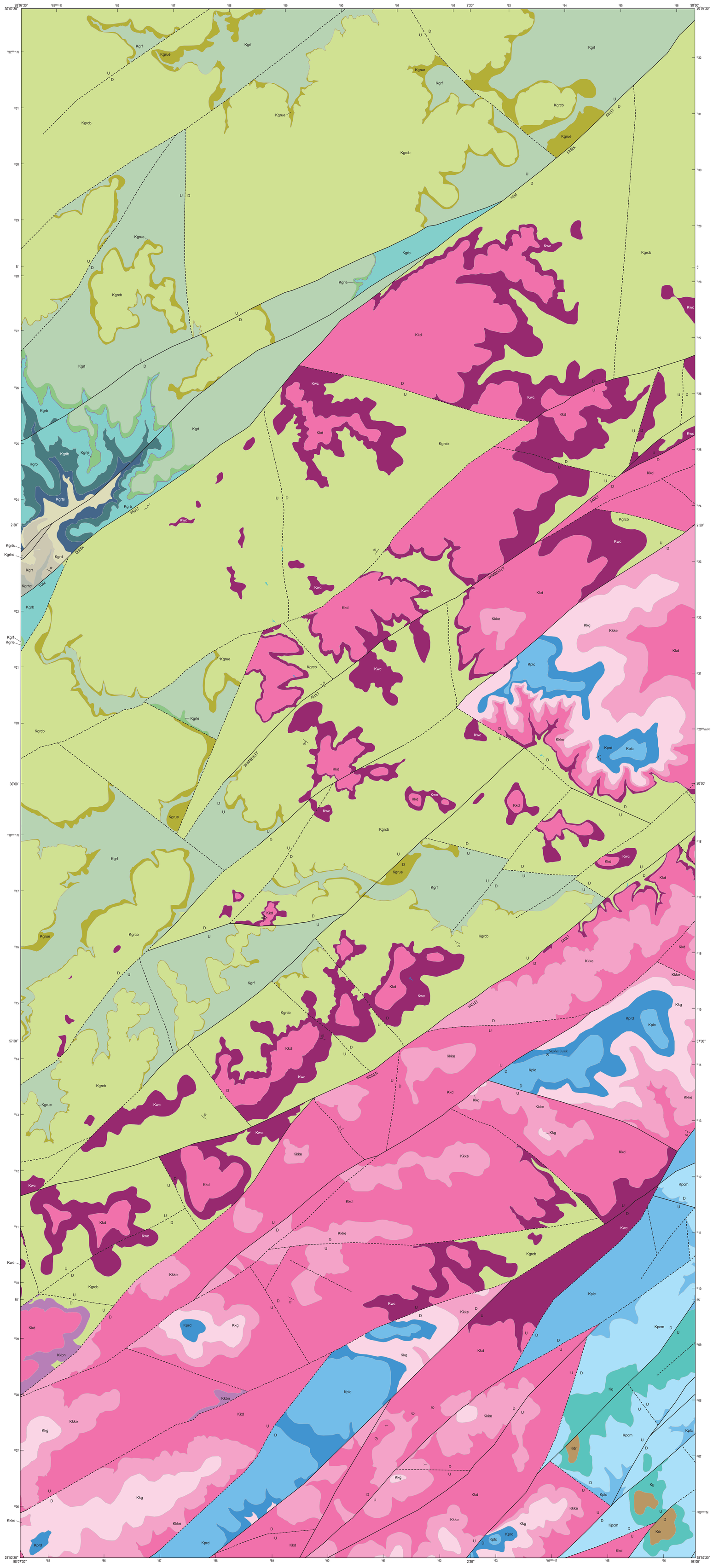
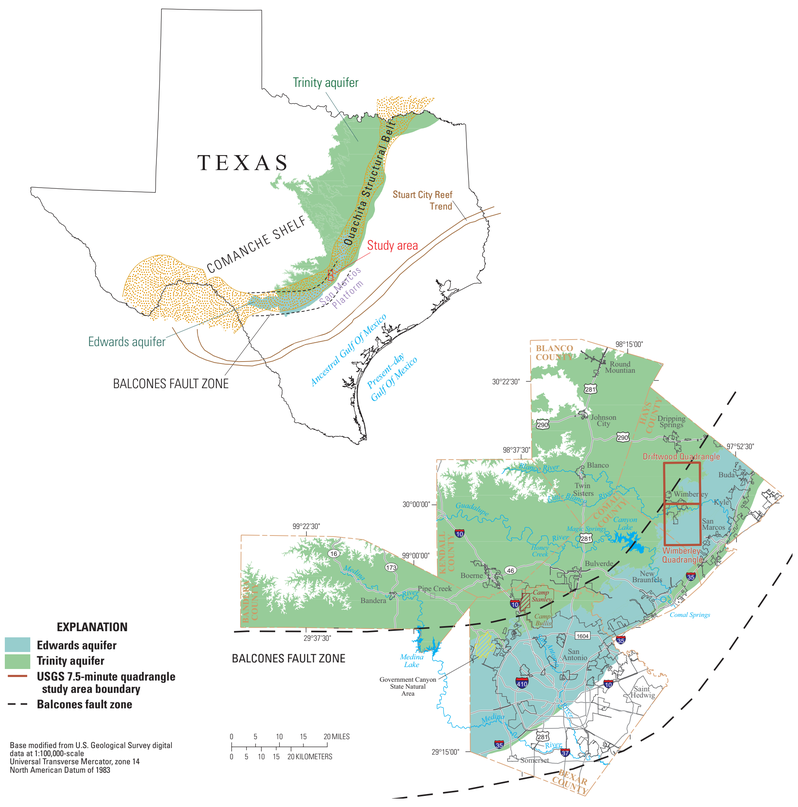
U.S. Department of the Interior
U.S. Geological Survey

