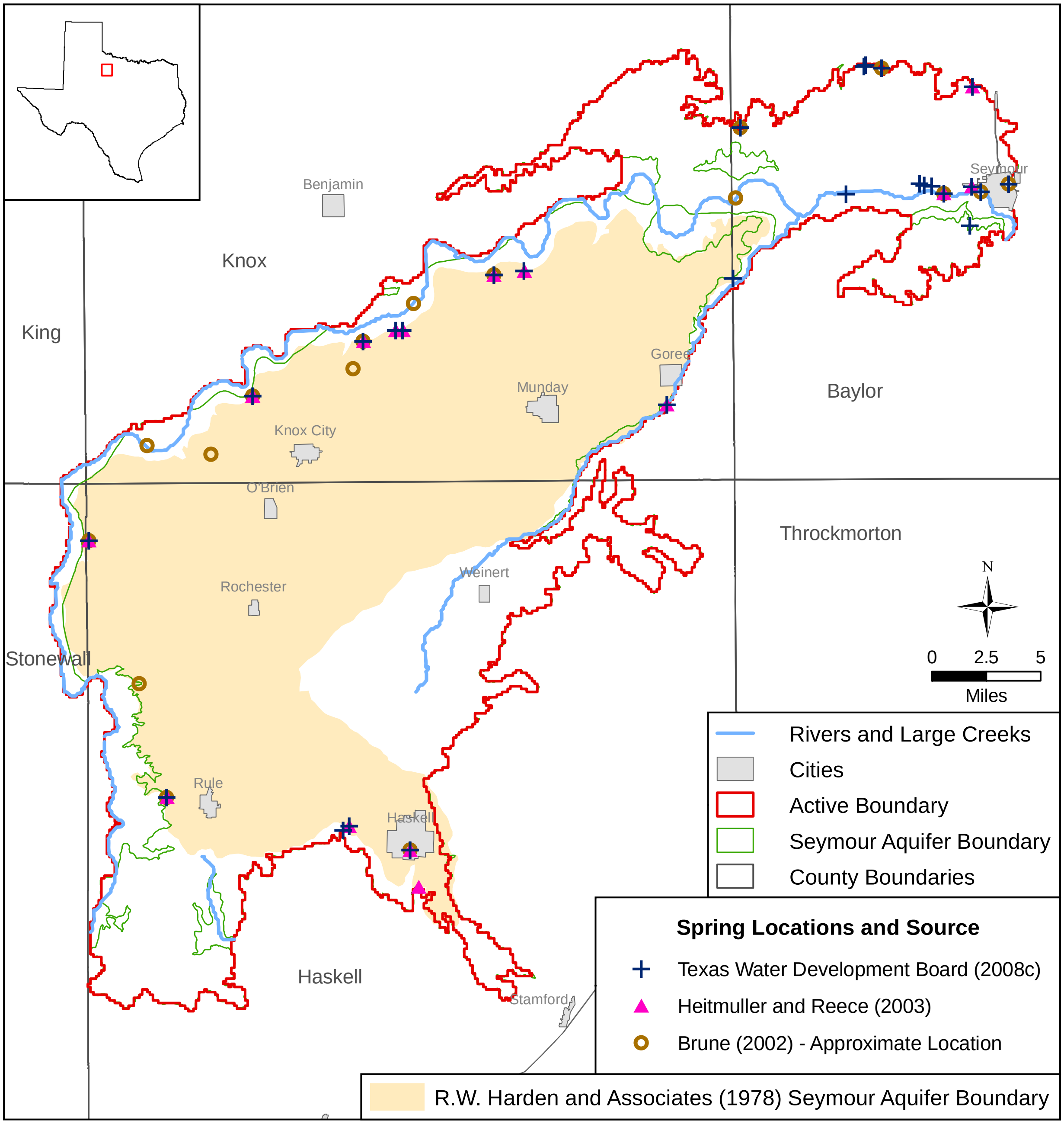


Figure 4.5.4 Locations of springs flowing from the Seymour Aquifer in the study area.

