

# GAM run 06-20

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October 12, 2006

## **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 Southeast Texas 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, Southeast Texas Groundwater Conservation District (GCD), which is composed of Tyler, Hardin, Jasper, and Newton counties (Figure 1).

## **DESCRIPTION OF REQUEST:**

Mr. Stover requested that we provide a model run with a desired future condition of “sustainability” in the district using the groundwater availability model (GAM) for the northern part of the Gulf Coast Aquifer (Kasmarek and Robinson, 2004; Kasmarek and others, 2005). Sustainability as defined by the district is maintaining present water levels.

## **METHODS:**

To develop a baseline, we ran the model from 1999 to 2050 using 1999 pumping rates (Table 1) for each year. 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 affected the aquifers. 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 water levels that were calibrated to measured values in 1999.

## **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 and also used 1999 water levels as the sustainable target water levels. We are aware of the District's Regulatory Plan that has been developed for the period 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 results of the model runs are illustrated in Figures 2 through 13. These figures show that groundwater levels will continue to slightly decline in Tyler, Hardin, Jasper and Newton counties during the 51-year predictive period and decline more rapidly in surrounding counties assuming 1999 pumping levels. In order to maintain present water levels, pumping will need to be decreased. This is further illustrated by Figures 14 through 22 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.



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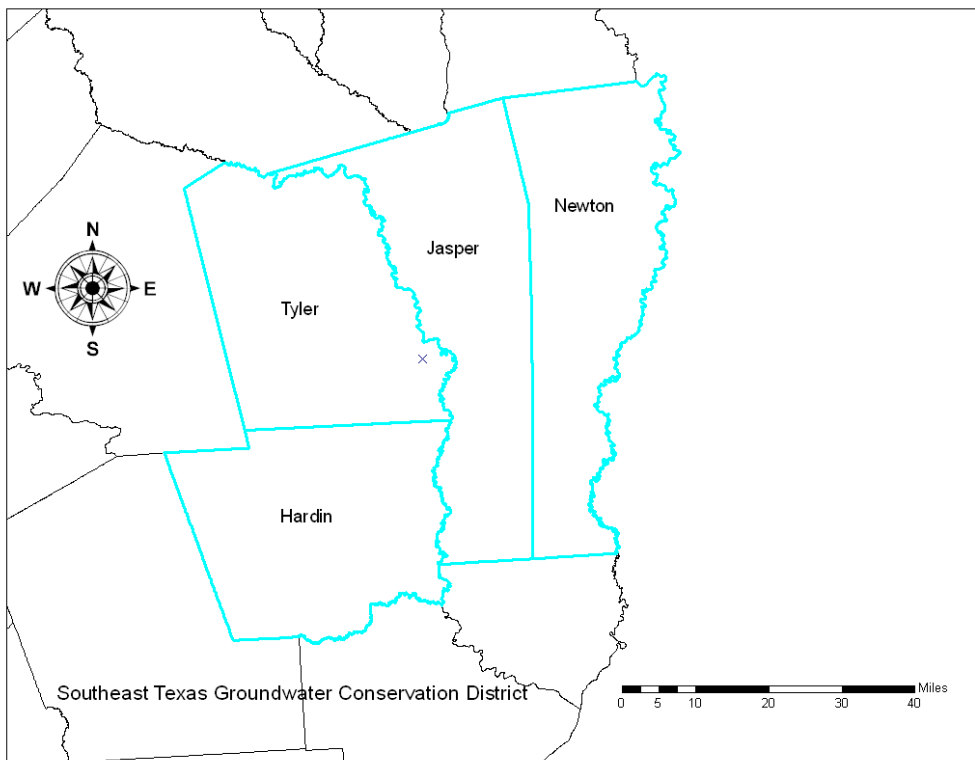


Figure 1: Location of the Southeast Texas GCD

Table 1: 1999 pumpage in acre-feet per year for the counties in the district and the surrounding counties

Aquifer	Newton	Jasper	Tyler	Hardin	Polk
Chicot	18	22,821	0	8,786	0
Evangeline	734	24,248	686	4,451	435
Burkville	0	0	11	174	42
Jasper	800	3,609	1,697	0	2,974

	Liberty	Jefferson	Orange	Angelina	
Chicot	864	2,700	19,392	0	
Evangeline	6,492	92	932	0	
Burkville	0	0	0	0	
Jasper	463	0	0	154	

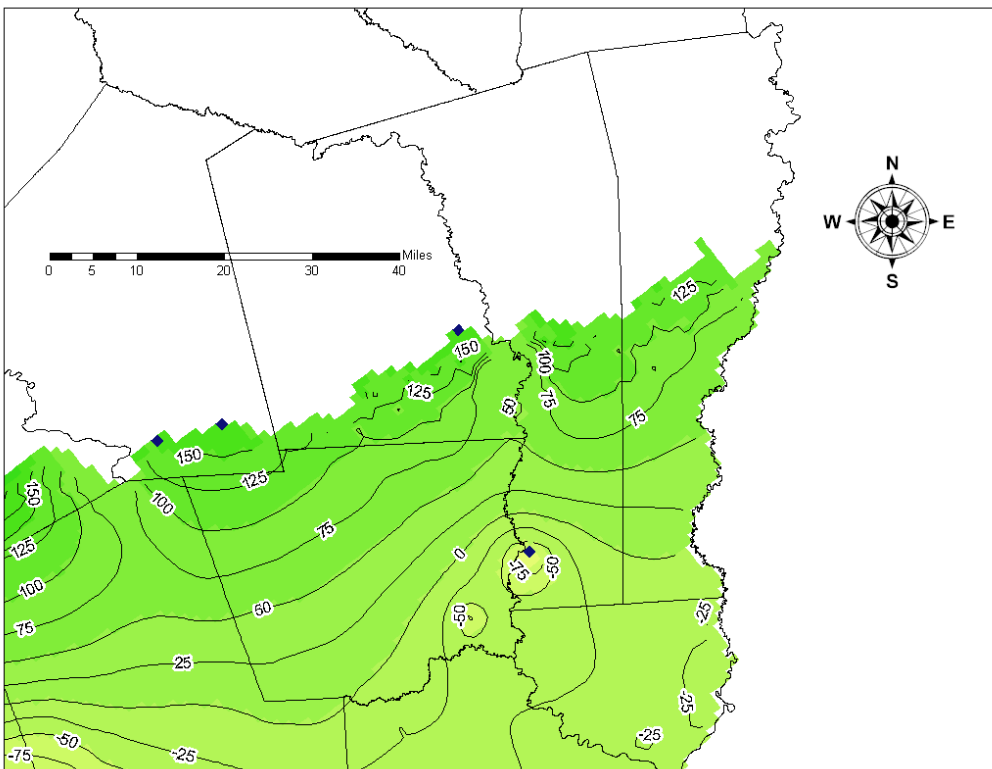


Figure 2: Water level map in 1999 for the Chicot aquifer (layer 1) in the Southeast Texas District. Contour interval is 25 feet.

