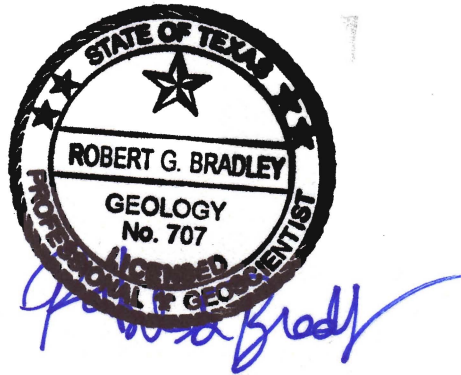


GTA Aquifer Assessment 10-05
Groundwater Management Area 7
Hickory Aquifer
Draft total pumping estimates
September 10, 2010

GTA Aquifer Assessment 10-05

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REQUESTOR:

Caroline Runge, of the Menard County Underground Water District acting on behalf of the member groundwater conservation districts of Groundwater Management Area 7.

DESCRIPTION OF REQUEST:

This is a re-evaluation based on data supplied by two groundwater conservation districts to update the results Aquifer Assessment 08-07 for the Hickory Aquifer. The Menard County Underground Water District (MCUWD) supplied additional data for this request.

DRAFT DESIRED FUTURE CONDITIONS:

- Hickory Aquifer – Four scenarios that allow water-level declines of 5, 10, 15, and 20 feet after 50 years, respectively.

METHODS:

The HCUWCD (Tybor, 2010) and the MCUWD (Caroline Runge, personal communication, 2010) supplied additional data for the Hickory Aquifer. HCUWCD supplied water-level data and water use data that indicates average water levels have remained steady for years 2005 – 2008. The average pumpage for these years was 916 acre-feet per year.

TWDB staff calculated a comparable estimate of 1,202 acre-feet per year of pumping, based on MCUWD information and the assertion of no noticeable water level declines in the district (Caroline Runge, personal communication, 2010). A transient hydrologic budget for the saturated portion of an aquifer is (Freeze and Cherry, 1979, p.365):

$$Q(t) = R(t) - D(t) + \frac{dS}{dt}$$

Where: Q(t)= total rate of groundwater withdrawal
R(t)= total rate of groundwater recharge to the basin
D(t)= total rate of groundwater discharge from the basin

$$\frac{dS}{dt} = \text{rate of change of storage in the saturated zone of the basin}$$

Based on the updated GCD data, the average annual water levels have not varied significantly for the last five years. This infers that the aquifer is near equilibrium conditions, therefore dS/dt can be set zero to obtain,

$$Q(t) = R(t) - D(t).$$

Bluntzer (1992) estimated the amount that could be that can be recovered by wells without significant impact to the aquifer was 2,000 acre-feet per year. Based on the information provided by the HCUWCD, it appears that an average of 916 acre-feet per year results in little water level decline between 2005 and 2008. Because of variation in the two methods, and variability in the data available, these two estimated pumpage amounts for HCUWCD were averaged to obtain a value of 1,458 acre-feet per year.

In Menard WCD, approximately 1,012 acre-feet per year may be pumped within MCUWD without removing water from aquifer storage.

Table 1 recaps the estimated annual volumes from water level declines of 5, 10, 15 and 20 feet from AA 08-07 (Thorkildsen and Backhouse, 2010).

The calculations were completed in a Microsoft Excel worksheet.

PARAMETERS AND ASSUMPTIONS:

- Parameters, assumptions, volumetric calculations, and areas were obtained from Aquifer Assessment 08-07 (Thorkildsen and Backhouse, 2010).
- Water level declines of 5, 10, 15, and 20 feet, respectively, were estimated to be uniform across the aquifer.

RESULTS:

The re-evaluated total pumping based on the conditions provided by GMA 7 for the Hill Country UWCD and Menard County UWD is summarized in Table 2 by groundwater conservation district and desired aquifer conditions.

Table 1. Summary of Estimated annual volume (acre-feet per year) from water level declines (Thorkildsen and Backhouse, 2010)

Groundwater Conservation District	5 ft. decline	10 ft. decline	15 ft. decline	20 ft. decline
Hill Country UWCD	144	288	432	576
Menard County UWD	2	4	6	8

UWCD = underground water conservation district

UWD = underground water district

Table 2. Summary of total pumping (acre-feet per year) based on water-level declines of 5, 10, 15, and 20 feet for the Hickory Aquifer for the Hill Country GCD and Menard County UWD.

Groundwater Conservation District	5 ft. decline	10 ft. decline	15 ft. decline	20 ft. decline
Hill Country UWCD	1,602	1,746	1,890	2,034
Menard County UWD	1,014	1,016	1,018	1,020

UWCD = underground water conservation district

UWD = underground water district

LIMITATIONS:

Additional data are needed to create improved estimates; these estimates are a fundamental interpretation of the requested conditions. This analysis assumes homogeneous and isotropic aquifers; however, conditions for the Hickory Aquifer may not behave in a uniform manner. The analysis further assumes that precipitation is the only source of aquifer recharge, lateral inflow to the aquifer is equal to lateral outflow from the aquifer, and that future pumping will not alter this balance.

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REFERENCES:

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, 130p.

Thorkildsen, D. and Backhouse, S., 2010, Draft Aquifer Assessment 08-07; Texas Water Development Board unpublished report.

Tybor, P., 2010, Ellenburger and Hickory aquifers average water levels and pumpage: Hill Country Underground Water Conservation District, 1 p.