

GAM run 06-21

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Texas Water Development Board
Groundwater Availability Modeling Section
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EXECUTIVE SUMMARY:

A 51-year predictive model run was done with the groundwater availability model (GAM) for the northern part of the Gulf Coast Aquifer to evaluate the amount of pumpage that resulted in a desired future condition (DFC) of “sustainability”, or zero water level declines, in the Lower Trinity Groundwater Conservation District (GCD). Using the 1999 estimated historic pumpage as the baseline pumpage, it was determined that even when only using this rate of pumpage, water levels declined in the aquifers of interest. Therefore, even with no additional pumpage above what was estimated to be produced from these aquifers in 1999, “sustainability” or zero water level declines, could not be achieved.

REQUESTOR:

Mr. John Stover, Lower Trinity GCD.

DESCRIPTION OF REQUEST:

Mr. Stover requested that we provide a model run with a desired future condition of “sustainability” in the Lower Trinity GCD (Figure 1) using the GAM for the northern part of the Gulf Coast Aquifer (Kasmarek and Robinson, 2004; Kasmarek and others, 2005). The district defined sustainability as maintaining present water levels (Figures 1 through 3).

METHODS:

To develop a baseline, we ran the model from 1999 to 2050 using 1999 pumping rates for each year (Table 1). We are aware of the Harris-Galveston County Subsidence District’s Regulatory Plan that has been developed through the year 2030 with an overall goal to reduce groundwater withdrawal to no more than 20 percent of total water demand. That scenario was not included in this model run. We produced maps of water levels and drawdowns in the Chicot, Evangeline, and Jasper aquifers for the years 1999, 2010, 2030 and 2050 to evaluate how current pumpage rates might affect the aquifers in the future. Since the Burkeville Formation is considered a confining unit, we did not analyze this layer of the model. We calculated drawdowns by subtracting the simulated water levels from 1999 water levels, which were calibrated to measured values.

PARAMETERS AND ASSUMPTIONS:

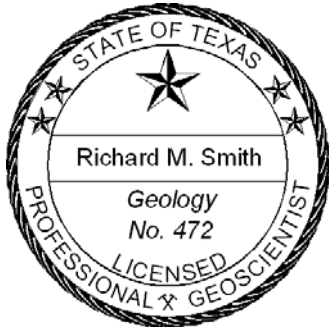
- For detailed discussion on assumptions and limitations of the northern part of the Gulf Coast Aquifer GAM, refer to Kasmarek and Robinson (2004) and Kasmarek and others (2005).
- We assumed pumping remained at 1999 levels. We also used 1999 water levels as the sustainable target water levels during our analysis. We are aware of the Harris-Galveston Subsidence District's Regulatory Plan that has been developed through the year 2030 with an overall goal to reduce groundwater withdrawal to no more than 20 percent of total water demand. However, that scenario was not included in this model run.
- The model includes four layers, representing the Chicot aquifer (Layer 1), the Evangeline aquifer (Layer 2), the Burkeville confining unit (Layer 3), and the Jasper aquifer (Layer 4).
- Quality of model calibration can be estimated using root mean square (RMS) error. RMS error evaluates differences between measured and simulated water levels in the wells considered for calibration. The RMS error is 31 feet for the Chicot aquifer, 45 feet for the Evangeline aquifer, and 38 feet for the Jasper aquifer for the calibration year 2000.

RESULTS:

The model suggests that groundwater levels will continue to decline during the 51-year predictive period throughout the entire district and surrounding counties when using the 1999-estimated pumpage. This means that even if current pumpage levels continue for the next 50 years within the district, water levels appear to decline due to pumpage from outside the district. Therefore, "sustainability" as defined by the district cannot occur, unless the present amount of pumpage within the district is reduced, without altering pumpage in areas outside the district within the groundwater management area. This is further illustrated by Figures 5 through 13, which show the amounts of drawdown for 2010, 2030, and 2050 using 1999 as the base year.

REFERENCES:

- Kasmarek , M. C., and Robinson, J. L., 2004, Hydrogeology and simulation of groundwater flow and land-surface subsidence in the northern part of the Gulf Coast aquifer system, Texas: U.S. Geological Survey Scientific Investigations Report 2004-5102, 111p.
- Kasmarek , M. C., Reece, B. D., and Houston, N. A., 2005, Evaluation of groundwater flow and land-surface subsidence caused by hypothetical withdrawals in the northern part of the northern part of the Gulf Coast aquifer system, Texas: U.S. Geological Survey Scientific Investigations Report 2005-5024, 70p.