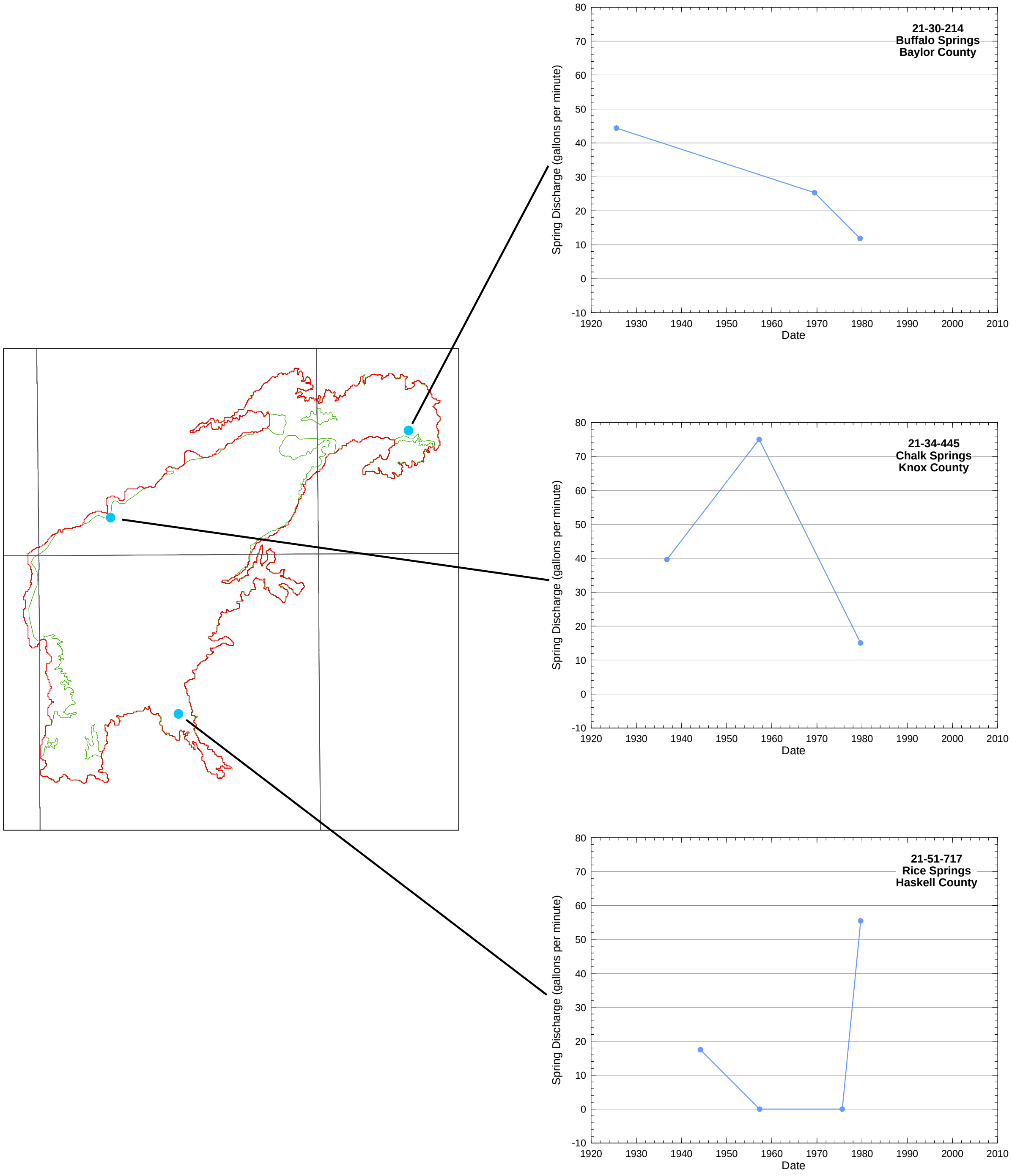


Figure 4.5.5 Hydrographs of discharge for selected springs flowing from the Seymour Aquifer.

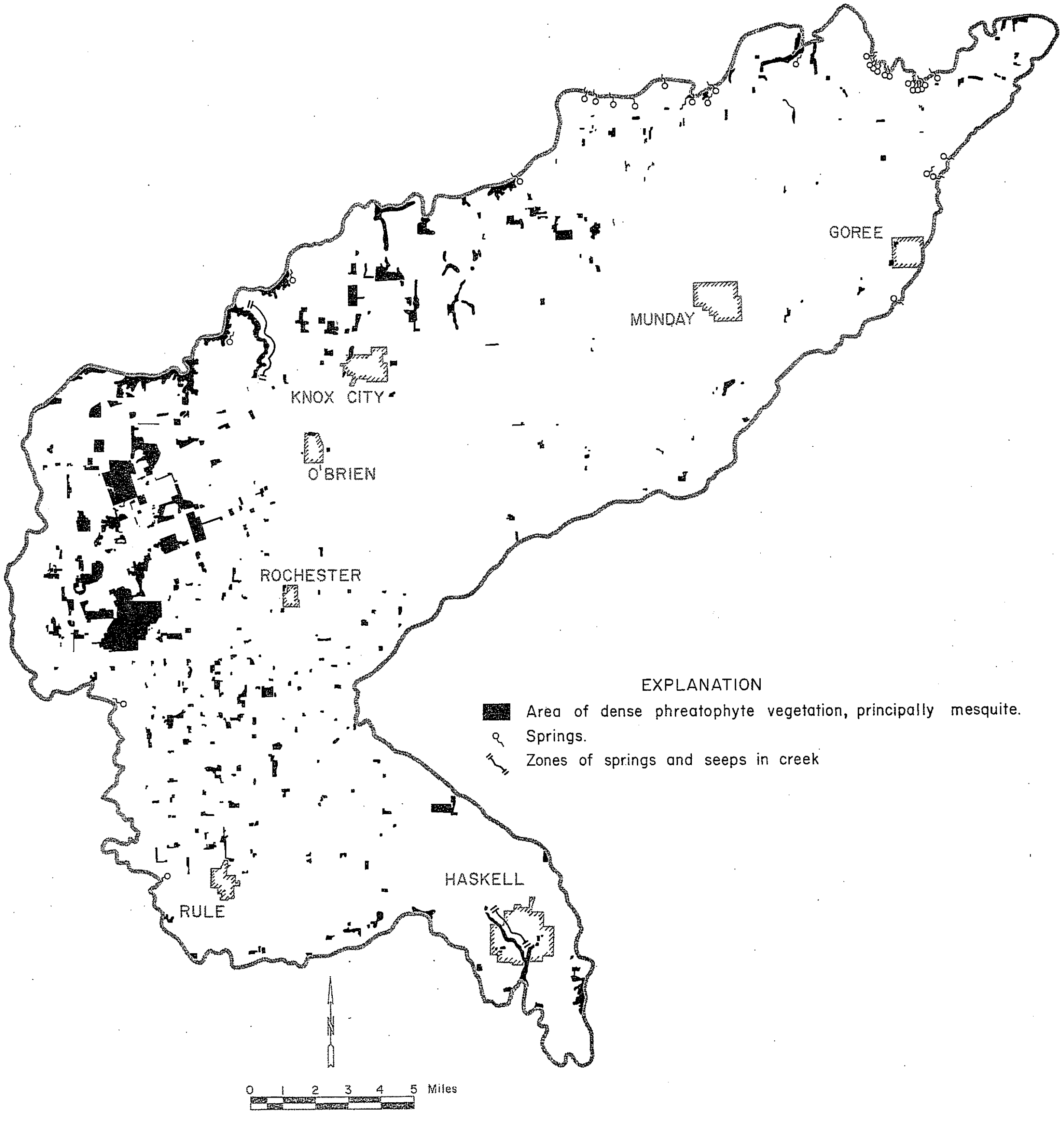


Figure 4.5.6 Locations of springs and zones of springs and seeps given in R.W. Harden and Associates (1978).

