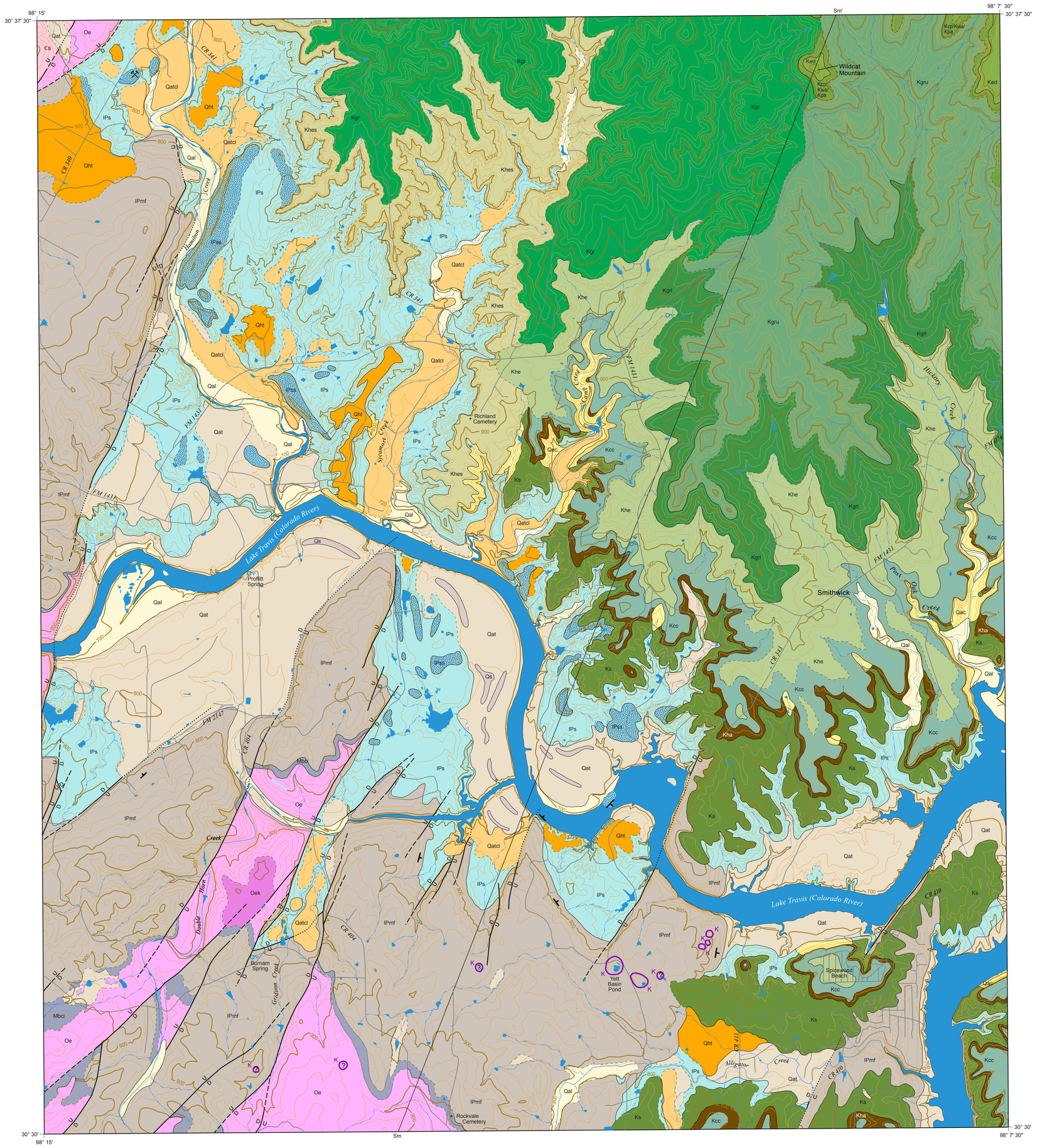
BUREAU OF ECONOMIC GEOLOGY
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GEOLOGIC MAP OF THE SMITHWICK QUADRANGLE
Open-File Map 0216



Quaternary

Qal—Qal—Alluvium along margins of Lake Travis, including Colorado River deposits near spillway level and lower reaches of tributary streams: sand, silt, and clay; local gravel; exposed thickness less than 10 ft.

