Hydrogeologic Atlas of Southwest Travis County, Central Texas

Brian B. Hunt[1], Lane P. Cockrell[1], Robin H. Gary[1], Jackie M. Vay[1], Vicky Kennedy[2], Brian A. Smith[1], and Justin P. Camp[1]

[1]Barton Springs/Edwards Aquifer Conservation District

[2]Travis County Transportation and Natural Resources Development Services

Executive Summary

Groundwater is an important resource for water supply, economic, and environmental needs. The Trinity Aquifer system supplies critical water resources for the Texas Hill Country region, including southwest Travis County (SWTC). In 1990, a Hill Country Priority Groundwater Management Area (PGMA) was defined and designated by the State in response to existing and projected groundwater availability issues within the Trinity Aquifers of the Hill Country (Cross and Bluntzer, 1990). Recent observations suggest groundwater availability is indeed limited in SWTC. The strain on finite water resources is exacerbated by the region's rapid population growth and economic development. In the absence of a groundwater conservation district, the area's hydrogeology has remained poorly characterized, with pumping and aquifer conditions largely unmonitored.

This study presents a compilation of existing and new hydrogeologic data in the form of a hydrogeologic atlas with accompanying digital datasets intended to improve the collective understanding of groundwater resources in SWTC. The study was a collaboration between the Barton Springs/Edwards Aquifer Conservation District and Travis County. The data and evaluations presented herein provide a baseline of information for various public and private interests and will benefit the Southwestern Travis County Groundwater Conservation District (SWTCGCD), which was created in 2017 by HB 4345 and confirmed by voters in November 2019.

The overall findings of this study corroborate the 1990 designation of the study area as a PGMA (Cross and Bluntzer, 1990). Portions of the Middle and Lower Trinity Aquifers in SWTC and northern Hays County are experiencing varying degrees of depletion and possible degradation of water quality in the Lower Trinity. Water-level data from Trinity wells in SWTC indicate an overall downward trend with minimal recovery during periods of high rainfall; in some areas, the Middle Trinity Aquifer has been almost completely dewatered. These effects are the result of the combined influence of geology, climate, and groundwater withdrawals. Furthermore, these effects vary geographically depending upon local hydrogeologic characteristics and groundwater demand (**Figure ES-1**). Four generalized, interconnected hydrogeologic areas are defined in this study based on these spatial variations ("Areas 1 to 4" in **Figure ES-1**).

The geology in SWTC appears to differ from Hays County to the south due to increased clastic sediment input that influenced geologic facies (rock types), thicknesses, and the primary porosity and permeability within the Lower and Middle Trinity Aquifers. In addition, faulting plays an important role in the geometry and aquifer boundaries of the region. In particular, the Bee Creek and Mount Bonnell Fault Zones are important structural features that appear to be at least partial barriers to regional groundwater flow and to partially compartmentalize the aquifers in SWTC. Fracturing and en echelon faulting created the enhanced karstic (secondary) porosity commonly found in central Hays County, but karstic and fracture porosity does not appear to be as well developed in SWTC.

The Lower Trinity is the primary aquifer of SWTC and northern Hays County, in contrast to most of Hays County, which primarily utilizes the Middle Trinity Aquifer. This is primarily due to the lower permeability and porosity of Middle Trinity units in SWTC, as well as the degree of depletion of the Middle Trinity Aquifer throughout SWTC. There are about 2,000 inventoried wells within SWTC (recorded since 2003; TWDB, 2019b), with about 75% of the wells completed in the Lower Trinity Aquifer. An estimated total of 1.4 billion gallons per year are pumped within SWTC—the Lower Trinity supplies about 63%, the Middle Trinity about 36%, and the Upper Trinity about 1%. Most of the large capacity water-supply use in SWTC occurs west of the Bee Creek Fault Zone (Area 1), while domestic irrigation use dominates the area between the Bee Creek and Mount Bonnell Fault Zones (Area 2).

Historic streamflow data suggest the Colorado River was a predominantly gaining stream (aquifers contributed to streamflow) prior to the construction of the Highland Lakes (TBWE, 1960). However, groundwater levels have lowered significantly in some areas since 1978 (**Figure ES-1**), possibly altering surface-groundwater exchange dynamics. The Colorado River and lakes may interact with the aquifers west of the Bee Creek Fault Zone, but perhaps only locally to the east of the fault zone.

Water levels in portions of the Middle and Lower Trinity Aquifers have been significantly lowered by hundreds of feet since 1978. Near the City of Bee Cave, historic Middle Trinity wells have become unusable as supply wells (Area 2). The Lower Trinity Aquifer is experiencing water-level declines between 2 and 3 feet per year throughout the study area and may also be experiencing deteriorating water quality. Due to the continued drawdown over time, portions of the Middle and Lower Trinity Aquifers can be described as experiencing depletion (equivalent to groundwater mining).

Throughout much of the study area, the Upper Trinity Aquifer is a shallow, freshwater, perched system that provides baseflows to streams and does not have a significant hydrologic connection to the deeper Middle and Lower Trinity Aquifers. The Upper Trinity Aquifer is partially in hydrologic communication with the overlying Edwards Aquifer within the Balcones Fault Zone. Availability of groundwater in the Upper Trinity Aquifer is limited by its local nature, thickness, and climatic influences. Many Upper Trinity wells are reported to cease production during periods of drought.