Scientific Investigations Map 3386
Pamphlet accompanies map





EXPLANATION

- Edwards aquifer
- Trinity aquifer
- USGS 7.5-minute quadrangle study area boundary
- Balcones fault zone

Base modified from U.S. Geological Survey digital data at 1:100,000-scale
Universal Transverse Mercator, zone 14
North American Datum of 1983

0 5 10 15 20 MILES
0 5 10 15 20 KILOMETERS

Figure 1. Location of the study area, Driftwood and Wimberley 7.5-minute quadrangles, Hays and Comal Counties, Texas. Aquifers from George and others, 2011.

Table 1. Summary of bedrock geology and hydrostratigraphy of the Edwards and Trinity aquifers within the Driftwood and Wimberley 7.5-minute quadrangles, Hays and Comal Counties, Tex.

[Period, Epoch, Group, Formation, members, and lithology modified from Imlay (1945), Whitney (1952), Lozo and Stricklin (1956), Stricklin and others (1971), Rose (1972), Stricklin and Smith (1973), Amsbury (1974), Inden (1974), Perkins (1974), Clark and others (2009, 2013, 2014), Weirman and others (2010), Blome and Clark (2014), and the U.S. Geological Survey National Geologic Map Database, GEOLEX (http://ngmdb.usgs.gov/Geolex.html); *Orbitolina minuta* (Douglas, 1960), *Orbitolina texana* (Roemer, 1852); aquifers from Maclay and Small (1976), and Ashworth (1983); thickness from outcrop, Clark and others (2009, 2014), Weirman and others (2010); hydrologic function modified from outcrop (Clark and others, 2009, 2013, 2014; Weirman and others, 2010; Clark and Morris, 2015); porosity types modified from Choquette and Pray (1970).

Fabric selective: IP, Interparticle porosity; IC, Intercrystalline porosity; SH, Shelter porosity; MO, Moldic porosity; BU, Burrowed porosity; FE, Fenestral; BP, Bedding plane porosity.