The seal appearing on this document was authorized by Richard M. Smith, P.G. on October 12, 2006

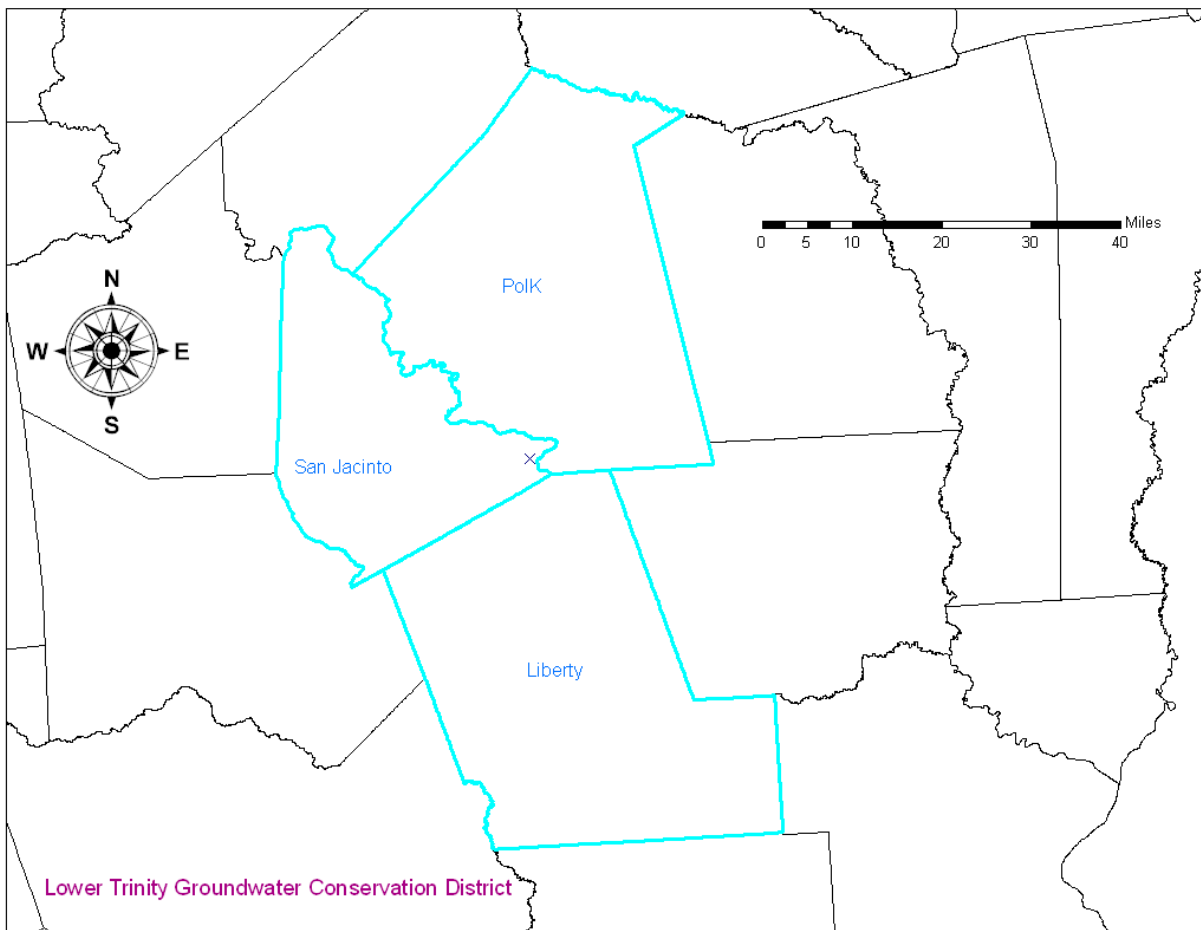


Figure 1: Location map of the Lower Trinity GCD

Table 1: 1999 pumpage from all counties within the Lower Trinity GCD and from surrounding counties. Values are reported in acre-feet per year.

County	Polk	San Jacinto	Liberty	Trinity	Angelina	Tyler
Chicot	0	0	864	0	0	0
Evangeline	435	647	6,492	0	0	686
Burkville	42	154	0	0	0	11
Jasper	2,974	711	463	154	154	1,697
County	Hardin	Jefferson	Chambers	Harris	Montgomery	Walker
Chicot	8,786	2,700	3,664	101,649	202	0
Evangeline	4,451	92	1,694	364,041	14,287	5
Burkville	174	0	0	0	1	0
Jasper	0	0	0	0	8,247	2,211