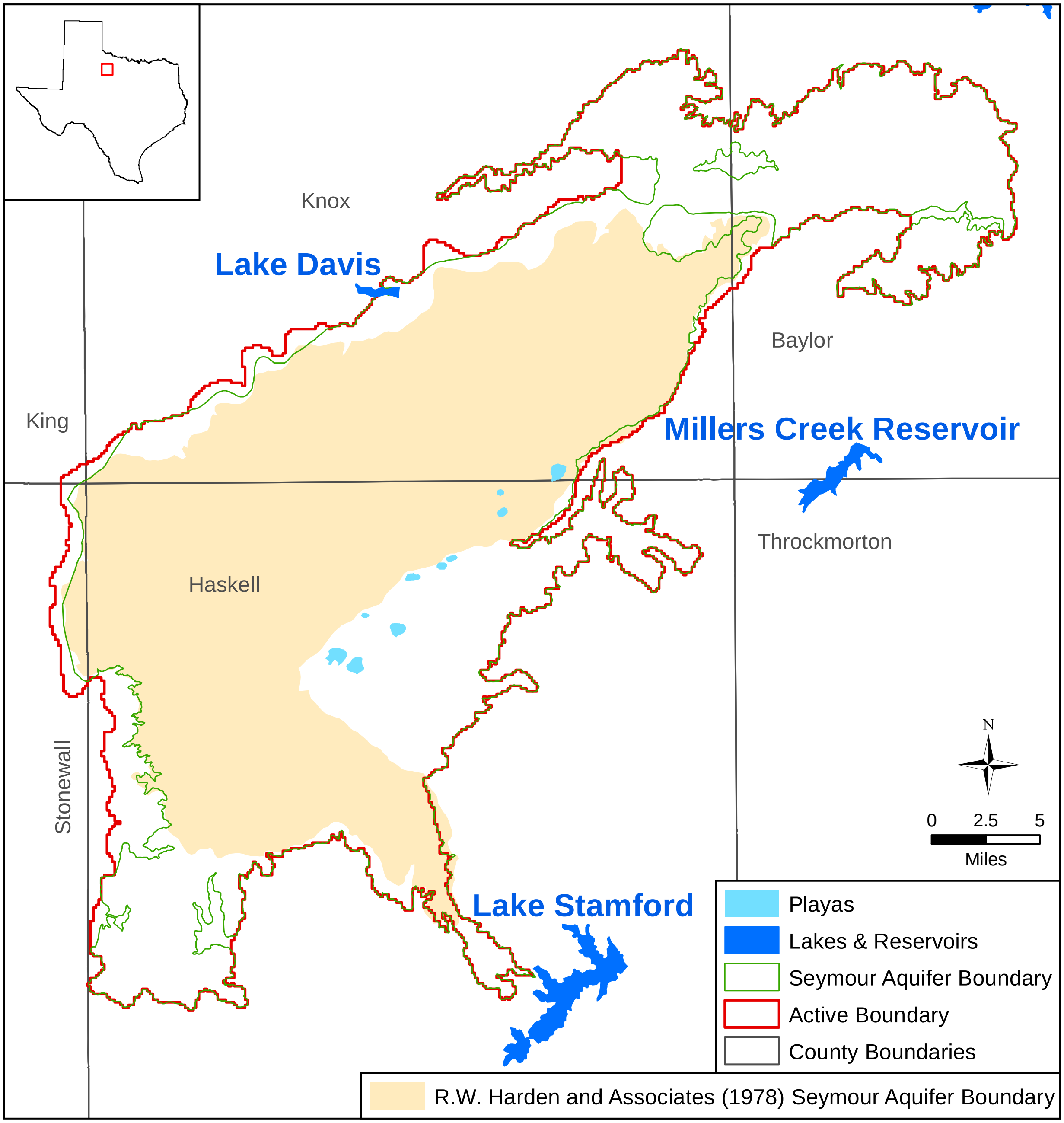


Figure 4.5.7 Locations of reservoirs and playas in the study area.

4.6 Hydraulic Properties

The Seymour Aquifer in Haskell, Knox, and Baylor counties includes the Seymour Formation and other Quaternary-age alluvium. The Seymour Formation generally consists of fluvial sheet deposits of clays, silts, sands, gravels and conglomerates, and some caliche and volcanic ash, that are isolated by incised river valleys. The Quaternary-age alluvium, which was deposited by the Brazos River, consists of silt, sand, and gravel derived primarily from the Seymour Formation. A fairly consistent deposit of sands and gravels is present near the base of the Seymour Formation over much of the model domain resulting in reasonably high permeabilities. The underlying Permian System, which includes the Clear Fork Group and a very small portion of the Wichita Group in the active model domain, consists of generally low-permeability rocks with poor water transmitting characteristics.

4.6.1 Data Sources

Development of hydraulic properties for the Seymour Aquifer considered transmissivity, hydraulic conductivity, specific capacity, and storage values reported in various TWDB reports, from the TWDB website (TWDB, 2008c), and from Texas Commission on Environmental Quality and Rolling Plains Groundwater Conservation District well records. Hydraulic properties for the Clear Fork Group were developed using specific capacity data from Texas Commission on Environmental Quality well records. The locations and sources of the hydraulic property data for the Seymour Aquifer are given in Figure 4.6.1.

4.6.2 Calculation of Hydraulic Conductivity from Specific Capacity

Because specific capacity is relatively easy to measure, requiring knowledge of only the pumping rate and drawdown, it is commonly reported in well records. However, hydraulic conductivity is a more useful parameter than specific capacity for regional groundwater modeling. The methodologies presented in Mace (2001) were used in an attempt to estimate hydraulic conductivity from specific capacity.

For the Seymour Aquifer, transmissivity and specific capacity were measured at 32 coincident locations (R.W. Harden and Associates, 1978; Myers, 1969). From these paired values, an attempt at an empirical correlation relating transmissivity to specific capacity was made as depicted in Figure 4.6.2. The low coefficient of determination of 0.3282 implies a very weak correlation between the two properties. In other words, only approximately 30 percent of the variability in transmissivity can be explained by specific capacity alone. For this reason, specific capacity measurements were not used to augment the hydraulic properties for the Seymour Aquifer. For each of the well tests reported by R.W. Harden and Associates (1978), the saturated thickness of the aquifer at the location was noted and used to calculate hydraulic conductivity from transmissivity.