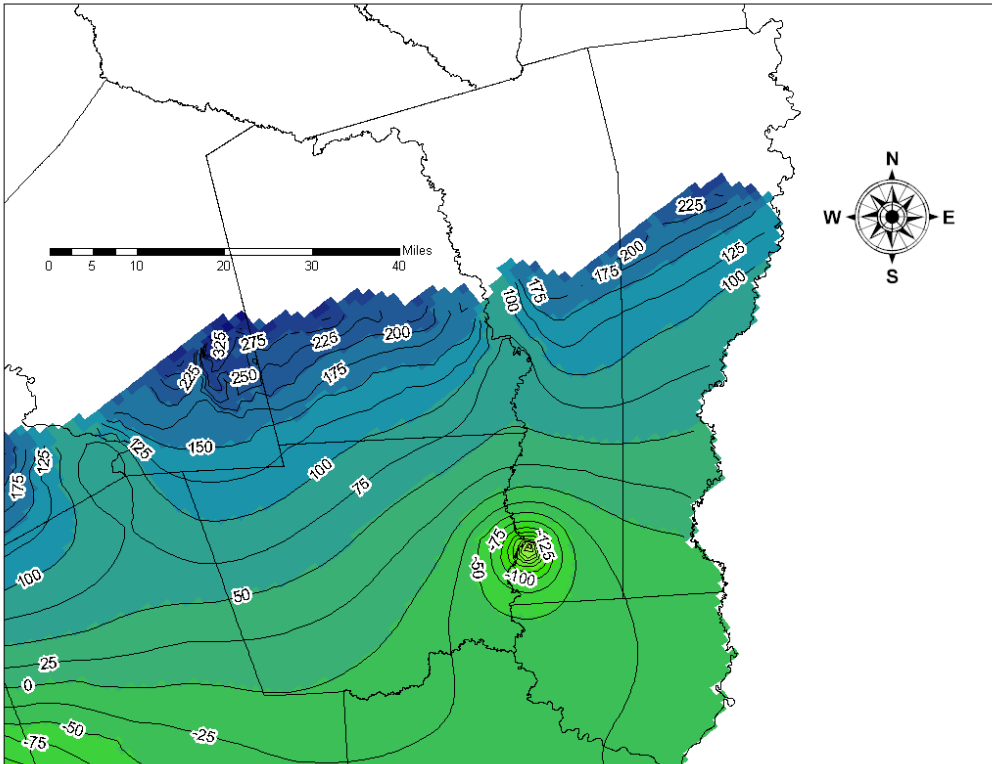


Figure 3: Water level map in 1999 for the Evangeline aquifer (layer 2). Contour interval is 25 feet.

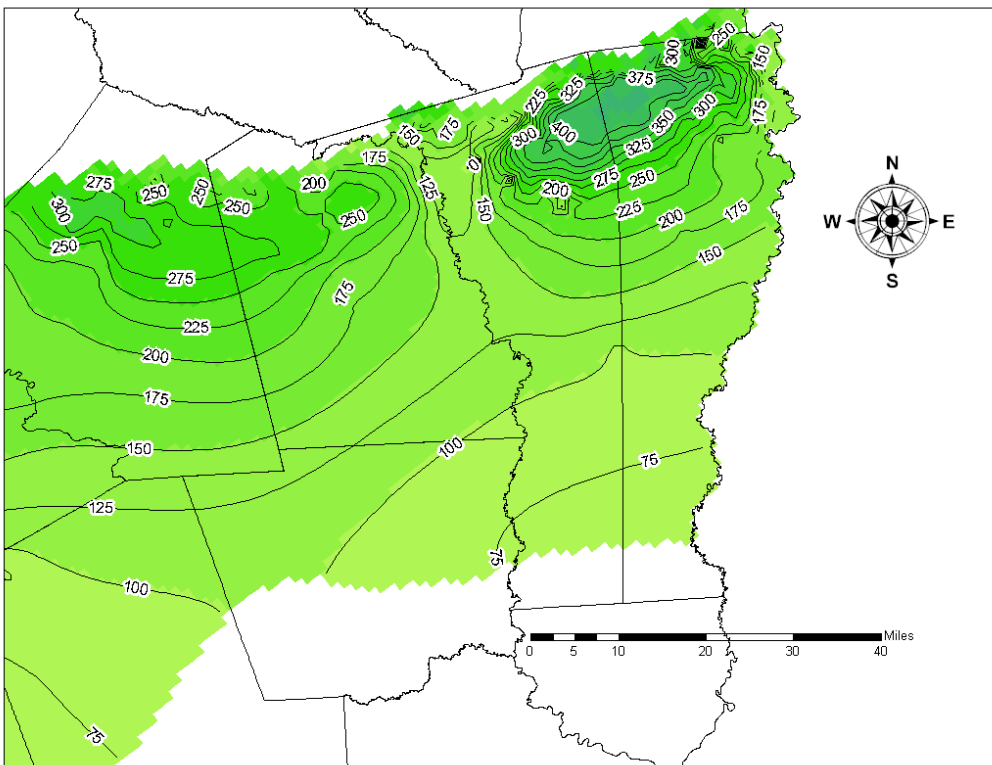


Figure 4: Water level map in 1999 for the Jasper aquifer (layer 4). Contour interval is 25 feet.

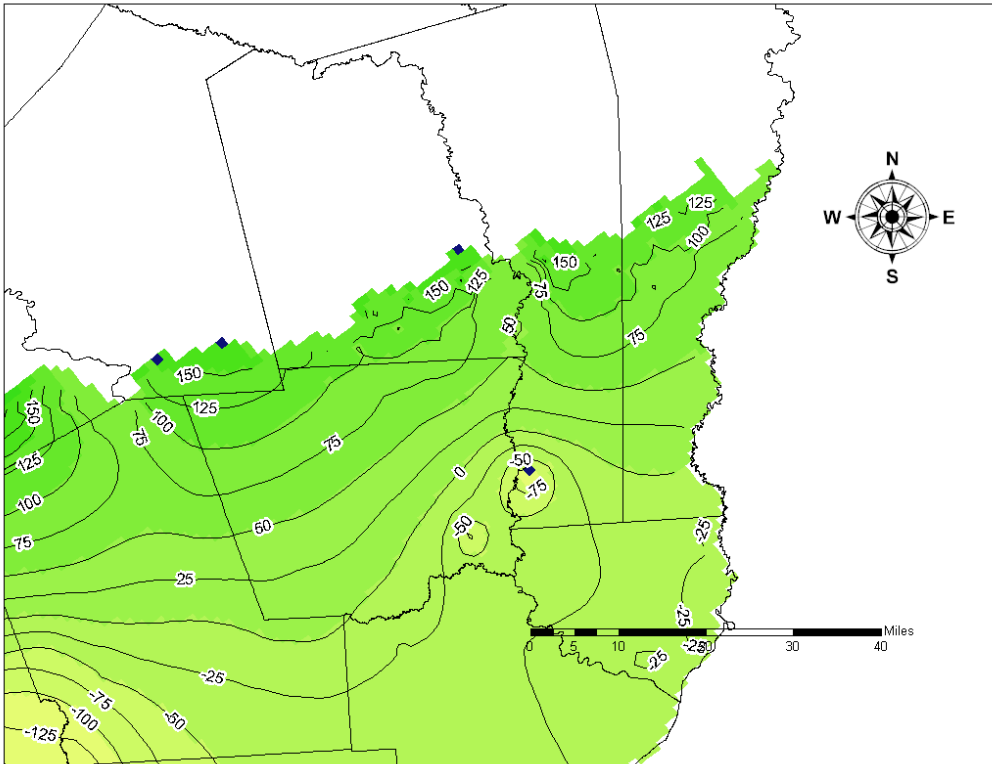


Figure 5: Water level map in 2010 for the Chicot aquifer (layer 1) with 1999 pumping. Contour interval is 25 feet.

