GAM run 04-16

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Groundwater Availability Modeling Section
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REQUESTOR:

Mr. Ray Brady, on behalf of the Hemphill County Groundwater Conservation District

DESCRIPTION OF REQUEST:

Mr. Brady requested that we run the Groundwater Availability Model (GAM) of the northern part of the Ogallala aquifer (Dutton and others, 2001; Dutton, 2004), based on present conditions and modeling parameters, to:

1. estimate the amount of groundwater that annually crosses the Hemphill County line from the north (from Lipscomb County), from the west (Roberts County), and from the south (Wheeler County);
2. estimate the amount of groundwater that annually crosses the Hemphill County line from Roberts County for the area north and the area south of the Canadian River; and
3. estimate the net change in water elevation and volume of water in storage in Hemphill County in 2055 compared to the present.

METHODS:

After running the model through 2060 using projected demand numbers that the Panhandle Regional Water Planning Group plans to include in their 2006 regional water plan, we generated a water-level map to determine the flow direction at the county boundaries both north and south of the Canadian River in addition to the county boundary of Hemphill with Lipscomb and Wheeler counties. We estimated flow volumes by zoning the counties and summing the horizontal flow numbers for those model cells on the county boundaries. We estimated water volumes by multiplying the saturated thickness of the county by the specific yield and the appropriate area.

PARAMETERS AND ASSUMPTIONS:

- See Dutton and others (2001) and Dutton (2004) for assumptions and limitations of the GAM. Root mean squared error for this model is 32 ft. This error will have more of an effect on model results where the aquifer is thin.
- The recharge in the model represents average climatic conditions for the entire model run of 2001 to 2060.
- Conditions in 1998 (the last year of the calibration period) represent present conditions.

- We assumed a specific yield of 0.15.
- To represent the demand numbers that the Panhandle Regional Water Planning Group plans to include in their 2006 regional water plan, we proportionally adjusted the pumping distribution in the predictive run from Dutton and others (2001). To extend this run from 2050 to 2060, we assumed the same distribution applied through 2060.

RESULTS:

Groundwater flows from Lipscomb, Roberts, and Wheeler counties into Hemphill County (Figure 1). Given present conditions, about 4,800 acre-feet per year flows south into Hemphill County from Lipscomb County. About 500 acre-feet per year flows from Roberts County into Hemphill County north of the Canadian River, and 5,500 acre-feet per year flows from Roberts County into Hemphill County south of the river. About 4,100 acre-feet per year flows north into Hemphill County from Wheeler County.

According to the GAM, the volume of water in Hemphill county at the present time is 13,400,000 acre-feet and the volume of water for 2055 is 13,200,000, a difference of 200,000 acre-feet. The change in water levels is barely discernable (compare Figures 1 and 2).

REFERENCES:

Dutton, A., 2004, Adjustments of parameters to improve the calibration of the Og-N model of the Ogallala aquifer, Panhandle Water Planning Area: prepared for Freese and Nichols, Inc. and the Panhandle Regional Water Planning Group by the Bureau of Economic Geology, The University of Texas at Austin, 9 p.

Dutton, A., Reedy, R., and Mace, R., 2001, Saturated thickness of the Ogallala aquifer in the Panhandle Water Planning Area–Simulation of 2000 through 2050 withdrawal projections: prepared for the Panhandle Water Planning Group by the Bureau of Economic Geology, The University of Texas at Austin, 54 p.

