PRELIMINARY SURFICIAL GEOLOGY OF THE SUMNER COUNTY PORTION OF THE BELLE PLAINE QUADRANGLE, KANSAS

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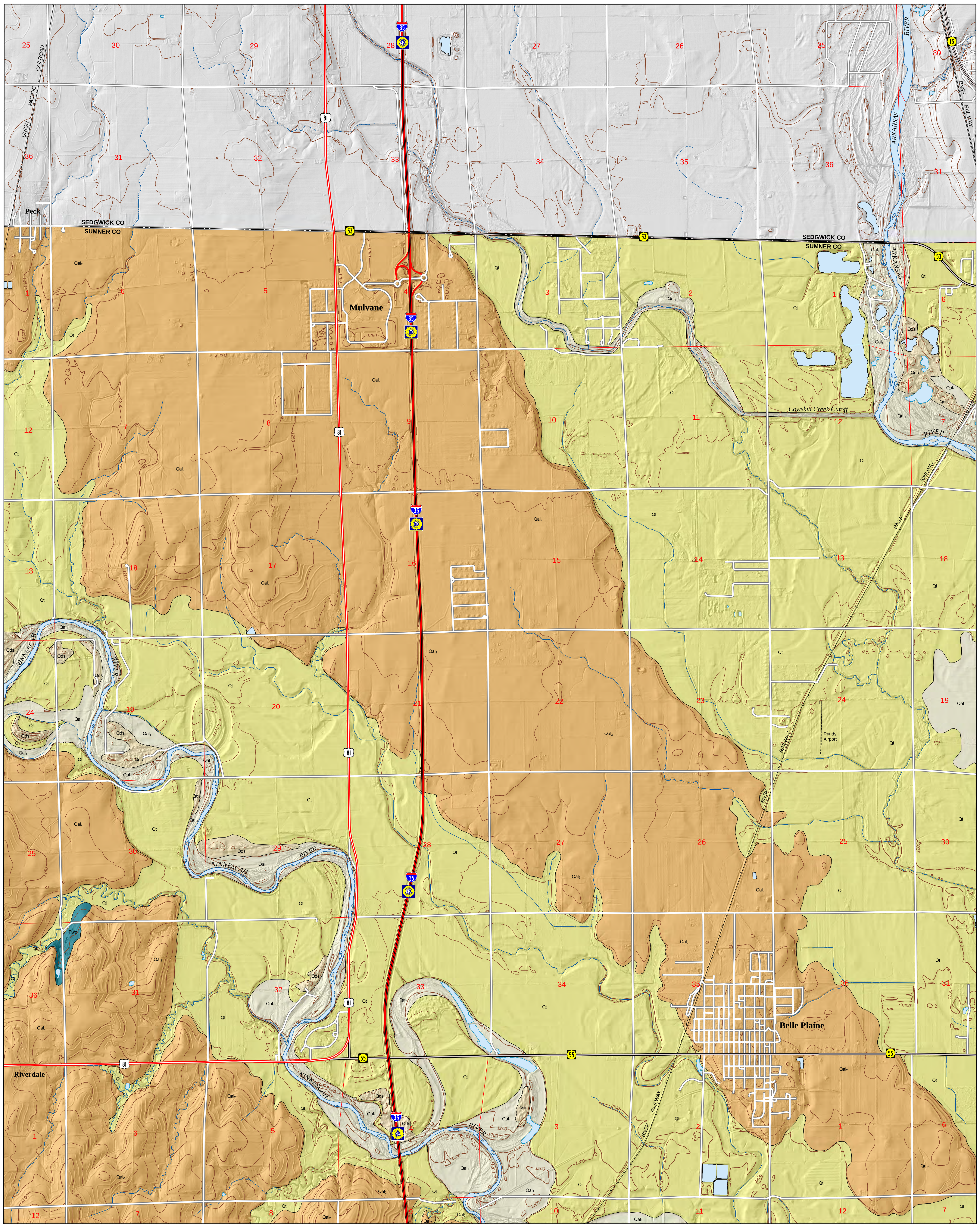


The following descriptions consist of a compilation of several sources, including field notes and measured sections, data from shallow (<10 m [33 ft]) cores collected during the course of mapping, U.S. Department of Agriculture Natural Resources Conservation Service databases, and lithologic and other data in Swineford (1955) and Walters (1961).

