

# GAM run 04-18

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## REQUESTOR:

Andrew Backus on behalf of the Hays Trinity Groundwater Conservation District.

## DESCRIPTION OF REQUEST:

What is the recharge rate for the Trinity aquifer within the Hays Trinity Groundwater Conservation District (HTGCD)?

## METHODS:

To address the request, we extracted data from the two groundwater availability models that include the Trinity (Hill Country) aquifer of Hays County. These models are: (1) the Trinity (Hill Country) aquifer Groundwater Availability Model (GAM), and (2) the Edwards-Trinity (Plateau) and Cenozoic Pecos Alluvium GAM (Mace and others, 2000; Anaya and Jones, 2004). The use of these models gives two different perspectives of the Trinity (Hill Country) aquifer.

We extracted the recharge totals for Hays County from the results of the Trinity (Hill Country) aquifer Groundwater Availability Model (GAM) (see GAM runs 02-01 and 02-02; Mace and others, 2000).

Additionally, we followed the same procedure as GAM run 04-17.

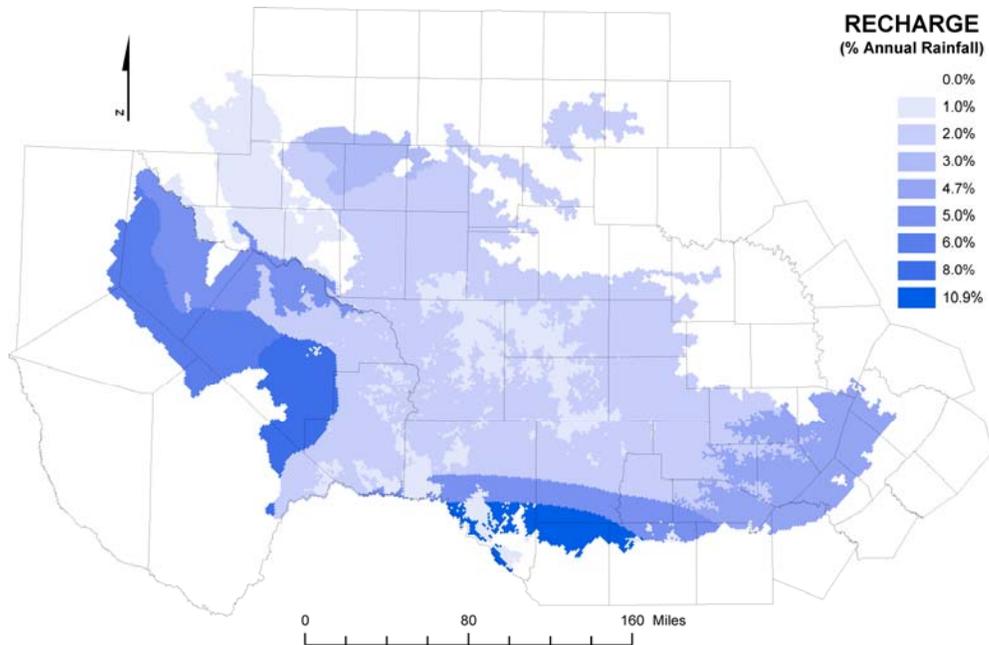
1. Exported the GIS attribute table used to distribute aquifer recharge for the Edwards-Trinity (Plateau) and Cenozoic Pecos Alluvium GAM into Microsoft Excel.
2. Used the Microsoft Excel pivot tables function to summarize average recharge by county as a percentage of annual rainfall.
3. Calculated the average annual recharge for the HTGCD portion of Hays County for two 30-year periods, 1961-1990 and 1971-2000, expressed as inches per year and acre-feet per year.

## PARAMETERS AND ASSUMPTIONS:

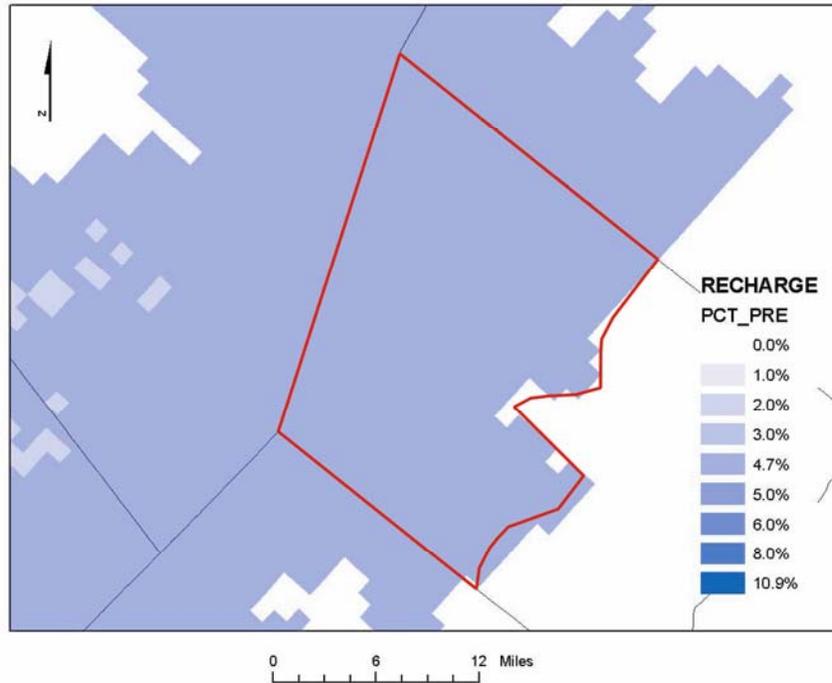
Recharge rates derived from the Trinity (Hill Country) GAM were obtained from water budget files for the pre-development (steady-state) stress period in the model. The pre-development stress period was calibrated to measured water levels for the winter of 1975-1976.