Qat—Qat—Alluvium and terrace deposits along margins of Lake Travis above spillway level; occurs as disjunct parcels of gently sloping land with thick soils; substrate sand, gravel, silt, and clay; thickness variable but locally more than 60 ft.

Qatcl—Qatcl—Alluvium and terrace/predominantly clay; valley-bottom deposits on Smithwick Shale terrain; eroded clay sediments mostly 10 to 20 ft thick; local eroded strath surfaces that may be covered by veneers of alluvium or colluvium or by clay soils; contains local flags and blocks of Smithwick Sandstone.

Qac—Qac—Alluvium and colluvium; mostly water-gathering slopes along various drainage courses but also including local side-slope deposits on steep surfaces (such as along steeply-cut lakeshore bluffs); substrate highly variable materials derived from mass wasting and sheet wash; includes massive breakdown blocks of limestone admixed with clay soil, to stony rubble, to valley-bottom sediments consisting of eroded clay soils and calcareous fragments ranging from silt to gravel; local caliche cement; thickness variable but deposits mainly constitute veneers over bedrock 2 to 10 ft thick.

Qs—Qs—Swale: elongated depression (former stream channel) on alluvial plain; contains predominantly fine-grained sediment; thickness estimated to be less than 5 ft; concave surfaces periodically pond water.

Qht—Qht—High alluvial terrace: high-standing alluvial deposits, 20+ ft thick; typically flat upland surfaces above modern stream valleys; includes both Colorado River deposits and those of tributary streams.

Cretaceous

Ked—Ked—Edwards Limestone: resistant, massive carbonate strata holding up outliers of the once more-extensive Edwards Plateau; variable thicknesses of diverse carbonate rocks, including well-indurated limestone, vuggy burrowed rock, rudist boundstones, friable dolomitic beds, and local pulverulite (similar to caliche, but probably originated as dolomitic limestone leached by percolating groundwater); maximum thickness about 80 ft; minimum thickness of erosional outliers less than 20 ft; may have local karst features, although none are denoted within limits of this map. Upland surfaces may receive seasonal recharge into a high-standing perched aquifer; seepage from base of this unit may occur following rainy periods.

Kcp/Kwa/Kpa—Kcp/Kwa/Kpa—Comanche Peak Formation, Walnut Formation, and Paluxy Sand, undivided: in northeast corner of quadrangle, steeply sloping interval lying beneath Edwards caprock comprising limestone, clayey limestone, and discontinuous thin sequences of friable sand above dolomitic strata of Glen Rose Formation; forms recessive slopes beneath Edwards cap; sequence comprises steeply sloping strata commonly covered by slope-wash debris, colluvium, or soil. Total thickness less than 100 ft. Unit forms aquitard beneath perched water-bearing sections of Edwards Limestone; Spanish oaks form distinctive band of vegetation within this interval.

Kgru—Kgru—Glen Rose Limestone (upper member): unit forms dissected, stepped terrain in northeast part of quadrangle; up to 300 ft thick; forms steep slopes beneath prominent hilltops and underlying recessive strata (Walnut/Comanche Peak/Paluxy) beneath Edwards Limestone caps. Glen Rose stair steps formed on interbedded carbonate rocks, with ledges of resistant limestone or silty dolomite beds forming caps of "risers" and floors of overlying "treads." In contrast, so-called "marly" intervals form recessive slopes (risers) beneath resistant ledges. Most recessive strata not marls, but limestone with heterogeneous fabric containing multiple irregular clay partings that weather rapidly (Woodruff and Wilding, 2008); local intervals contain abundant fossils, including casts of bivalves, gastropods, and echinoids. Friable sandstone beds occur near upper contact; well-cemented, granular, sandy limestone beds occur locally near base of unit. Basal part of unit leached evaporitic horizons containing vuggy limestone, boxwork fabric, and poorly formed geodes. Upper Member of Glen Rose comprises Upper Trinity aquifer (Brune and Duffin, 1983), although viability of stratigraphic unit as water-bearing unit highly limited, owing to lack of continuous sequences of strata with porosity and permeability sufficient to allow efficient hydrologic communication; because of local occurrence of leached evaporate minerals, water quality possibly inferior.