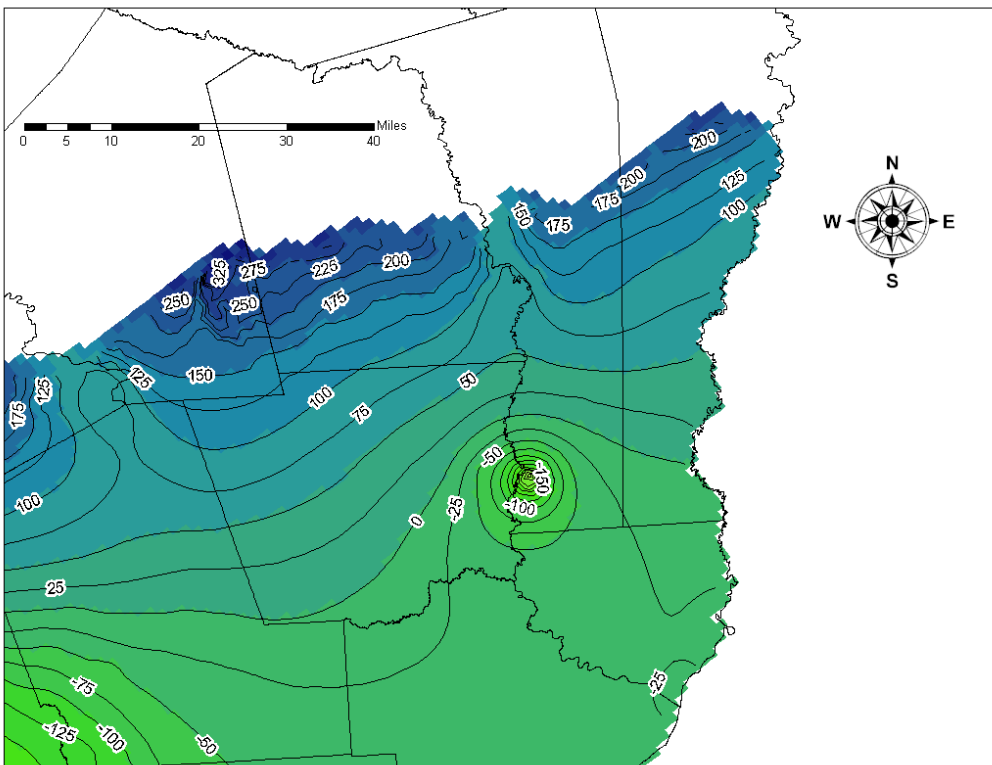


Figure 6: Water level map in 2010 for the Evangeline aquifer (layer 2) with 1999 pumping. Contour interval is 25 feet.

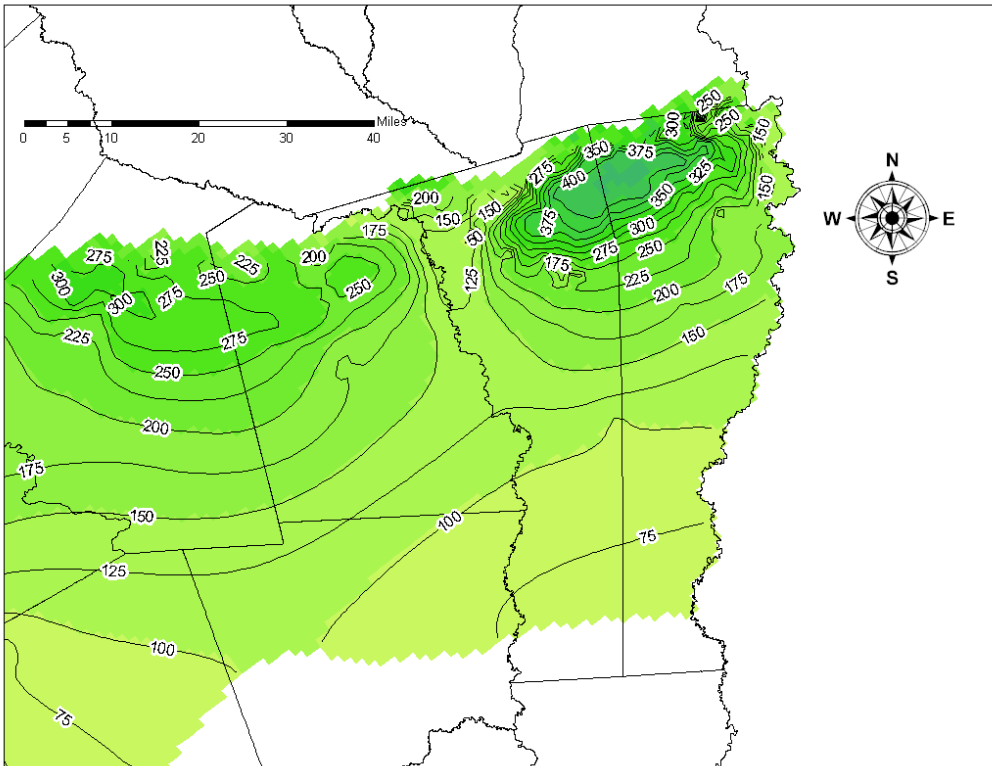


Figure 7: Water level map in 2010 for the Jasper aquifer (layer 4) with 1999 pumping. Contour interval is 25 feet.

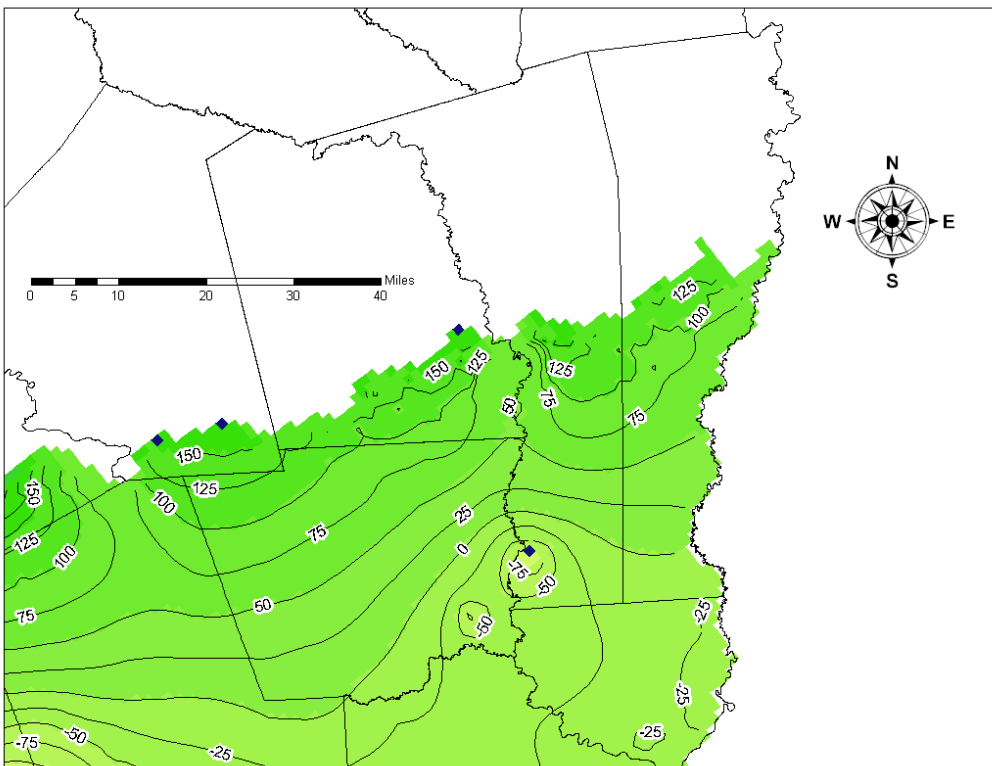


Figure 8: Water level map in 2030 for the Chicot aquifer (layer 1) with 1999 pumping. Contour interval is 25 feet.