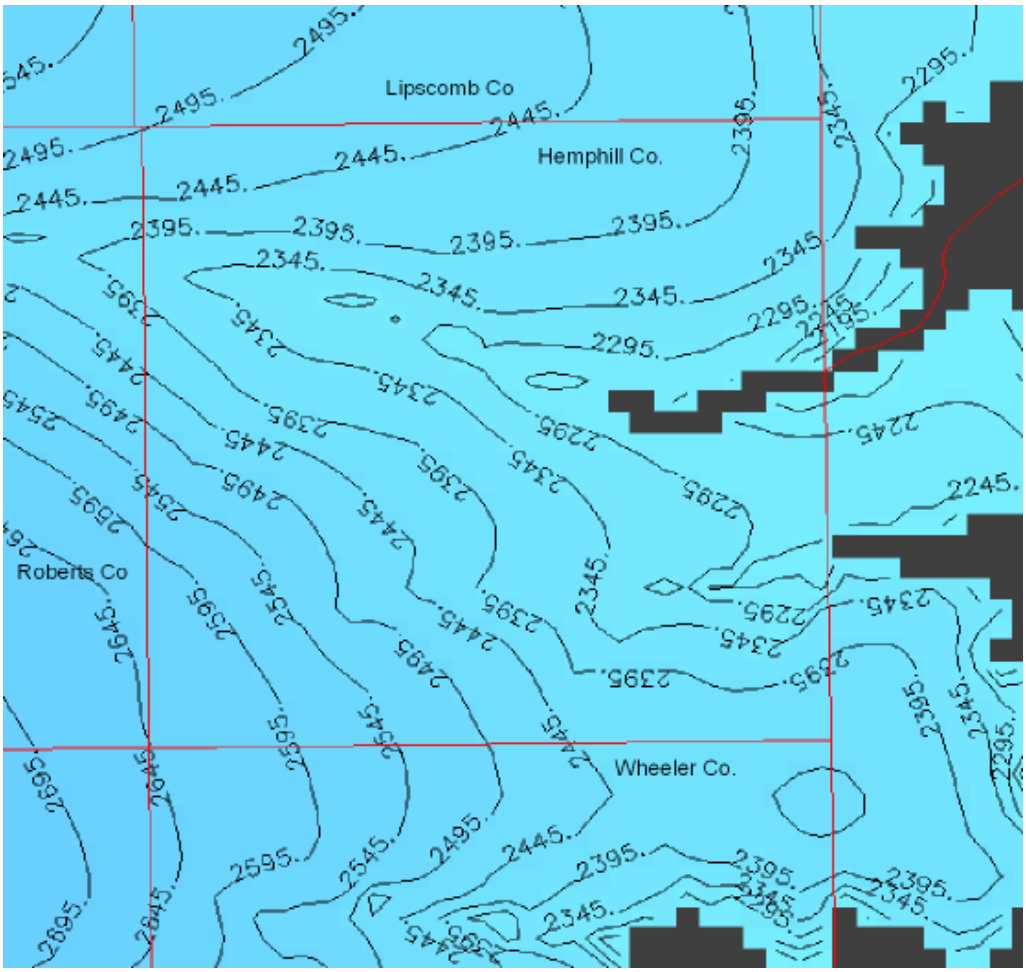

Figure 1: Water-level elevation at the end of the transient period in 1998. North is towards the top of the graph, the contour interval is 50 feet, and the dark gray cells are inactive cells in the model.

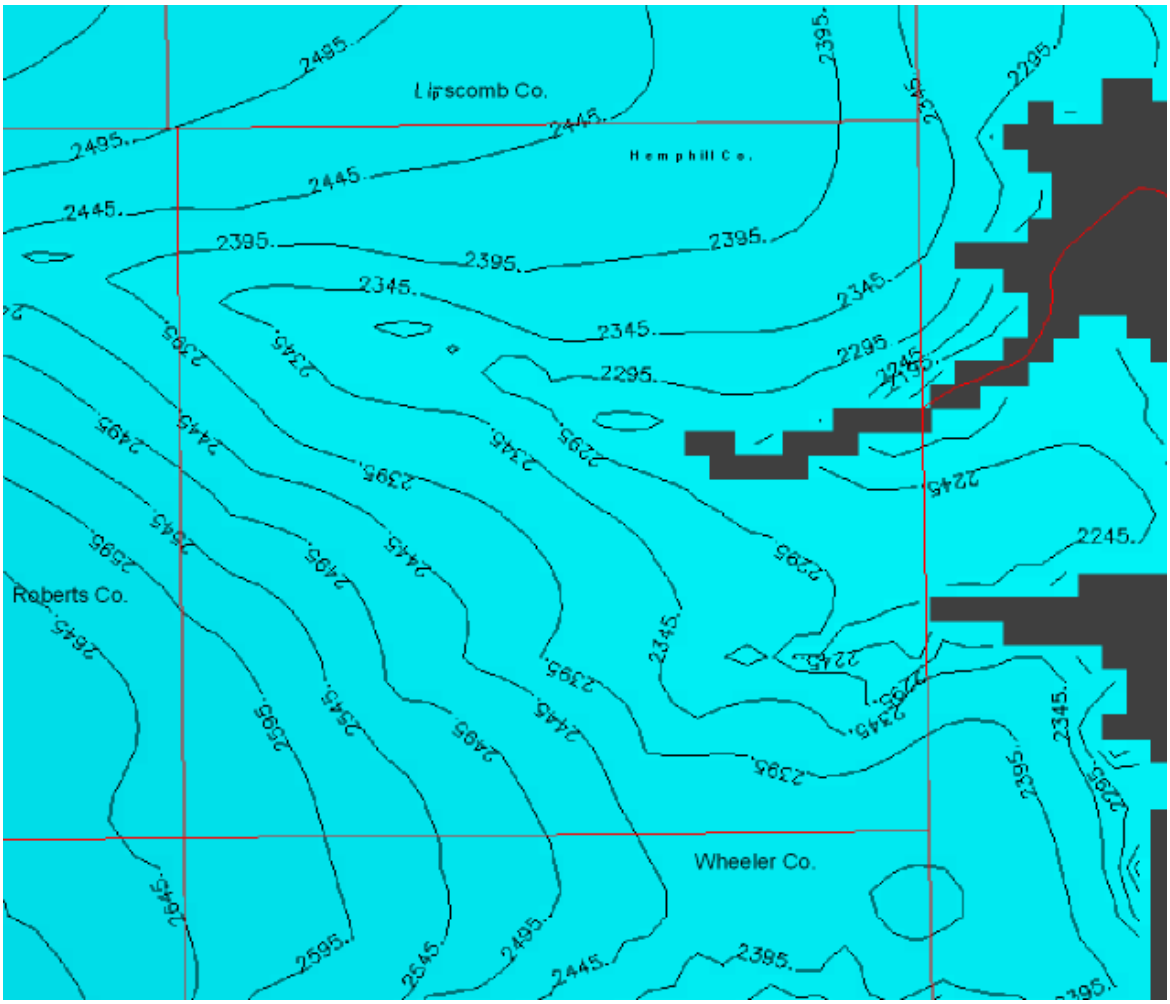

Figure 2: Water-level elevation in 2055 in the predictive run. North is towards the top of the graph, the contour interval is 50 feet, and the dark gray cells are inactive cells in the model.