GAM Run 08-23

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EXECUTIVE SUMMARY:

We ran a 50-year (2000 through 2050) predictive simulation with the groundwater availability model for the northern part of the Queen City, Sparta, and Carrizo-Wilcox aquifers using county-wide estimates of pumpage derived from the 2007 State Water Plan (see Table 1), along with average recharge, evapotranspiration rates, and initial streamflows. The model run indicates that producing this amount of pumpage in the model for the predictive time period results in the following:

- water level declines of 10 to 20 feet in most of the Sparta and Queen City aquifers, with higher drawdowns in the Nacogdoches and Cherokee county portions of the Queen City Aquifer;
- sparse rebound areas throughout the Sparta and Queen City aquifers;
- water level declines of 10 to 60 feet in most of the Carrizo and Upper Wilcox aquifers with significant drawdowns of up to 300 feet at the border of Wood, Upshur, and Smith counties and the southwest corner of Smith county; and
- water level declines of up to 160 feet in the same tri-county area as mentioned above in the Middle and/or Lower Wilcox aquifers. These two aquifers also exhibit low rebound in the southern parts and on the fringes.

The previous model run, GAM Run 07-20 (Smith and Wade, 2007), was a baseline run using 1999 pumpage rates and pumping locations for a 50-year predictive simulation.

REQUESTOR:

Mr. David Alford of the Piney Woods Groundwater Conservation District made the request for this run on behalf of Groundwater Management Area 11.

DESCRIPTION OF REQUEST:

Mr. Alford asked us to perform a model run using the groundwater availability model for the northern part of the Queen City, Sparta, and Carrizo-Wilcox aquifers. Each year of the predictive model run (2000 to 2050) would use pumpage specified in the Water for Texas 2007 State Water Plan.

METHODS:

To address the request, we used county-wide estimates of pumpage derived from the 2007 State Water Plan (Table 1) on an annual basis throughout the model simulation and ran the model for 50 years. We only used information in the 2007 State Water Plan to 2050 instead of 2060 so comparisons to the previous baseline pumpage simulation (GAM Run 07-20) could reasonably be made. For this simulation the 1999 baseline pumpage was adjusted to 2007 State Water Plan estimates by evenly distributing additional pumpage to all active cells in each county. Resulting water levels and water level declines and county water budgets were then evaluated and are described in the results section below.

PARAMETERS AND ASSUMPTIONS:

- We used version 2.01 of the groundwater availability model for the northern portion of the Queen City, Sparta, and Carrizo-Wilcox aquifers.

- We used Groundwater Vistas Version 5 (Environmental Simulations, Inc. 2007) as the interface to process model output results.

- See Fryar and others (2003) and Kelley and others (2004) for assumptions and limitations of the groundwater availability model for the northern part of the Queen City, Sparta, and Carrizo-Wilcox aquifers.

- The model includes eight layers, representing:

    1. Sparta Aquifer (Layer 1)
    2. Weches confining unit (Layer 2)
    3. Queen City Aquifer (Layer 3)
    4. Reklaw confining unit (Layer 4)
    5. Carrizo Aquifer (Layer 5)
    6. Upper Wilcox Aquifer (Layer 6)
    7. Middle Wilcox Aquifer (Layer 7)
    8. Lower Wilcox Aquifer (Layer 8)

- In the Sabine Uplift area, the Simsboro Formation (Middle Wilcox Aquifer) is not distinguishable and the Wilcox Group is informally divided into the Upper Wilcox and the Lower Wilcox aquifers (Kelley and others, 2004). In the current version of the groundwater availability model, layers 6 and 7 represent the Upper Wilcox and Lower Wilcox aquifers in this area. Layer 8 is included in the model in this area, but it is of nominal thickness and is not intended to represent the Lower Wilcox aquifer.

- The mean absolute error (a measure of the difference between simulated and actual water levels during model calibration) in the groundwater availability model is 16 feet for the Sparta Aquifer, 21 feet for the Queen City Aquifer, 25 feet for the Carrizo Aquifer, and 21 feet for the Upper Wilcox Aquifer for the calibration period (1980 to 1989) and 15, 24, 28, and 24 feet for the same aquifers respectively in the verification period (1990 to

1999), or between five and eight percent of the range of measured water levels (Kelley and others, 2004).

- Recharge rates are based on average (1961 to 1990) precipitation (Kelley and others, 2004).

- Evaporation rates and initial streamflow rates are based on long-term steady-state conditions (Kelley and others, 2004).

- For applying pumpage in the model, we initially assumed 1999 pumping rates and pumping locations. If county-wide pumpage in Water for Texas 2007 was greater than the total 1999 county-wide pumpage, we evenly distributed the additional pumpage across the applicable layer in the county. For vertical distribution of the additional pumpage in the Carrizo-Wilcox Aquifer we applied a weighted distribution factor based on the 1999 vertical pumpage assignments. If county-wide pumpage in Water for Texas 2007 was less than the total 1999 county-wide pumpage, we assumed the 1999 pumpage.

- We applied pumpage derived from the 2007 State Water Plan for areas in and outside of Groundwater Management Area 11 within Texas. For areas outside of Texas we kept 1999 pumpage estimates constant.

RESULTS:

The components of the water budget (Table 2) are described below.

- Storage — This component represents water stored in the aquifer. The storage component that is included in "Inflow" is water that is removed from storage in the aquifer (resulting in a water level decline). The storage component that is included in "Outflow" is water that is added back into storage in the aquifer (resulting in a water level increase). Since this is a county-wide budget, this component of the budget is often seen as water both going into and out of the aquifer because water levels will decline in some areas (water is being removed from storage) and will rise in others (water is being added to storage).

- Reservoirs — This is water that leaks from reservoirs into the aquifer or from the aquifer into the reservoir. This component can be shown as "Inflow" or "Outflow" in the budget. Reservoirs in this model are modeled with the river package which makes the same physical calculations as the reservoir package.

- Springs and seeps — This represents water that drains from an aquifer if water levels are above the elevation of the spring or seep. This component is always shown as "Outflow", or discharge, from an aquifer. Springs and seeps are modeled using the MODFLOW Drain package.

- General-Head Boundary (GHB) — The model uses general-head boundaries to simulate the lateral aquifer boundaries. In addition, the downdip portions (areas where the layer is confined or covered by other aquifers or geologic formations) of the top layer in the model are modeled with general-head boundaries to simulate the vertical movement of groundwater between the Sparta Aquifer (layer 1) and younger sediments that overlie the Sparta Aquifer.

- Wells — This represents water produced from wells in each aquifer. In the model for the northern portion of the Queen City, Sparta, and Carrizo-Wilcox aquifers, this component is always shown as “Outflow” from an aquifer, because all wells included in the model produce (rather than inject) water. Wells are represented in the model using the MODFLOW Well package.

- Rivers and Streams — This represents water that flows between streams and rivers and an aquifer. The direction and amount of flow depend on the water levels in the stream or river relative to the water levels in the aquifer. In areas where water levels in the stream or river are above the water level in the aquifer, water flows into the aquifer and is shown as “Inflow” in the budget. In areas where water levels in the aquifer are above the water level in the stream or river, water flows out of the aquifer and into the stream and is shown as “Outflow” in the budget. Rivers and streams are represented in the model using the MODFLOW Stream package.

- Recharge — This component simulates areally distributed recharge due to precipitation falling on the outcrop areas of aquifers. Recharge is always shown as “Inflow” into an aquifer. This component does not include runoff from precipitation events that may later recharge an aquifer as stream losses, which is included in the model using the stream (or river) package. Recharge is represented in the model for the northern portion of the Queen City, Sparta, and Carrizo-Wilcox aquifers using the MODFLOW Recharge package.

- Evapotranspiration — This is water that flows out of an aquifer due to evaporation and/or plant transpiration. This component of the budget will always be shown as “Outflow”. Evapotranspiration is represented in the model using the MODFLOW Evapotranspiration (EVT) package.

- Lateral flow between counties—This component describes net lateral flow within an aquifer between adjacent counties.

- Vertical flow between aquifers—This component describes the vertical flow, or leakage, between two aquifers. This flow is controlled by the water levels in each aquifer and aquifer properties of each aquifer that define the amount of leakage that can occur. “Inflow” to an aquifer from an overlying or underlying aquifer will always equal the “Outflow” from the other aquifer.

It is important to note that sub-regional water budgets for individual counties are not exact. This is due to the one-mile spacing of the model grid and because we assumed each model cell is assigned to a single county based on the cell centroid location. The water budgets for an individual cell containing a county boundary are assigned to either one county or the other and therefore very minor variations in the county-wide budgets may be observed. Also, some of the county pumping totals (Wells) listed in Table 2 differ from the amounts listed in Table 1 due to dry cells. Where dry cells occur the pumping for that cell is turned off, so the county total is reduced.

Figures 1 through 6 provide the initial water levels for the Sparta Aquifer (layer 1, Figure 1), the Queen City Aquifer (layer 3, Figure 2), the Carrizo Aquifer (layer 5, Figure 3), the Upper Wilcox Aquifer (layer 6, Figure 4), the Middle and/or Lower Wilcox Aquifer (layer 7, Figure 5), and the Lower Wilcox Aquifer (layer 8, Figure 6). Water levels after 50 years are shown in Figures 7 through 12 for the Sparta Aquifer (layer 1, Figure 7), the Queen City Aquifer (layer 3, Figure 8), the Carrizo Aquifer (layer 5, Figure 9), the Upper Wilcox Aquifer (layer 6, Figure 10), the Middle and/or Lower Wilcox (layer 7, Figure 11), and the Lower Wilcox Aquifer (layer 8, Figure 12). In interpreting the figures for the Lower Wilcox Aquifer, the following should be kept in mind:

- layer 8 only includes about three percent of the model pumpage; and

- layer 8 does not represent the Lower Wilcox Aquifer in the Sabine Uplift area. The area north of and including the following counties: Rains, Wood, Upshur, Gregg, northeast corner of Rusk, and Harrison represents a dummy extension of the Lower Wilcox Aquifer. This extension was created due to limitations in the modeling software package. Layer 7 represents the Lower Wilcox Aquifer in the Sabine Uplift area since the Middle Wilcox is not distinguishable in the subsurface.

The following discussion focuses on results as they pertain to Groundwater Management Area 11; however, the effect of pumping in counties adjacent to Groundwater Management Area 11 is apparent in all figures.

- Water level differences in the Sparta Aquifer (layer 1) after 50 years are shown in Figure 13. The Sparta Aquifer for the most part shows low water level declines of up to 20 feet, with minor rebound areas.

- Water levels in the Queen City Aquifer (layer 3) after 50 years show declines less than 40 feet in most areas (Figure 14) with two higher decline areas in Nacogdoches and Cherokee counties exceeding 40 feet; however, small areas in the outcrop show rebounds in excess of 30 feet.

- Water level differences after 50 years in the Carrizo Aquifer (layer 5) are shown in Figure 15. Water level declines are moderate (20 to 60 feet) throughout most of the layer with very high declines (up to 300 feet) in two areas: (1) along the border between Wood, Smith, and Upshur counties and (2) the southwest corner of Smith County. Small clusters of dry cells become apparent on the northwest and eastern parts of the aquifer. The rebound is rather insignificant.

- The Upper and Middle and/or Lower Wilcox layers (layer 6 and 7) mirror the Carrizo Aquifer to some extent (Figures 16 and 17). While the very high declines seen in the Wood–Smith–Upshur area are still apparent in these layers, the magnitude is diminished to roughly 240 feet in the Upper Wilcox and about 140 feet in the Middle and/or Lower Wilcox. Also, the dry cells are less apparent and no longer clustered. Beginning with the

Upper Wilcox and through to the Lower Wilcox a trend of increasing rebound is becoming apparent with larger areas in the south-central and eastern portions of the aquifers.

- Along the southwestern lateral boundary water level declines of up to 160 feet occur in the Wilcox aquifers (Figure 16, 17, and 18) outside of Groundwater Management Area 11. These declines are due to pumping in the Bryan-College Station area represented by declining water levels in the general head boundary package.

REFERENCES:

Environmental Simulations, Inc. 2007, Guide to Using Groundwater Vistas Version 5, 381 p.

Fryar, D., Senger, R., Deeds, N., Pickens, J., Jones, T., Whallon, A. J., and Dean, K. E., 2003, Groundwater Availability Model for the Northern Carrizo-Wilcox Aquifer: contract report to the Texas Water Development Board, 529 p.

Kelley, V. A., Deeds, N. E., Fryar, D. G., and Nicot, J. P., 2004, Groundwater availability models for the Queen City and Sparta aquifers: contract report to the Texas Water Development Board, 867 p.

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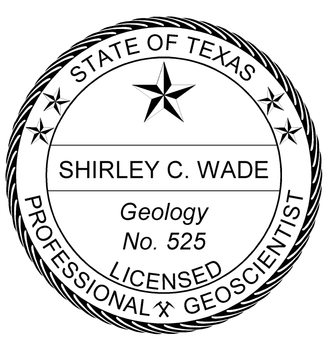

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Table 1. Pumping applied in the 50-year predictive model run based on the 2007 State Water Plan (the 2007 column). The 1999 column represents the pumping in the last year of the transient calibration period, and it is included for comparative purposes. Values are reported in acre-feet per year.

