

GAM run 03-15

by Shirley Wade

Texas Water Development Board
Groundwater Availability Modeling Section
(512) 463-7847
July 18, 2003

REQUESTOR:

Mr. Lonnie Stewart, Bee Groundwater Conservation District

DESCRIPTION OF REQUEST:

Mr. Stewart requested the following information from the Southern Carrizo-Wilcox aquifer Groundwater Availability Models (GAM) for the Bee Groundwater Conservation District (GCD):

- Water Budget,
- Storage information, and
- Water-level drawdown.

In addition, Mr. Stewart requested information about recharge to the Gulf Coast aquifer in Bee County.

METHODS:

To address the request, we:

- Ran the predictive (2000-2050) model for the Southern Carrizo-Wilcox aquifer Groundwater Availability Model (Deeds and others, 2003) and queried the budget files for each aquifer layer in Bee County for a year with long-term average recharge and a year with drought-of-record recharge.
- Estimated storage by calculating layer thickness for each model cell (layer top elevation minus bottom elevation), multiplying by cell area (1 mi²) and specific yield, and summing all of the model cells within Bee County.
- Extracted maps of predicted drawdown or water level decline for the period 2000-2050 from the final Southern Carrizo-Wilcox model report.
- Located Gulf Coast aquifer recharge value from the TWDB Bee County report (Meyers and others, 1966).

PARAMETERS AND ASSUMPTIONS:

None: Data request.

RESULTS:

Recharge

The Carrizo-Wilcox model does not have any direct infiltration recharge in Bee County; however, according to TWDB Report 17, Ground-Water Resources of Bee County, Texas, by B.N. Meyers and O.C. Dale, U.S. Geological Survey, February 1966, the approximate recharge to the Gulf Coast aquifer in Bee County is 9,000 acre-feet per year.

Water budget

Table 1 shows the water budget in Bee County for the Southern Carrizo-Wilcox GAM. The drought of record for the Carrizo-Wilcox model was included in the last three years of the 2050 run ending with February 2050. Therefore, the year with drought-of-record conditions was selected as 2049. The simulation year selected for average conditions was 2045. It should be noted that in these budgets the recharge represents average conditions or drought-of-record conditions. However, the pumpage input during the predictive period is based on the Regional Water Planning Group predictions.

Aquifer Storage

The total volume of storage in Bee County for each layer in the Carrizo-Wilcox aquifer model is shown in Table 2. However, it should be noted that the water in the Carrizo-Wilcox aquifer at the depths found in Bee County is likely to be brackish to saline (Deeds and others, 2003; Figure 2.15).

2050 Drawdown

Predicted water-level declines from 2000 to 2050 for the Carrizo and Lower Wilcox aquifers are shown in Figures 1 and 2, respectively. In Figures 1 and 2 positive numbers indicate water level decline and negative numbers indicate water level rebound.

REFERENCES:

Deeds, N., Kelley, V., Fryar, D., and Jones, T., 2003, Groundwater Availability Model for the Southern Carrizo-Wilcox Aquifer: Final Report prepared for the Texas Water Development Board.

Meyers, B. N. and Dale, O. C., 1966, Ground-Water Resources of Bee County, Texas: Texas Water Development Board Report 17, 101 p..

Table 1. Bee County flow budget for the Southern Carrizo-Wilcox aquifer model in acre-feet per year.

Aquifer	Lyr	Storage	X-flow in	X-flow out	upper		lower		Wells	Recharge	ET	GHB	Streams	Total		% diff
					Z flow in	Z flow out	Z flow in	Z flow out						In	Out	
Average Recharge Conditions																
Carrizo-Wilcox	1	-37	270	-366	0	0	113	-1	-86	0	0	106	0	490	-490	0
	2	-33	85	-88	1	-113	149	0	0	0	0	0	0	234	-234	0
	3	-21	370	-198	0	-149	0	-3	0	0	0	0	0	370	-370	0
	4	-17	16	-8	3	0	6	0	0	0	0	0	0	25	-25	0
	5	-30	25	-12	0	-6	23	0	0	0	0	0	0	49	-49	0
	6	-115	273	-135	0	-23	0	0	0	0	0	0	0	273	-273	0
	All	-253	1,040	-807	4	-292	292	-4	-86	0	0	106	0	1,442	-1,442	0
Drought Conditions																
Carrizo-Wilcox	1	-24	261	-365	0	0	114	0	-87	0	0	101	0	476	-476	0
	2	-20	80	-87	0	-114	141	0	0	0	0	0	0	221	-221	0
	3	-9	348	-199	0	-141	1	-1	0	0	0	0	0	350	-350	0
	4	-12	15	-9	1	-1	6	0	0	0	0	0	0	22	-22	0
	5	-31	25	-12	0	-6	24	0	0	0	0	0	0	49	-49	0
	6	-114	273	-135	0	-24	0	0	0	0	0	0	0	273	-273	0
	All	-209	1,001	-807	1	-286	286	-1	-87	0	0	101	0	1,390	-1,390	0

Notes:

1. Layer 1: Queen City aquifer
2. Layer 2: Reklaw unit
3. Layer 3: Carrizo aquifer
4. Layer 4: Upper Wilcox aquifer
5. Layer 5: Middle Wilcox aquifer
6. Layer 6: Lower Wilcox aquifer
7. All: sum of layers 1,2, 3, 4, 5, and 6
8. **GHB** refers to flow into or out of the top of the Queen City.
9. **ET** refers to groundwater extraction due to evapotranspiration.
10. **Reserv. Leakage** Refers to leakage from reservoirs (or lakes) into groundwater or from groundwater into reservoirs.
11. **X-flow in** refers to lateral flow into the county.
12. **X-flow out** refers to lateral flow out of the county.