Kgrl—Kgrl—Glen Rose Limestone (lower member): contact between lower and upper Glen Rose generally marked by locally prominent bed or sequence of thin-bedded (commonly iron-stained) and well-indurated limestone, Corbula bed, containing myriad fossils of tiny (sunflower-kernel-sized) clam. Marker bed not typically found within map limits, so boundary inferred by presence of locally prominent bench above recessive, weathered interval containing diverse fossil casts of clams, gastropods, and echinoids (*Salenia texana* interval). Thin, ledge-forming limestone over light-colored marly sequence forming couplet commonly recognized on aerial photographs and in field; local presence of quartz-granule-bearing limestone (or local limy sandstone) interval at presumed stratigraphic level of Corbula bed suggesting shallow-marine scour possibly removed diagnostic fossil-bearing beds. Contact interval marks top of 75- to 100-ft-thick sequence of stepped strata, largely dolomitic and containing horizons of silty dolomite and dolomitic limestone with vuggy porosity. Lower Glen Rose sufficiently permeable to be upper part of middle Trinity aquifer, including underlying Hensel Sand and Cow Creek Limestone (Brune and Duffin, 1983). At base, lower member of Glen Rose interfingering with underlying Hensel Sand. Fine-grained sand beds between intervals of silty (and sandy) dolomite.

Kgr—Kgr—Glen Rose Limestone, undivided: in its updip extent, marker beds are not clearly expressed at the contact between upper and lower members of the Glen Rose. Composite unit consists of interbedded limestone and dolomitic limestone with sandy dolomitic strata near lower contact; thin- to medium-bedded; total exposed thickness approximately 250 ft forms stepped terrain as seen in upper and lower members to the east.

Khe—Khe—Hensel Sand: at gradational contact with Glen Rose Limestone, silty dolomite beds interfinger with fine-grained dolomitic sands. Lower in section, clastic fraction more coarse-grained and more diverse—from quartz arenite, to subarkose, to granule, pebble, and cobble conglomerate. Cementation predominantly calcite, from weak to moderately strong. Festoon crossbedding evident locally, especially near base of formation; 40 to 80 ft thick. Sandy clay soils supporting mesquite and post oak; widespread, uniform permeability allowing infiltration into middle Trinity aquifer; contact with underlying Cow Creek Limestone unconformable.

Kcc—Kcc—Cow Creek Limestone: various carbonate rock types including fine-grained marine limestone strata that interfinger with underlying Hammett Shale (including local sandy and silty beds) and that coarse upward to include oyster-reef deposits, shell coquinas, and crossbedded shell-fragment beach rock. Karst landforms occurring locally, especially above lakeshore bluffs, where joints enlarged by dissolution. Infiltration and storage of groundwater in bottommost formation composing middle Trinity aquifer; 40 to 65 ft thick; upper surface locally consists of discontinuous weathered caliche accumulation, friable; approximately 5 ft thick (Stricklin and others, 1971).

Kha—Kha—Hammett Shale: calcareous claystone and siltstone admixed with local lenses of sand and conglomerate; typically about 20 ft thick (locally up to 30 ft). Outcrops rare owing to interval being covered by soil or slump blocks of overlying limestone. Along lakeshore bluffs and steeply sloping stream valleys, mappable interval discontinuous. Locally light-colored bands along topographic benches formed on upper intervals of Sycamore Sand; contact with underlying Sycamore Sand unconformable; shale forms aquitard between middle and lower Trinity aquifers.

Ks—Ks—Sycamore Sand: mostly conglomerate (moderately well cemented), local sand lenses deposited on irregular (eroded) surface on underlying Paleozoic terrain; 30 to 75 ft thick. Component sediments range from silt–clay to cobble–boulder sizes; clasts typically well rounded, consisting of assorted durable Paleozoic and Precambrian rocks of Llano Uplift. Bedding generally indistinct, but prominent trough-fill crossbedding locally well expressed. Typical landscape steeply cut slopes adjacent to Lake Travis and resistant caps and benches with mesquite and post oak above Paleozoic claystone and sandstone strata; comprises recharge zone for lower Trinity aquifer. Unconformable contact marking buried erosional surface termed Wichita Paleoplain (Hill, 1901); missing interval represented by unconformity, including Permian, Triassic, and Jurassic, as well as lower half of Cretaceous. Relief roughly 160 ft (O'Sullivan, 1967).