Aquifer ►	**Sparta**		**Queen City**		**Carrizo**		**Upper Wilcox**		**Middle Wilcox**		**Lower Wilcox**	
County ▼	**1999**	**2007**	**1999**	**2007**	**1999**	**2007**	**1999**	**2007**	**1999**	**2007**	**1999**	**2007**
Anderson	157	600	770	18,320	3,291	6,999	1,044	2,221	162	345	124	265
Angelina	282	670	96	1,060	17,485	25,536	1,913	2,794	0	0	0	0
Bowie	0	0	0	0	0	0	2,076	9,213	1,183	5,250	273	1,210
Camp	0	0	253	3,610	644	1,913	360	1,071	313	931	2	6
Cass	0	0	525	38,189	1,536	1,937	684	862	374	472	176	222
Cherokee	221	350	904	21,850	3,889	5,380	3,962	5,480	7	9	0	0
Franklin	0	0	0	0	258	2,022	156	1,222	774	6,066	301	2,361
Gregg	0	0	291	7,500	1,475	4,094	845	2,345	396	1,100	0	0
Harrison	0	0	408	10,020	2,480	5,376	781	1,693	522	1,131	212	460
Henderson	0	0	783	15,350	3,886	4,889	1,414	1,779	1,052	1,324	1,254	1,577
Hopkins	0	0	0	0	624	596	198	189	1,968	1,877	2,200	2,099
Houston	709	870	244	400	830	5,181	6	39	0	0	0	0
Marion	0	0	151	15,150	767	1,384	230	415	125	226	3	6
Morris	0	0	207	9,540	624	1,311	189	398	448	940	5	10
Nacogdoches	339	400	313	4,860	9,595	21,013	4,321	9,463	302	662	1	2
Panola	0	0	0	0	1,405	3,266	331	769	2,195	5,102	530	1,232
Rains	0	0	0	0	0	0	437	680	426	662	275	428
Rusk	0	4,250	58	0	2,548	6,776	1,882	5,006	3,199	8,508	0	1
Sabine	66	290	0	0	456	4,124	183	1,658	51	464	51	464
San Augustine	60	200	0	0	401	1,075	229	615	0	0	0	0
Shelby	0	0	0	0	1,300	4,656	908	3,250	1,326	4,746	27	98
Smith	0	0	1,172	52,800	6,099	14,636	5,556	13,332	1,856	4,453	0	0
Titus	0	0	0	0	569	3,205	336	1,893	1,039	5,853	33	183
Trinity	15	600	0	0	27	2,161	0	0	0	0	0	0
Upshur	0	0	1,286	25,000	2,677	4,088	1,486	2,269	394	602	0	0
Van Zandt	0	0	251	3,750	1,789	3,432	789	1,514	2,072	3,974	1,130	2,167
Wood	0	0	1,444	9,852	2,783	13,256	1,210	5,761	462	2,200	3	14

Table 2. Water budgets for each county in Groundwater Management Area 11 at the end of the 50-year predictive simulation using pumpage based on State Water Plan 2007 information for the northern part of the Queen-City, Sparta, and Carrizo-Wilcox aquifers. Values are reported in acre-feet per year.

Sparta	Anderson		Angelina		Bowie		Camp		Cass		Cherokee		Franklin	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Springs and seeps	0	0	0	0	–	–	–	–	–	–	0	0	–	–
Evapotranspiration	0	4,668	0	0	–	–	–	–	–	–	0	1,226	–	–
General-Head Boundary	0	0	3,978	1,069	–	–	–	–	–	–	374	144	–	–
Recharge	12,295	0	544	0	–	–	–	–	–	–	9,627	0	–	–
Reservoirs	0	0	0	0	–	–	–	–	–	–	0	0	–	–
Storage	17	216	167	0	–	–	–	–	–	–	1,060	161	–	–
Rivers and Streams	0	2,862	37	1,020	–	–	–	–	–	–	94	1,868	–	–
Wells	0	600	0	672	–	–	–	–	–	–	0	349	–	–
Net Lateral Flow	614	95	1,765	711	–	–	–	–	–	–	202	1,497	–	–
Vertical Flow Layer Top	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Vertical Flow Layer Bottom	74	4,558	116	3,134	–	–	–	–	–	–	72	6,184	–	–
Queen City														
Springs and seeps	0	39	0	0	–	–	0	0	0	0	0	82	–	–
Evapotranspiration	0	8,138	0	0	–	–	0	79	0	1,559	0	4,830	–	–
General-Head Boundary	0	0	0	0	–	–	0	0	0	0	0	0	–	–
Recharge	30,983	0	0	0	–	–	2,319	0	40,642	0	27,348	0	–	–
Reservoirs	0	0	0	0	–	–	0	0	0	0	971	0	–	–
Storage	6,235	623	46	0	–	–	1,184	1	7,072	119	5,781	1,233	–	–
Rivers and Streams	1,161	16,429	0	0	–	–	146	527	467	6,326	846	8,051	–	–
Wells	0	18,318	0	1,064	–	–	0	3,448	0	38,189	0	21,822	–	–
Net Lateral Flow	3,596	2,199	101	149	–	–	781	228	800	953	1,958	3,073	–	–
Vertical Flow Layer Top	5,480	29	3,138	65	–	–	–	–	–	–	7,403	61	–	–
Vertical Flow Layer Bottom	131	1,810	0	2,005	–	–	9	156	17	1,850	51	5,203	–	–

Table 2. Continued ...

Carrizo	Anderson In	Anderson Out	Angelina In	Angelina Out	Bowie In	Bowie Out	Camp In	Camp Out	Cass In	Cass Out	Cherokee In	Cherokee Out	Franklin In	Franklin Out
Springs and seeps	0	0	0	0	–	–	0	0	0	0	0	0	0	32
Evapotranspiration	0	0	0	0	–	–	0	378	0	0	0	42	0	800
General-Head Boundary	0	0	0	0	–	–	0	0	0	0	0	0	0	0
Recharge	335	0	0	0	–	–	1,428	0	0	0	1,895	0	5,465	0
Reservoirs	0	0	0	0	–	–	0	0	0	0	0	0	0	0
Storage	1,018	0	42	0	–	–	1,147	148	473	46	832	213	28	103
Rivers and Streams	154	1,967	0	0	–	–	0	9	0	0	11	501	20	1,092
Wells	0	6,999	0	25,298	–	–	0	1,912	0	1,937	0	5,413	0	1,902
Net Lateral Flow	6,190	2,197	20,627	3,228	–	–	443	789	0	0	3,195	3,852	316	691
Vertical Flow Layer Top	2,238	59	2,485	0	–	–	1,081	0	2,572	0	7,714	217	89	0
Vertical Flow Layer Bottom	1,605	318	5,368	0	–	–	38	903	208	1,033	1,149	4,557	0	1,298
Upper Wilcox														
Springs and seeps	0	0	0	0	0	0	0	220	0	0	0	0	0	60
Evapotranspiration	0	33	0	0	0	0	0	340	0	415	0	0	0	484
General-Head Boundary	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recharge	385	0	0	0	26	0	306	0	2,806	0	0	0	1,806	0
Reservoirs	0	0	0	0	0	0	740	0	0	0	0	0	90	45
Storage	737	0	446	0	186	0	301	274	358	1,372	1,000	0	303	42
Rivers and Streams	0	635	0	0	701	0	6	90	218	272	0	0	0	960
Wells	0	2,219	0	2,801	0	1,696	0	1,082	0	859	0	5,503	0	1,225
Net Lateral Flow	3,402	1,978	7,765	2,417	765	22	642	512	797	1,372	3,897	3,905	520	553
Vertical Flow Layer Top	318	1,605	0	5,368	–	–	903	38	1,033	208	4,557	1,149	1,298	0
Vertical Flow Layer Bottom	1,991	362	2,375	0	38	0	19	362	146	861	2,013	910	0	646

Table 2. Continued ...

Middle Wilcox	Anderson		Angelina		Bowie		Camp		Cass		Cherokee		Franklin	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Springs and seeps	0	0	0	0	0	104	0	0	0	0	0	0	0	0
Evapotranspiration	0	0	0	0	0	2,359	0	0	0	0	0	0	0	182
General-Head Boundary	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recharge	15	0	0	0	9,952	0	0	0	53	0	0	0	6,009	0
Reservoirs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Storage	369	0	9	255	457	623	49	0	73	71	527	0	395	415
Rivers and Streams	0	455	0	0	135	2,036	0	0	0	0	0	0	22	717
Wells	0	345	0	0	0	5,200	0	943	0	470	0	18	0	5,867
Net Lateral Flow	1,713	1,222	2,354	249	914	794	1,309	804	716	852	1,792	1,977	1,296	930
Vertical Flow Layer Top	362	1,991	0	2,375	0	38	362	19	861	146	910	2,013	646	0
Vertical Flow Layer Bottom	1,557	2	517	0	555	856	46	0	34	198	854	74	182	440
Lower Wilcox														
Springs and seeps	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Evapotranspiration	0	0	0	0	0	0	0	0	0	0	0	0	0	0
General-Head Boundary	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recharge	0	0	0	0	21	0	0	0	0	0	0	0	81	0
Reservoirs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Storage	421	0	1	86	6	1	2	0	3	0	380	1	0	0
Rivers and Streams	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wells	0	268	0	0	0	272	0	1	0	176	0	0	0	301
Net Lateral Flow	2,699	1,298	649	47	44	98	95	51	63	53	1,180	778	83	122
Vertical Flow Layer Top	2	1,557	0	517	856	555	0	46	198	34	74	854	440	182
Vertical Flow Layer Bottom	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table 2. Continued ...

Sparta	Gregg In	Gregg Out	Harrison In	Harrison Out	Henderson In	Henderson Out	Hopkins In	Hopkins Out	Houston In	Houston Out	Marion In	Marion Out	Morris In	Morris Out
Springs and seeps	–	–	–	–	–	–	–	–	0	0	–	–	–	–
Evapotranspiration	–	–	–	–	–	–	–	–	0	7,793	–	–	–	–
General-Head Boundary	–	–	–	–	–	–	–	–	6,627	4,090	–	–	–	–
Recharge	–	–	–	–	–	–	–	–	22,181	0	–	–	–	–
Reservoirs	–	–	–	–	–	–	–	–	0	0	–	–	–	–
Storage	–	–	–	–	–	–	–	–	389	468	–	–	–	–
Rivers and Streams	–	–	–	–	–	–	–	–	78	7,902	–	–	–	–
Wells	–	–	–	–	–	–	–	–	0	873	–	–	–	–
Net Lateral Flow	–	–	–	–	–	–	–	–	1,555	2,860	–	–	–	–
Vertical Flow Layer Top	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Vertical Flow Layer Bottom	–	–	–	–	–	–	–	–	1,698	8,541	–	–	–	–
Queen City														
Springs and seeps	0	18	0	0	0	95	–	–	0	0	0	0	0	0
Evapotranspiration	0	711	0	344	0	4,926	–	–	0	379	0	112	0	293
General-Head Boundary	0	0	0	0	0	0	–	–	0	0	0	0	0	0
Recharge	6,572	0	11,497	0	17,595	0	–	–	2,179	0	7,811	0	6,369	0
Reservoirs	0	0	0	0	1,693	0	–	–	0	0	640	0	441	0
Storage	1,971	67	936	993	2,957	1,063	–	–	546	76	6,391	0	2,535	0
Rivers and Streams	392	61	202	228	357	1,370	–	–	309	5,275	398	332	450	178
Wells	0	7,380	0	10,107	0	15,443	–	–	0	399	0	15,150	0	9,291
Net Lateral Flow	306	387	155	479	2,423	618	–	–	1,251	3,359	998	216	557	363
Vertical Flow Layer Top	–	–	–	–	–	–	–	–	8,419	1,794	–	–	–	–
Vertical Flow Layer Bottom	3	620	6	646	6	1,516	–	–	139	1,560	15	443	12	240

Table 2. Continued ...

Carrizo	Gregg		Harrison		Henderson		Hopkins		Houston		Marion		Morris	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Springs and seeps	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Evapotranspiration	0	0	0	1,203	0	416	0	436	0	0	0	0	0	0
General-Head Boundary	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recharge	119	0	3,659	0	4,883	0	2,451	0	0	0	0	0	183	0
Reservoirs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Storage	3,829	0	2,780	84	2,987	48	0	330	130	0	287	52	203	87
Rivers and Streams	62	41	0	558	0	388	0	361	0	0	0	0	0	0
Wells	0	4,047	0	5,151	0	4,543	0	418	0	5,182	0	1,383	0	1,199
Net Lateral Flow	780	371	433	84	1,721	3,933	100	287	6,468	4,953	149	137	185	238
Vertical Flow Layer Top	1,125	5	2,397	0	2,171	0	28	0	1,507	16	1,108	8	734	0
Vertical Flow Layer Bottom	311	1,764	454	2,642	275	2,708	0	747	2,045	0	326	290	544	324
Upper Wilcox														
Springs and seeps	0	0	0	0	0	0	0	0	0	0	0	0	0	185
Evapotranspiration	0	0	0	1,389	0	1,935	0	267	0	0	0	395	0	749
General-Head Boundary	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recharge	0	0	7,300	0	6,226	0	2,259	0	0	0	1,943	0	2,561	0
Reservoirs	0	0	0	0	0	0	0	0	0	0	16	0	0	0
Storage	109	0	385	2,971	516	521	17	1,047	1,137	0	209	857	497	0
Rivers and Streams	0	0	187	2,269	24	1,234	4	301	0	0	73	670	0	209
Wells	0	2,320	0	1,702	0	1,790	0	197	0	37	0	415	0	395
Net Lateral Flow	1,945	748	658	915	1,312	2,834	63	861	2,233	2,175	783	496	901	1,091
Vertical Flow Layer Top	1,764	311	2,642	454	2,708	275	747	0	0	2,045	290	326	324	544
Vertical Flow Layer Bottom	144	583	380	1,851	358	2,555	0	415	900	12	290	447	52	1,161

Table 2. Continued ...