Recharge rates from the Edwards-Trinity (Plateau) and Cenozoic Pecos Alluvium GAM was calibrated as a percentage of annual rainfall within the model (Figures 1 and 2). The methodology is discussed in the GAM report (Anaya and Jones, 2004).

Please note that the calculated recharge rates in this analysis represent estimates of total infiltration of precipitation and do not include recharge from other processes, such as inflow of water from streams and lakes, and cross-formational flow within the Trinity aquifer and from adjacent aquifers. The water budget of the Trinity (Hill Country) aquifer GAM indicate that under steady-state conditions there is net outflow from the aquifer to rivers and adjacent aquifers (see GAM run 02-01).



**Figure 1. Distributed recharge for the Edwards-Trinity (Plateau) and Cenozoic Pecos Alluvium GAM.**



**Figure 2. Recharge for the Trinity (Hill Country) aquifer from the Edwards-Trinity (Plateau) GAM. The HTGCD jurisdiction is indicated by the red line. (PCT\_PRE = Percentage of annual rainfall).**

## RESULTS

The following results were obtained from the two GAMs that include the Trinity (Hill Country) aquifer of Hays County.

Precipitation recharge rates from the Trinity (Hill Country) aquifer GAM for the HTGCD jurisdiction are 27,000 and 5,900 ac-ft/yr to the Upper and Middle Trinity aquifers, respectively. This gives us a total recharge rate of 32,900 ac-ft/yr.

Precipitation recharge rates from the Edwards-Trinity (Plateau) and Cenozoic Pecos Alluvium GAM for the HTGCD jurisdiction are listed in Table 1. The table lists: (1) the annual recharge expressed as a percentage of annual precipitation, (2) the area over which recharge is applied, and (3) total recharge to the Trinity (Hill Country) aquifer recharge areas within Hays County. Total recharge is expressed in inches per year and acre-feet per year, based on mean annual precipitation for each of two periods, 1961 through 1990 and 1971 through 2000.

In the Edwards-Trinity (Plateau) and Cenozoic Pecos Alluvium GAM, the calibrated recharge rate for the Trinity (Hill Country) aquifer of Hays County was 4.7 percent of annual rainfall. This recharge rate produces total average annual recharge of 31,100 and 32,500 acre-feet based on 1961-1990 and 1971-2000 mean annual rainfall, respectively.

**Table 1. Average annual recharge rates for the Hays Trinity Groundwater Conservation District.**

<i>County recharge values for the Trinity (Hill Country) aquifer, where it is exposed at the surface.</i>		
<i>Annual recharge values were extracted from the calibrated Edwards-Trinity (Plateau) and Cenozoic Pecos Alluvium GAM as a percentage of annual rainfall. The average annual recharge values below were calculated for 30-year mean annual rainfall periods of 1961 through 1990 and 1971 through 2000 for comparison.</i>		
COUNTY	DESCRIPTION	RECHARGE VALUES
Hays	Annual recharge as a percent of annual rainfall (percent)	4.70
	Recharge area (square miles)	370
	Mean annual recharge (1961 to 1990 rainfall) (inches per year)	1.58
	Mean annual recharge (1961 to 1990 rainfall) (acre-feet per year)	31,100
	Mean annual recharge (1971 to 2000 rainfall) (inches per year)	1.65
	Mean annual recharge (1971 to 2000 rainfall) (acre-feet per year)	32,500

The range of average recharge rates for the HTGCD jurisdiction lie between 31,000 and 33,000 ac-ft/yr. These values are based on results of calibrated groundwater-flow models that indicate recharge of 4.7 percent of average annual rainfall. These results do not differ much from previous work by the Texas Water Development Board that reported recharge rates of 4 to 5 percent of average annual rainfall (Ashworth, 1983; Bluntzer, 1992).

**REFERENCES:**

Anaya, R. and Jones, I. C., 2004, Groundwater Availability Model for the Edwards-Trinity (Plateau) and Cenozoic Pecos Alluvium Aquifer Systems, Texas: Texas Water Development Board GAM report, [http://www.twdb.state.tx.us/gam/eddt\\_p/eddt\\_p.htm](http://www.twdb.state.tx.us/gam/eddt_p/eddt_p.htm), 208 pp

Ashworth, J. B., 1983, Ground-water availability of the lower Cretaceous formations in the Hill Country of south-central Texas. Texas Department of Water Resources Report 273, 65 pp.

Bluntzer, R. L., 1992, Evaluation of the ground-water resources of the Paleozoic and Cretaceous aquifers in the Hill Country of central Texas. Texas Water Development Board Report 339, 130 pp.

Mace, R. E., Chowdhury, A. H., Anaya, R., and Way, S.-C., 2000, Groundwater availability of the Trinity aquifer, Hill Country area, Texas: numerical simulations through 2050. Texas Water Development Board Report 353, 117 pp.