Not-fabric selective: FR, Fracture porosity; CH, Channel porosity; BR, Breccia; VUG, vug porosity; CV, Cave porosity; *no further subdivision; **not present in the study area]

Geology							Hydrostratigraphy					
Period	Epoch	Group	Formation	Member (formal and informal)	Lithology and ichnology	Map abbreviations and color	Hydrologic unit	Hydrostratigraphic unit[1] (HSU)	Thickness[2] (outcrop in the study area, in feet)	Hydrologic function	Porosity type	Field identification
Cretaceous	Late Cretaceous	Washita	Del Rio Clay	*	Fossiliferous blue-green to yellow-brown clay, packstone, iron nodules; *Ilymatogyra arietina*	Kdr	Confining unit	*	40–50	Confining	None	Clay, holds water, fossiliferous; *Ilymatogyra arietina*
			Georgetown	*	Reddish-brown, gray to light tan shaley mudstone and wackestone, black dendrites, iron nodules, iron staining; *Plesiotorrilites brazoensis*, *Waconella waconesis*	Kg	Edwards aquifer	I	20–30	Confining	MO	Black dendrites, iron nodules and staining, *Plesiotorrilites brazoensis*, *Waconella waconesis*
		Edwards	Person	Cyclic and marine (undivided)	Pelletal limestone, mudstone, miliolid grainstone, packstone, chert (bedded and large nodules); caprinid, cross-bedded	Kpcm		II	80–90	Aquifer	MO, BU, VUG, BP, FR, CV	Thin graded cycles; massive beds to relatively thin beds; cross-beds, caprinids
				Leached and collapsed (undivided)	Recrystallized limestone, mudstone, wackestone, packstone, grainstone; chert (bedded and large nodules); iron-stained, stromatolitic, *Toucasia* sp., *Montastrea roemeriana*, oysters	Kplc		III	70–90	Aquifer	BU, VUG, FR, BP, BR, CV	Bioturbated iron-stained beds separated by massive limestone beds; stromatolitic limestone, *Montastrea roemeriana*
				Regional dense	Dense, shaley, mudstone, wackestone, oyster-shell mudstone and wackestone, iron staining, chert	Kprd		IV	20	Confining	FR, CV	Wispy iron-oxide stains, thin bedded, often white in aerial photographs
			Kainer	Grainstone	Miliolid, skeletal fragmented grainstone, mudstone, wackestone; chert (beds and nodules); cross-bedded and ripple marked	Kkg		V	40	Aquifer	IP, BU, FR, BP, CV	Cross-bedded, ripple marks, miliolid grainstone
				Kirschberg evaporite	Highly altered crystalline limestone, chalky mudstone, occasional grainstone associated with tidal channels; chert (beds and nodules); coarse-grained spar, breccia and travertine, dissolution has removed all evaporites in the study area	Kkke		VI	40–50	Aquifer	IP, MO, VUG, FR, BR, CV	Boxwork porosity with neospar and travertine frame
				Dolomitic	Chert (absent in lower 20 ft), dolomitic mudstone, wackestone, packstone, grainstone	Kkd		VII	90–120	Aquifer	IP, IC, MO, BU, VUG, FR, BP, CV	Massively bedded light gray, *Toucasia* sp., abundant
			Walnut Clay	Basal nodular	Shaley, nodular limestone, burrowed mudstone, wackestone, packstone, miliolid grainstone, dolomite, contains dark, spherical textural features locally known as black rotund bodies (BRBs); caprinid, *Ceratostreon* [*Exogyra*] *texana*, miliolid, gastropods; area transitions to basal nodular containing oyster beds and shale	Kkbn / Kwc		VIII	40	Aquifer, confining unit in areas without caves	IP, MO, BU, BP, FR, CV	Massive, nodular and mottled limestone, BRBs and orange wisps, *Ceratostreon* [*Exogyra*] *texana*, seeps and springs, ferns growing near contact of underlying unit
		Trinity	Glen Rose Limestone	Upper	Alternating beds of burrowed wackestone, packstone, miliolid grainstone, argillaceous limestone	Kgrcb	Upper zone of the Trinity aquifer	Camp Bullis	230	Confining	BU, BP, FR, occasional CV	Alternating beds of limestone and argillaceous limestone, fossils rare, stair-step topography