Middle Wilcox	Gregg		Harrison		Henderson		Hopkins		Houston		Marion		Morris	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Springs and seeps	0	0	0	202	0	0	0	362	0	0	0	2	0	0
Evapotranspiration	0	0	0	9,013	0	895	0	1,965	0	0	0	990	0	0
General-Head Boundary	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recharge	0	0	21,965	0	3,548	0	16,898	0	0	0	183	0	458	0
Reservoirs	0	0	0	21	0	3	0	0	0	0	163	49	0	0
Storage	122	0	76	5,117	1,301	84	106	5,603	502	3	56	37	484	2
Rivers and Streams	0	0	502	5,510	6	1,707	108	3,449	0	0	0	58	294	1,709
Wells	0	1,088	0	1,132	0	1,330	0	1,300	0	0	0	224	0	933
Net Lateral Flow	1,313	806	1,332	3,769	1,411	2,168	106	2,919	631	818	1,127	391	1,020	762
Vertical Flow Layer Top	583	144	1,851	380	2,555	358	415	0	12	900	447	290	1,161	52
Vertical Flow Layer Bottom	32	11	308	891	432	2,707	370	2,404	575	0	95	30	100	57
Lower Wilcox														
Springs and seeps	0	0	0	0	0	203	0	0	0	0	0	0	0	0
Evapotranspiration	0	0	0	0	0	835	0	0	0	0	0	0	0	0
General-Head Boundary	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recharge	0	0	0	0	1,316	0	363	0	0	0	0	0	0	0
Reservoirs	0	0	0	0	1,634	0	0	0	0	0	0	0	0	0
Storage	5	0	2	4	225	2,025	0	46	416	9	2	0	2	0
Rivers and Streams	0	0	0	0	74	982	0	0	0	0	0	0	0	0
Wells	0	0	0	459	0	1,580	0	2,200	0	0	0	3	0	4
Net Lateral Flow	66	50	111	234	1,938	1,840	43	194	789	620	96	31	82	35
Vertical Flow Layer Top	11	32	891	308	2,707	432	2,404	370	0	575	30	95	57	100
Vertical Flow Layer Bottom	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table 2. Continued ...

Sparta	Nacogdoches		Panola		Rains		Rusk		Sabine		San Augustine		Shelby	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Springs and seeps	0	0	–	–	–	–	–	–	0	66	0	0	–	–
Evapotranspiration	0	3,937	–	–	–	–	–	–	0	519	0	2,122	–	–
General-Head Boundary	388	206	–	–	–	–	–	–	974	394	1,284	1,094	–	–
Recharge	17,811	0	–	–	–	–	–	–	3,389	0	8,055	0	–	–
Reservoirs	0	0	–	–	–	–	–	–	123	27	0	0	–	–
Storage	675	526	–	–	–	–	–	–	6	418	0	2,093	–	–
Rivers and Streams	290	5,584	–	–	–	–	–	–	19	2,637	0	2,114	–	–
Wells	0	398	–	–	–	–	–	–	0	288	0	200	–	–
Net Lateral Flow	1,251	909	–	–	–	–	–	–	593	411	306	1,022	–	–
Vertical Flow Layer Top			–	–	–	–	–	–	–	–	–	–	–	–
Vertical Flow Layer Bottom	188	9,043	–	–	–	–	–	–	206	550	150	1,148	–	–
Queen City														
Springs and seeps	0	0	0	0	–	–	0	0	0	0	0	0	0	0
Evapotranspiration	0	2,580	0	110	–	–	0	1,961	0	0	0	72	0	142
General-Head Boundary	0	0	0	0	–	–	0	0	0	0	0	0	0	0
Recharge	8,187	0	105	0	–	–	5,044	0	0	0	145	0	164	0
Reservoirs	0	0	0	0	–	–	0	0	0	0	0	0	0	0
Storage	1,606	2,191	0	0	–	–	42	1,000	0	1	0	118	0	1
Rivers and Streams	0	658	0	0	–	–	0	653	0	0	0	0	0	0
Wells	0	4,875	0	0	–	–	0	57	0	0	0	6	0	0
Net Lateral Flow	223	295	9	0	–	–	40	245	1	1	0	4	0	9
Vertical Flow Layer Top	11,741	104	–	–	–	–	444	0	695	36	1,384	16	–	–
Vertical Flow Layer Bottom	3	11,058	0	3	–	–	17	1,670	24	681	1	1,312	0	11

Table 2. Continued ...

Carrizo	Nacogdoches		Panola		Rains		Rusk		Sabine		San Augustine		Shelby	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Springs and seeps	0	0	0	0	–	–	0	375	0	0	0	106	0	0
Evapotranspiration	0	6,513	0	67	–	–	0	17,100	0	225	0	5,421	0	24
General-Head Boundary	0	0	0	0	–	–	0	0	0	0	0	0	0	0
Recharge	18,327	0	835	0	–	–	46,067	0	3,622	0	9,668	0	913	0
Reservoirs	0	0	0	0	–	–	0	0	0	25	0	0	0	0
Storage	1,493	83	150	0	–	–	2,516	865	17	251	101	102	107	0
Rivers and Streams	0	4,419	0	0	–	–	70	15,510	0	0	44	1,481	0	0
Wells	0	21,230	0	944	–	–	0	6,750	0	4,112	0	1,101	0	916
Net Lateral Flow	6,908	9,782	134	6	–	–	935	3,387	2,563	2,211	2,719	5,149	6	40
Vertical Flow Layer Top	16,593	27	–	–	–	–	3,534	123	900	4	1,439	0	–	–
Vertical Flow Layer Bottom	3,759	5,024	0	101	–	–	1	9,010	110	382	462	1,072	0	44
Upper Wilcox														
Springs and seeps	0	0	0	8	0	0	0	172	0	1,385	0	0	0	163
Evapotranspiration	0	742	0	3,853	0	0	0	3,126	0	930	0	372	0	7,351
General-Head Boundary	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recharge	2,417	0	6,220	0	376	0	21,667	0	3,801	0	2,910	0	28,913	0
Reservoirs	0	0	198	0	0	0	281	41	1,239	17	0	0	130	0
Storage	891	554	199	48	174	30	2,446	3,737	380	1	292	392	313	2,752
Rivers and Streams	99	999	0	1,198	64	39	385	5,166	0	2,168	0	424	95	9,403
Wells	0	9,459	0	753	0	521	0	5,024	0	1,651	0	629	0	3,236
Net Lateral Flow	9,822	4,387	1,002	530	71	53	1,029	5,987	2,068	1,636	4,048	5,843	595	4,038
Vertical Flow Layer Top	5,024	3,759	101	0	–	–	9,010	1	382	110	1,072	462	44	0
Vertical Flow Layer Bottom	2,356	711	34	1,364	0	44	67	11,630	145	117	291	491	2	3,146

Table 2. Continued ...

Middle Wilcox	Nacogdoches		Panola		Rains		Rusk		Sabine		San Augustine		Shelby	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Springs and seeps	0	0	0	28	0	54	0	0	0	0	0	0	0	1,060
Evapotranspiration	0	0	0	5,493	0	951	0	0	0	0	0	0	0	2,168
General-Head Boundary	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recharge	396	0	29,025	0	6,759	0	34	0	0	0	0	0	15,432	0
Reservoirs	0	0	67	0	0	71	0	0	0	0	0	0	1,609	0
Storage	31	382	1,208	2,507	32	2,502	163	242	230	0	49	15	917	1,109
Rivers and Streams	29	0	1,168	22,010	195	1,527	10	0	0	0	0	0	373	8,754
Wells	0	661	0	5,092	0	662	0	8,507	0	460	0	4	0	4,731
Net Lateral Flow	3,475	1,584	4,941	1,535	159	1,018	1,256	3,680	732	390	1,300	1,506	1,064	4,100
Vertical Flow Layer Top	711	2,356	1,364	34	44	0	11,630	67	117	145	491	291	3,146	2
Vertical Flow Layer Bottom	453	114	607	1,682	124	526	73	670	0	81	51	75	265	881
Lower Wilcox														
Springs and seeps	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Evapotranspiration	0	0	0	0	0	84	0	0	0	0	0	0	0	0
General-Head Boundary	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recharge	0	0	0	0	184	0	0	0	0	0	0	0	0	0
Reservoirs	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Storage	9	50	1	2	37	43	56	3	51	0	9	12	7	6
Rivers and Streams	0	0	0	0	1	4	0	0	0	0	0	0	0	0
Wells	0	0	0	1,231	0	421	0	0	0	460	0	0	0	103
Net Lateral Flow	756	374	279	120	14	66	107	756	355	28	348	369	93	607
Vertical Flow Layer Top	114	453	1,682	607	526	124	670	73	81	0	75	51	881	265
Vertical Flow Layer Bottom	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Table 2. Continued ...

Sparta	Smith		Titus		Trinity		Upshur		Van Zandt		Wood	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Springs and seeps	0	0	–	–	0	0	0	0	–	–	0	7
Evapotranspiration	0	746	–	–	0	0	0	0	–	–	0	368
General-Head Boundary	0	0	–	–	1,269	574	0	0	–	–	0	0
Recharge	22,614	0	–	–	0	0	1,129	0	–	–	4,108	0
Reservoirs	0	0	–	–	0	0	0	0	–	–	0	0
Storage	85	889	–	–	30	0	0	55	–	–	31	400
Rivers and Streams	0	1,549	–	–	0	0	0	0	–	–	0	81
Wells	0	0	–	–	0	601	0	0	–	–	0	0
Net Lateral Flow	0	21	–	–	729	385	39	124	–	–	124	39
Vertical Flow Layer Top			–	–	–	–	–	–	–	–	–	–
Vertical Flow Layer Bottom	0	19,493	–	–	146	614	0	990	–	–	0	3,366
Queen City												
Springs and seeps	0	0	0	0	0	0	0	0	0	10	0	0
Evapotranspiration	0	713	0	299	0	0	0	764	0	1,269	0	952
General-Head Boundary	0	0	0	0	0	0	0	0	0	0	0	0
Recharge	30,646	0	739	0	0	0	23,373	0	5,779	0	14,806	0
Reservoirs	504	0	0	0	0	0	65	39	0	0	0	0
Storage	12,039	670	114	92	42	0	5,029	1,221	782	0	1,738	3,681
Rivers and Streams	2,596	8,113	0	85	0	0	980	2,253	0	532	1,459	5,827
Wells	0	52,864	0	135	0	0	0	24,735	0	3,716	0	9,852
Net Lateral Flow	2,113	3,202	4	121	181	49	1,351	1,560	308	909	1,656	1,106
Vertical Flow Layer Top	19,285	0	–	–	574	88	962	0	–	–	3,317	0
Vertical Flow Layer Bottom	0	1,622	0	124	13	673	1	1,188	0	432	0	1,556

Table 2. Continued ...

Carrizo	Smith		Titus		Trinity		Upshur		Van Zandt		Wood	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Springs and seeps	0	0	0	0	0	0	0	0	0	0	0	120
Evapotranspiration	0	0	0	338	0	0	0	0	0	167	0	811
General-Head Boundary	0	0	0	0	0	0	0	0	0	0	0	0
Recharge	1,650	0	1,576	0	0	0	697	0	4,755	0	6,259	0
Reservoirs	0	0	0	0	0	0	0	0	0	0	0	0
Storage	12,275	146	691	103	44	0	3,536	46	941	94	3,331	335
Rivers and Streams	185	483	41	137	0	0	75	0	0	1,278	768	0
Wells	0	14,604	0	1,749	0	2,158	0	4,076	0	2,541	0	12,819
Net Lateral Flow	3,505	2,289	210	117	5,166	5,255	941	1,217	1,112	2,203	2,959	899
Vertical Flow Layer Top	2,867	0	133	0	789	0	1,284	0	677	0	2,620	0
Vertical Flow Layer Bottom	1,905	4,864	222	428	1,413	0	1,252	2,446	62	1,264	1,801	2,753
Upper Wilcox												
Springs and seeps	0	0	0	223	0	0	0	0	0	0	0	593
Evapotranspiration	0	0	0	1,104	0	0	0	0	0	3,166	0	866
General-Head Boundary	0	0	0	0	0	0	0	0	0	0	0	0
Recharge	54	0	3,826	0	0	0	0	0	9,947	0	3,674	0
Reservoirs	0	0	905	0	0	0	0	0	0	0	1,539	4
Storage	2,723	0	1,428	59	433	0	120	0	1,017	1,809	1,265	1,380
Rivers and Streams	30	0	95	1,664	0	0	0	0	290	912	70	564
Wells	0	13,323	0	1,870	0	0	0	2,262	0	1,508	0	5,755
Net Lateral Flow	6,064	1,698	396	1,098	2,000	1,691	1,001	1,083	878	3,208	2,582	895
Vertical Flow Layer Top	4,864	1,905	428	222	0	1,413	2,446	1,252	1,264	62	2,753	1,801
Vertical Flow Layer Bottom	4,476	1,287	19	854	671	0	1,445	415	17	2,749	1,889	1,912

Table 2. Continued ...

Middle Wilcox	Smith		Titus		Trinity		Upshur		Van Zandt		Wood	
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out
Springs and seeps	0	0	0	91	0	0	0	0	0	0	0	0
Evapotranspiration	0	0	0	850	0	0	0	0	0	1,344	0	97
General-Head Boundary	0	0	0	0	0	0	0	0	0	0	0	0
Recharge	0	0	11,855	0	0	0	0	0	10,695	0	2,748	0
Reservoirs	0	0	0	0	0	0	0	0	0	0	161	24
Storage	820	0	248	2,741	96	87	314	0	849	1,419	338	2,819
Rivers and Streams	0	0	155	2,807	0	0	0	0	180	3,411	69	15
Wells	0	4,449	0	5,802	0	0	0	597	0	3,914	0	2,205
Net Lateral Flow	6,007	1,275	823	1,573	975	616	1,772	565	1,092	3,407	3,938	2,205
Vertical Flow Layer Top	1,287	4,476	854	19	0	671	415	1,445	2,749	17	1,912	1,889
Vertical Flow Layer Bottom	2,280	193	589	639	302	0	138	32	154	2,206	151	62
Lower Wilcox												
Springs and seeps	0	0	0	0	0	0	0	0	0	0	0	0
Evapotranspiration	0	0	0	0	0	0	0	0	0	2,387	0	0
General-Head Boundary	0	0	0	0	0	0	0	0	0	0	0	0
Recharge	0	0	15	0	0	0	0	0	6,553	0	0	0
Reservoirs	0	0	0	0	0	0	0	0	0	0	0	0
Storage	486	0	0	1	46	39	30	0	109	842	18	1
Rivers and Streams	0	0	0	0	0	0	0	0	0	2,152	0	0
Wells	0	0	0	32	0	0	0	0	0	2,168	0	19
Net Lateral Flow	1,784	186	85	117	593	299	132	57	461	1,624	231	138
Vertical Flow Layer Top	193	2,280	639	589	0	302	32	138	2,206	154	62	151
Vertical Flow Layer Bottom	–	–	–	–	–	–	–	–	–	–	–	–

