Environmental Geology of Urban Growth Areas Within the Edwards Aquifer and Balcones Fault Zone, South-Central Texas

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New geologic maps of areas within the Edwards aquifer that are undergoing increased urban development, population growth, and exploitation of natural resources provide basic geologic information necessary for managing water and land resources and construction practices. The Edwards aquifer is currently the sole-source aquifer of San Antonio and is an important water resource for much residential, agricultural, and industrial use in south-central Texas. Map areas include the urban growth corridors of Georgetown, New Braunfels-San Antonio, and west San Antonio (Fig. 1). The objective of this extended abstract is to present the general physical geology of the map areas and to identify geologic attributes critical for land use and water resource management, urban planning, and construction practices. Standard methods used to construct the geologic maps included field mapping at a base-map scale of 1:24,000, interpreting aerial photographs, and reviewing existing maps. Map digitization for a geographic information system (GIS) and preparation for publication of 1:100,000-scale maps are in progress.

Normal faults that cross the map areas are part of the Balcones Fault Zone, the main structural control on the Edwards limestone aquifer and recharge zone. This fault zone consists mostly of multiple fault blocks bound by a long series of southeast- and east-dipping, en echelon normal faults. Some narrow grabens, <1 mi wide, also exist. Faults are more abundant in the New Braunfels-San Antonio and west San Antonio corridors, where the largest faults exceed 500 ft of throw, than in the Georgetown corridor, where the largest fault has <400 ft of offset. Smaller faults, some with throws of <1 ft, are common throughout the areas.

Strata at the study areas consist mostly of Cretaceous limestone, marl, and shale that represent >2000 ft of shelf and shelf-margin deposition. Lesser Tertiary mudstone, sandstone, and limestone also exist. Late Tertiary to Quaternary gravel and sand occur as remnant and well-preserved terrace and drainageway alluvium. Within the New Braunfels-San Antonio and west San Antonio areas much of the outcrop belt consists of cyclic, shallow subtidal to tidal-flat limestones and dolomitic limestones of the Cretaceous Glen Rose Formation and Edwards Group. Platform facies of the Edwards Group within the fault zone and Edwards Plateau and the Kainer/Person and Fort Terrett/Segovia Formations grade southwestward into Edwards platform-margin facies represented by the