Khes—Khes—Hensel/Sycamore Formations, undivided: in updip areas north of Lake Travis, clear evidence is lost for mappable Hammett Shale or Cow Creek Limestone; in this area basal Cretaceous section consists of undifferentiated assorted strata of sandstone, ranging from poorly indurated sands, locally variegated, to well-cemented sandstones with calcite cement and conglomerates containing both limestone clasts and other materials derived from crystalline rocks of the Llano uplift. Local shaly horizons, oyster beds, and bored limestone cobbles provide indications for intervals representing the Hammett shale or its contact with Sycamore Sand below; these discontinuous outcrops are not extensive enough to be mappable throughout the area. Maximum thickness in map area about 150 ft; minimum thickness is about 50 ft in western-most occurrence of unit.

Pennsylvanian

IPs—IPs—Smithwick Shale: claystone, generally nonfissile, dark greenish-gray to gray, weathered to olive brown; contains local flags of hard sandstone; maximum exposed interval on quadrangle about 200 ft thick east of Hamilton Creek near the northern map boundary; water-well data in the vicinity of Hamilton Creek suggest a thickness in that area of 450 ft (Warner, 1961); apparent thicknesses distorted in vicinity of faults. Exposures commonly covered by colluvium on steep slopes; local slumping; low-permeability substrate forming aquitard beneath lower Trinity aquifer. Formation dips northeast, and thickens markedly in the subsurface as it approaches the frontal reaches of the Ouachita structural belt.

IPss—IPss—Smithwick Sandstone: sandstone, dense, well-cemented, fine-grained occurring in discontinuous lenses with strata ranging from thin to medium bedded; local steep dips suggest submarine slump deposits (turbidites), although graded bedding is not readily seen. Maximum mapped thickness of sandstone substrate approximately 100 ft; in subsurface, these disjunct deposits undoubtedly occur, but thickness and extent are unknown. In cross section, such deposits are subsumed within the general subsurface extent of the Smithwick Shale.

IPmf—IPmf—Marble Falls Limestone: limestone, dark, fossiliferous (commonly petroliferous), well-indurated, moderately to thickly bedded with shaly partings common; contain siliceous zones (mostly broken fossil fragments), and local black chert. Total thickness mapped on quadrangle, approximately 200 ft; total thickness in type area about 350 ft (Namy, 1969), but thicknesses distorted owing to variable dips in vicinity of faults. Occurs on hilly, tree-covered terrain and contains locally significant karst features; functions as important local aquifer in this area.

Mississippian/Devonian

Mbci—Mbci—Barnett/Chappel/Ives undifferentiated: sequence consists of several units that are poorly exposed or that occur in areas in which no access was granted to properties; their presence mostly inferred based on unpublished mapping by Barnes (n.d.); units include the Barnett Shale, Chappel Limestone, and Ives Breccia, which are thin (less than 20 ft thick and laterally discontinuous). Although not well expressed in outcrop, Barnett Shale inferred on aerial photos by locally distinct vegetative assemblage consisting of dense thorny brush species; described (Barnes, 1981) as dark-colored, petroliferous shale with limestone and phosphate concretions; where observed, material highly weathered and expressed by calichified section. Chappel Limestone consists of accumulations of crinoidal fragments; Ives Breccia consists of broken chert fragments.

Ordovician/Cambrian

Oe—Oe—Ellenburger Group: limestone and dolomite, dense, mostly thick-bedded and well-indurated with locally abundant, light-colored chert; mapping by Barnes (1981) includes three formations (approximately 400 ft thick in the general area but undivided here); total mapped thickness on quadrangle about 200 ft; thicknesses distorted because of extensive areas of fault displacement. Expressed as rugged tree-covered uplands with local karst features; functions as locally important aquifer.