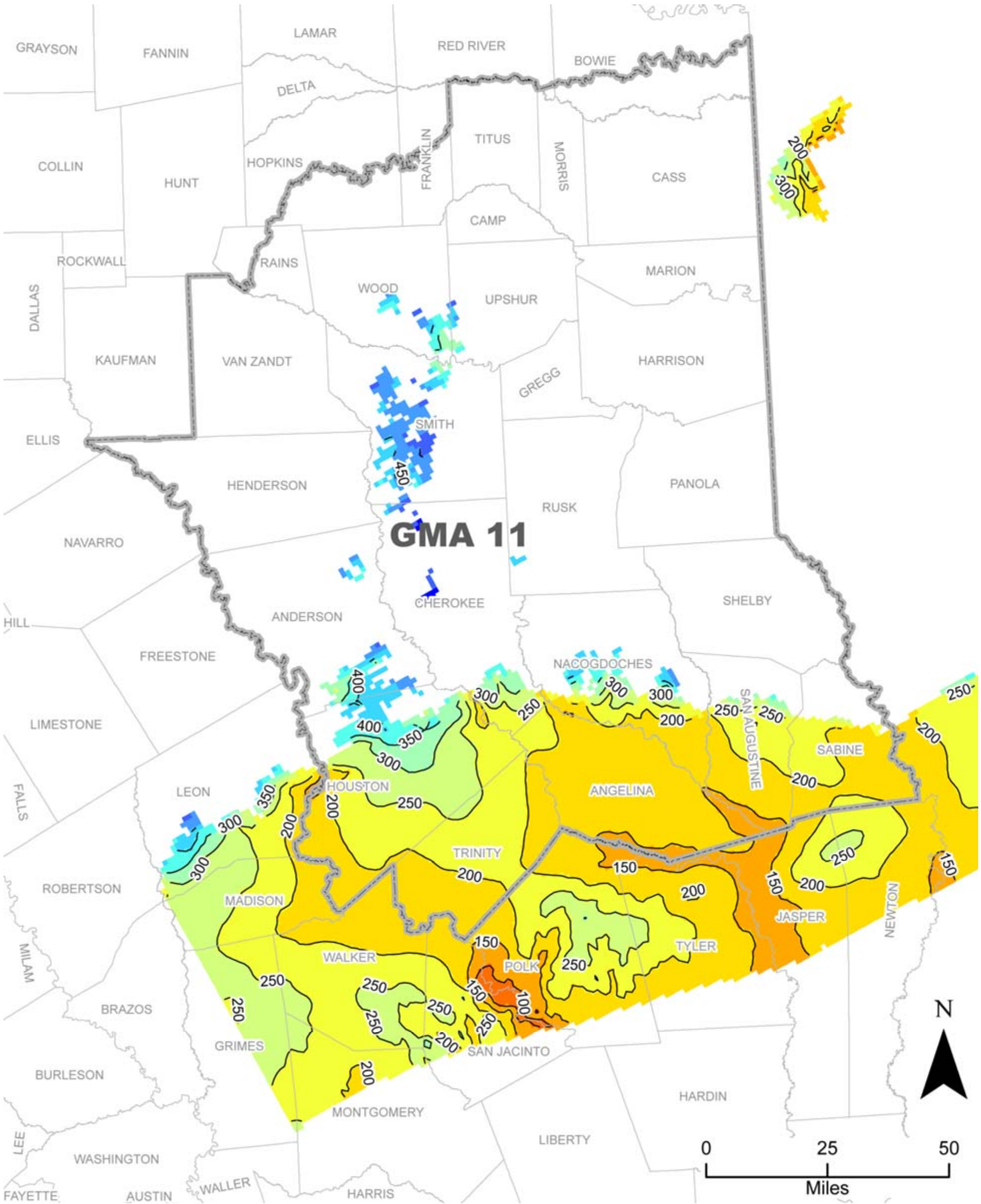

Figure 1. Water levels (in feet above mean sea level) in the Sparta Aquifer (layer 1) in 1999. Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 50 feet.

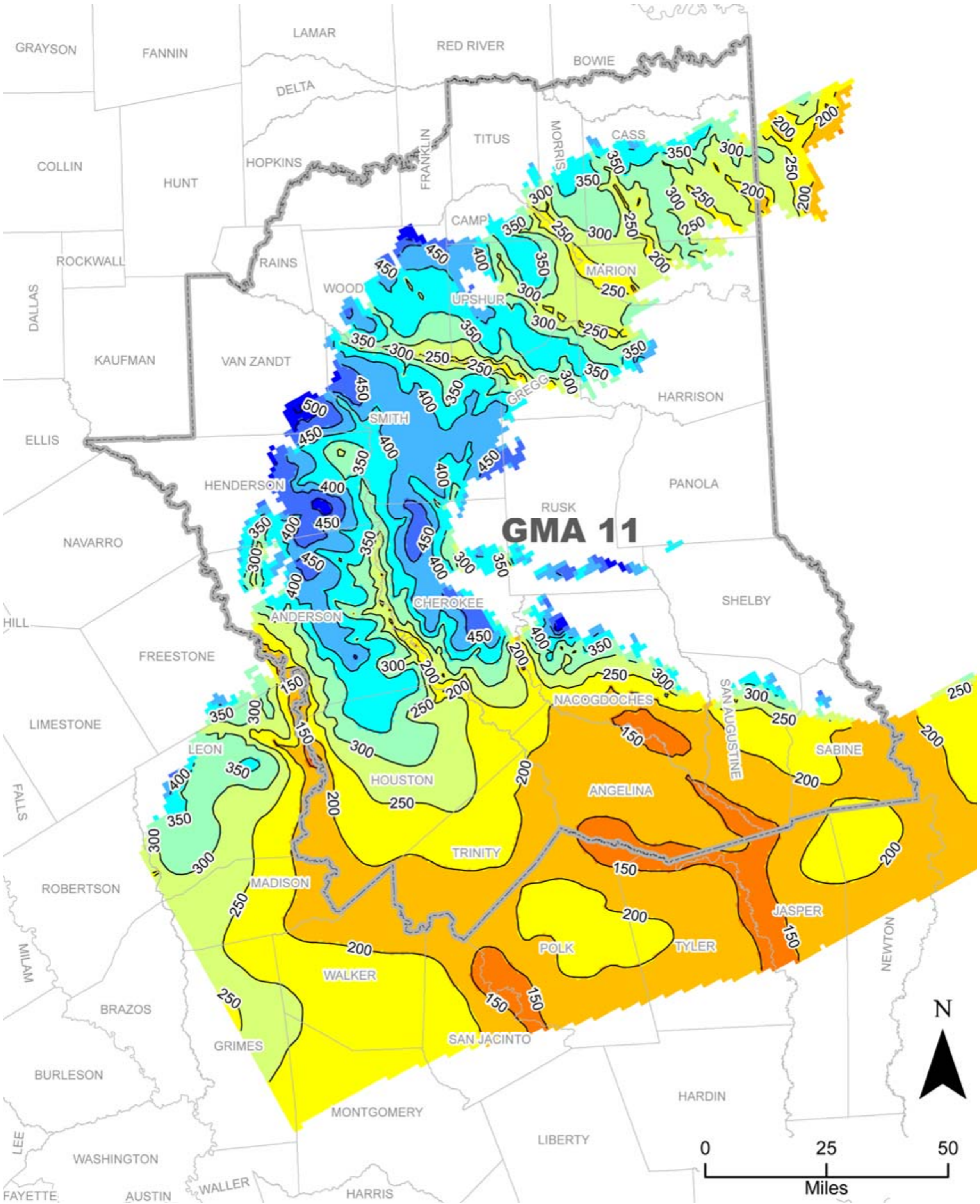

Figure 2. Water levels (in feet above mean sea level) in the Queen City Aquifer (layer 3) in 1999. Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 50 feet.

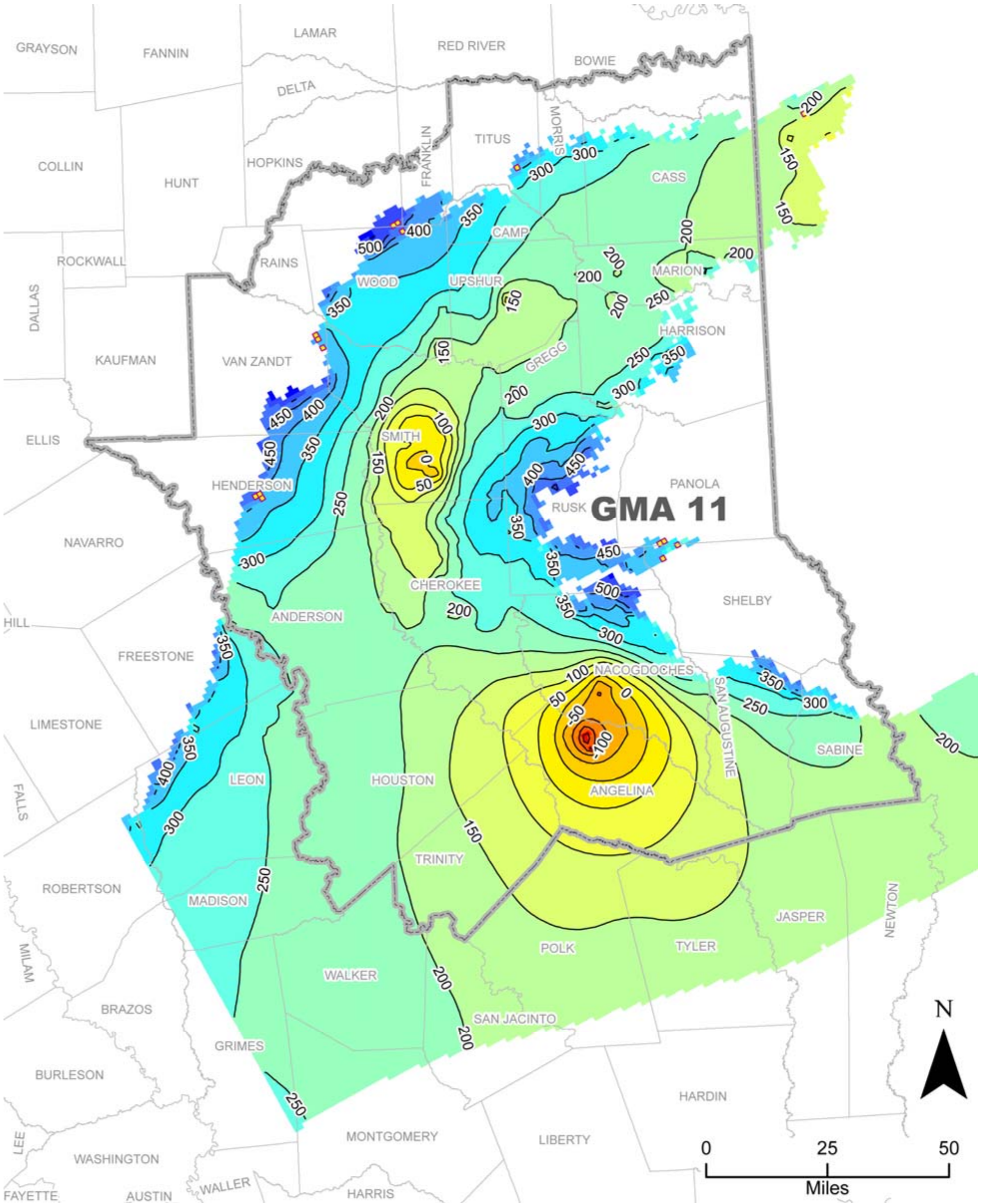

Figure 3. Water levels (in feet above mean sea level) in the Carrizo Aquifer (layer 5) in 1999. Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 50 feet.

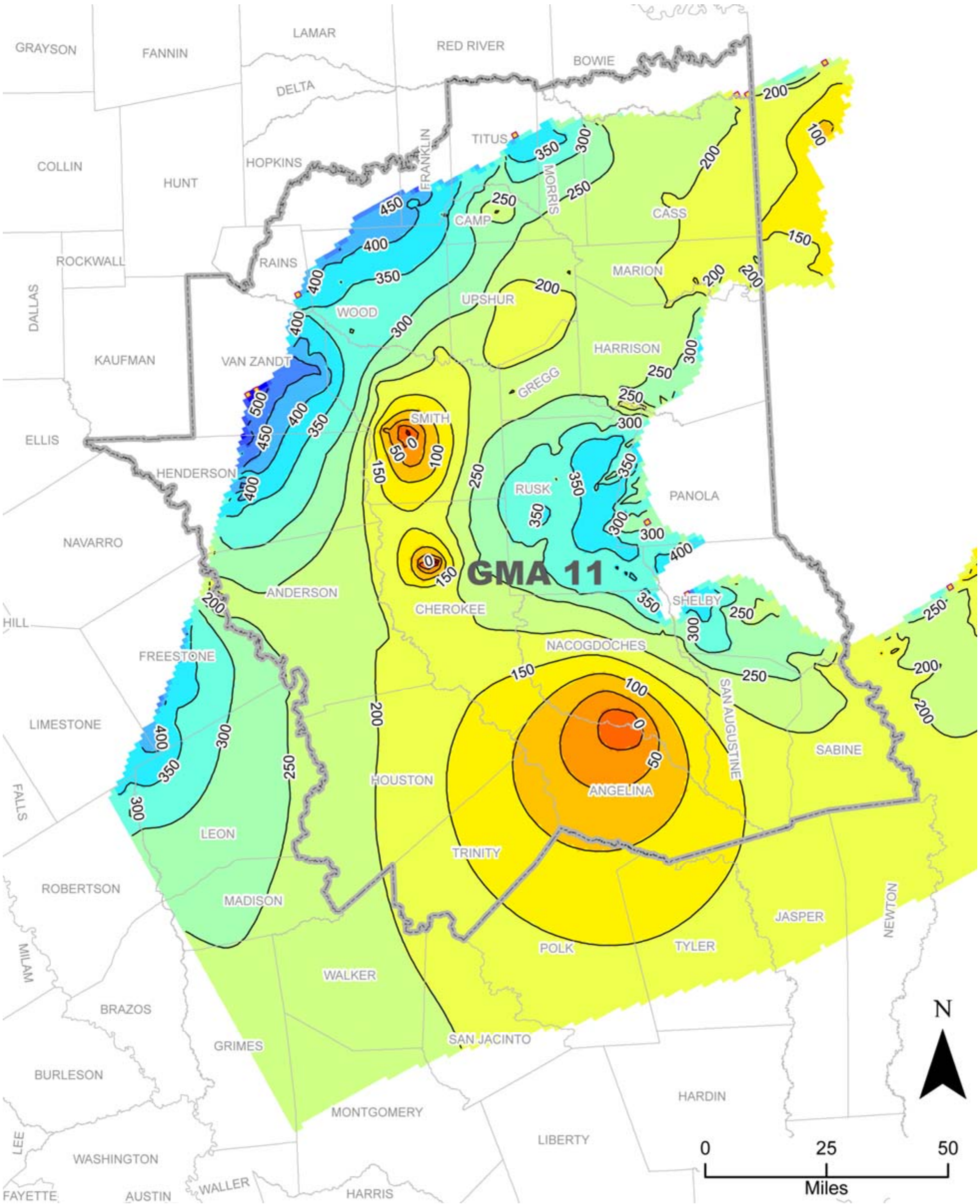

Figure 4. Water levels (in feet above mean sea level) in the Upper Wilcox Aquifer (layer 6) in 1999. Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 50 feet.