No transmissivity measurements are available for the Clear Fork Group, so no empirical relationship could be developed to estimate transmissivity from the specific capacity measurements. Instead, the analytical methodology presented in Mace (2001) was used to estimate transmissivity for these units. Specifically, the analytical method of Theis and others (1963) was used. The empirical correction for well loss according to Equation 64 of Mace (2001) was applied to the drawdowns; however, the low conductivity of the Clear Fork Group sediments and the correspondingly low pumping rates resulted in negligible well losses (average of 1 percent) in most cases. Hydraulic conductivity was calculated from transmissivity using well screen length for these data. No transmissivity or specific capacity measurements were available for the Wichita Group.

4.6.3 Analysis of the Hydraulic Property Data

Figure 4.6.3 shows a histogram of the hydraulic conductivity data for the Seymour Aquifer. This figure indicates that the data are closer to being lognormally distributed than being normally distributed. Summary statistics of the hydraulic conductivity data for the Seymour Aquifer and Clear Fork Group are presented in Table 4.6.1. The similarity between the geometric mean and median for both formations indicates that the distribution of hydraulic conductivity is approximately lognormal. While the Clear Fork Group exhibits low mean hydraulic conductivity values, the actual value may be still lower than that presented. This is because wells in the Clear Fork Group are necessarily located in the highest conductivity portions of the formation and, therefore, biased high.

4.6.4 Variogram Analysis of Hydraulic Conductivity

The spatial distribution of hydraulic properties can be characterized by a variogram analysis. A variogram analysis quantifies gross spatial correlation and variability (for detailed background information on geostatistics, refer to Isaaks and Srivastava, 1989). Typical hydrogeologic properties show some spatial correlation indicated by lower variance for nearby measurements. As the distance between measurements increases, variance increases until it becomes constant. That constant value corresponds to the ensemble variance of the entire dataset. At the separation distance where the variance becomes constant, no correlation between measurements exists. The variogram describes the degree of spatial variability between observation points as a function of distance. Spatial variability is described in terms of the nugget (variance at zero separation), range (correlation length), and the sill (ensemble variance). The variogram can also be used as a tool to characterize horizontal anisotropy in hydraulic conductivity. In an aquifer with horizontal anisotropy, hydraulic conductivity is a function of horizontal direction. For a detailed explanation of directional variogram terminology and calculation, see Deutsch and Journel (1992).

The variogram analysis was completed on logarithmically transformed hydraulic conductivity data. Directional variograms were calculated along 10 degree increments and compared to an omnidirectional variogram of the data to help delineate any directional trends. A lag width of 20,000 feet (3.8 miles) and a total lag of 120,000 feet (22.7 miles) were used. The data exhibited no distinct directional trends. Although the variogram changed with direction, closer analysis revealed that these differences were likely due to the geometry of the data, rather than any data trend. In the end, an omnidirectional variogram was retained.

Figure 4.6.4 shows the experimental variogram calculated for the Haskell-Knox-Baylor pod of the Seymour Aquifer. The range for the variogram is between 10 and 15 miles. The initial slope of the variogram appears almost linear, although this may be an artifact of the data spacing. Figure 4.6.4 also shows the model variogram fit of the data using a spherical variogram model. The equation for the spherical model is:

$$(h) \qquad \begin{array}{lll} C_0 \quad C_1(1.5\frac{h}{A} \quad 0.5\ \frac{h}{A}^{\ 3}\ ) & h & A \\ C_0 \quad C_1 & h & A \end{array} \qquad (4.6.1)$$

where C_0 is the nugget, C_1 is the scale (sill minus nugget), A is the range parameter, and h is the lag distance. For the model variogram shown in Figure 4.6.4, a nugget of 0.018, a scale of 0.112, and a range of 12 miles were fit to the data.

4.6.5 Spatial Distribution of Hydraulic Conductivity

The hydraulic conductivity data for the Seymour Aquifer were kriged using the variogram model described above. The resulting spatial distribution of hydraulic conductivity within the Seymour Aquifer is depicted in Figure 4.6.5. Although the kriging tends to smooth the irregularities in the sampled data, hydraulic conductivity varies approximately one order of magnitude (from 150 to 1,500 ft per day) over the aquifer.

A small topographic break which separates the Seymour Aquifer into two sections of older and younger deposits was noted by R.W. Harden and Associates (1978). They also reported that the steepest gradients in water levels were observed across this break indicating that the two units are poorly connected. Figure 4.6.6 depicts the location of the topographic break. The location was estimated using the 30 meter digital elevation map and a map depicting the approximate location of the two units in R.W. Harden and Associates (1978). A significance test was conducted to investigate whether hydraulic conductivities differ between the older and younger sections. That test indicates that hydraulic conductivities in the two sections are significantly different, with the younger units exhibiting higher hydraulic conductivities. However, only five measurements are available within the younger section, so the associated statistics are somewhat suspect.

4.6.6 Vertical Hydraulic Conductivity

No vertical hydraulic conductivity data for the hydrogeologic units in the study area were found in the literature review. The stratified nature of sediments will likely result in some degree of anisotropy in hydraulic conductivity. While horizontal hydraulic conductivity is dominated by the higher permeability sediments, vertical hydraulic conductivity will be dominated by the lower permeability strata and will tend to be lower than the horizontal hydraulic conductivity. Domenico and Schwartz (1998) list values of horizontal to vertical hydraulic conductivity ratios that range from 2 to 10 for materials similar to sediments in the study area. At the scale of the Haskell-Knox-Baylor pod of the Seymour Aquifer, higher anisotropy ratios may exist.

4.6.7 Storativity

For unconfined aquifers, the applicable storage coefficient is the specific yield which is defined as the volume of water an unconfined aquifer releases from storage per unit surface area of aquifer per unit decline in the water table (Freeze and Cherry, 1979). A literature review was conducted for specific yield of the Seymour Aquifer (Table 4.6.2). Specific yield ranged from 0.03 to 0.30 and the arithmetic means reported for two studies ranged from 0.11 to 0.15. Figure 4.6.1 shows the locations of specific yield estimates. Domenico and Schwartz (1998) list values of specific yield that range from 0.03 to 0.28 for materials similar to the sediments of the Seymour Aquifer in the active model area. Lohman (1972) gives 0.1 and 0.3 and Freeze and Cherry (1979) give 0.01 to 0.3 as general limits for the specific yield of unconfined aquifers. Originally, augmenting specific capacity values with inferred porosity data was considered. This idea was later deemed inferior to using measured data for the Seymour Aquifer and was dismissed. Specific yields were assumed to be approximately 0.15 for both of the Clear Fork and Wichita groups, which is about the middle of the values given in Freeze and Cherry (1979) for unconfined aquifers.