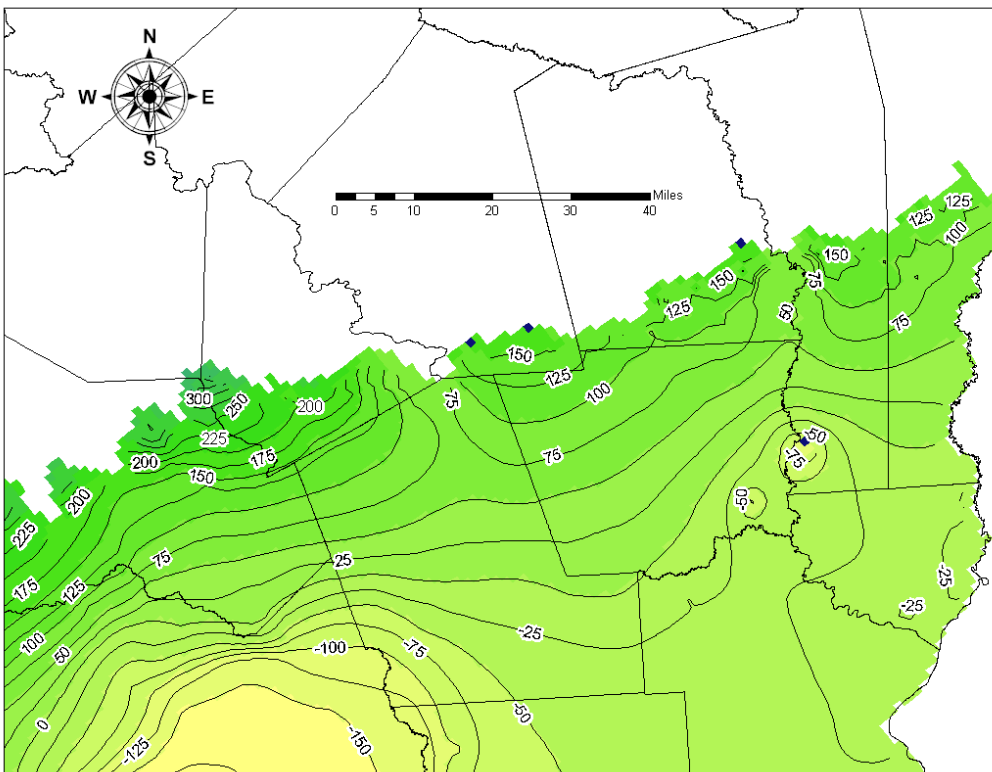


Figure 2: Water levels in 1999 for the Chicot aquifer (layer 1) in the Lower Trinity GCD. Contour interval is 25 feet.

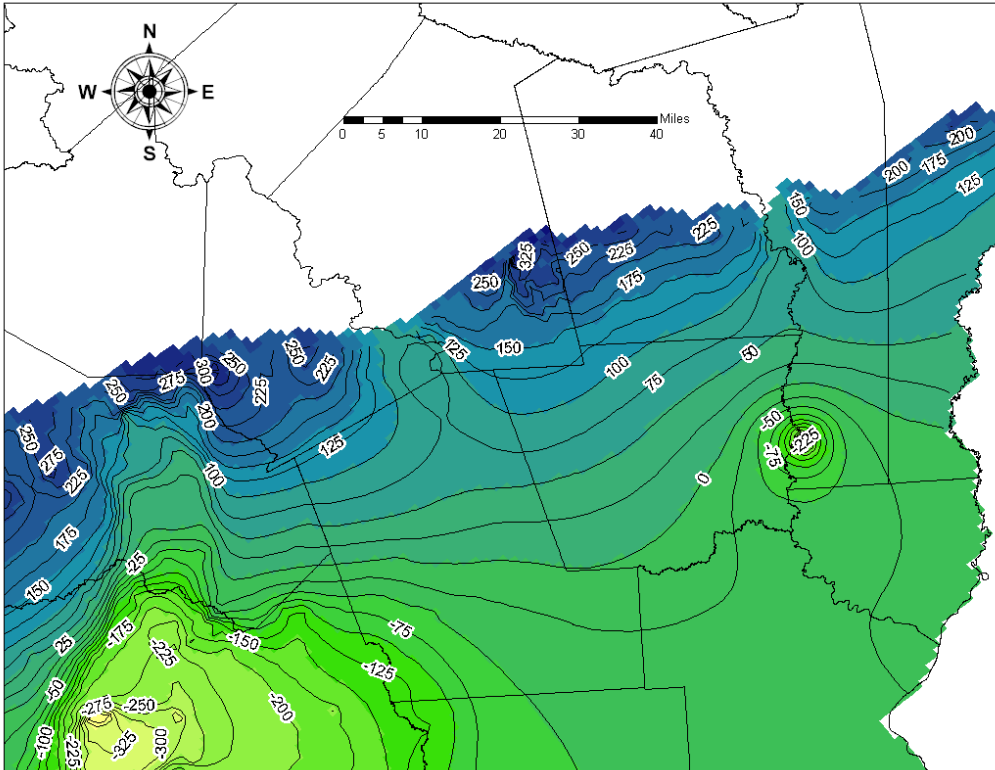


Figure 3: Water levels in 1999 for the Evangeline aquifer (layer 2). Contour interval is 25 feet.