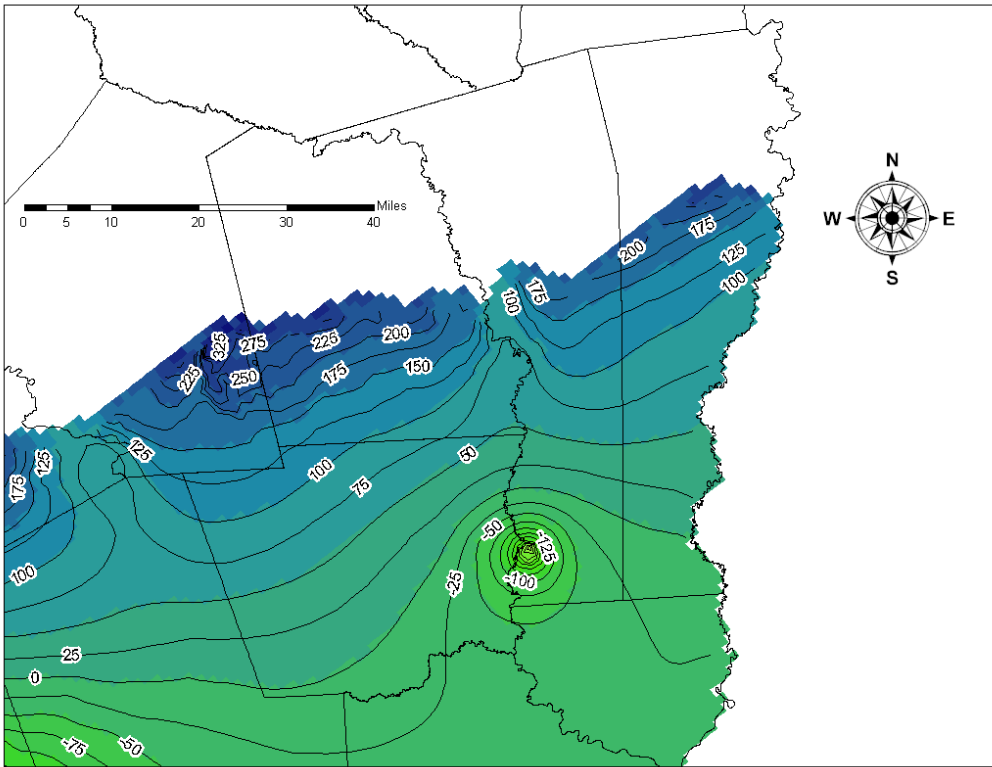


Figure 9: Water level map in 2030 for the Evangeline aquifer (layer 2) with 1999 pumping. Contour interval is 25 feet.

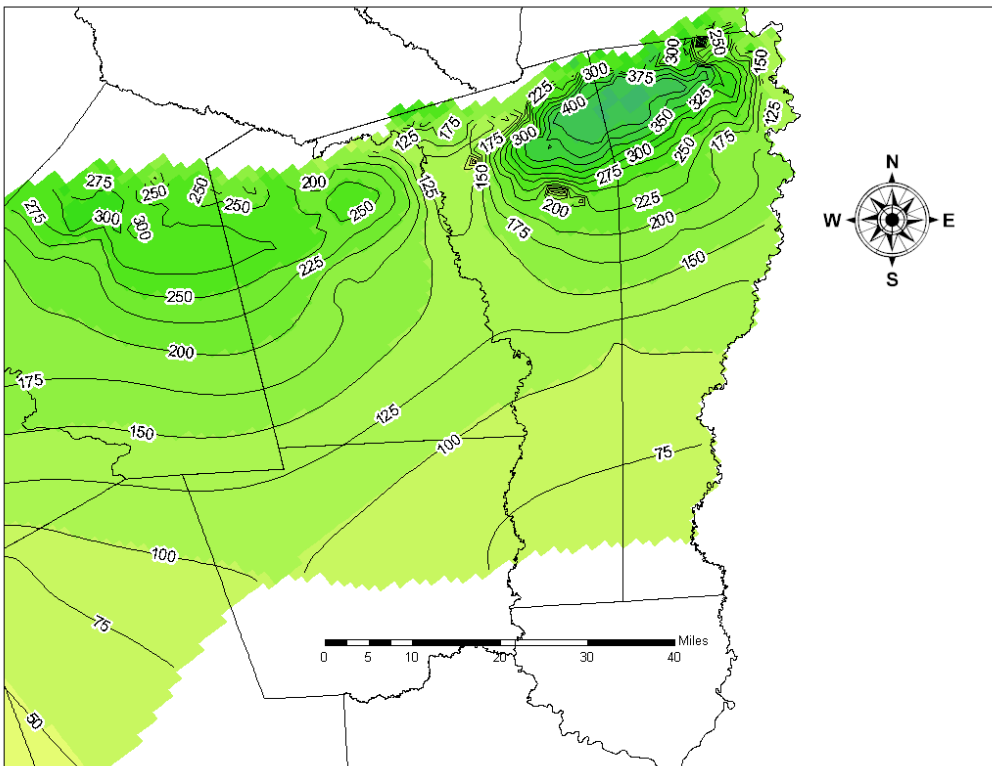


Figure 10: Water level map in 2030 for the Jasper aquifer (layer 4) with 1999 pumping. Contour interval is 25 feet.



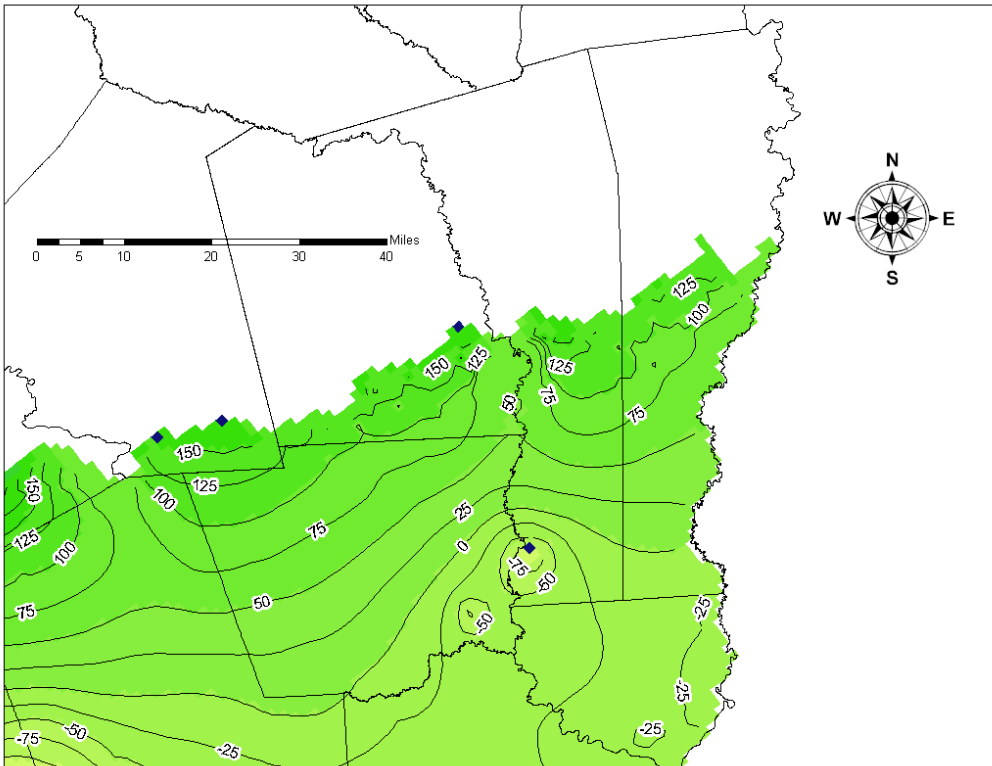


Figure 11: Water level map in 2050 for the Chicot aquifer (layer 1) with 1999 pumping. Contour interval is 25 feet.