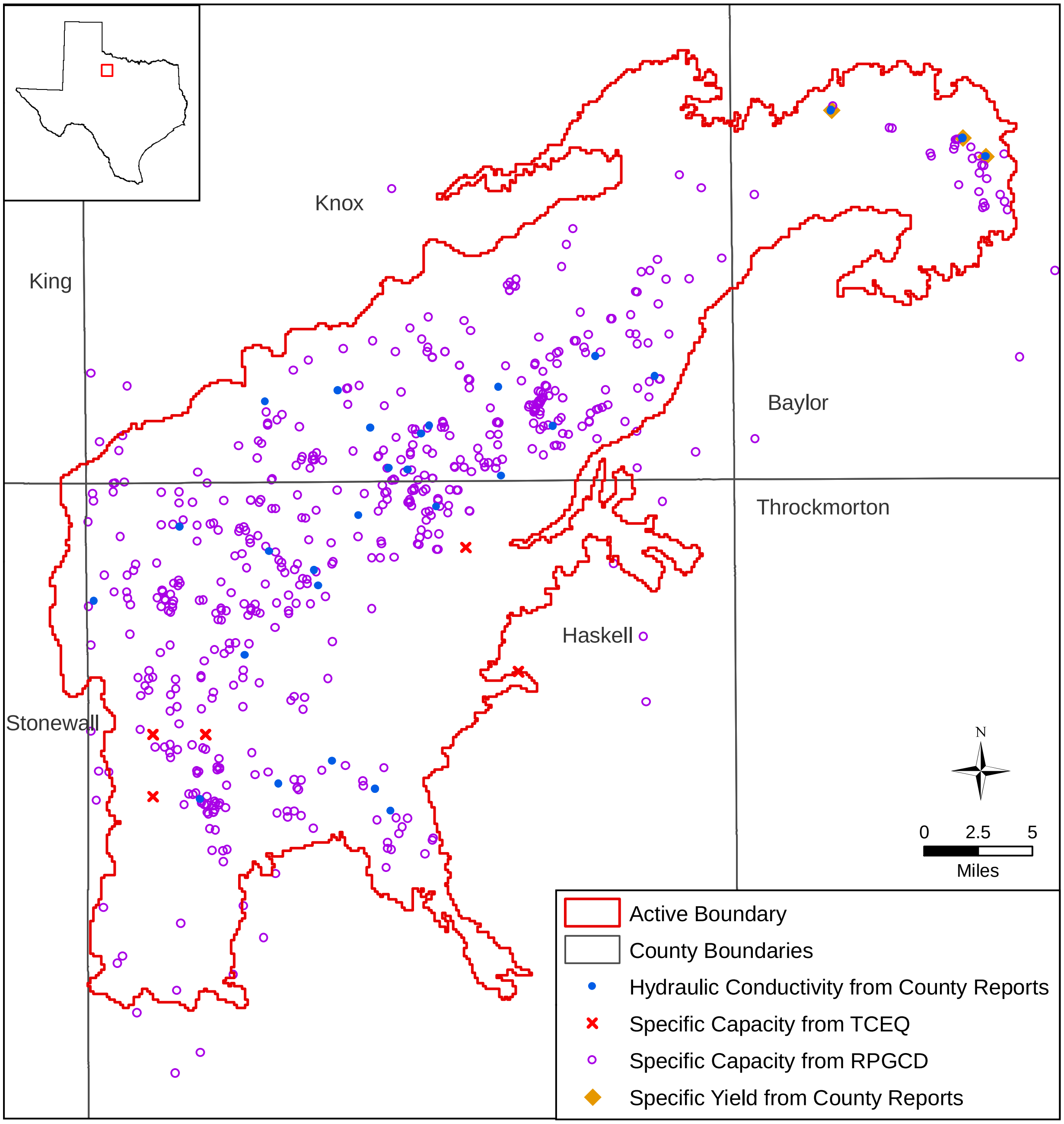
Table 4.6.1 Summary statistics for hydraulic conductivity data (feet per day) for the Seymour Aquifer and Clear Fork Formation.

Statistic	Seymour Aquifer	Clear Fork Group
Number of Samples	44	19
Arithmetic Mean	564.8	6.0
Median	342.6	2.3
Geometric Mean	386.0	2.6
Standard Deviation K	549.8	8.9
Standard Deviation Log10(K)	0.37	0.71

K = hydraulic conductivity

Table 4.6.2 Specific yield values for the Seymour Aquifer from the literature.

County	State Well Number	Specific Yield		Reference
		Point	Average	
Baylor	21-30-387	0.03	0.11	Preston (1978)
Baylor	21-30-385	0.04		
Baylor	21-22-911	0.04		
Baylor	21-22-912	0.06		
Baylor	21-22-913	0.08		
Baylor	21-21-941	0.16		
Baylor	21-21-940	0.18		
Baylor	21-30-386	0.30		
Haskell-Knox			0.15	R.W. Harden & Associates (1978)



TCEQ = Texas Commission on Environmental Quality
RPGCD = Rolling Plains Groundwater Conservation District

Figure 4.6.1 Locations and sources of hydraulic property data for the Seymour Aquifer.