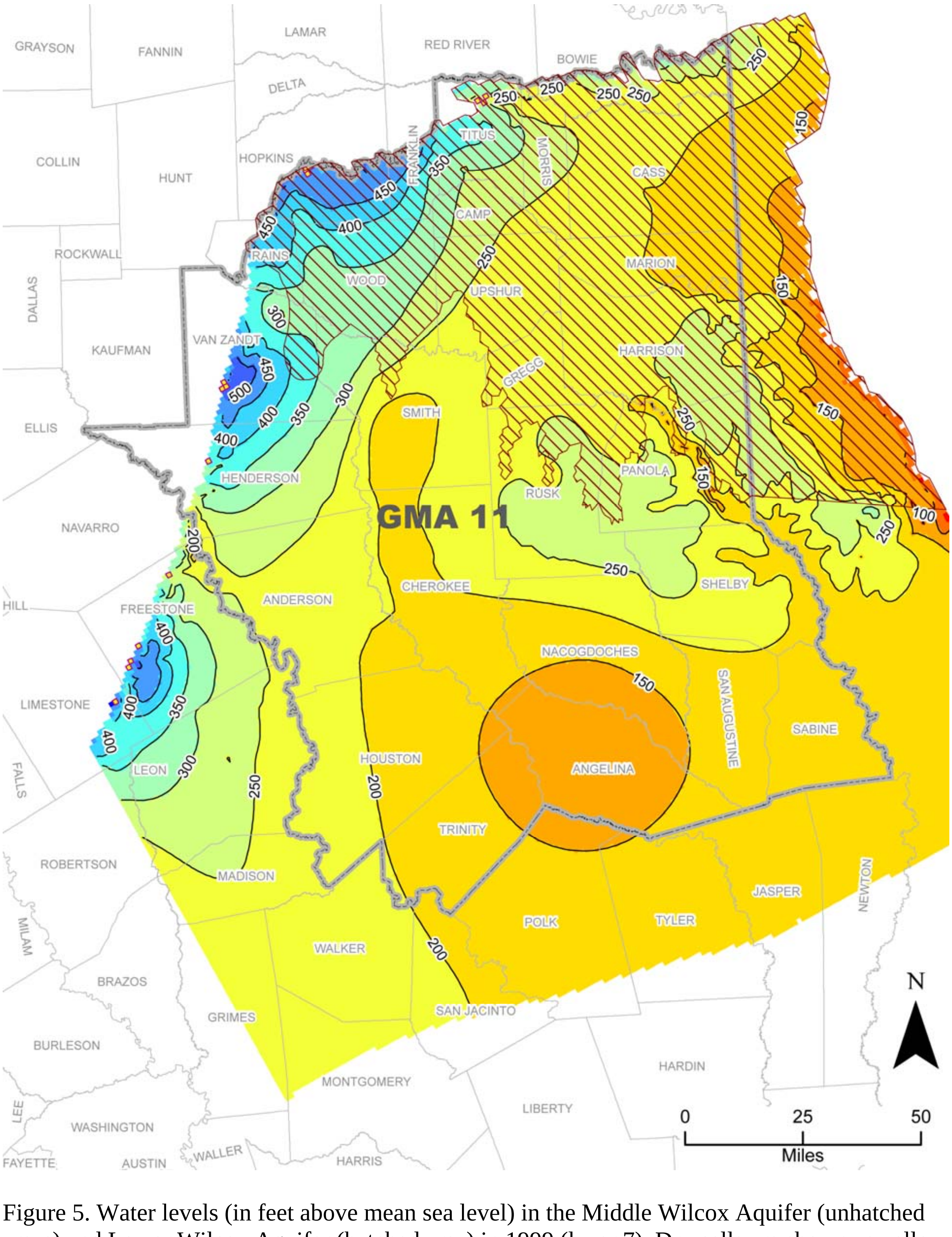

Figure 5. Water levels (in feet above mean sea level) in the Middle Wilcox Aquifer (unhatched areas) and Lower Wilcox Aquifer (hatched area) in 1999 (layer 7). Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 50 feet.

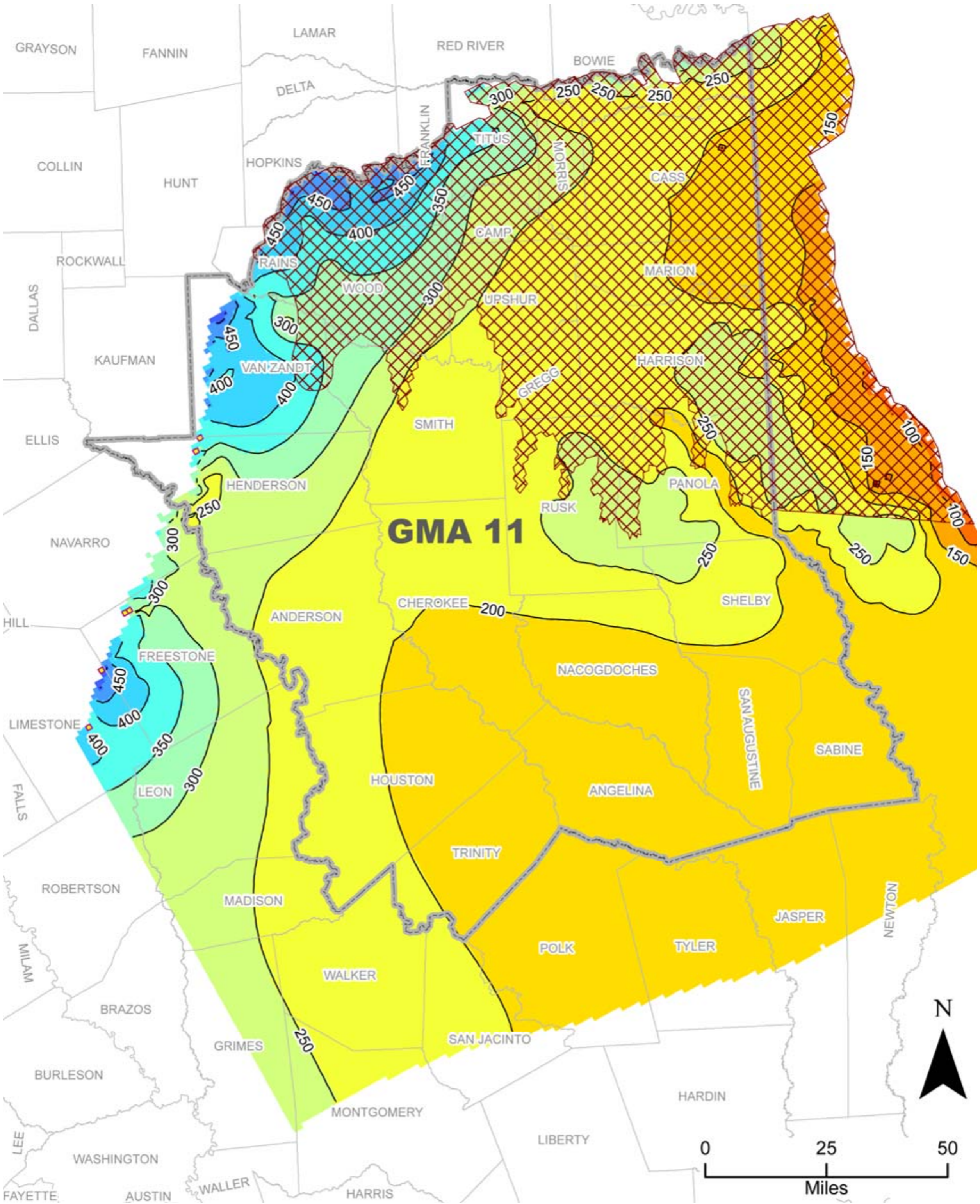

Figure 6. Water levels (in feet above mean sea level) in the Lower Wilcox Aquifer (layer 8) in 1999. The cross-hatched area indicates areas where the Lower Wilcox was modeled in layer 7. Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 50 feet.

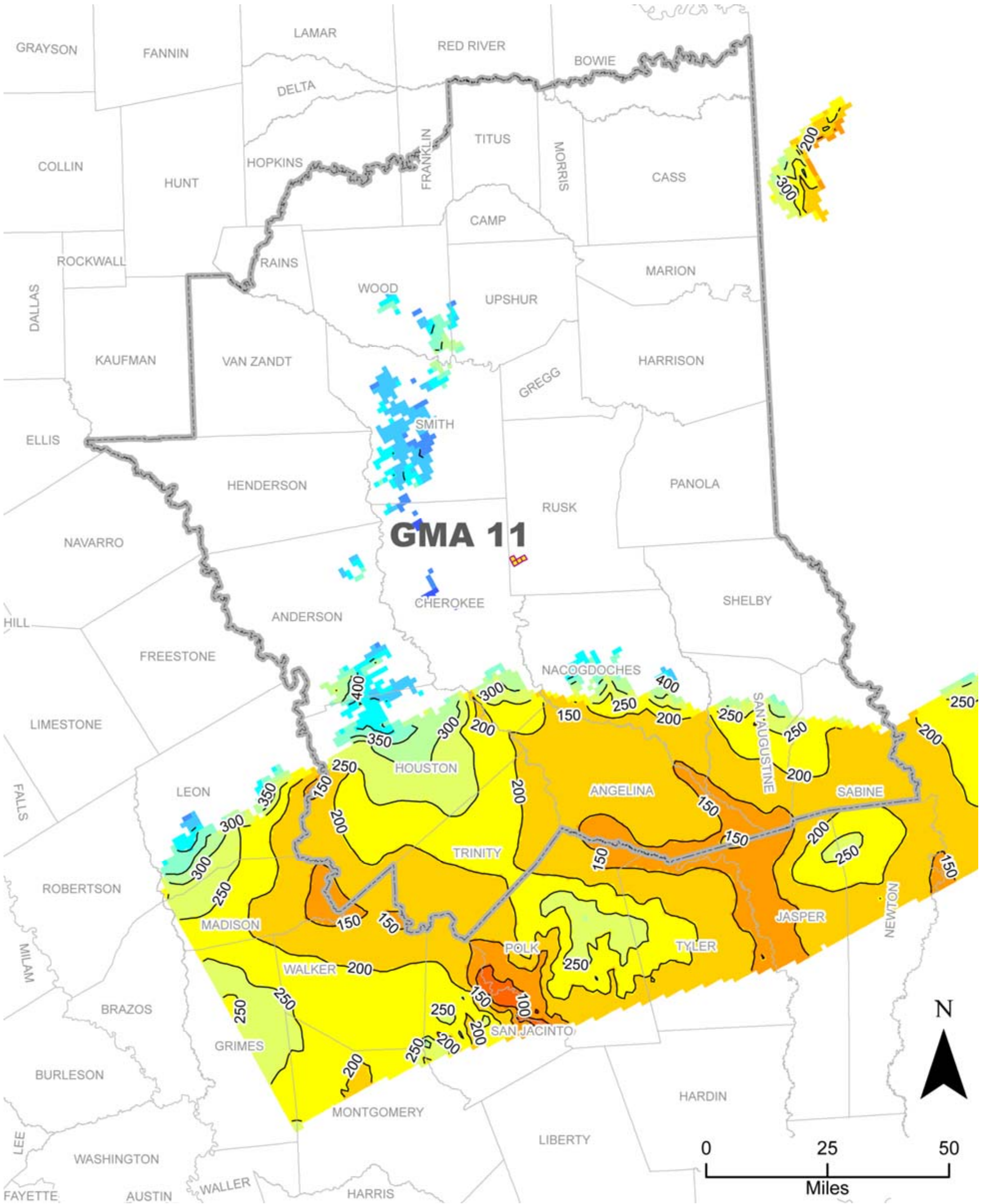

Figure 7. Water levels (in feet above mean sea level) in the Sparta Aquifer (layer 1) in 2050. Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 50 feet.