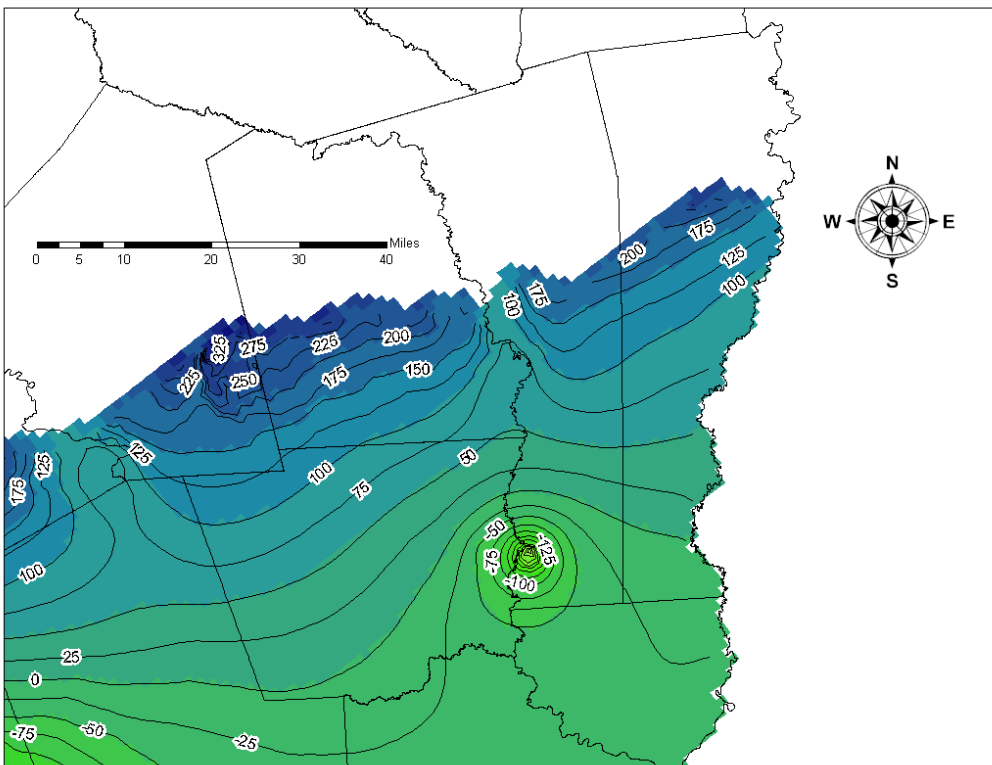


Figure 12: Water level map in 2050 for the Evangeline aquifer (layer 2) with 1999 pumping. Contour interval is 25 feet.

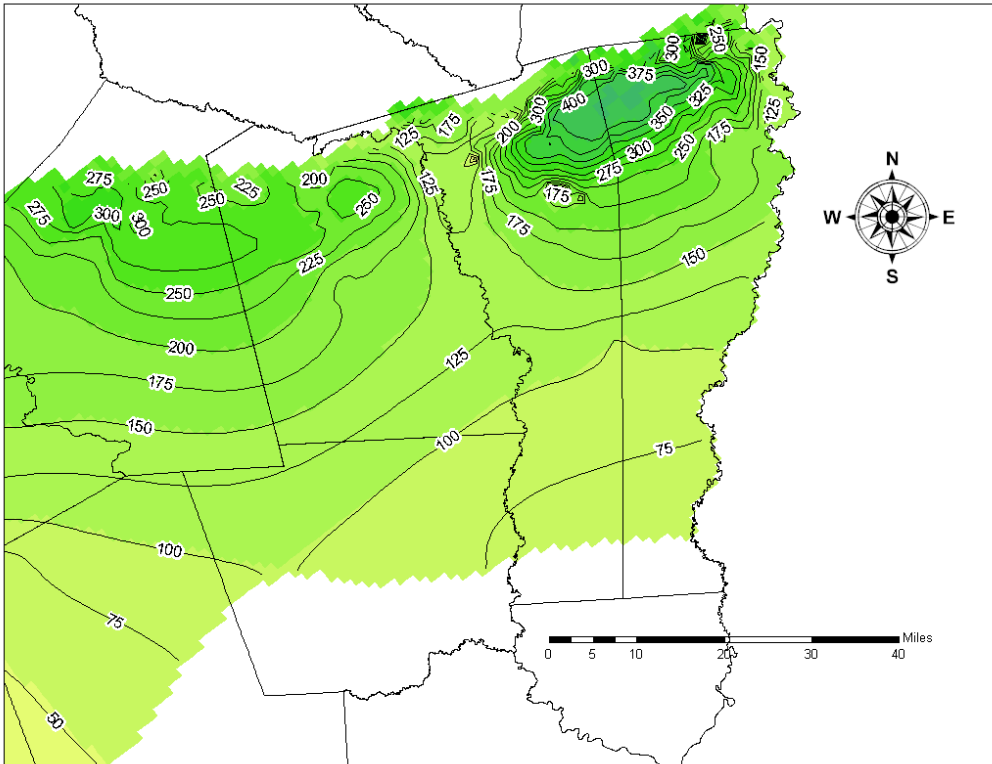


Figure 13: Water level map in 2050 for the Jasper aquifer (layer 4) with 1999 pumping. Contour interval is 25 feet.