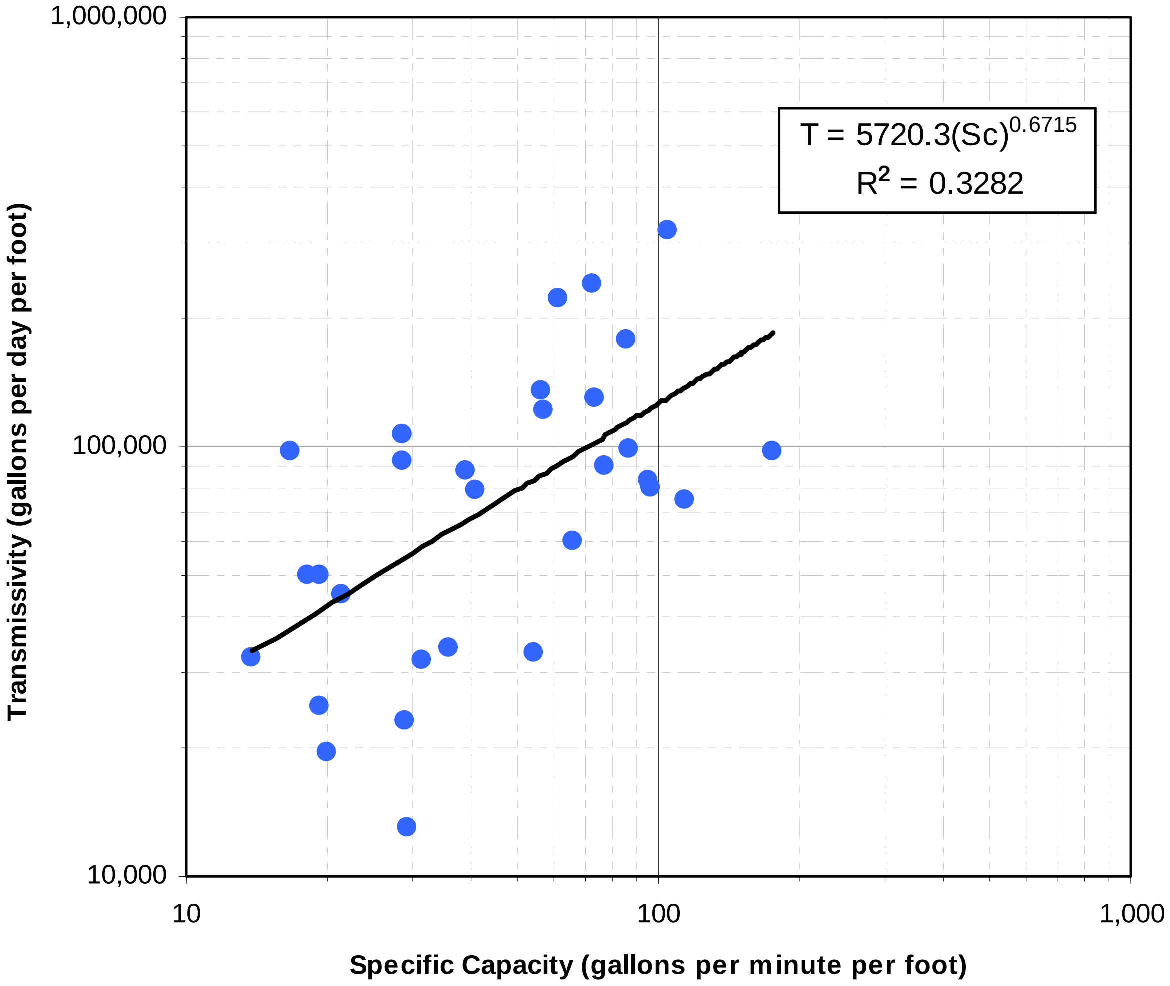


Figure 4.6.2 Empirical correlation between transmissivity (T) and specific capacity (Sc) for the Seymour Aquifer.
Note: (R^2 = coefficient of determination).