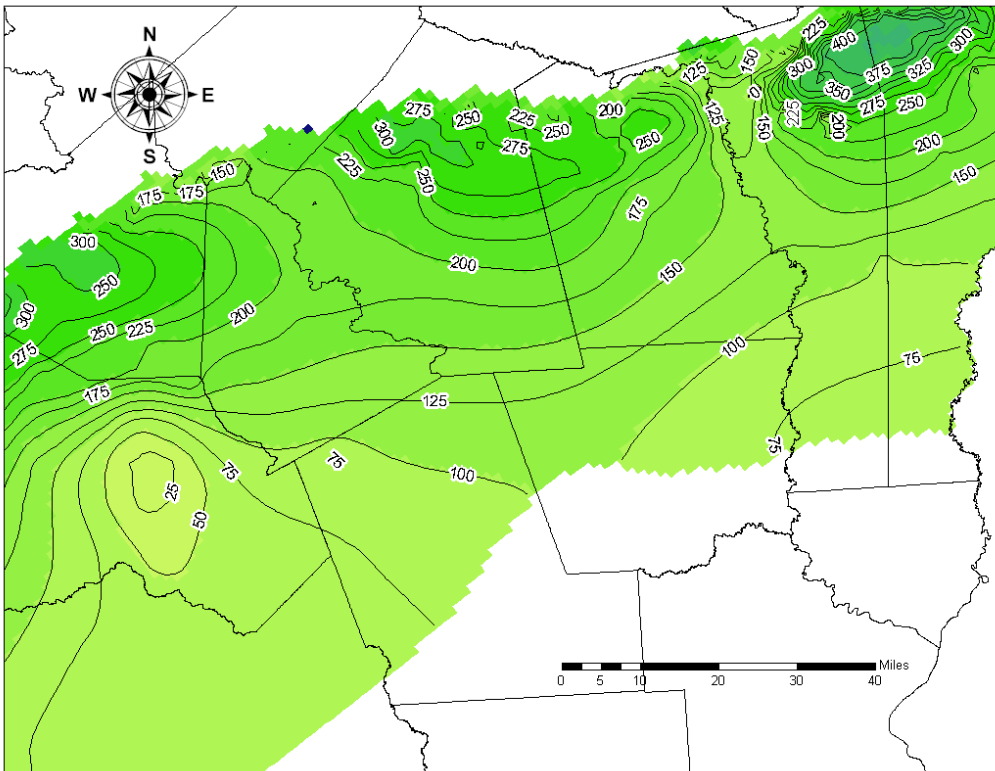


Figure 4: Water levels in 1999 for the Jasper aquifer (layer 4). Contour interval is 25 feet.

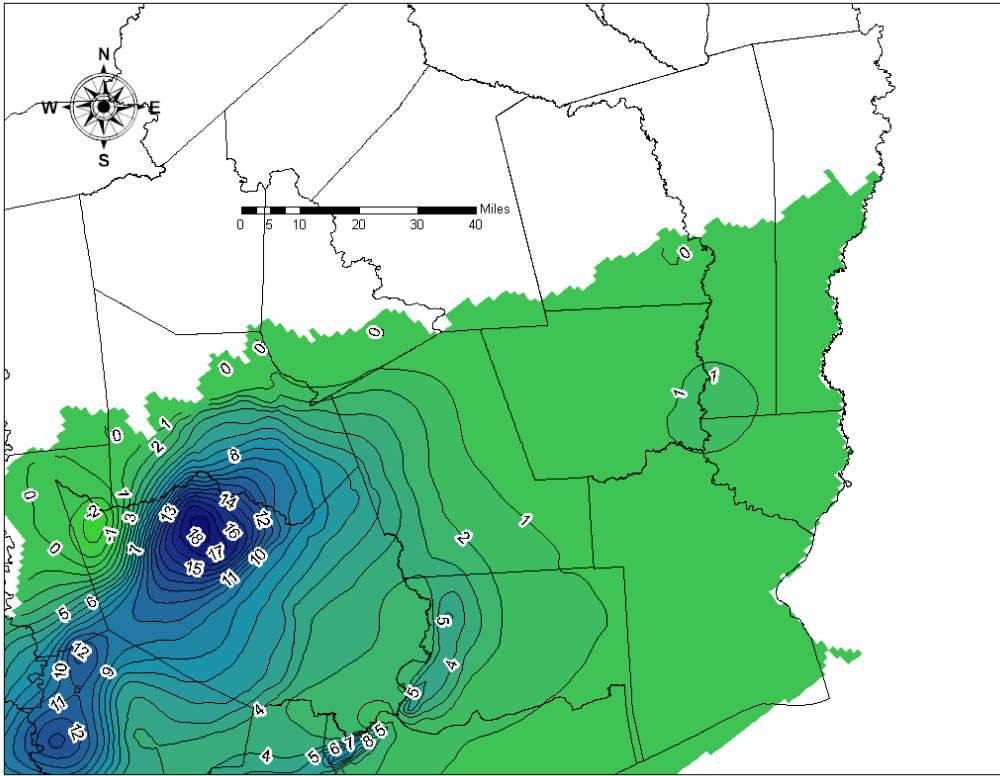


Figure 5: Drawdown in 2010 in the Chicot aquifer with continued 1999 pumping. Contour interval is 1 foot.