GEOLOGIC UNITS

CENOZOIC

Quaternary System
Pleistocene-Holocene

Qal_1

Undifferentiated floodplain alluvium—Floodplain deposits are associated with most of the principal streams in Sumner County, including the Arkansas, Ninnescah, and Chikaskia rivers. Most streams in the county have undergone deep incision during the latest Holocene and have recently re-established floodplains within the incised channels in some areas. Hence, floodplain deposits are likely less than 1,000 years old. Floodplain alluvium is composed of silt, sand, and gravel and is relatively thin, probably not exceeding 20 ft (6 m) in thickness.

Qt

Alluvial terrace deposits—Stream terrace deposits are present in all major stream valleys in the county. Radiocarbon and luminescence ages indicate that terrace deposits are late Pleistocene to Holocene in age (30,000–1,500 yr B.P.). Terrace deposits are composed of clay, silt, sand, and gravel and likely do not exceed 70 ft (21 m) in thickness. Terrace alluvium in the principal stream valleys tends to be coarser grained, being chiefly derived from upland alluvial deposits (Qal_2) in the county as well as sediments comprising the High Plains succession in adjacent western counties (e.g., Kingman and Harper). Terrace deposits in smaller stream valleys are primarily derived from local shale units of the Permian Sumner Group and therefore tend to be finer grained.

Qal_2

Upland alluvium—Upland alluvial deposits are extensive in Sumner County and are found well above (up to 65 ft [20 m]) and often distant from modern stream valleys. Upland alluvium is composed chiefly of silt, sand, and gravel. These deposits are reddish brown in color and coarser sediments are typically arkosic. Upland alluvium may be up to 90 ft (27 m) thick.

Qds

Dune sand—Isolated eolian sand deposits occur primarily on floodplain (Qal_1) and terrace (Qt) surfaces in Sumner County. These deposits are associated with major streams (e.g., the Arkansas and Chikaskia rivers) as they provide the source for the windblown sediments. Luminescence dating of the Hutchinson dunes, which mantle alluvial deposits of the Arkansas River in Reno County, indicate that eolian sand deposition has most recently occurred episodically over the last 2,100 years (Halfen et al., 2012). Dune sand thickness is highly variable but is generally less than 30 ft (9 m) thick.

PALEOZOIC

Permian System
Leonardian Series

Pwe

Wellington Formation—The Wellington Formation ranges from 40 to 650 ft (12 to 198 m) in thickness and consists principally of gray to greenish-gray shale with minor amounts of limestone, dolomite, siltstone, gypsum, and anhydrite, representing marine, brackish, and freshwater environments (Swineford, 1955; Walters, 1961). The Wellington Formation contains the following formally recognized members, in ascending order: the Hollenberg Limestone, the Carlton Limestone, the Hutchinson Salt, and the Milan Limestone, as well as two unnamed members (Sawin et al., 2008). The Wellington Formation is bounded by the Nolans Limestone below and the Ninnescah Shale above. Throughout the county, the formation either crops out or is covered unconformably by Quaternary deposits.

The Hollenberg Limestone is a persistent bed of argillaceous, dolomitic limestone and comprises the lower 40 ft (12 m) of the formation. The Carlton Limestone primarily consists of gray-green shales containing numerous discontinuous thin (<0.5 ft [15 cm]) beds of limestone and can be up to 60 ft (18 m) thick. The middle part of the Wellington Formation is composed of the Hutchinson Salt Member. No outcrops of this member are present in the county because of its high solubility. The Hutchinson Salt Member is thickest in the northwest part of the county but likely does not exceed 150 ft (45 m). A distinct color change from gray-green to red and purplish-red shale occurs in the upper part of the Wellington Formation. The Milan Limestone marks the top of the Wellington Formation and may be as much as 8 ft (2.5 m) thick. It consists of one to three thin beds of dolomitic limestone containing bright-green copper carbonate. In many places in Sumner County, the Milan cannot be recognized; hence the contact between the Wellington Formation and the overlying Ninnescah Shale is indefinite.