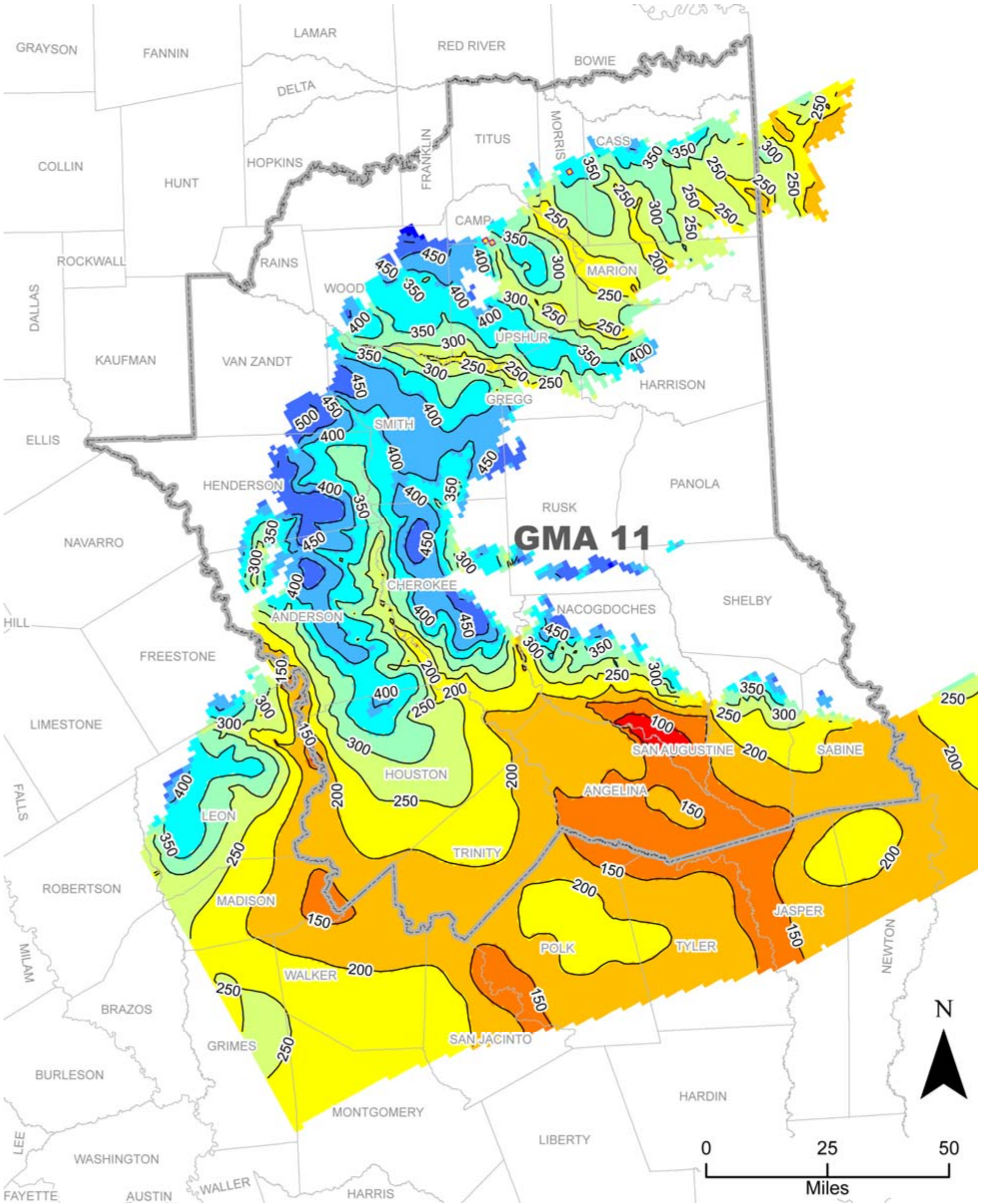

Figure 8. Water levels (in feet above mean sea level) in the Queen City Aquifer (layer 3) in 2050. Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 50 feet.

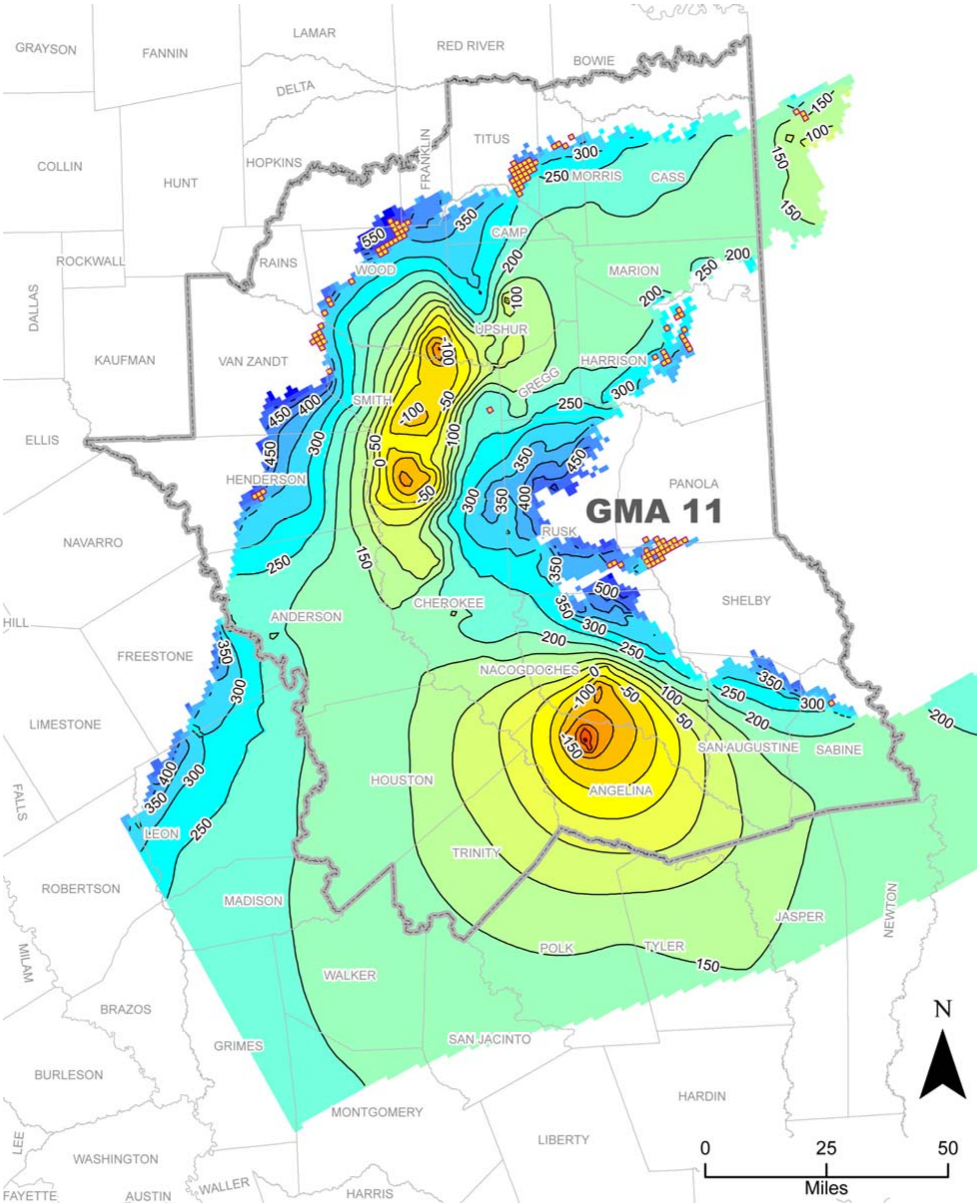

Figure 9. Water levels (in feet above mean sea level) in the Carrizo Aquifer (layer 5) in 2050. Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 50 feet.

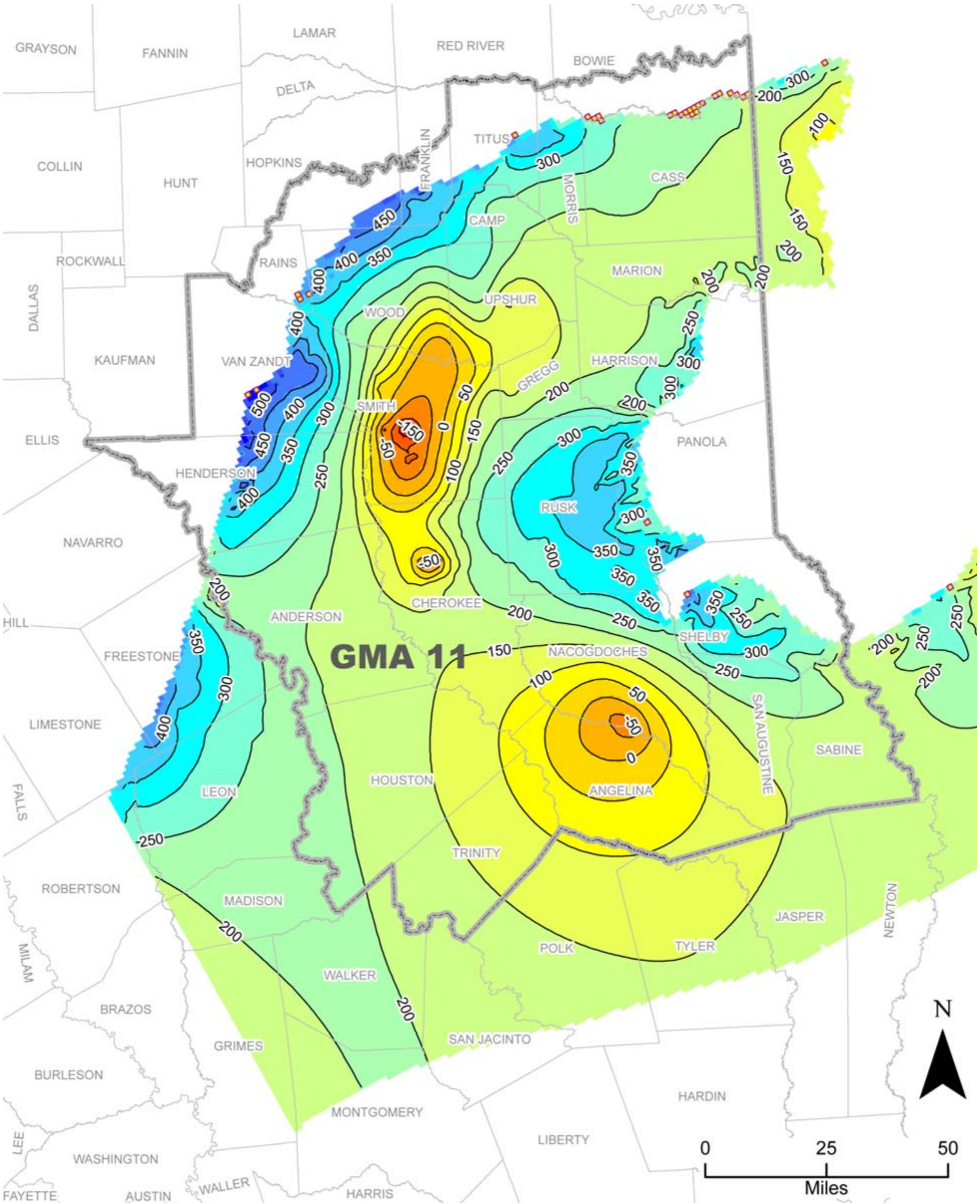

Figure 10. Water levels (in feet above mean sea level) in the Upper Wilcox Aquifer (layer 6) in 2050. Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 50 feet.

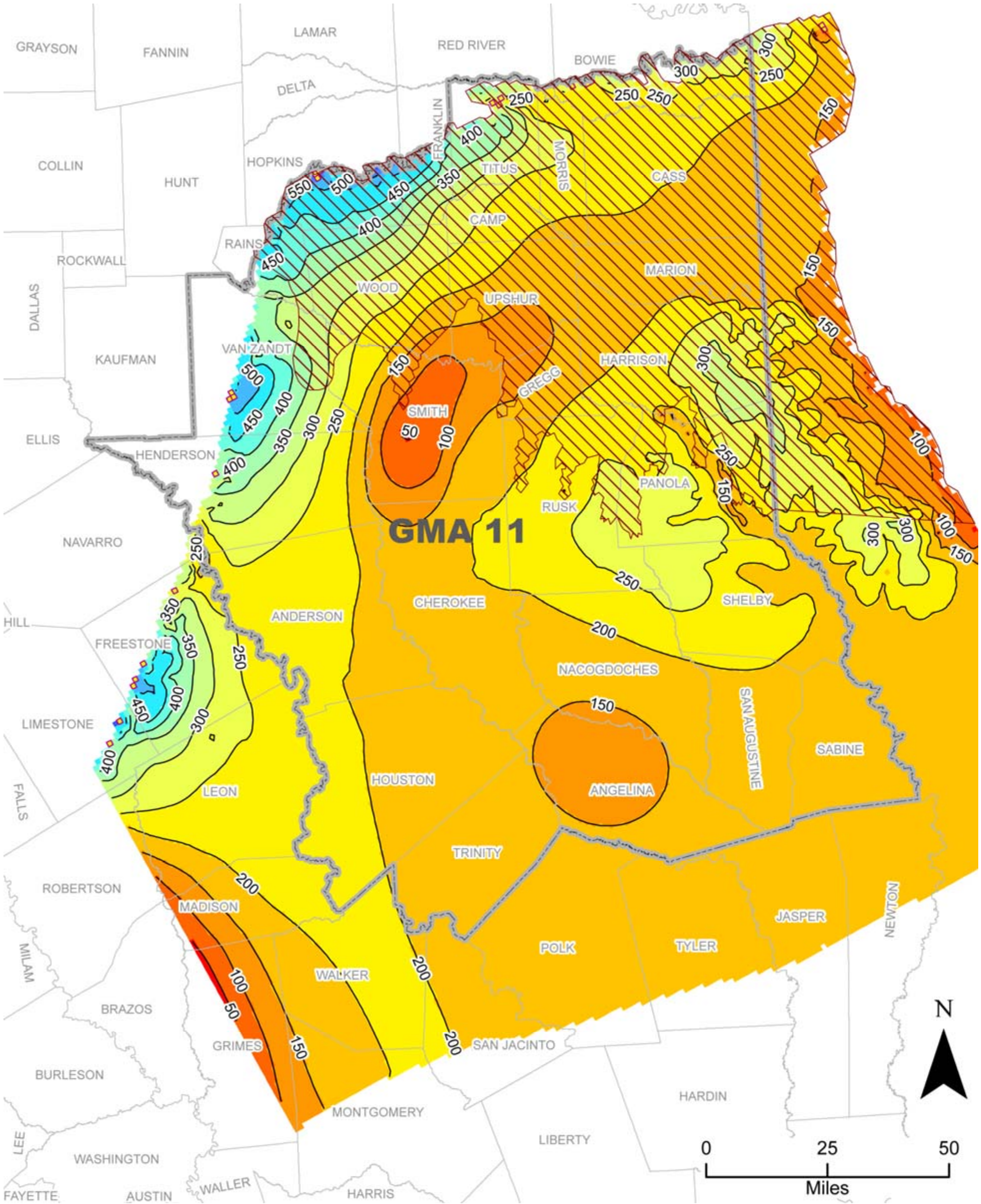

Figure 11. Water levels (in feet above mean sea level) in the Middle Wilcox Aquifer (unhatched areas) and Lower Wilcox Aquifer (hatched area) in 2050 (layer 7). Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 50 feet.

