Hydrologic Changes in Central Texas and their Implications for Aquifer Management

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Recent studies document an increase in the water budget (total discharge) of the karstic Barton Springs segment of the Edwards Aquifer (Barton Springs aquifer) of Central Texas. This paper reviews historic (1850s to present) hydrologic data from Central Texas to characterize changes in the hydrologic cycle influencing the aquifer. The aquifer is the sole or primary source of drinking water for an estimated 60,000 people and Barton Springs is habitat for an endangered species of salamander. Analyses focused on sites with long and continuous data within a 75-mile radius of Barton Springs. Data sources include nine rainfall stations, eight stream and springflow stations, numerous monitor wells, and groundwater pumping records.

Historic data indicate a climatic shift to warmer and wetter conditions since the 1850s. Streamflow and springflow data show an increase in flows and flow variability over the period of record, with a significant increase since the 1960s. This is occurring while pumping from the Edwards Aquifer has more than doubled in recent decades. Low-streamflow data have been statistically flat over the period of record and have been decreasing over the past 30 years. Similarly, low springflows are generally flat at Barton and San Marcos Springs over the period of record. The exception is Comal Springs which has an increasing trend for all flow regimes and no change in variability. Groundwater production in the Trinity Aquifer of the Hill Country has dramatically increased since the 1960s. The Trinity Aquifer supports baseflows that ultimately recharge the Edwards Aquifer. Available groundwater-level data from the Trinity Aquifer show declines of about 1-3 ft/yr over the past 25 years in some areas.

Wetter conditions and more runoff in the streams after 1960 have increased the overall water budget within the Barton Springs aquifer. Low-springflow percentiles at Barton and San Marcos Springs appear most sensitive to decreases in baseflow of contributing streams. Increasing groundwater development and the resulting decreasing water levels in the Trinity Aquifer are likely responsible for reducing baseflows of contributing streams. Increasing temperatures may also be a factor in reducing baseflows. In addition, low-springflow percentiles appear sensitive to pumping within the Barton Springs aquifer, supporting the primary strategy (pumping reductions during drought) for aquifer management. However, this study recognizes the importance of management of the Trinity Aquifer and sustaining baseflows of the contributing watersheds. It is important to note that the climate shift since 1960 may not completely account for the apparent two-fold increase in the drought water budget of the Barton Springs aquifer when comparing the 1950s and 2009 droughts. Other factors to consider are increased (induced) flow from adjacent groundwater sources, urban recharge, and land use changes. This study suggests a need for deeper understanding of the hydrodynamics of the water budget during drought conditions, which has direct implications for management of the Barton Springs aquifer.

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