					Dissolved evaporites, highly altered crystalline limestone and chalky mudstone, breccia, boxwork voids	Kgrue		Upper evaporite	10	Aquifer	IP, MO, BU, BR	Spring and seeps
					Alternating wackestone, packstone, miliolid grainstone, argillaceous limestone, mudstone, silty mudstone at base; *Hemiaster* sp., *Neithea* sp., *Orbitolina minuta* (Douglas, 1960), *Porocystis golobularis*, *Protocardia texana*, *Tapes decepta*, *Turritella* sp., gastropods, mollusks; (section not subdivided into an upper and lower unit as in Bexar and Comal Counties)	Kgrf		Fossiliferous	120–130	Semi-confining	MO, BU, FR, CV	Limestone and argillaceous limestone, *Orbitolina minuta* (Douglas, 1960)
					Dissolved evaporites, highly altered crystalline limestone and chalky mudstone, breccia, boxwork voids; Corbula beds	Kgrle		Lower evaporite	10	Aquifer	IP, MO, BU, BR	Weathers to an orangish red with a pebbly texture, often has less cedar growth and thicker grasses, boxwork porosity, *Corbula* sp., spring and seeps
				Lower	Wackestone, grainstone, argillaceous wackestone, shale, evaporites; monopleurid, *Toucasia* sp., *Macraster* sp., *Nerinia* sp., *Orbitolina texana* (Roemer, 1852), *Porocystis golobularis*, *Salenia texana*, gastropods, pecten, and pelecypods	Kgrb	Middle zone of the Trinity aquifer	Bulverde	30–40 (typically 30)	Semi-confining	MO, BR, BP, FR	*Salinia texana* bed immediately below Corbula bed, abundant fossils including *Porocystis golobularis*, *Orbitolina texana* (Roemer, 1852), *Macraster* sp., *Nerinia* sp., pecten, gastropods, pelecypods
					Mudstone, wackestone, argillaceous wackestone, boundstone; caprinid, monopleurid, *Toucasia* sp., *Orbitolina texana* (Roemer, 1852), gastropods, pectens, pelecypods	Kgrlb		Little Blanco	30–40 (typically 30)	Aquifer	MO, BU, BP, FR	Limestone beds thicker and more resistive to erosion than overlying and underlying units, *Orbitolina texana* (Roemer, 1852), patch reefs
					Argillaceous wackestone, shale; *Orbitolina texana* (Roemer, 1852), gastropods, pelecypods	Kgrts		Twin Sisters	30–40 (typically 30)	Semi-confining; Confining shale beds	IP	Thick argillaceous beds, thin shale beds, *Orbitolina texana* (Roemer, 1852), contains ponds and seeps, often little vegetation, steeper slopes often with "badlands" type weathering, thinner in areas where patch reefs are present in the underlying Doeppenschmidt HSU
					Mudstone, wackestone, packstone, grainstone, boundstone, argillaceous wackestone and packstone, miliolid grainstone; caprinid, *Toucasia* sp.	Kgrd		Doeppen-schmidt	40–80 (typically 40)	Aquifer	IP, MO, BU, BP, FR, CV	*Orbitolina texana* (Roemer, 1852), limestone beds thicker and more resistive than overlying and underlying patch reefs formed on rudist, reefal talus
					Alternating beds of argillaceous wackestone, packstone; mudstone, wackestone, packstone, grainstone, miliolid grainstone; monopleurid, *Nerinia* sp., *Orbitolina texana* (Roemer, 1852), *Tylostoma* sp., and oysters, pectens, and pelecypods	Kgrr		Rust	40–70 (typically 40)	Semi-confining	IP, FR, CV	Forms stair-step topography with soils, *Orbitolina texana* (Roemer, 1852)
					Wackestone, packstone, grainstone, boundstone, burrows; caprinid, miliolid, *Orbitolina texana* (Roemer, 1852), *Toucasia* sp., *Trigonia* sp., *Turritella* sp., various corals, pectens, shell fragments	Kgrhc		Honey Creek	45–60 (typically 55)	Aquifer	IP, MO, BU, BP, FR, CH, CV	Thick beds of wackestone, packstone, grainstone; corals, caprinid, *Trigonia* sp., cliff forming; outcrop often contains large limestone float with large channel and moldic porosity, caves and springs