CITED REFERENCES

Halfen, A. F., Johnson, W. C., Hanson, P. R., Woodburn, T. L., Ludvigson, G. A., and Young, A. R., 2012, Activation history of the Hutchinson dunes in east-central Kansas, USA during the past 2,200 years: Aeolian Research 5, p. 9–20.

Sawin, R. S., Franseen, E. K., West, R. R., Ludvigson, G. A., and Watney, W. L., 2008, Clarification and changes in Permian stratigraphic nomenclature in Kansas; *in*, Current Research in Earth Sciences: Kansas Geological Survey, Bulletin 254, part 2. http://www.kgs.ku.edu/Current/2008/Sawin/index.html.

Swineford, A., 1955, Petrography of Upper Permian rocks in south-central Kansas: Kansas Geological Survey, Bulletin 111, 179 p.

Walters, K. L., 1961, Geology and ground-water resources of Sumner County, Kansas: Kansas Geological Survey, Bulletin 151, 198 p.

ADDITIONAL SOURCE

Bayne, C. K., 1962, Geology and ground-water resources of Cowley County, Kansas: Kansas Geological Survey, Bulletin 158, 219 p.

EXPLANATION

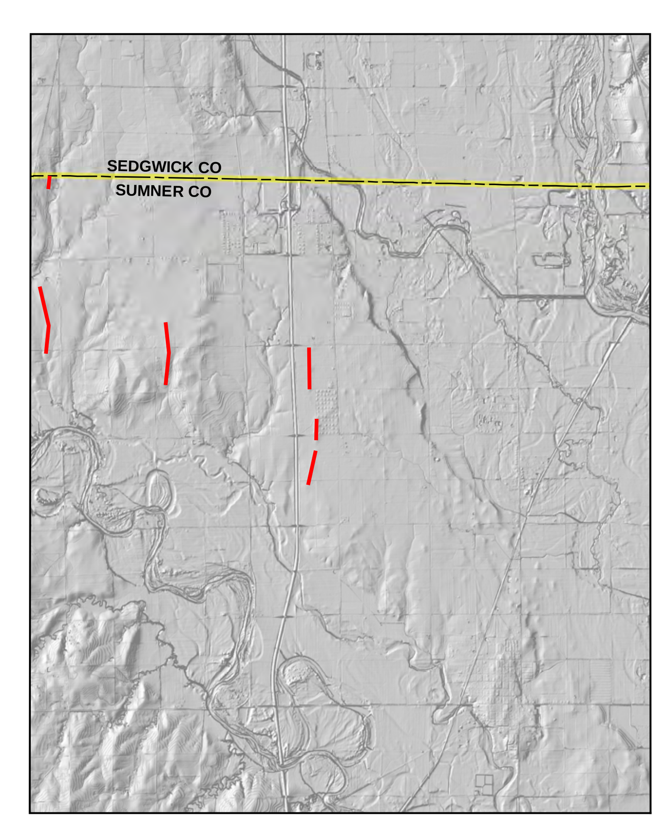
Boundaries and Locations
- County boundary
- Township/range line
- Section line

Transportation
- Interstate highway – Kansas Turnpike
- U.S. highway
- State highway
- Local road
- Railroad
- Unpaved landing strip

Geologic Unit Boundaries
- Observed contact

Hydrology
- Perennial stream
- Intermittent stream
- Water body
- Water body – manmade shoreline

Topography
- 1200 Elevation contour (50-foot interval)
- Elevation contour (10-foot interval)
- Depression contour (10-foot interval)



Inset showing mapped lineaments as potential surface expressions of structural features (e.g., faults, folds, joints, ridges). South-central Kansas, like other parts of the central and eastern United States, resides in a region of relatively low historical and instrumentally recorded seismicity. Despite this, the state has experienced approximately 3,500 earthquakes since 2013, with more than 130 of the events recorded as magnitude 3.0 or greater. This recent spate of seismicity raises concerns about the potential risk that structural features (faults, folds, joints, and ridges) may pose for moderate to large earthquakes. Investigations into the size or extent of these faults include mapping previously unrecognized surface features, such as lineaments, that may reflect more deeply seated structural features.