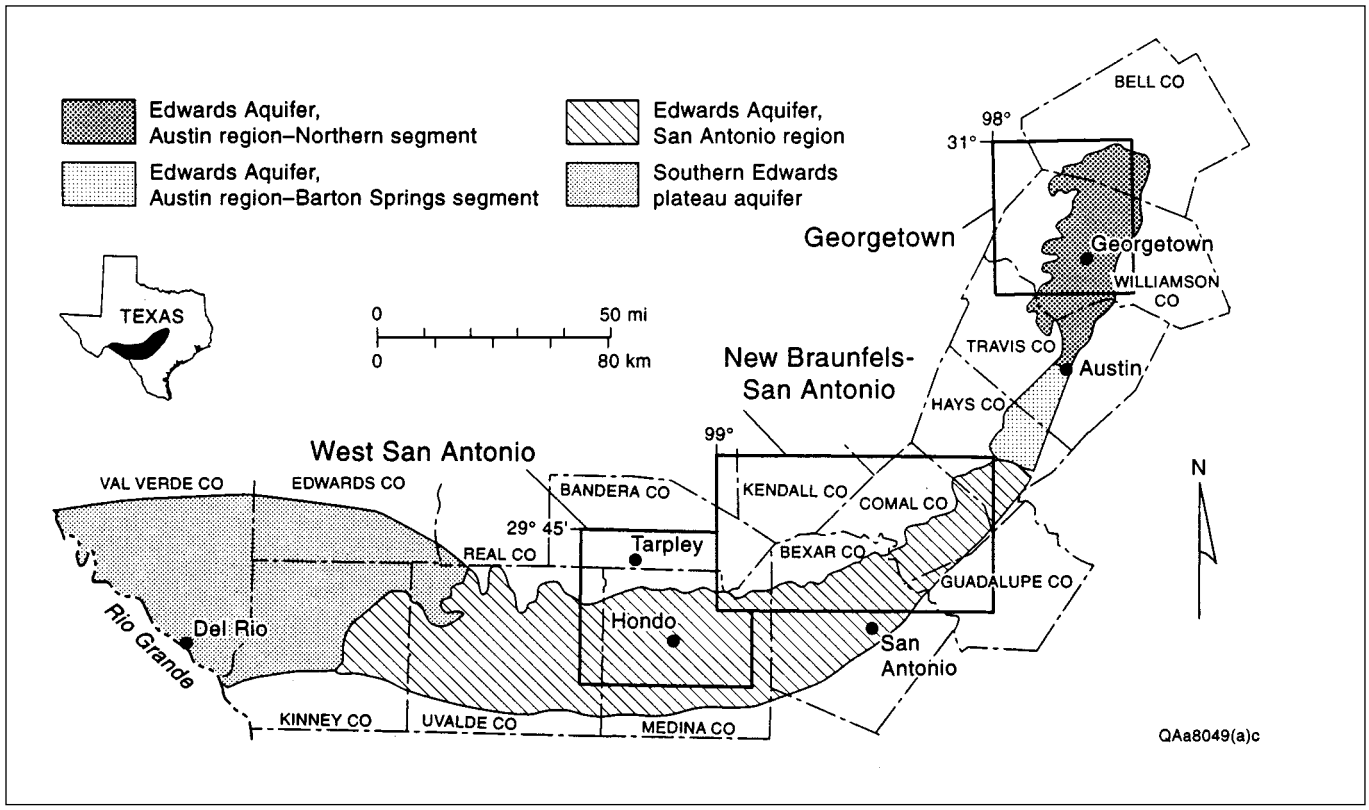

Figure 1. Location of study areas.

lower and upper Devils River Formation. Beneath Glen Rose strata are nearshore siliciclastic-rich limestones of the Hensel and Cow Creek Formations that locally crop out along the Guadalupe River. Cretaceous open-shelf limestones and shelf/prodelta shale that overlie the Edwards Group comprise Georgetown limestone, Del Rio claystone and mudstone, Buda limestone, Eagle Ford shale, and Austin chalk and limestone. Overlying Austin strata are shelf marls, argillaceous limestones, and mudstone/shale of the Taylor Group and mudstone/shale of the Navarro Group. In the west San Antonio corridor, Cretaceous Taylor Group deposits have graded into grain-rich limestones and marls of the Anacacho Formation, and Navarro sediments have graded into mudstone/shale and siliciclastic sandstone of the Escondido Formation. Strata in the Georgetown corridor are similar to strata in the other areas, although Kainer, Person, and thin Walnut strata grade into a thicker sequence of Walnut limestone, argillaceous limestone, and marl, Comanche Peak limestone, and Edwards limestone, dolomitic limestone, and argillaceous limestone. Georgetown strata thicken within the Georgetown corridor.

Basic geologic knowledge concerning faults and the limestone and dolomitic limestone that contain the Edwards aquifer is required to manage issues such as ground-water flow and aquifer response to pumpage and recharge. In the New Braunfels-San Antonio and west San Antonio corridors, the outcrop belt of the Georgetown, Kainer, Person, lower and upper Devils River, and Walnut make up the recharge zone of the aquifer.

Stratigraphically equivalent Edwards aquifer strata in the Georgetown corridor comprise Comanche Peak, Edwards, and Georgetown deposits. Some large faults within the aquifer may act as barriers to ground water flow, whereas other faults and joints form local and regional ground water conduits. Features such as sinkholes and solution cavities may be key recharge features, especially if they occur in stream beds. Geologic maps of the study areas also illustrate outcropping strata of other important water-bearing units, including the Cretaceous Glen Rose, Hensel, and Cow Creek Formations, and Late Tertiary to Quaternary Uvalde and Leona gravel and sand.

Geologic data for the study areas are important to land use decisions such as locating landfills and other waste disposal sites, planning construction projects, and designing foundations. For example, mudstone and claystone of the Cretaceous Taylor and Navarro Formations and Tertiary Midway Group may be better host strata for landfills than more porous strata. Del Rio clay often causes construction problems related to swelling and shrinking. Clay-rich intervals of Cretaceous formations such as the Del Rio, Eagle Ford, upper Taylor, Navarro, Escondido, and the Tertiary Midway Group, and some unconsolidated late Tertiary to Quaternary Uvalde, Leona, and terrace gravel and sand have a higher potential for slope failure than do the Cretaceous limestone units. Harder limestone units within the Glen Rose, Walnut, Kainer, Person, Devils River, Edwards, Georgetown, and Buda Formations are more difficult to excavate than softer clay-rich units. Strata with the greatest potential for large solution cavities and sinkholes are in the Glen Rose, Kainer, Person, Devils River, and Edwards Formations. To meet the demand for construction materials, limestone is quarried from Glen Rose, Kainer, Person, Edwards, Georgetown, Comanche Peak, and Austin units to produce rock aggregate, cement, and some building stone. Some Uvalde, Leona, and terrace sand and gravel deposits are also mined.