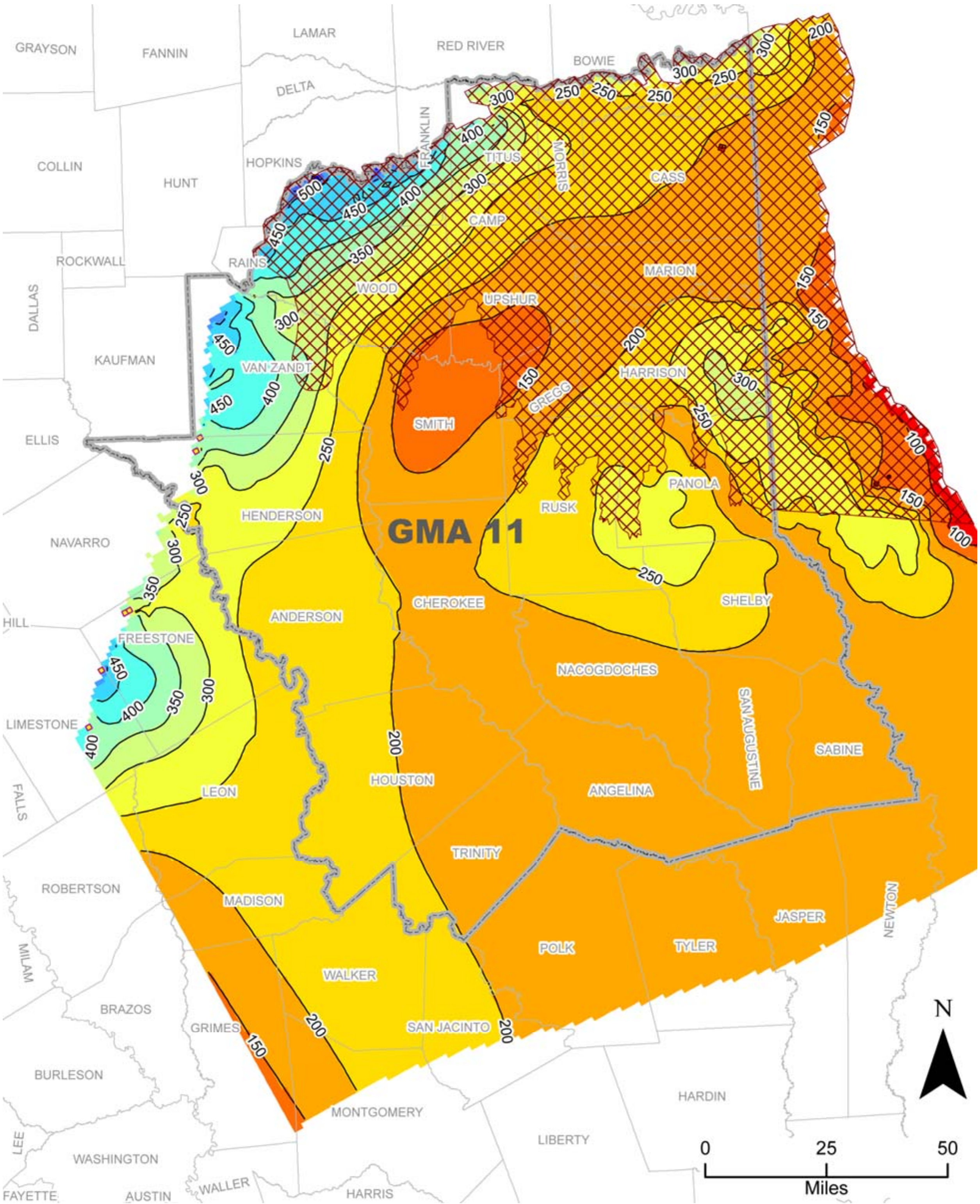

Figure 12. Water levels (in feet above mean sea level) in the Lower Wilcox Aquifer (layer 8) in 2050. The cross-hatched area indicates areas where the Lower Wilcox was modeled in layer 7. Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 50 feet.

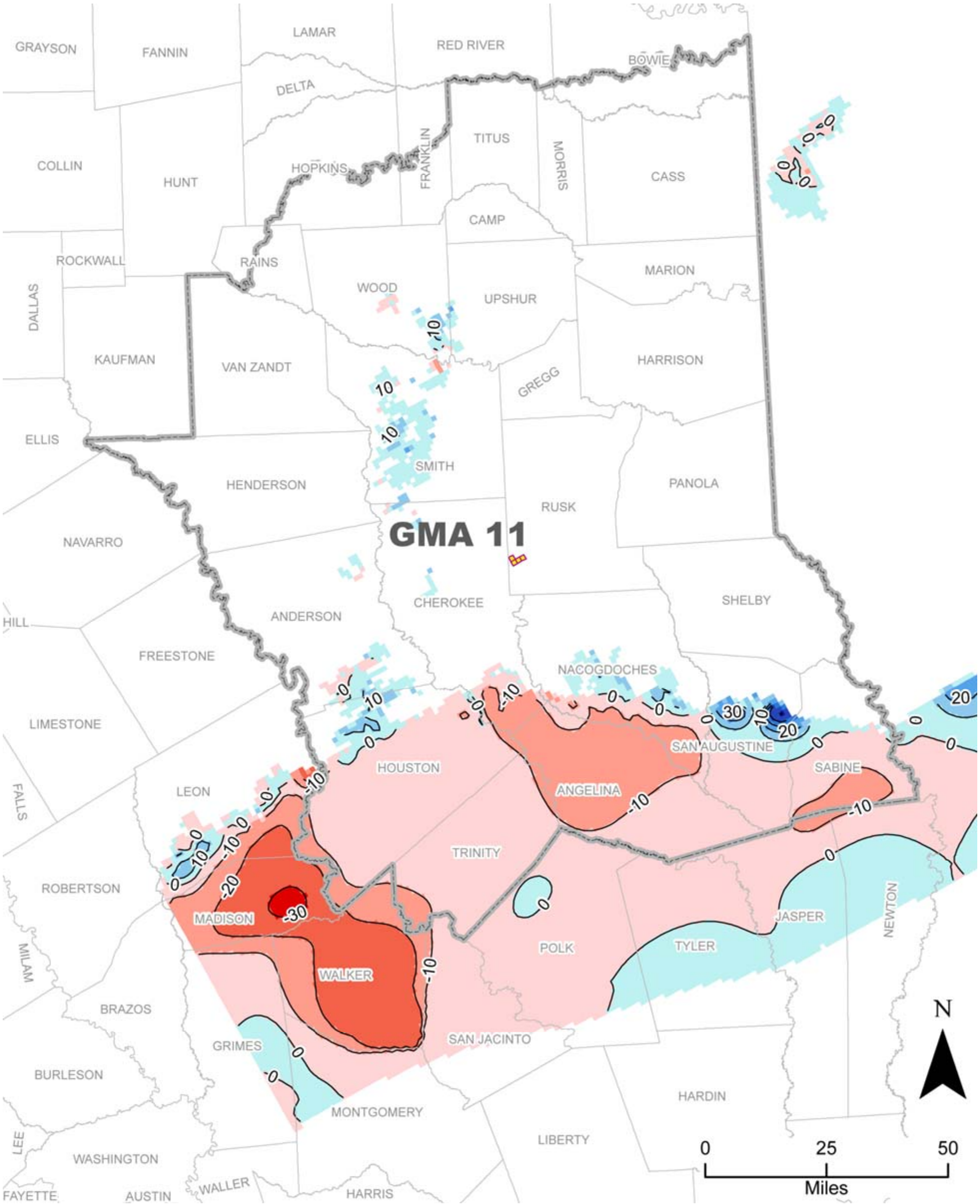

Figure 13. Water level differences in the Sparta Aquifer after 50 years of pumpage and using 1999 water levels as a baseline. Positive numbers indicate rebound (blue areas) and negative numbers show decline (red areas). Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 10 feet.

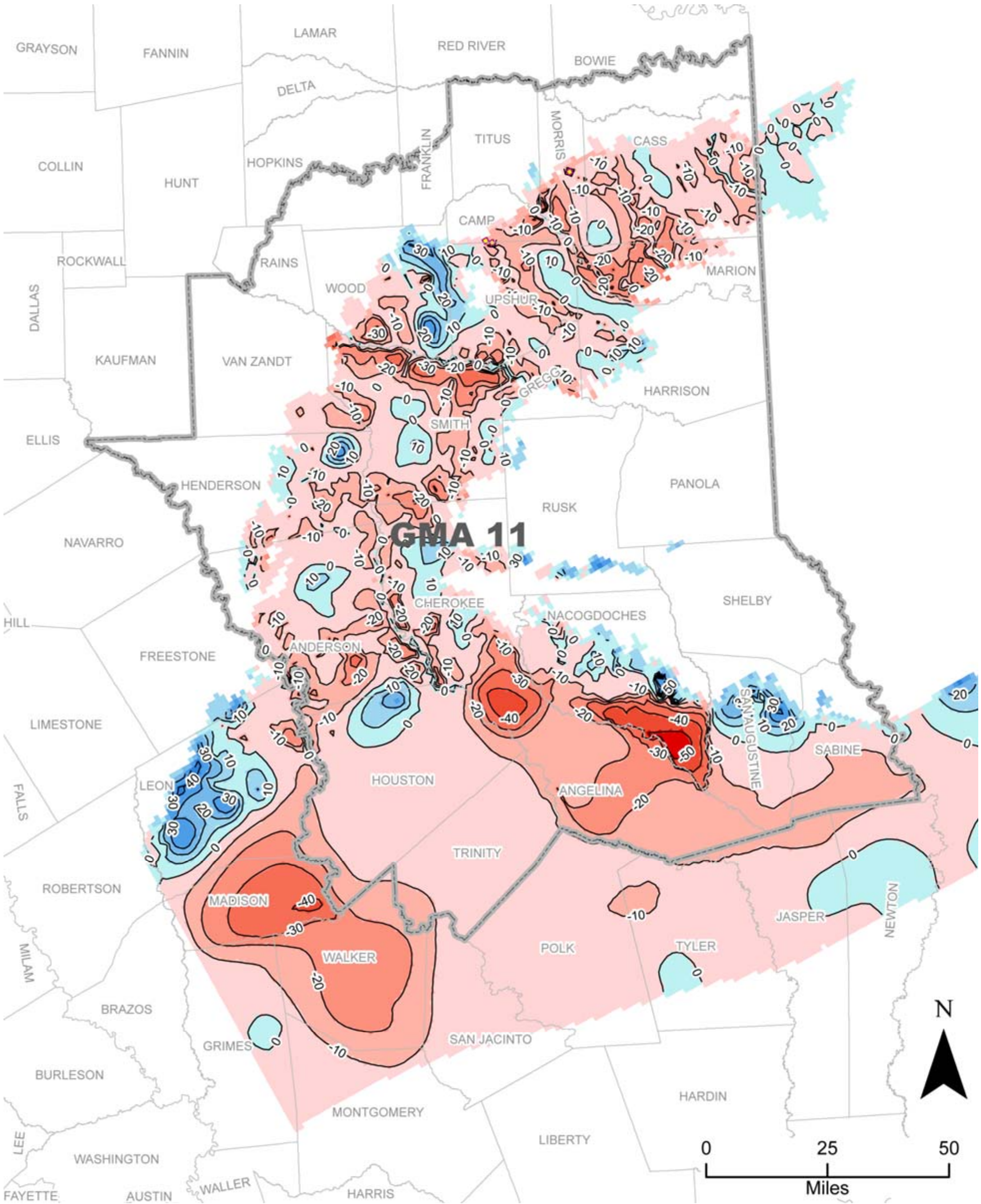

Figure 14. Water level differences in the Queen City Aquifer after 50 years of pumpage and using 1999 water levels as a baseline. Positive numbers indicate rebound (blue areas) and negative numbers show decline (red areas). Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 10 feet.