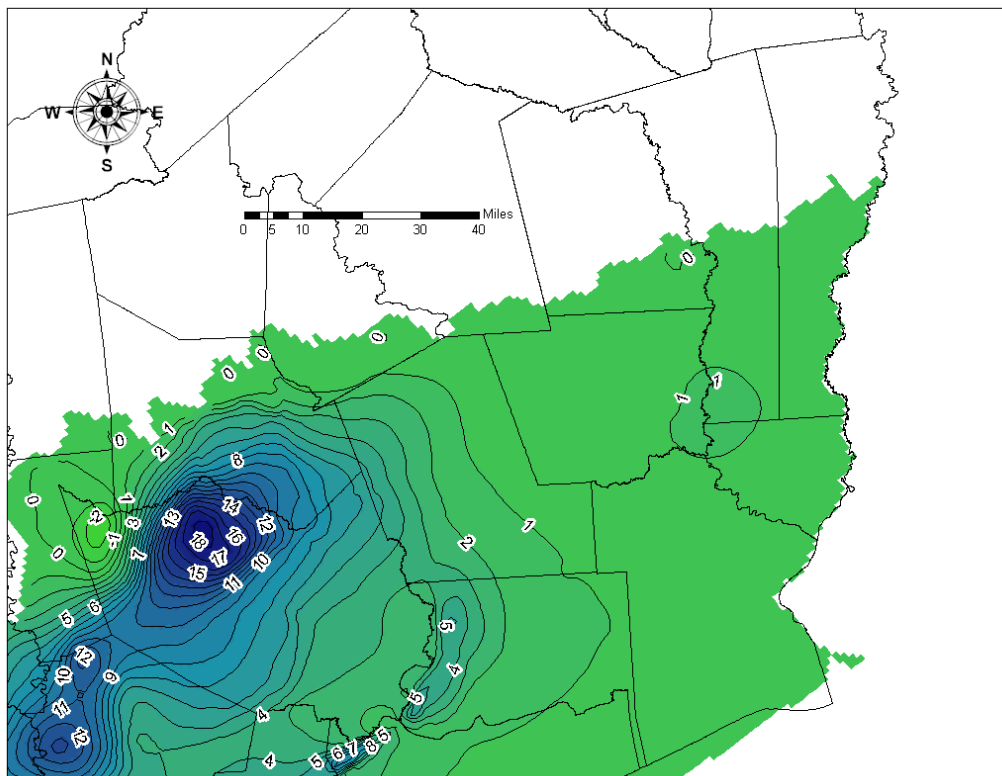


Figure 14: Drawdown in 2010 in the Chicot aquifer with continued 1999 pumping. Contour interval is 1 feet.

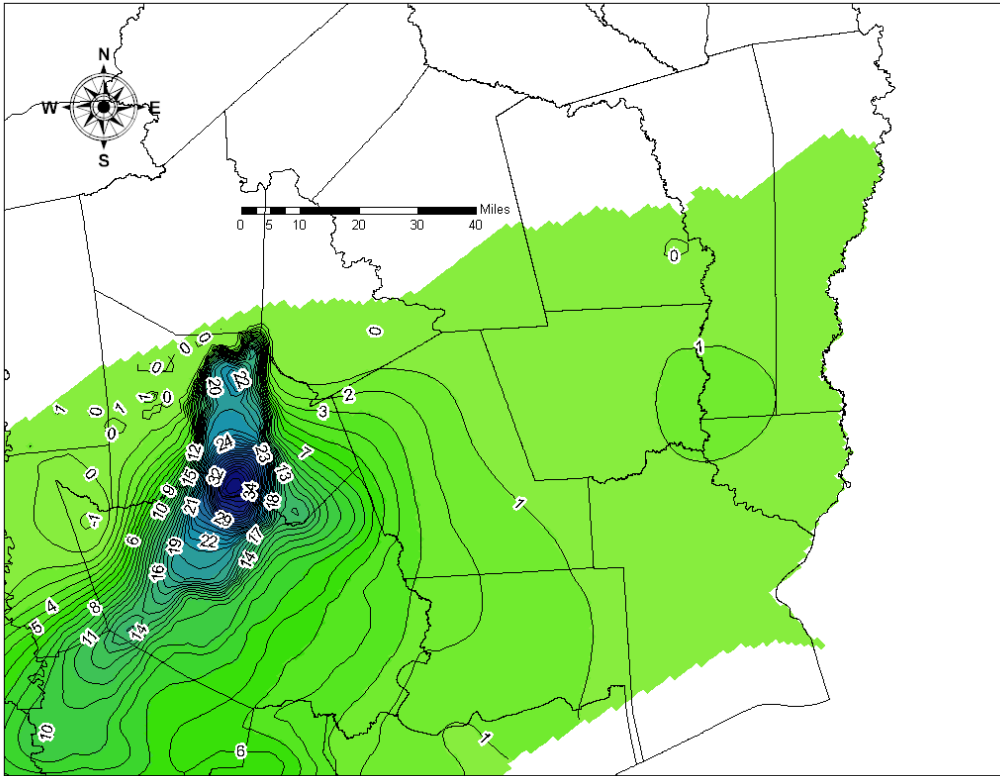


Figure 15: Drawdown in 2010 in the Evangeline aquifer with continued 1999 pumping. Contour interval is 1 feet.

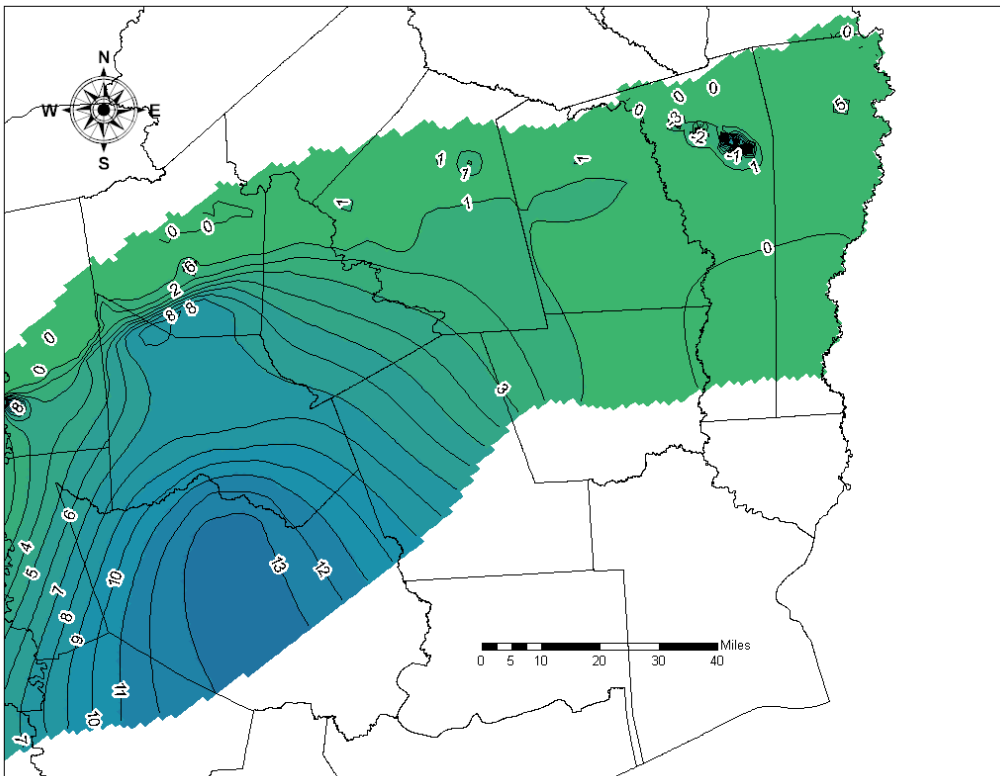


Figure 16: Drawdown in 2010 in the Jasper aquifer with continued 1999 pumping. Contour interval is 1 feet.