Oek—Oek—Ellenburger karst complex: areas of preservation of disjunct bedrock units in paleokarst features on ancient Ellenburger erosion surface, inferred on the basis of incomplete mapping by Barnes (n.d.). Mapped occurrence on one hilltop in area bounded by faults; thickness of interval approximately 50 ft; thickness of preserved inliers unknown; unit consists of Ellenburger Group, containing remnants of Mississippian and Devonian units (discussed above); other stratigraphic units may also be present; not known to occur elsewhere on Smithwick Quadrangle.

Cs—Cs—San Saba Limestone: dolomite and limestone with local glauconite and chert; well-indurated rock; restricted a to single, fault-bound occurrence at northwest corner of map area; thickness in this area about 80 ft; total unit thickness 215–325 ft (Barnes, 1981).

Legend

- Contact; dashed where approximate; dotted where covered
- Normal fault; U, upthrown block; D, downthrown block; dashed where approximate; dotted where covered
- Dip and strike of beds, dipping between 2° and 15°
- Stream
- Intermittent stream
- Spring
- Karst feature (? where questionable)
- Road
- Elevation; contour interval 20 ft
- Quarry
- Surface water bodies; normal pool elevation of Lake Travis = 681 ft (msl)

Acknowledgments

The mapping of this quadrangle is based on analyses of aerial photographs and extensive fieldwork. The topographic base was created from digital files of the Texas Natural Resources Information Services (TNRIS) for the U.S. Geological Survey, Smithwick, Texas, 7.5-minute topographic quadrangle map. Digital files of roads, county boundaries, drainage, and lakeshores were also obtained from TNRIS.

Part of the map is derived (and locally modified) from Woodruff (1973). Regional mapping by Barnes (1981) provided locally helpful stratigraphic information; also, owing to difficult to nonexistent access to properties in the western and southwestern parts of the quadrangle, I relied on many of Barnes's stratigraphic and structural interpretations of Paleozoic rock units on unpublished Bureau of Economic Geology maps. I also relied on stratigraphic work on the Walnut and Comanche Peak Formations by Moore (1959, 1961, 1964), by O'Sullivan (1967) on the basal Cretaceous rock units, and by Kimberly (1961), McBride and Kimberly (1963), Namy (1969), and Warner (1961) on the stratigraphy and structure of Pennsylvanian rock units and their structural dislocations. Special appreciation is extended to Edward W. Collins for ongoing consultation and for worthwhile discussions in the field, and to Earle F. McBride and Brian B. Hunt for providing helpful feedback during a final field review.

I am indebted to staff of the U.S. Fish and Wildlife Survey for allowing access to the tracts that compose the northwestern parcels of the Balcones Canyonlands National Wildlife Reserve (NWR). The permit for access was authorized by Deborah Holle, Reserve Manager. Scott Rowin, Wildlife Biologist, provided information about specific sites, including computer-generated copies of aerial maps. I also extend thanks to private landowners for access to their properties, especially Doug English in the lakeshore areas due north of Spicewood, and the late Dudley H. Holland for upland areas on basal Cretaceous substrate east of Hamilton Creek, in the northwest part of the map area. Access to the NWR tracts on this quadrangle was allowed by David Johnston, owner of Hickory Pass Ranch.

Work on this map was supported by the STARR program. Computer graphics work done to construct the map was by Cathy Brown. Editing was done by Chris Parker and Justin Perry. The author disclaims any responsibility or liability for interpretations from this map.

References

Barnes, V. E., Project Director, 1981, Llano sheet: The University of Texas at Austin, Bureau of Economic Geology, Geologic Atlas of Texas, scale 1:250,000.

Brune, G., and Duffin, G., 1983, Occurrence, availability, and quality of ground water in Travis County, Texas: Texas Department of Water Resources Report 276, 219 p.

Hill, R. T., 1901, Geography and geology of the Black and Grand Prairies, Texas: U.S. Geological Survey 21st Annual Report, part VII—Texas, 666 p.

Kimberly, J. E., 1961, Sedimentology of the Smithwick Formation, Burnet County, Texas: The University of Texas at Austin, M.A. thesis, 95 p.