[1]Informal
[2]Thickness range based on field mapping in the study area

EXPLANATION OF HYDROSTRATIGRAPHIC UNITS

Formation	Member (Formal and informal)	Informal hydrostratigraphic unit	
Del Rio Clay	*	Kdr	Upper Confining Unit (UCU)
Georgetown	*	Kg	I
Person	Cyclic and marine, undivided	Kpcm	II
	Leached and collapsed, undivided	Kplc	III
	Regional dense member	Kprd	IV
Kainer	Grainstone	Kkg	V
	Kirschberg evaporite	Kkke	VI
	Dolomitic	Kkd	VII
Walnut Clay	Basal nodular	Kkbn / Kwc	VIII
Glen Rose Limestone	Upper Glen Rose Limestone	Kgrcb	Camp Bullis
		Kgrue	Upper evaporite
		Kgrf	Fossiliferous
		Kgrle	Lower evaporite
	Lower Glen Rose Limestone	Kgrb	Bulverde
		Kgrlb	Little Blanco
		Kgrts	Twin Sisters
		Kgrd	Doeppenschmidt
		Kgrr	Rust
		Kgrhc	Honey Creek

98°15'00" 98°07'30" 98°00'00" 97°52'30"
30°15'00" HENLY | DRIPPING SPRINGS | SIGNAL HILL
30°07'30" ROUGH HOLLOW | DRIFTWOOD | MOUNTAIN CITY
30°00'00" DEVILS BACKBONE | WIMBERLEY | SAN MARCOS NORTH
29°52'30" SATTLER | HUNTER | SAN MARCOS SOUTH
29°45'00"

Index map showing map area in yellow and adjacent U.S. Geological Survey (USGS) 7.5-minute quadrangles.

MAP EXPLANATION

- **Fault**—Type unspecified, dashed where inferred; U, upthrown block; D, downthrown block
- **Contact**—Between hydrostratigraphic units
- **Corbula bed contact**—The *Corbula* sp. bed
- **Study boundary**
- **Strike and dip of hydrostratigraphic unit**
- **Cave**—Orientation unspecified
- **Sink**
- **Spring**

CONVERSION FACTORS

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)

Base from U.S. Geological Survey 7.5-minute quadrangles
Driftwood 1964, rev. 1986; and Wimberley, Tex. 1989
U.S. Geological Survey bases downloaded from and cropped by Texas Natural Resources Information System accessed on March 2017 at https://tnris.org/
North American Datum of 1983 (NAD83)
Universal Transverse Mercator Projection, zone 14

TRUE NORTH
GRID NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 2016

SCALE 1:24 000
1 1/2 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
CONTOUR INTERVAL 20 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

TEXAS
LOCATION OF QUADRANGLES

Original data were collected in the field with the use of handheld global positioning system (GPS) enabled devices. While in the field mapping, attributes were tagged to the waypoints.
Lithologic and hydrostratigraphic descriptions are from field observations and previous investigations.
Digital cartography and geographic information systems (GIS) database by Diana E. Pedraza
Edit and digital layout by J.A. Herrick
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For more information concerning this publication, contact
Director, USGS Texas Water Science Center
U.S. Geological Survey
1505 Ferguson Lane
Austin, Texas 78754–4501
(512) 927-3500

Or visit the Texas Water Science Center Web site at
http://tx.usgs.gov/

Bedrock Geology and Hydrostratigraphy of the Edwards and Trinity Aquifers Within the Driftwood and Wimberley 7.5-Minute Quadrangles, Hays and Comal Counties, Texas

By
Allan K. Clark and Robert R. Morris

2017

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U.S. Geological Survey
1505 Ferguson Lane
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