# Conclusions and Future Work

This Atlas is a compilation of existing and new hydrogeologic data that contributes to a better understanding of groundwater resources in southwest Travis County (SWTC) and the surrounding areas. These data will be essential to future hydrogeologic studies of the region and will lead to refined conceptual and numerical groundwater flow models. Ultimately, these results could be used to develop strategies and policies to help preserve and conserve groundwater resources in the region.

Results of the study indicate that portions of the Middle and Lower Trinity Aquifers in SWTC and northern Hays County are experiencing moderate to significant groundwater depletion and possibly degradation of water quality in the Lower Trinity. These changes are likely the result of the combined effects of groundwater withdrawals, climate, geology, and setting of the aquifers in the study area. In addition, the study area is experiencing rapid population growth and economic development, which will add to the demand and stress (pumping) on groundwater resources of the region.

The overall findings of this study corroborate the 1990 designation of the study area as a Priority Groundwater Management Area (PGMA), first described by Cross and Bluntzer (1990). A PGMA is defined as: "…an area designated and delineated by TCEQ that is experiencing, or is expected to experience, within 50 years, critical groundwater problems including shortages of surface water or groundwater, land subsidence resulting from groundwater withdrawal, or contamination of groundwater supplies" (TCEQ, 2019).

## Summary Findings

Some of the key geologic and aquifer findings are summarized below with references to Areas 1 through 4, which are defined and described in **Section 16**.

### Geology

Subtle lithologic differences between SWTC and Hays County appear to have had profound influences on the aquifers of the region. We suggest that SWTC has a higher percentage of clastic sediments (sand and gravel) compared to Hays County. The source of those increased clastics is thought to be related to the Lower Cretaceous "Sycamore River" postulated by Ewing (2016). This increased clastic input potentially influenced geologic facies, thicknesses, and the primary porosity and permeability within the Lower and Middle Trinity Aquifers in SWTC (**Sections 3 and 4**). Such a change may have limited the development of reef units within SWTC that are often important aquifer units of the Middle Trinity in Hays County.

Geologic structure is also one of the most important aspects of the hydrogeology of the study area. The Bee Creek and Mount Bonnell Faults Zones are important structural features that appear to be partial barriers to regional groundwater flow in SWTC. Those same fault zones do not appear to have the same structural style or hydraulic properties within Hays County. In addition, these fault zones strongly influence the regional geometry and structural setting of the aquifers (**Section 7**). Fracturing and en-echelon faulting created the enhanced karstic (secondary) porosity commonly found in central Hays County (Area 3 in **Section 16**). However, fracturing and karstic porosity does not appear to be as well-developed in SWTC (Areas 1 and 2).

### Aquifers

The Lower Trinity is the primary aquifer of SWTC (Areas 1 and 2), in contrast to Hays County (Area 3), where the Middle Trinity is primarily utilized. Of the roughly 2,000 wells drilled in SWTC since 2003, about 75% of the wells are completed in the Lower Trinity Aquifer.

We estimate that a total of 1.4 billion gallons per year is pumped from the Southwestern Travis County Groundwater Conservation District, with the Lower Trinity supplying about 63%, the Middle Trinity about 36%, and the Upper Trinity about 1%. Groundwater use in Areas 1 and 2 includes domestic, stock, public water supply, and irrigation (**Section 10**). Most of the large capacity water-supply use occurs west of the Bee Creek Fault Zone (Area 1). Irrigation use dominates the area between the Bee Creek and Mount Bonnell Fault Zones (Area 2) (**Section 10**).

The Colorado River appears to have been a predominantly gaining stream (aquifers contributed to streamflow) prior to the construction of the Highland Lakes (TBWE, 1960) (**Section 13**). However, groundwater levels in some areas have lowered significantly since 1978, possibly altering the surface-groundwater exchange dynamics (**Section 11**). 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. Further study is needed on this topic.

Water levels in the Middle and Lower Trinity Aquifers, particularly in portions of Area 2 near the City of Bee Cave, have been significantly lowered by hundreds of feet since 1978 (**Section 11**). In certain portions of Area 2, historic Middle Trinity wells have become unusable. New wells no longer target the Middle Trinity owing to water-level declines. The Lower Trinity is experiencing declining water-level trends on the order of 2 to 3 feet per year in Area 2 and may also be experiencing deteriorating water quality with decreasing water levels (**Sections 12 and 14**). Due to continued drawdown over time, portions of the Middle and Lower Trinity Aquifers can be described as experiencing moderate to significant depletion.

The differences in geology and hydrogeology are reflected in the contrasting groundwater availability potential within the study area. The groundwater availability of the Middle Trinity Aquifer in SWTC (Areas 1 and 2) appears to be limited by aquifer properties, boundaries conditions such as faults and rivers, and depletion of storage caused by pumping. In contrast, in Hays County groundwater availability of the Middle Trinity is being 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 such as faults and rivers, and reductions in storage caused by pumping.