Differences in the geology and hydrogeology in Travis and Hays Counties are reflected in contrasting groundwater availability potential of the Middle and Lower Trinity Aquifers. The groundwater availability of the Middle Trinity Aquifer in SWTC appears to be limited by aquifer properties, boundary conditions such as faults and rivers, and significant reductions in storage caused by pumping. In contrast, in Hays County groundwater availability of the Middle Trinity is limited by negative impacts associated with drought and pumping (Gary et al., 2019). One of these impacts is springflow reduction resulting from capture. Throughout the study area, groundwater availability of the Lower Trinity may be limited by aquifer properties, boundary conditions, and reductions in storage caused by pumping.

This study shows that the Middle and Lower Trinity Aquifers in SWTC are experiencing moderate to significant depletion. This Hydrogeologic Atlas refines the area's hydrogeologic framework and conceptual model, establishes current aquifer conditions, and estimates groundwater use in SWTC. The results of this study will provide a baseline for future groundwater studies of the region and help inform strategies and policies to manage and protect the region's groundwater resources.

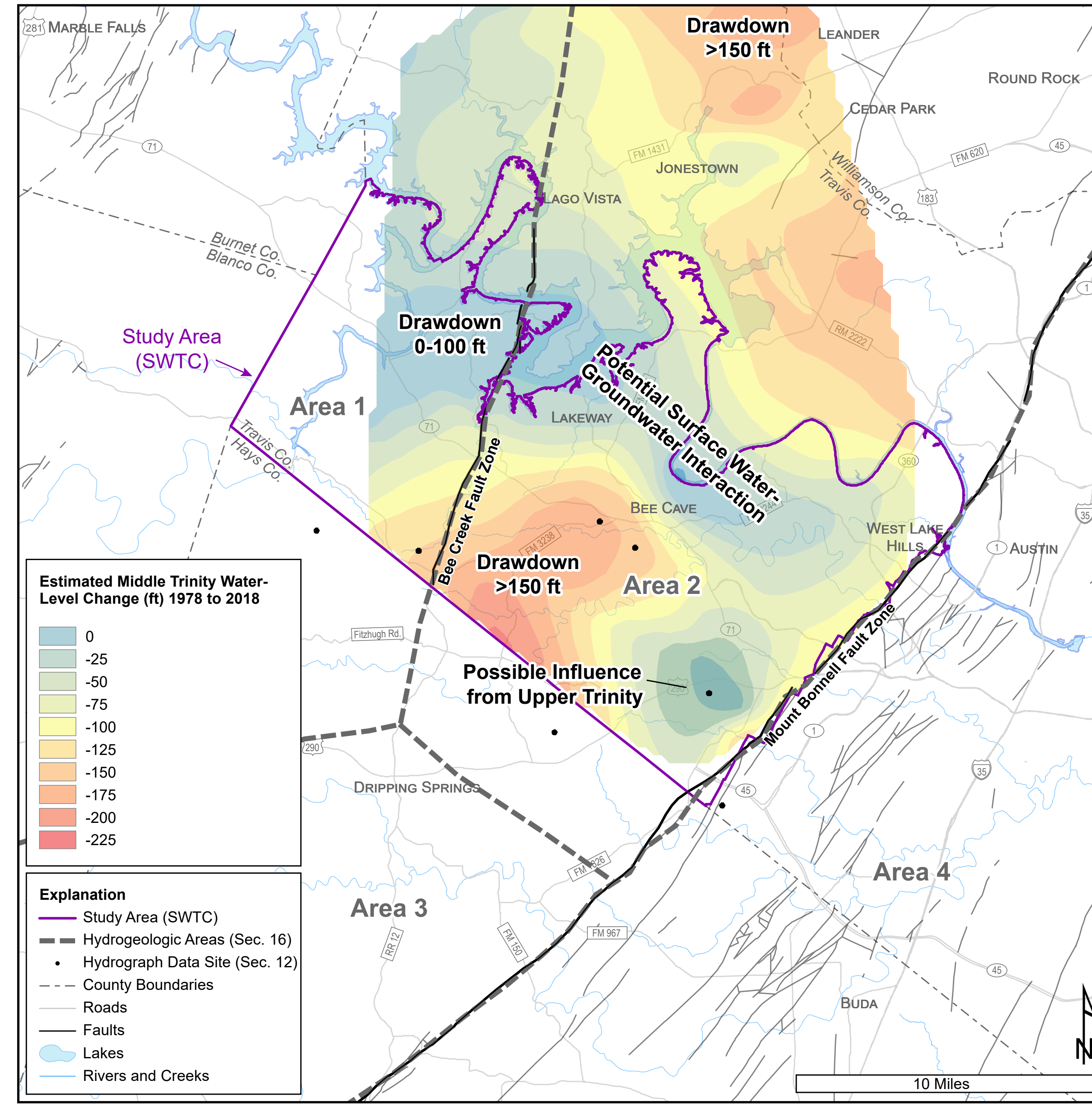

Figure ES-1 Estimated Water-Level Changes in the Middle Trinity Aquifer from Spring 1978 to Fall 2018.

Water-level changes from spring 1978 to fall 2018 are shown in feet for the Middle Trinity Aquifer. Four interconnected areas (Areas 1 to 4) were defined in this study based on generalized hydrogeologic characteristics. The study area, southwest Travis County (SWTC), is outlined in purple and is coincident with the Southwestern Travis County Groundwater Conservation District. Water-level declines up to 200 feet occur south of the Colorado River in Area 2, near the City of Bee Cave, and north of the Colorado River. The decline of Middle Trinity water levels is likely beyond any variation in seasonality and represents long-term depletion. 1978 water-level data from Brune and Duffin (1983).