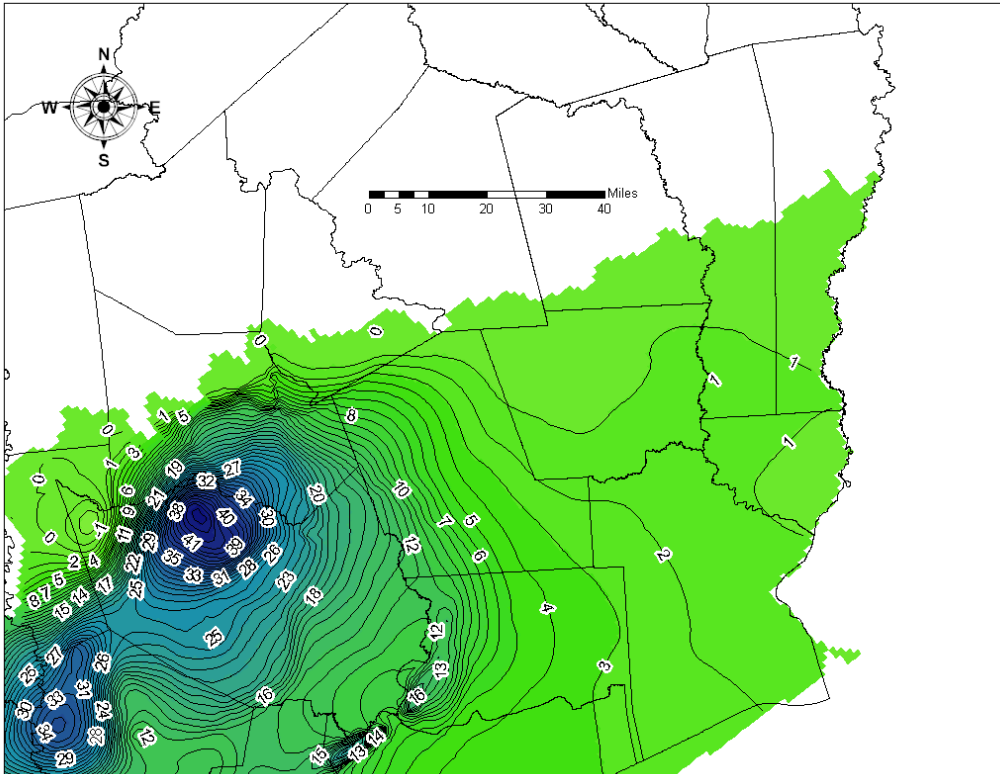


Figure 17: Drawdown in 2030 in the Chicot aquifer with continued 1999 pumping. Contour interval is 1 foot.

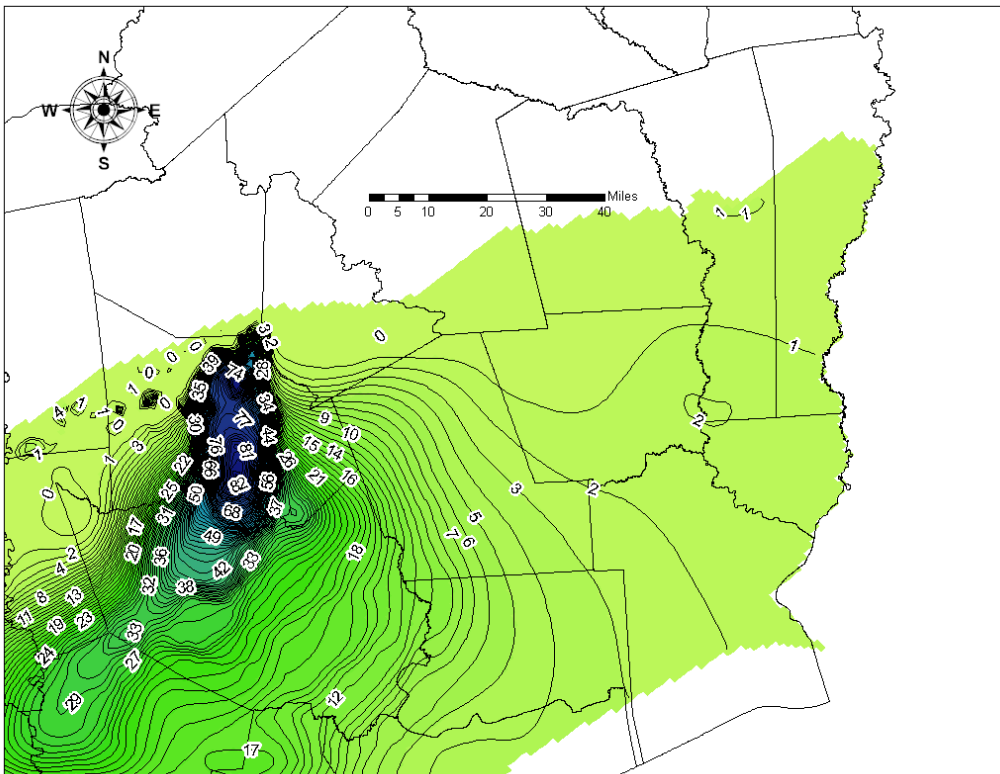


Figure 18: Drawdown in 2030 in the Evangeline aquifer with continued 1999 pumping. Contour interval is 1 foot.

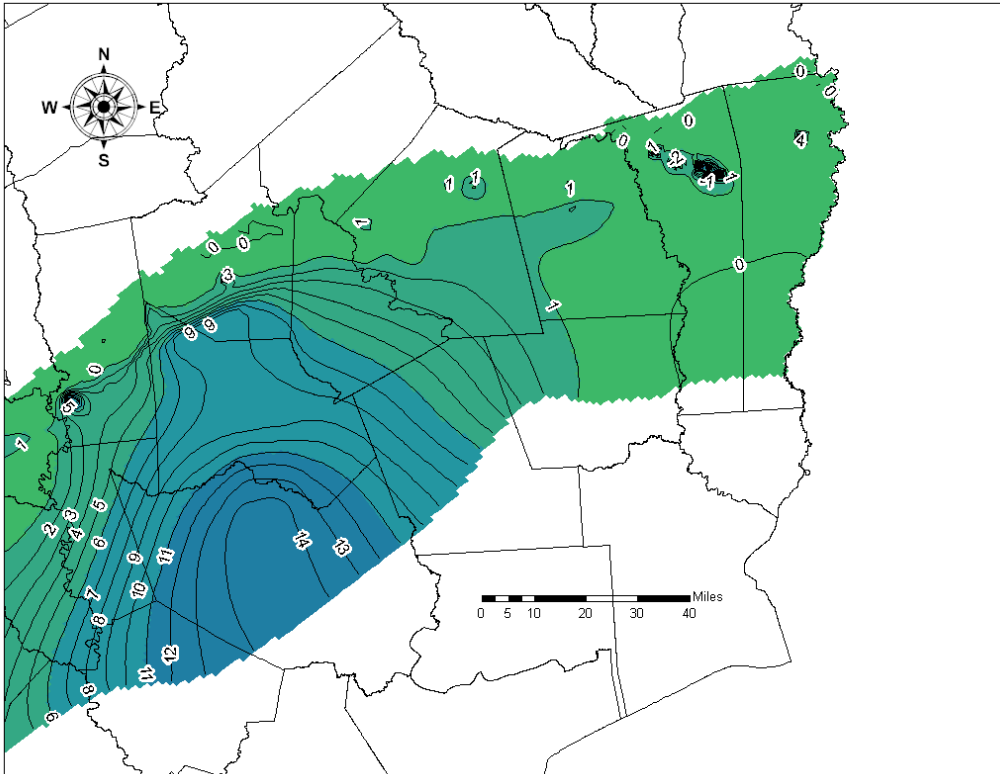


Figure 19: Drawdown in 2030 in the Jasper aquifer with continued 1999 pumping. Contour interval is 1 feet.