The Upper Trinity Aquifer is a shallow, freshwater perched system that provides baseflows to streams (**Sections 13 and 14**) and does not appear to have a significant regional hydrologic connection to the deeper Middle and Lower Trinity Aquifers. However, near the Balcones Fault Zone in SWTC, water-level data suggest that the Middle Trinity may receive recharge from the Upper Trinity locally, though this could

# Section 17
# Conclusions and Future Work

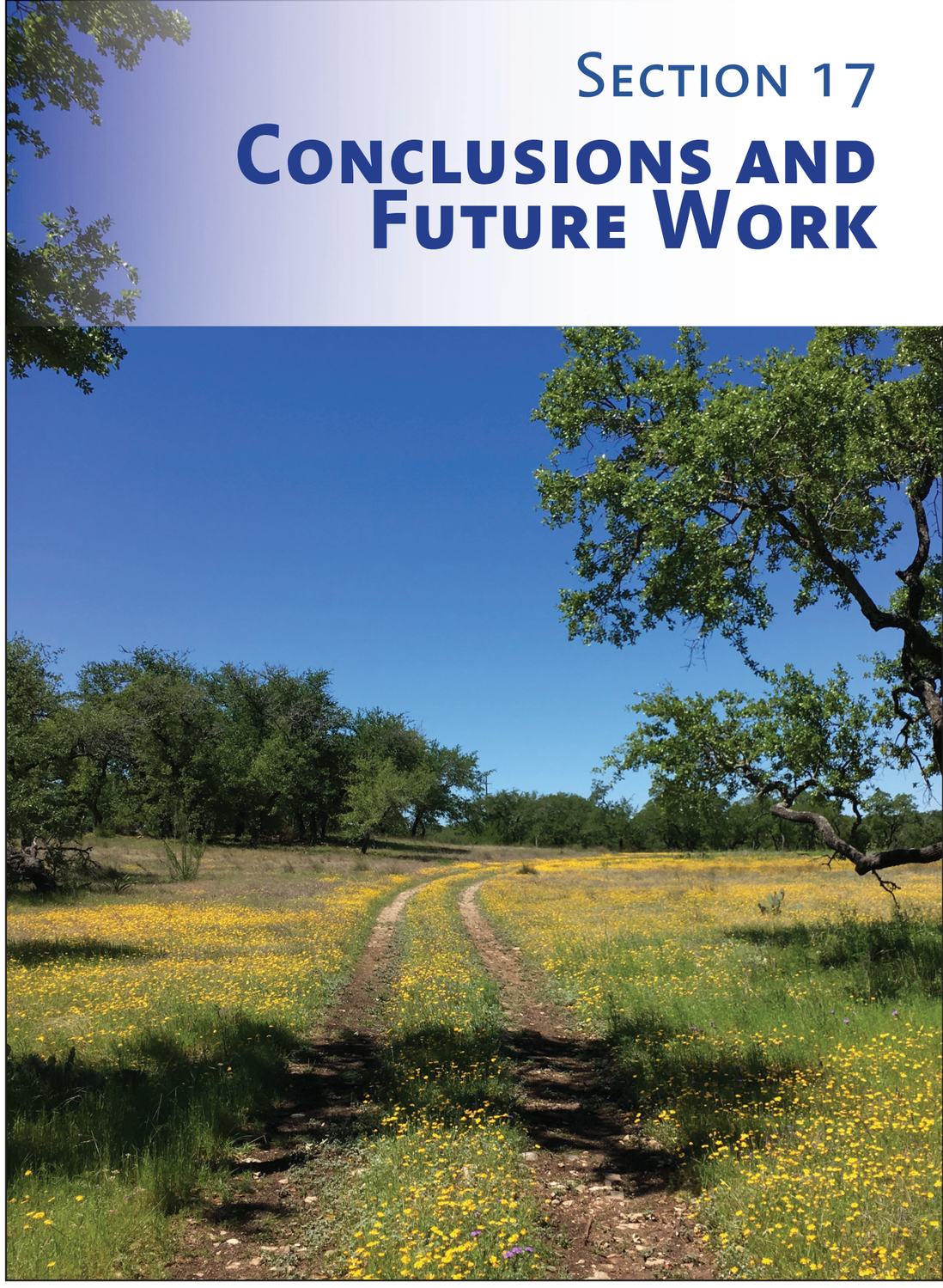

**Figure 17.1 Present-Day Hill Country Landscape.**
*Central Texas' diverse tectonic, geologic, and depositional history influenced rock composition and structure and are key components to understanding groundwater resources.*

be an artifact of well completions. Within the Balcones Fault Zone (Area 4), the Upper Trinity is partially in hydrologic communication with the overlying Edwards Aquifer (Wong et al., 2014). Groundwater availability in the Upper Trinity Aquifer is limited by its local nature, thickness, climate, land use, and aquifer properties. Many Upper Trinity wells are commonly reported to cease production during periods of drought.

## Future Work

There is inherent uncertainty with any hydrogeologic study, and some aspects of the hydrogeology remain poorly constrained in the study area. For example, the hydrogeologic connection between the Colorado River and underlying aquifers is poorly characterized. In addition, the extent and relationship of drawdown from pumping in the Trinity units to the north (Travis, Williamson, and Bell Counties) is largely unknown. This Atlas is the starting point for understanding the hydrogeology in SWTC and surrounding areas, and additional collection and evaluations of hydrogeologic data within SWTC should continue to be a priority. Some of those tasks include:

- Improving the inventory of all wells and pumping estimates, especially large pumping wells;
- Increasing the network of monitor wells for all aquifers;
- Increasing the geochemical sampling from wells;
- Characterizing the geology and hydrogeology of the Bee Creek and Mount Bonnell Fault Zones;
- Assessing the potential of the Paleozoic aquifers;
- Assessing innovative water technologies and strategies such as aquifer storage and recovery (ASR); and
- Development of local to regional numerical groundwater flow models.

**Figure 17.2 Geologic Discussion.**
*Eddie Collins leads discussion about core from Hamilton Pool during an Austin Geological Society (AGS) field trip in 2007. Dennis Trombatore (black shirt) inspects core with AGS members listening.*

**Figure 17.3 Pedernales River in Southwest Travis County.**
*Pedernales River at Milton Reimers Ranch County Park in southwest Travis County. Photograph taken on 1/25/2019 from atop the "Prototype Wall," facing west .*