McBride, E. F., and Kimberly, J. E., 1963, Sedimentology of Smithwick Shale (Pennsylvanian), eastern Llano region, Texas: American Association of Petroleum Geologists Bulletin, v. 47, no. 10, p. 1840–1854.

Moore, C. H., Jr., 1959, Stratigraphy of the Walnut Formation, south-central Texas: The University of Texas at Austin, M.A. thesis, 110 p.

_____ 1961, Stratigraphy of the Fredericksburg Division, south-central Texas: The University of Texas Austin, Ph.D. dissertation, 91 p.

_____ 1964, Stratigraphy of the Fredericksburg Division, south-central Texas: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 52, 48 p.

Namy, J. N., 1969, Stratigraphy of the Marble Falls Group, southeastern Burnet County, Texas: The University of Texas at Austin, Ph.D. dissertation, 385 p.

O'Sullivan, W. J., 1967, Trinity Division of Smithwick area, Burnet County, Texas: The University of Texas at Austin, M.A. thesis, 92 p.

Stricklin, F. L., Jr., Smith, C. I., and Lozo, F. E., 1971, Stratigraphy of Lower Cretaceous Trinity deposits of Central Texas: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 71, 63 p.

Warner, R. H., 1961, Structural geology of Carboniferous rocks near Marble Falls, Burnet County, Texas: The University of Texas at Austin, M.A. thesis, 72 p.

Woodruff, C. M., Jr., 1973, Land-use limitations related to geology in the Lake Travis vicinity, Travis and Burnet Counties, Texas: The University of Texas at Austin, Ph.D. dissertation, 161 p.

Woodruff, C. M., Jr., and Wilding, L. P., 2008, Bedrock, soils, and hillslope hydrology in the Central Texas Hill Country, USA: implications on environmental management in a carbonate-rock terrain: Environmental Geology, v. 55, p. 605–618.

SCALE 1:24,000

0 1 2 MILES

0 1 2 KILOMETERS

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, ZONE 14N NAD 83
CONTOUR INTERVAL = 20 FEET

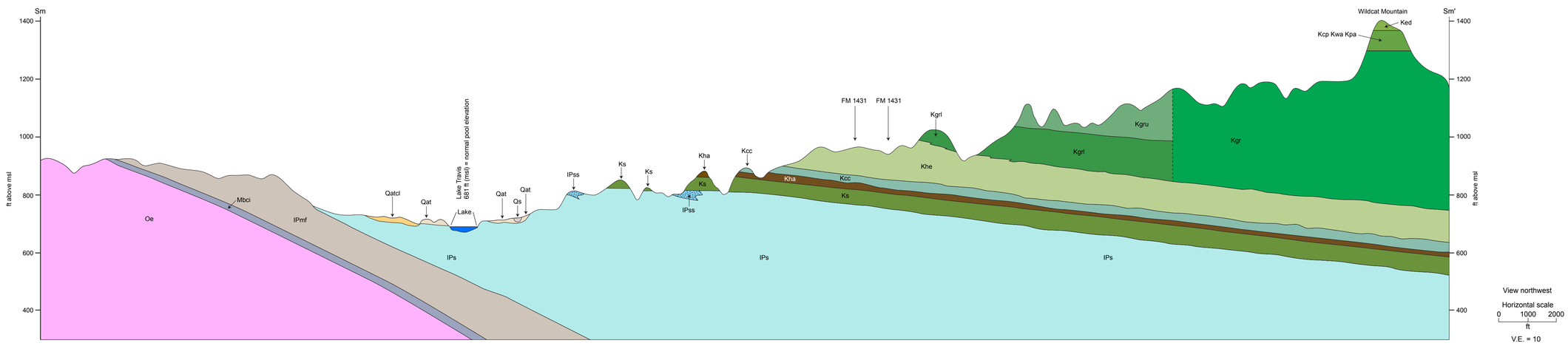
N
4.4° MN
Approximate 2014 Magnetic North
(MN) declination

TEXAS

GEOLOGIC MAP OF THE SMITHWICK QUADRANGLE, TEXAS

C. M. Woodruff, Jr.

2014



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