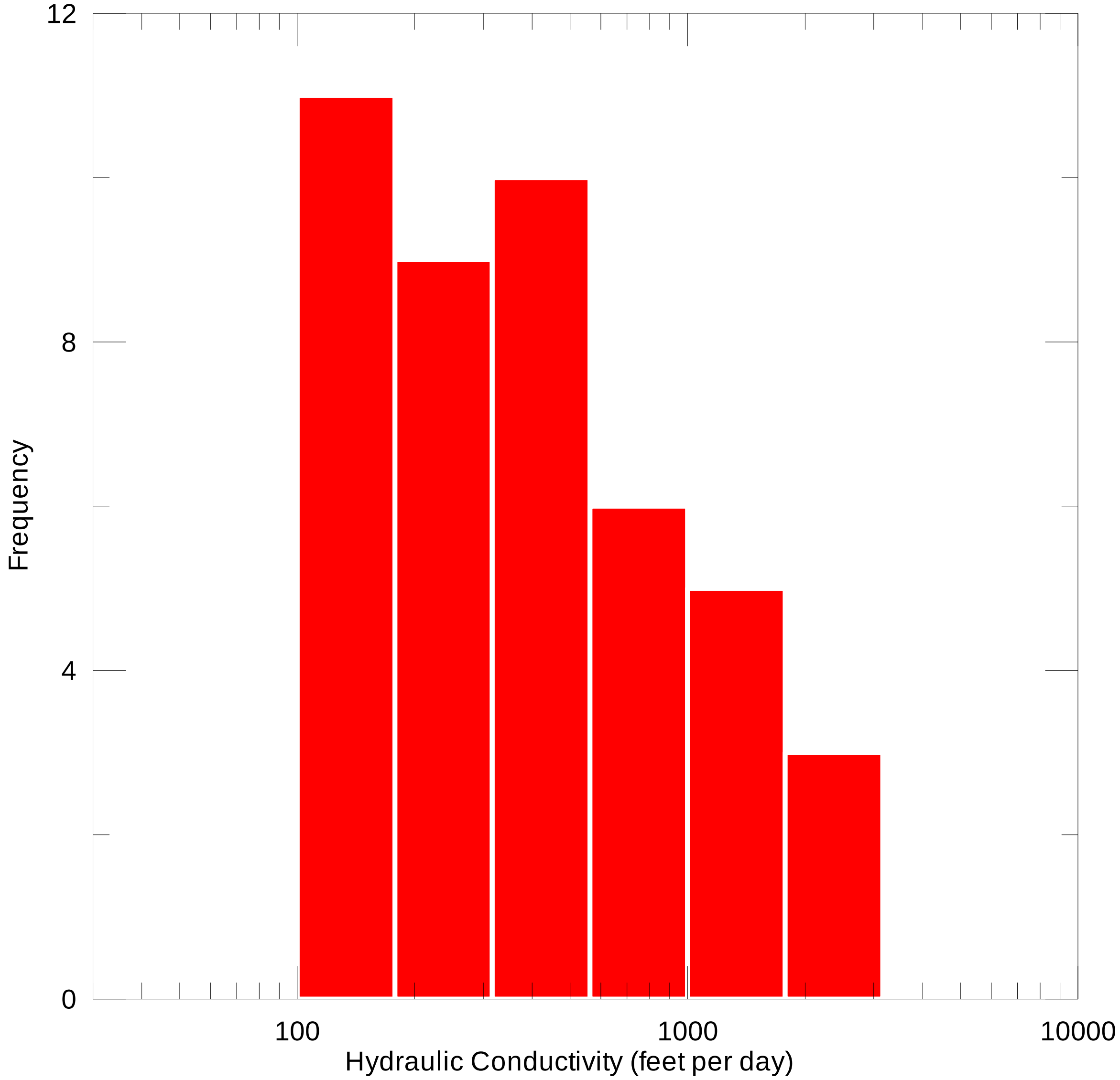


Figure 4.6.3 **Histogram of hydraulic conductivity data for the Seymour Aquifer.**

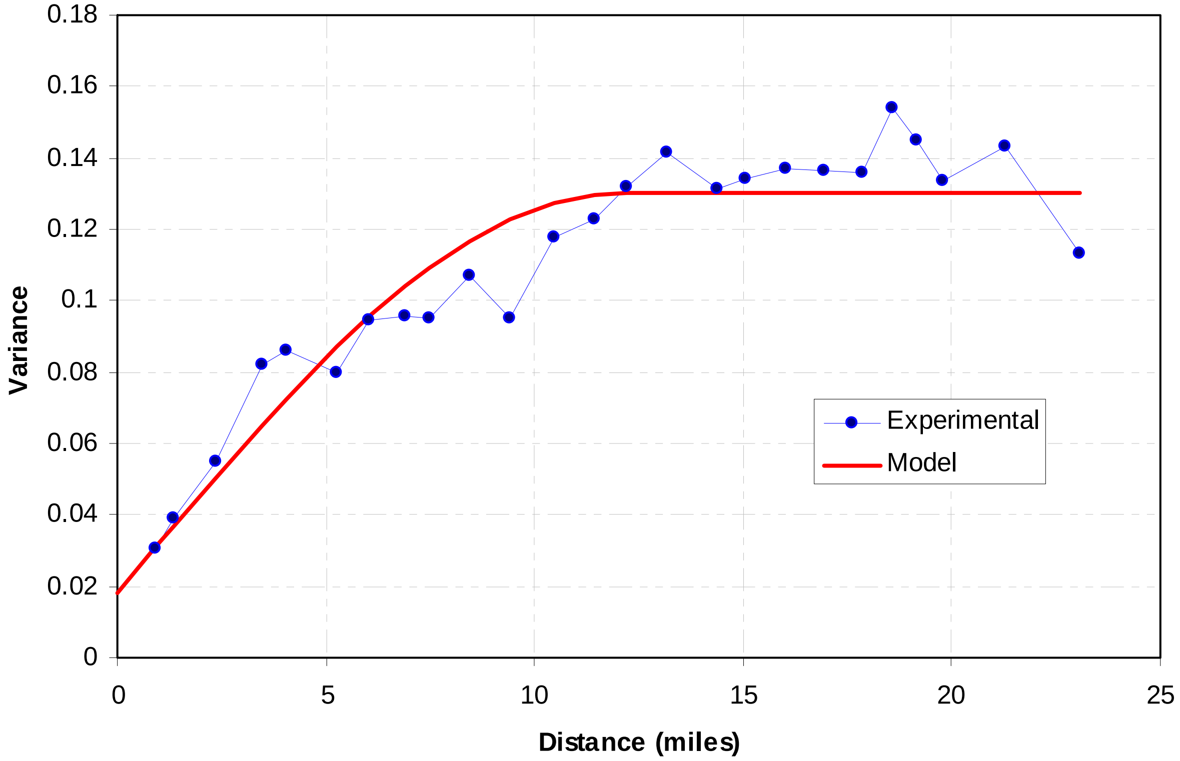


Figure 4.6.4 **Experimental variogram of log10 of hydraulic conductivity for the Seymour Aquifer.**