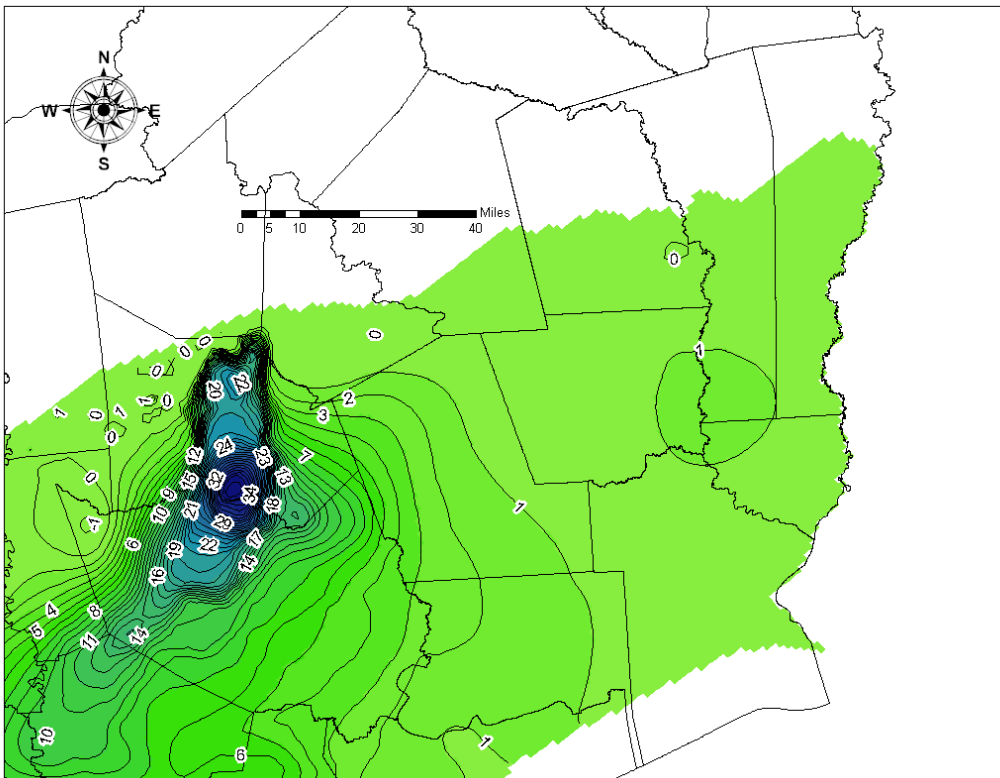


Figure 6: Drawdown in 2010 in the Evangeline aquifer with continued 1999 pumping. Contour interval is 1 foot.

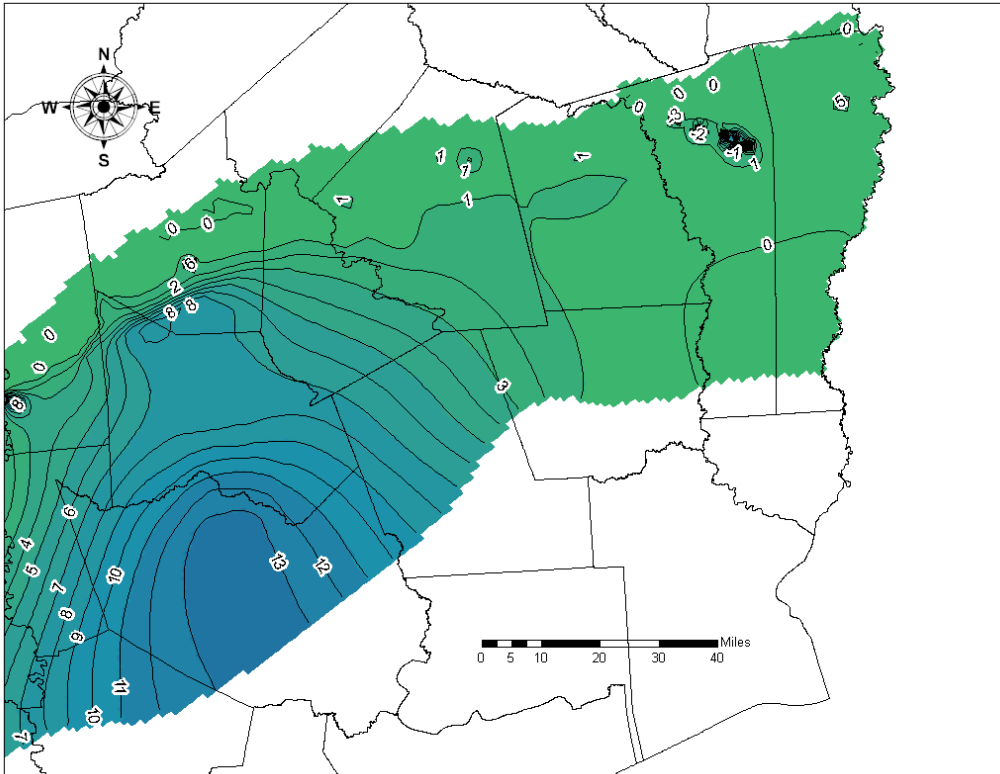


Figure 7: Drawdown in 2010 in the Jasper aquifer with continued 1999 pumping. Contour interval is 1 feet.