Lineaments were mapped using aerial photography and bare-earth LiDAR Digital Elevation Models (DEMs), based on one or more of the following criteria: (1) Visible offset in marker beds; (2) relatively low- to high-relief linear ridges that are not obvious geomorphic features due to erosion, slumping, subsidence, or dune formation; (3) linear ridges that cross drainage divides; (4) ridges that display curvilinear or backstepping (en echelon) configurations; (5) rectilinear or parallel drainage patterns; and (6) linear drainage patterns that align across drainage divides.

Elevation contours are presented for general reference. Used in the U.S. Geological Survey's current US Topo 1:24,000-scale topographic map series, they were generated from hydrographically improved 1/3 arc-second National Elevation Dataset (NED) data and smoothed during processing for use at 1:24,000 scale. In some places, the contours may be more generalized than the base data used for compilation of geologic outcrop patterns. Outcrop patterns on the map will typically reflect topographic variation more accurately than the associated contour lines. Repeated fluctuation of an outcrop line across a contour line should be interpreted as an indication that the mapped rock unit is maintaining a relatively constant elevation along a generalized contour.

1-meter LiDAR hillshades (2010 imagery) and 1-foot Kansas NG911 2014 digital imagery were used as references in the digital mapping. USDA Natural Resources Conservation Service (NRCS) SSURGO data and other geologic maps and bulletins were used to supplement the mapping. Field mapping was undertaken from October 2019 to February 2020. Roads and highways are shown on the base map as represented by data from the U.S. Census Bureau. U.S. Department of Agriculture – Farm Services Agency (USDA-FSA) National Agriculture Imagery Program (NAIP) imagery also was used to check road locations.

Shaded relief is based on 1-meter hydroflattened bare-earth DEMs from the State of Kansas LiDAR Database. The DEM images, in ERDAS IMAGINE format, were mosaicked into a single output DEM, downsampled to 2-meter resolution, and reprojected to decimal degrees. The output DEM was then converted to a hillshade, a multidirectional shaded-relief image using angles of illumination from 0°, 225°, 270°, and 315° azimuths, each 45° above the horizon, with a 4x vertical exaggeration.

This geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program, award number G19AC00231 (FY2019).

This map was produced using the ArcGIS system developed by Esri (Environmental Systems Research Institute, Inc.).

SUGGESTED REFERENCE TO THE MAP

Layzell, A. L., and Dunham, J. W., 2020, Preliminary surficial geology of the Sumner County portion of the Belle Plaine quadrangle, Kansas: Kansas Geological Survey, Open-File Report 2020-5, scale 1:24,000, unpublished.

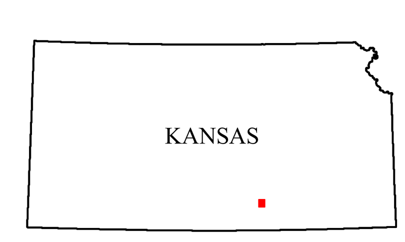
SCALE 1:24 000

KILOMETERS: 1 0.5 0 1 2
METERS: 1000 500 0 1000 2000
MILES: 1 0.5 0 1
FEET: 1000 500 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, ZONE 14
NORTH AMERICAN DATUM OF 1983

3°22'
TRUE NORTH
MAGNETIC NORTH

APPROXIMATE MEAN DECLINATION, 2020



QUADRANGLE LOCATION

Bayneville	Derby	Rose Hill
Zyba	Belle Plaine	Mulvane
Wellington	Dalton	Oxford

ADJOINING 7.5' QUADRANGLES