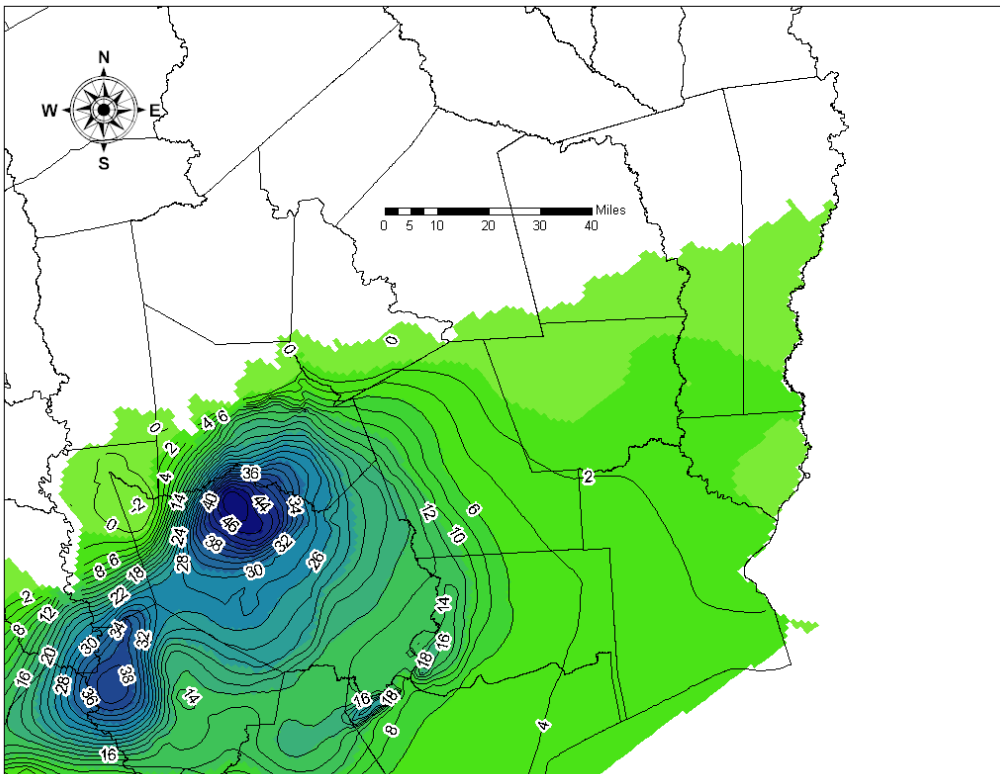


Figure 20: Drawdown in 2050 in the Chicot aquifer with continued 1999 pumping. Contour interval is 2 feet.

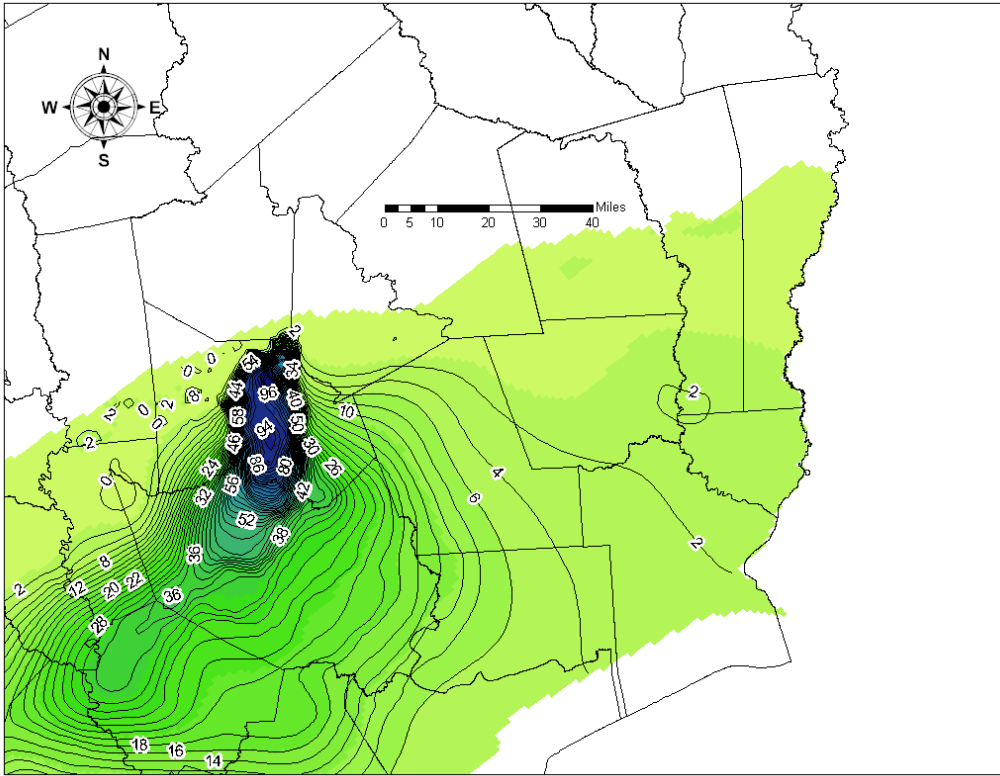


Figure 21: Drawdown in 2050 in the Evangeline aquifer with continued 1999 pumping. Contour interval is 2 feet.

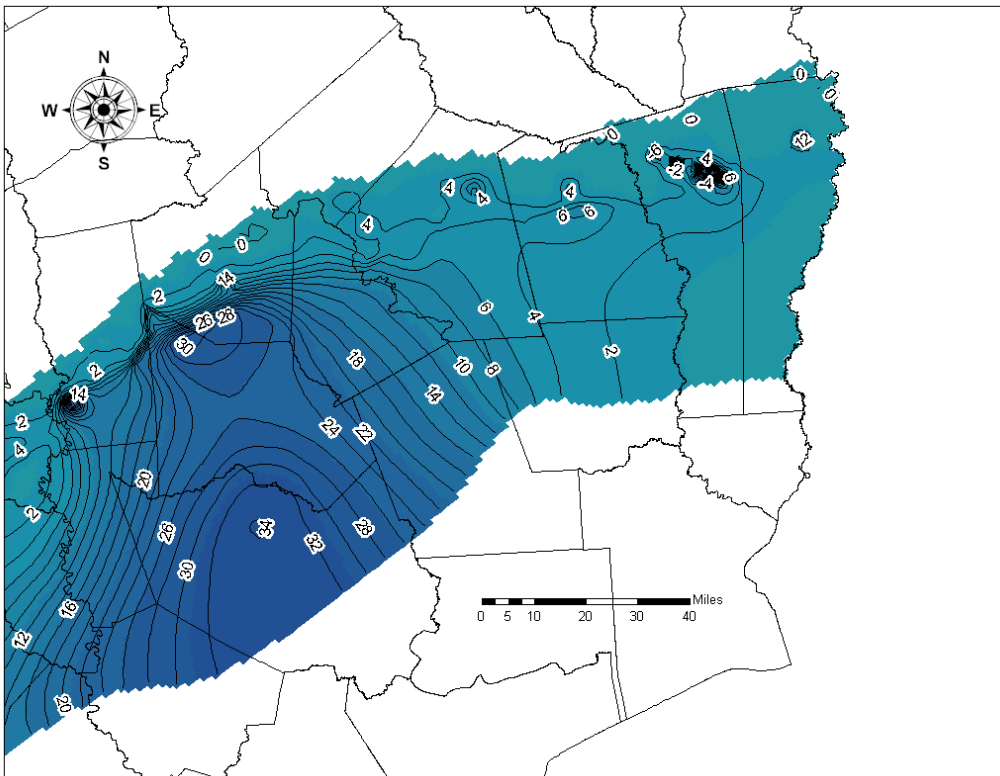


Figure 22: Drawdown in 2050 in the Jasper aquifer with continued 1999 pumping. Contour interval is 2 feet.