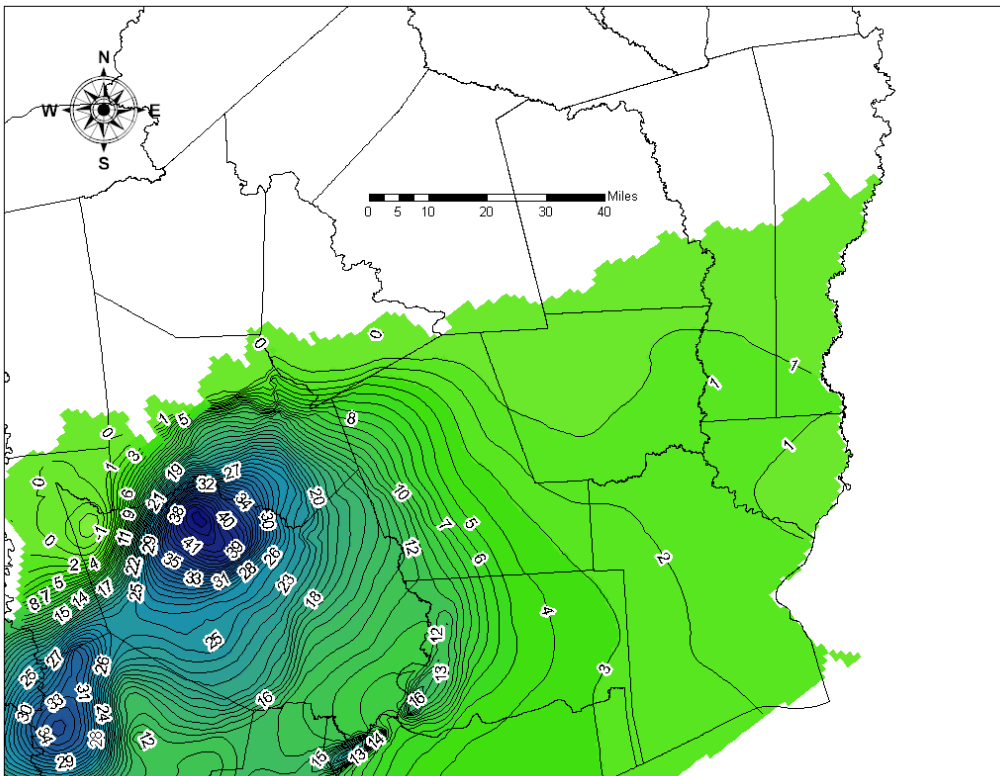


Figure 8: Drawdown in 2030 in the Chicot aquifer with continued 1999 pumping. Contour interval is 1 feet.

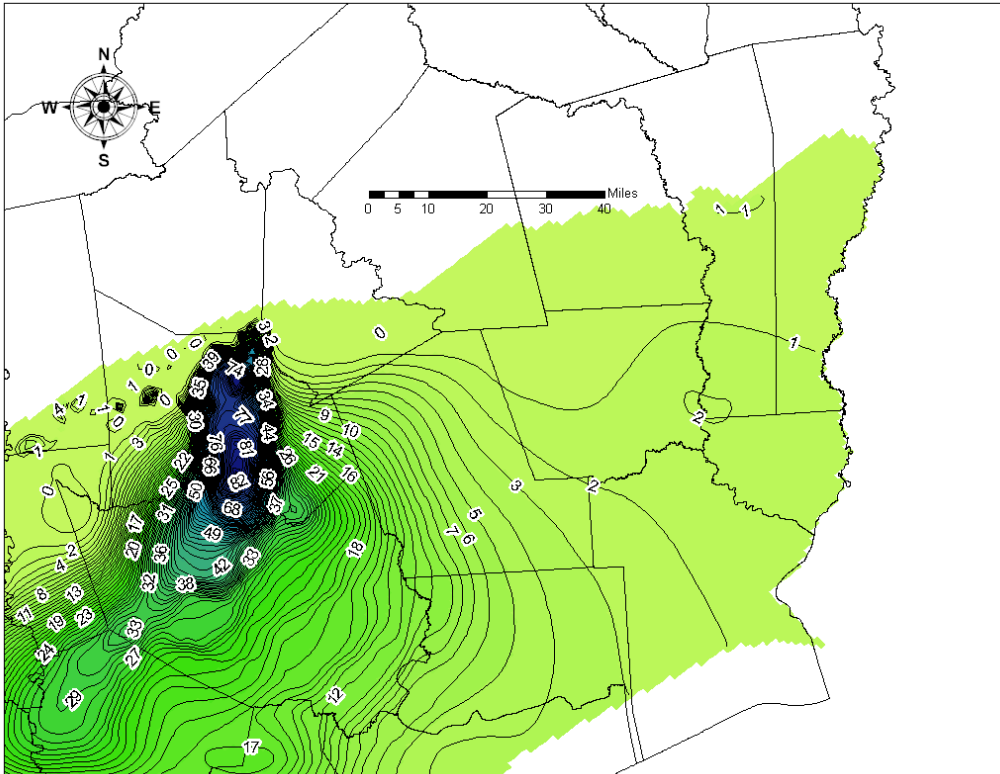


Figure 9: Drawdown in 2030 in the Evangeline aquifer with continued 1999 pumping. Contour interval is 1 feet.