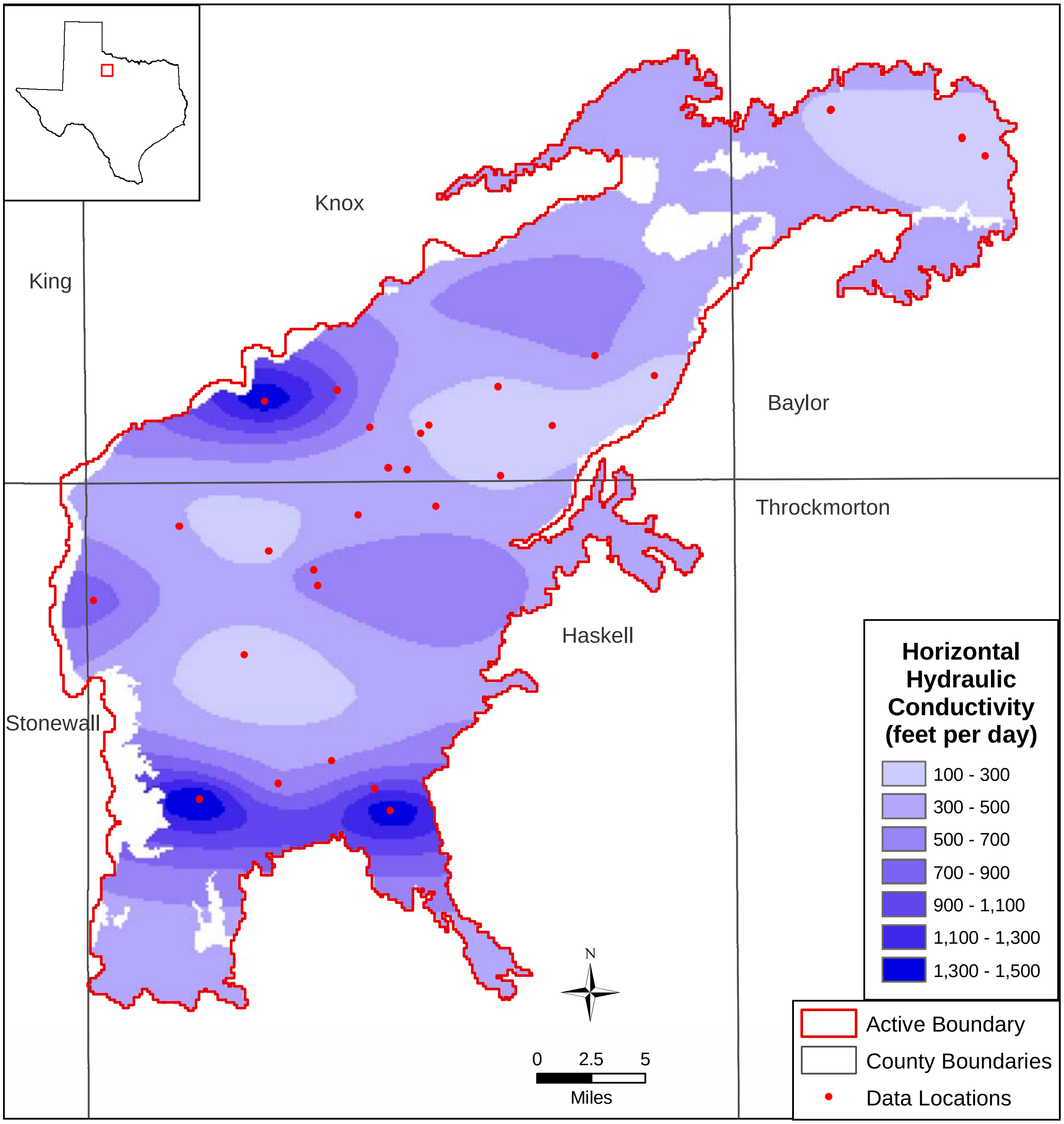


Figure 4.6.5 **Kriged map of hydraulic conductivity for the Seymour Aquifer.**

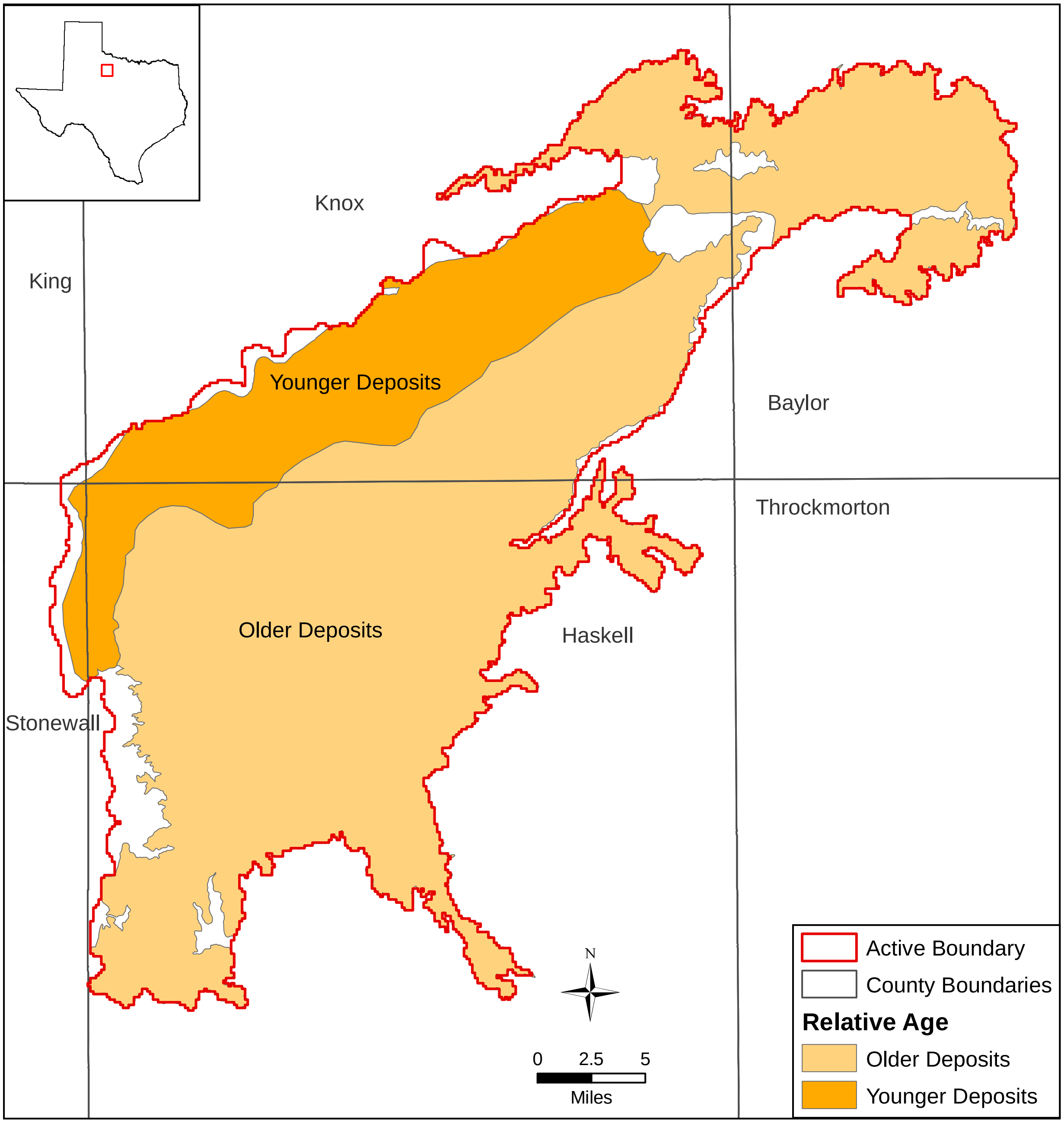


Figure 4.6.6 **Location of older and younger deposits within the Seymour Aquifer.**