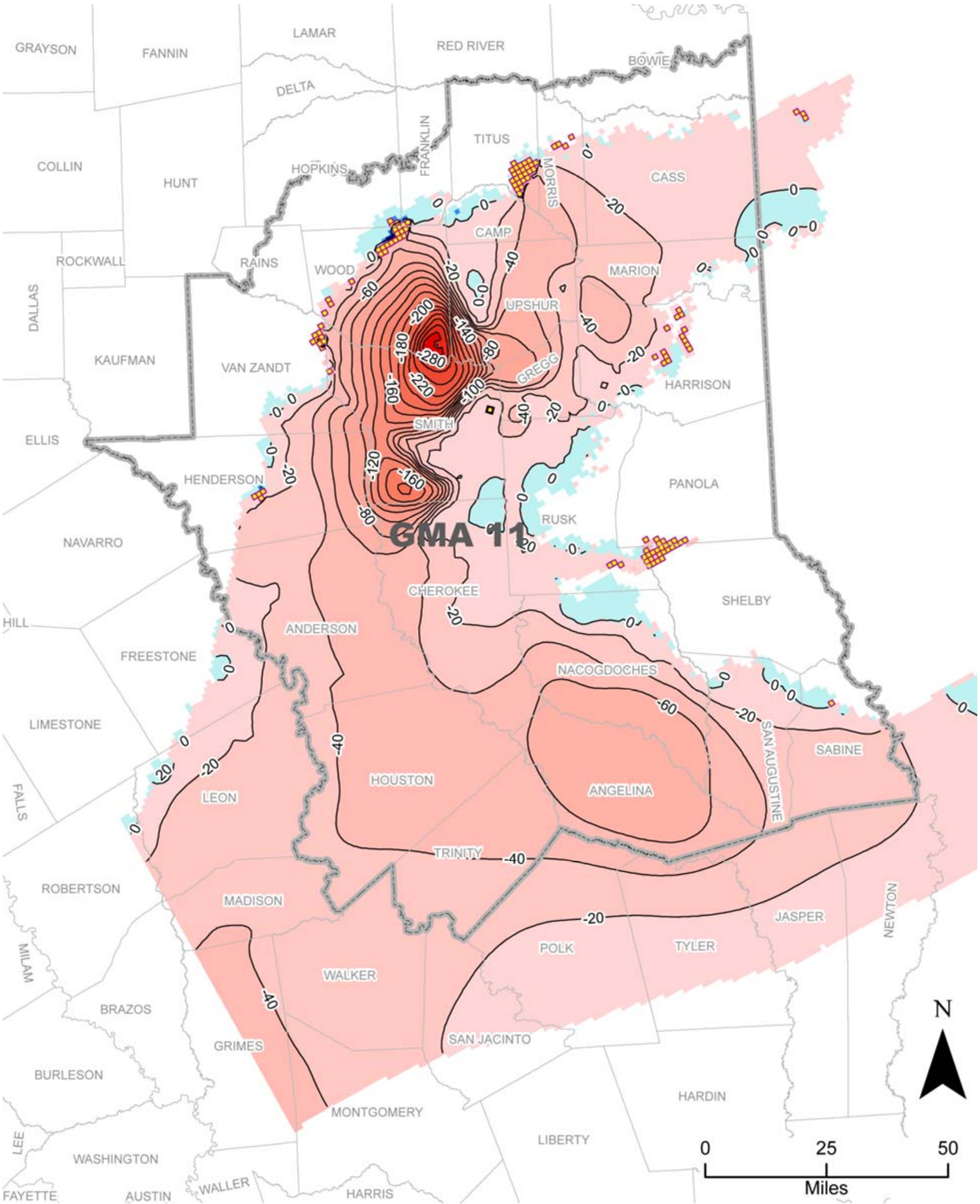

Figure 15. Water level differences in the Carrizo Aquifer after 50 years of pumpage and using 1999 water levels as a baseline. Positive numbers indicate rebound (blue areas) and negative numbers show decline (red areas). Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 20 feet.

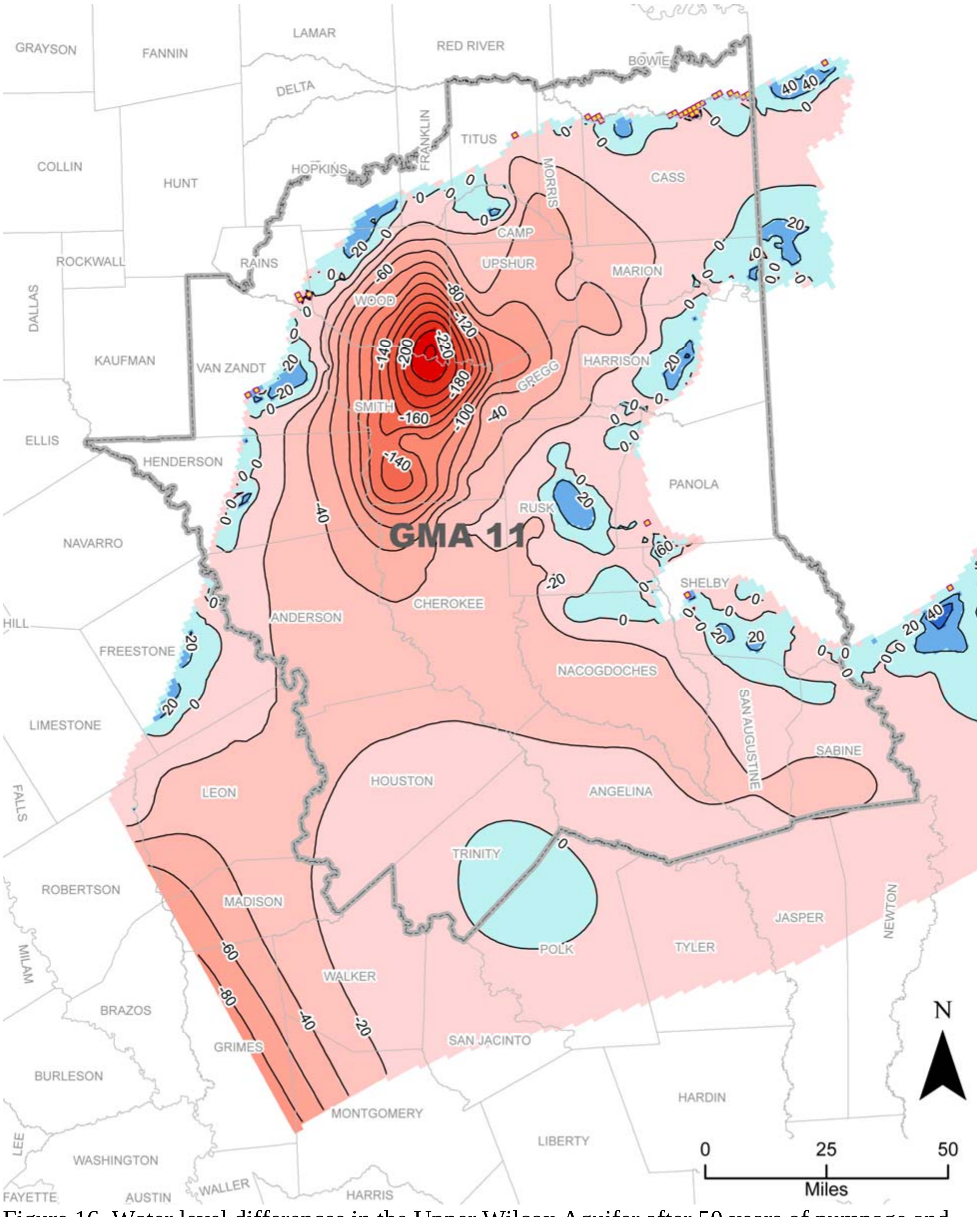

Figure 16. Water level differences in the Upper Wilcox Aquifer after 50 years of pumpage and using 1999 water levels as a baseline. Positive numbers indicate rebound (blue areas) and negative numbers show decline (red areas). Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 20 feet.

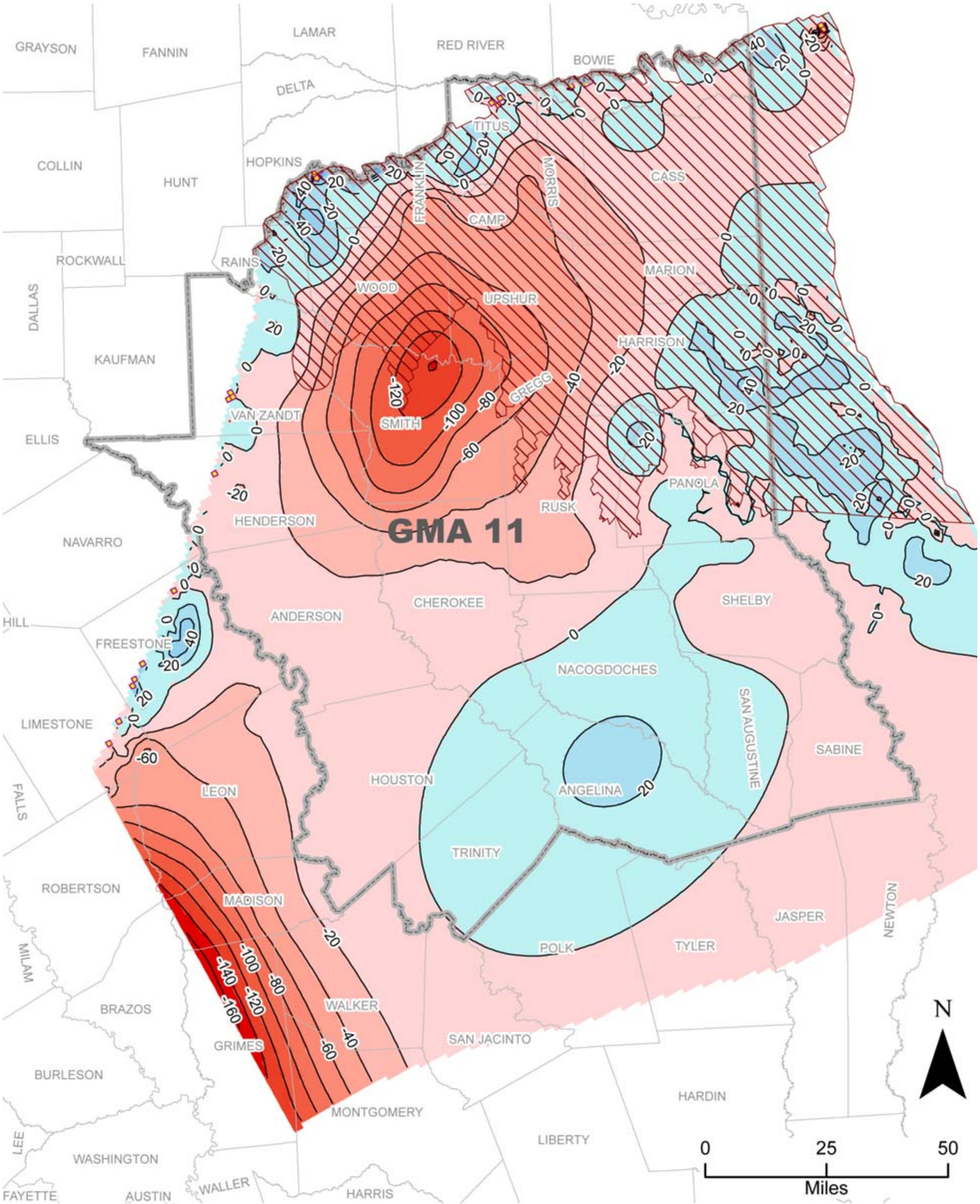

Figure 17. Water level differences in the Middle Wilcox Aquifer (unhatched areas) and Lower Wilcox Aquifer (hatched area) after 50 years of pumpage and using 1999 water levels as a baseline. Positive numbers indicate rebound (blue areas) and negative numbers show decline (red areas). Dry cells are shown as yellow squares with a purple outline. Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 20 feet.

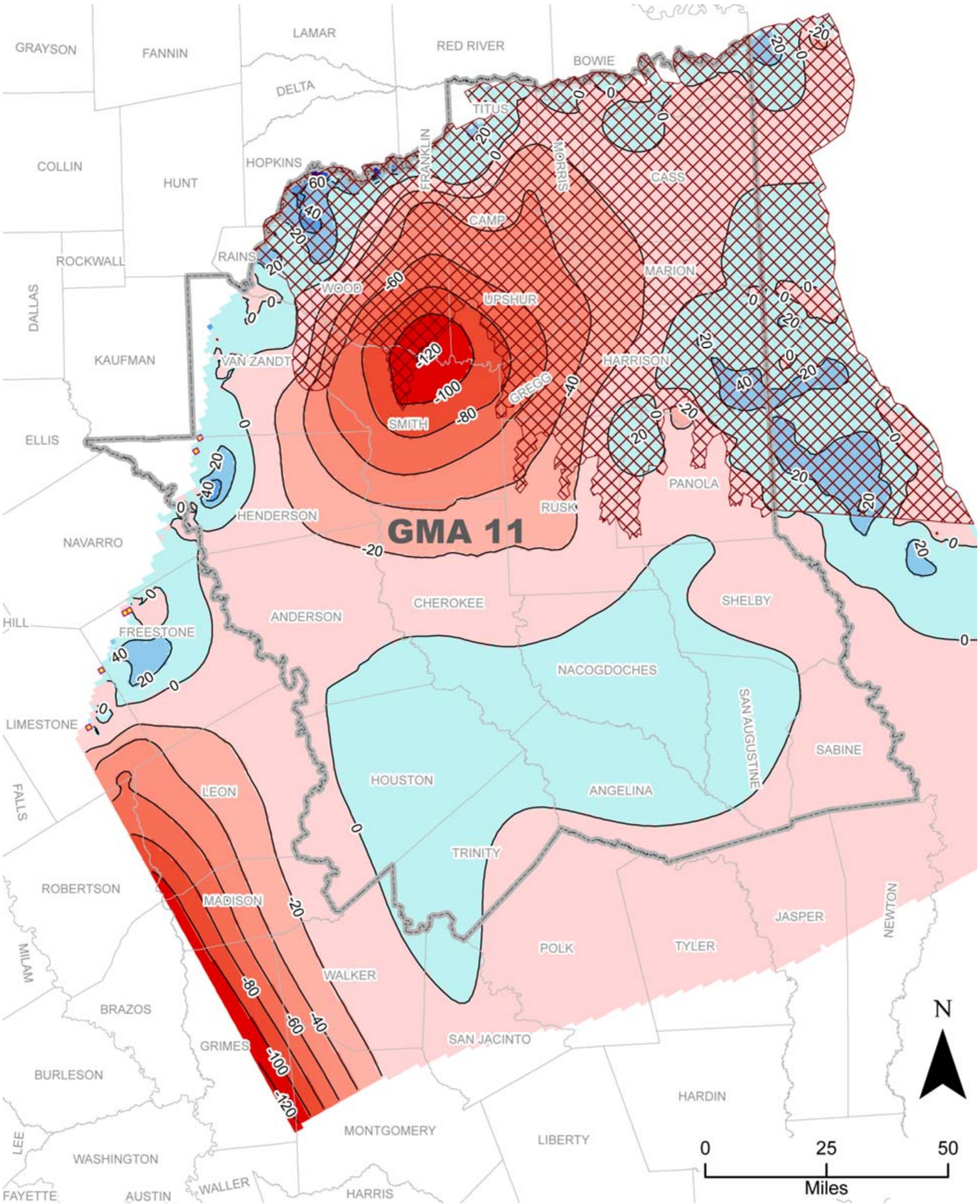

Figure 18. Water level differences in the Lower Wilcox Aquifer after 50 years of pumpage and using 1999 water levels as a baseline. The cross-hatched area indicates areas where the Lower Wilcox was modeled in layer 7.Positive numbers indicate rebound (blue areas) and negative numbers show decline (red areas). Dry cells are shown as yellow squares with a purple outline.

Groundwater Management Area 11 is represented by the thicker dark grey line. Contour interval is 20 feet.