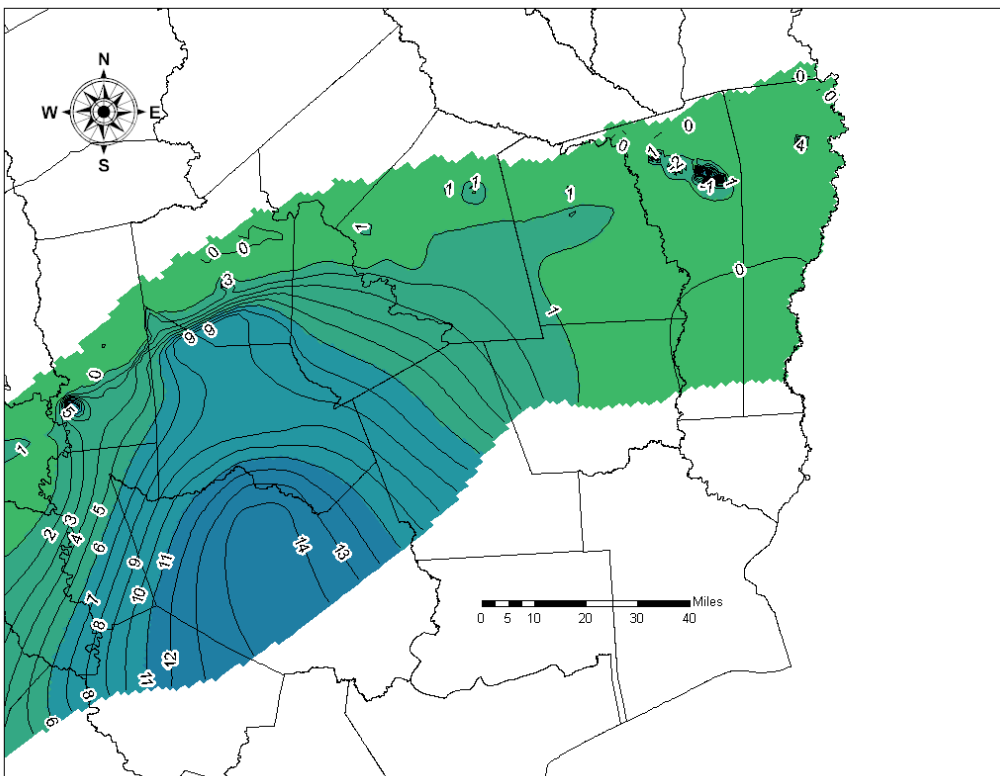


Figure 10: Drawdown in 2030 in the Jasper aquifer with continued 1999 pumping. Contour interval is 1 feet.

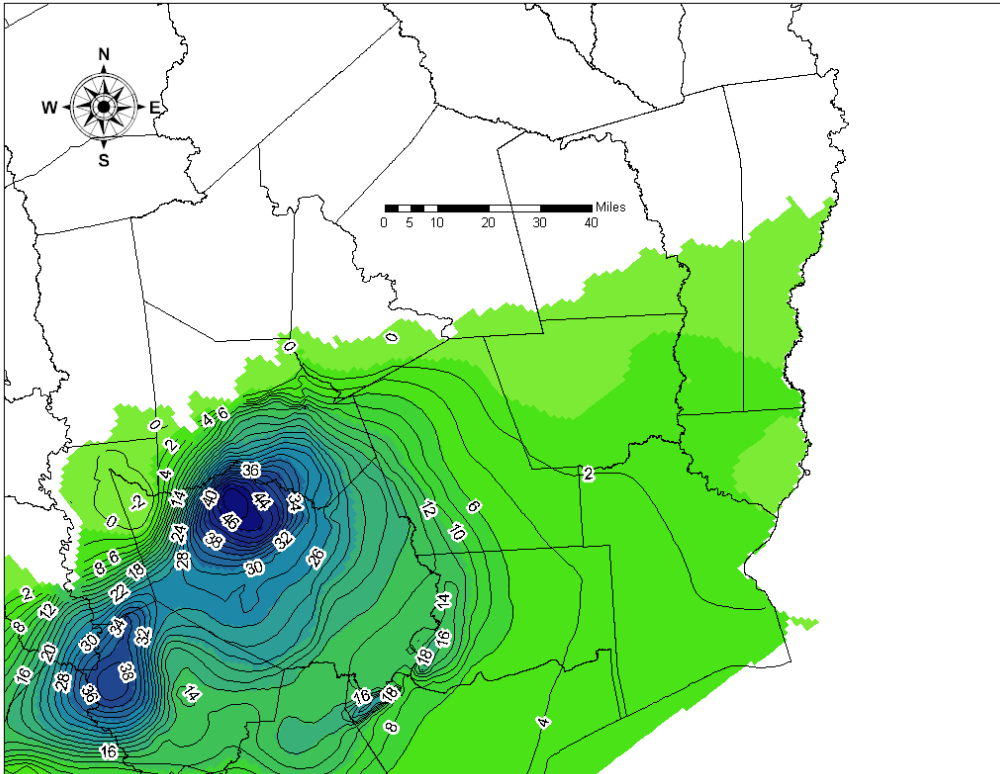


Figure 11: Drawdown in 2050 in the Chicot aquifer with continued 1999 pumping. Contour interval is 2 feet.