13. **upper - Z-flow in** refers to flow into the layer from the layer above.
14. **upper - Z-flow out** refers to flow out of the layer into the layer above.
15. **lower - Z-flow in** refers to flow into the layer from the layer below.
16. **lower - Z-flow out** refers to flow out of the layer into the layer below.
17. **Wells** is for pumping input.
18. A negative sign refers to flow out of the layer in the county.
19. A positive sign refers to flow into the layer in the county.
20. The numbers are rounded to the nearest 1 acre-ft.

Table 2. Total aquifer storage based on Southern Carrizo-Wilcox Groundwater Availability Model

Layer	Average Thickness feet	Total Area (mi²)	Total Storage acre-ft
1	1076	77	12,844,000
2	882	77	10,523,000
3	655	77	7,813,000
4	396	77	4,729,000
5	704	77	8,407,000
6	1899	77	22,661,000
Total			66,978,000

Note:

Layer 1: Queen City aquifer

Layer 2: Reklaw unit

Layer 3: Carrizo aquifer

Layer 4: Upper Wilcox aquifer

Layer 5: Middle Wilcox aquifer

Layer 6: Lower Wilcox aquifer

Total storage rounded to the nearest 1,000 acre-ft

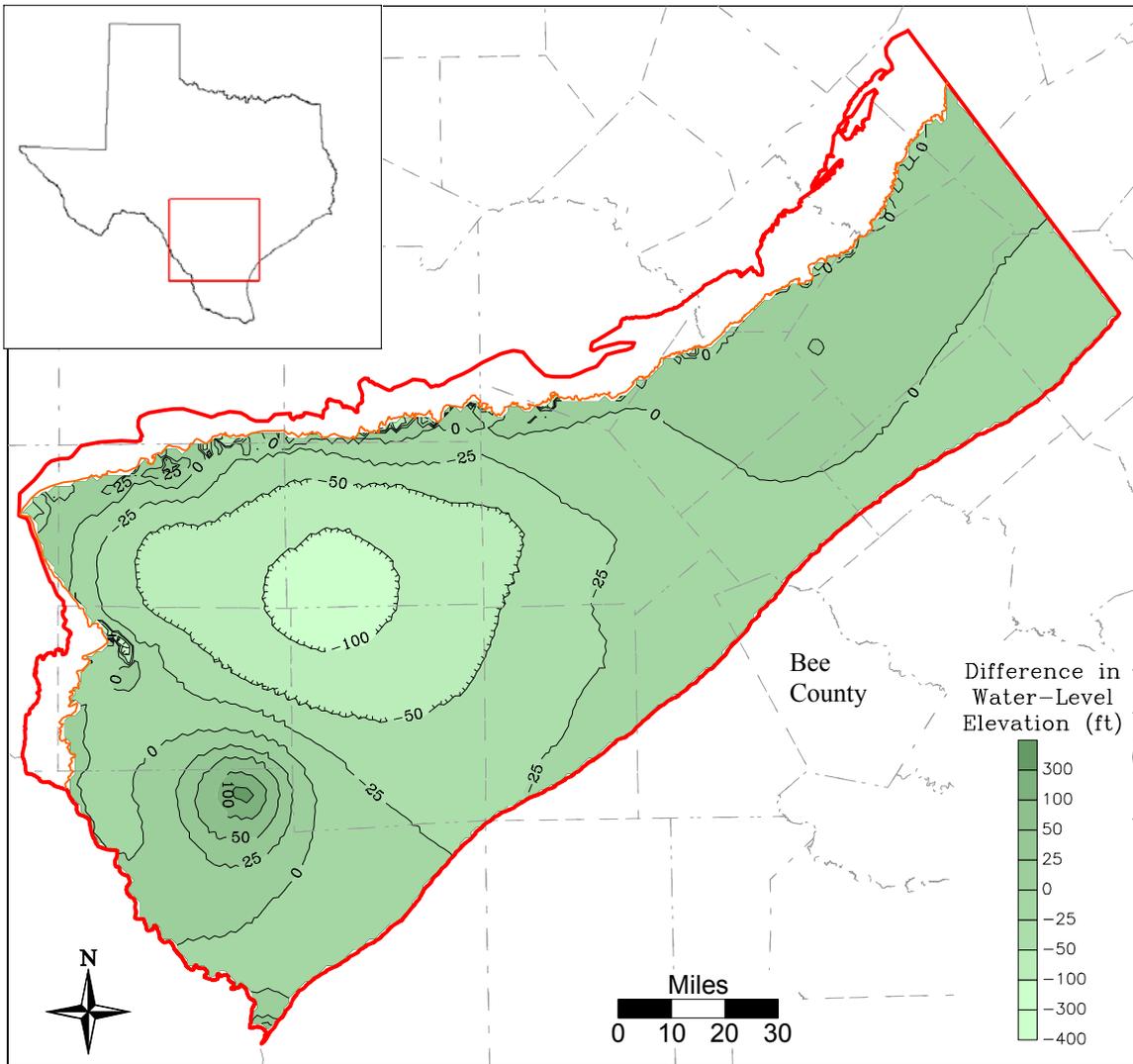


Figure 1. Model calculated water-level changes in the Carrizo aquifer between 2000 and 2050. Positive numbers refer to decline in feet, negative numbers refer to increase in feet. (Deeds and others, 2003; Figure 10.2.4)

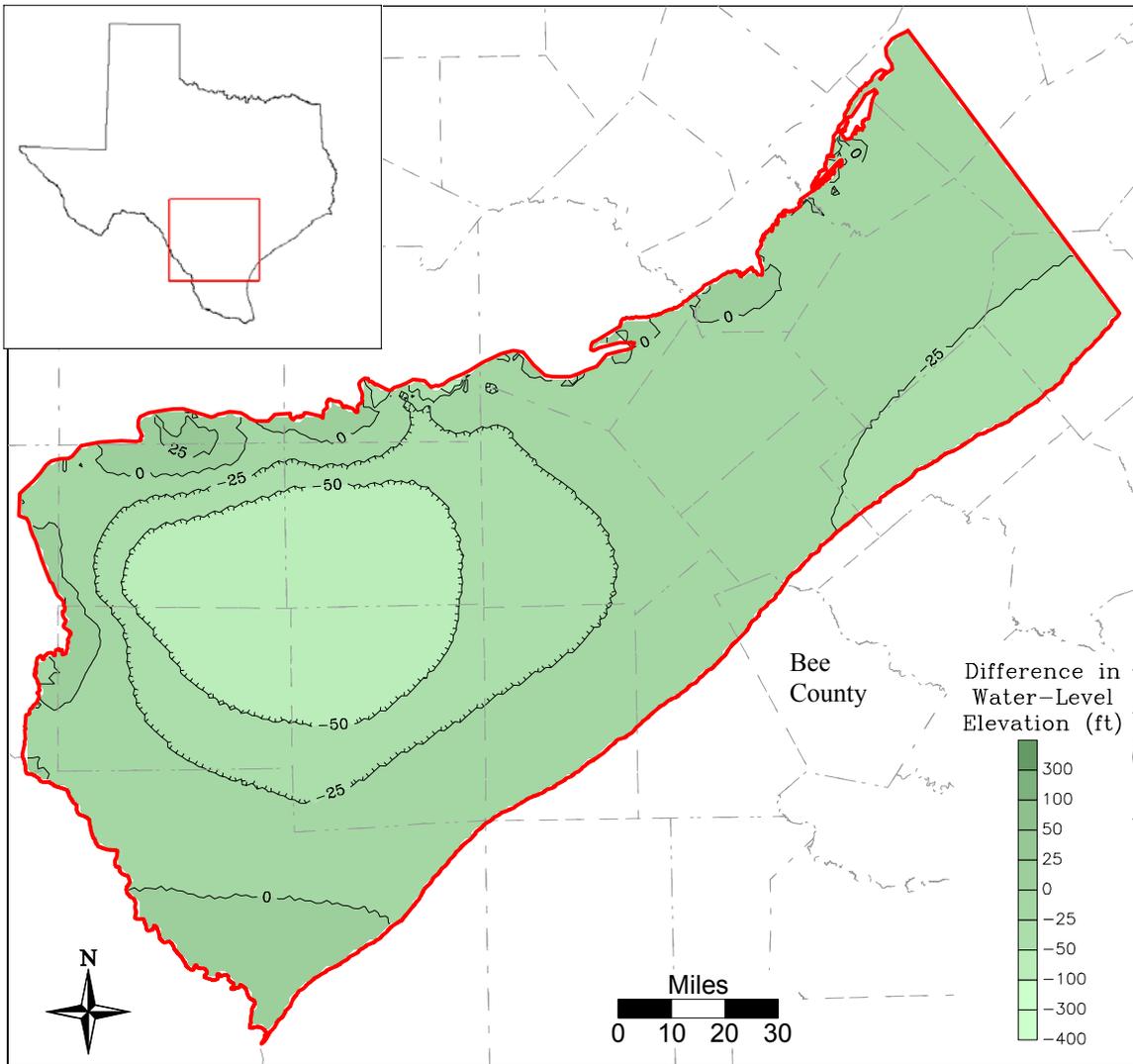


Figure 2. Model calculated water-level changes in the Lower-Wilcox aquifer between 2000 and 2050. Positive numbers refer to decline in feet, negative numbers refer to increase in feet. (Deeds and others, 2003; Figure 10.2.10)