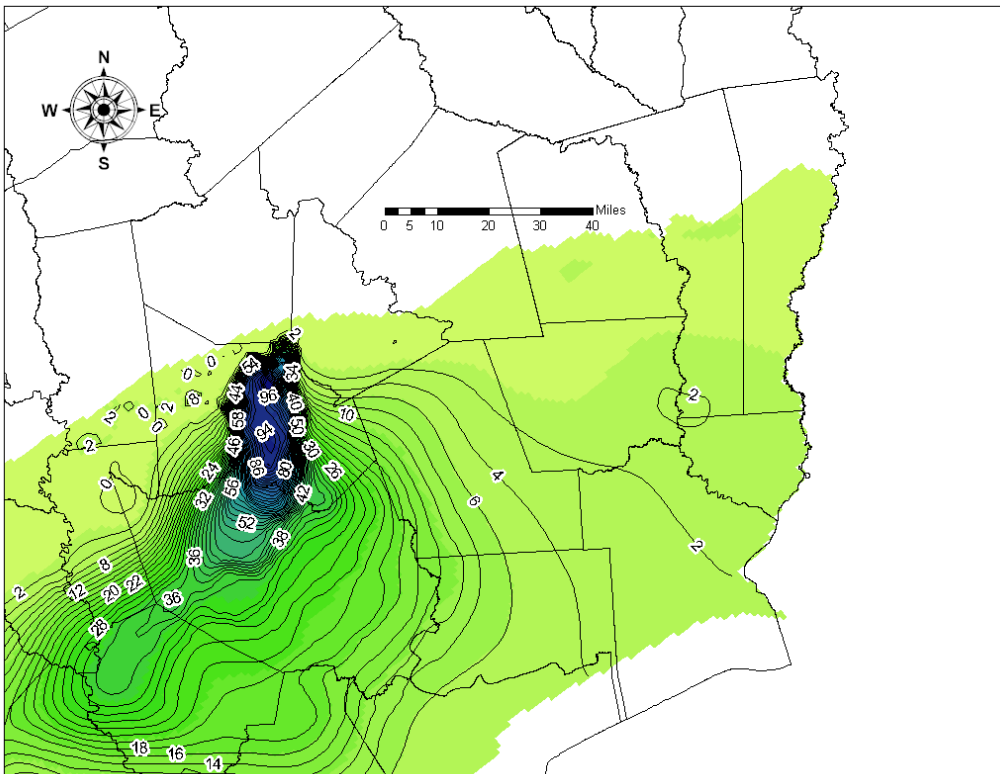


Figure 12: Drawdown in 2050 in the Evangeline aquifer with continued 1999 pumping. Contour interval is 2 feet.

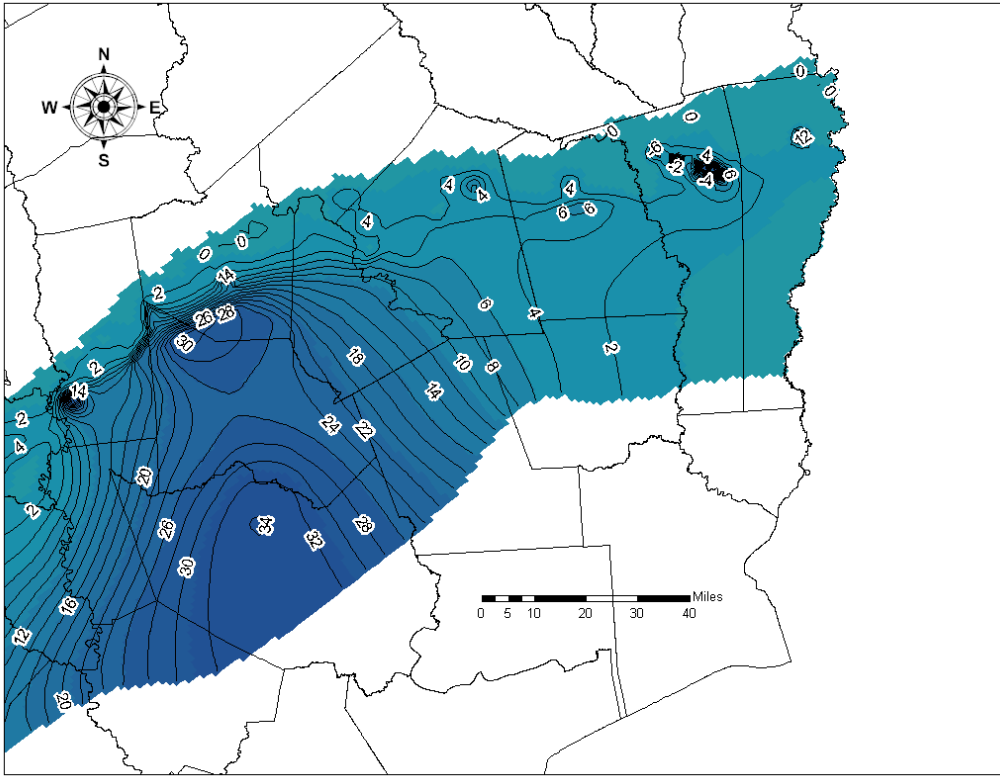


Figure 13: Drawdown in 2050 in the Jasper aquifer with continued 1999 pumping. Contour interval is 2 feet.