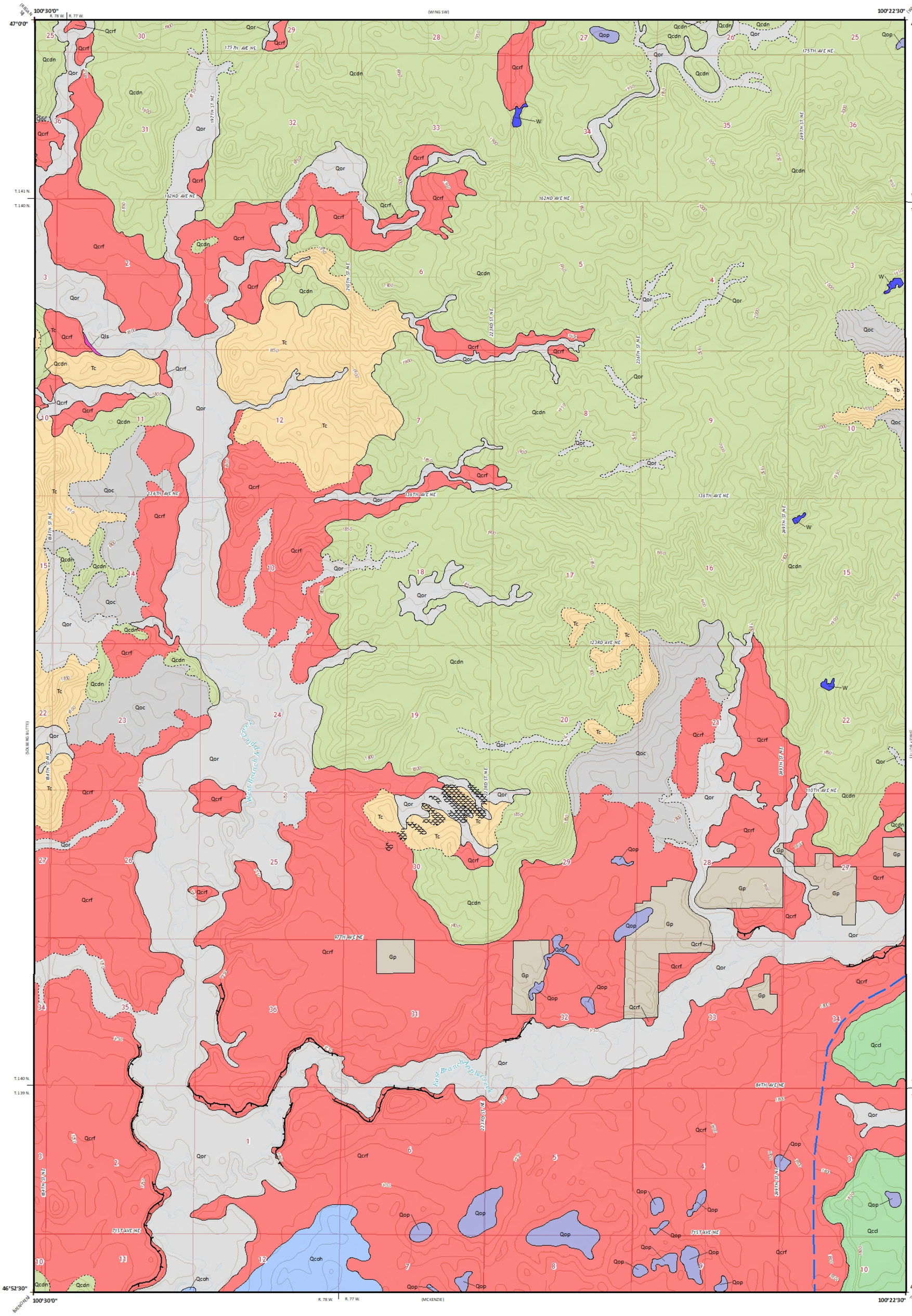
North Dakota Geological Survey
24K: McKn NW - sg

Edward C. Murphy, State Geologist
Lynn D. Helms, Director Dept. of Mineral Resources

Surface Geology
McKenzie NW Quadrangle, North Dakota

Lorraine A. Manz

2021



QUATERNARY SYSTEM

HOLOCENE

OAHE FORMATION

Sand, silt, clay, gravel, and organic debris; all postglacial sediment deposited on the landscape; includes river sediment, windblown sediment, and lake sediment.

Qls **Landslide deposits**
Moderately to poorly sorted combination of soil, unconsolidated sediments, and sedimentary rocks that has slid down the local slope under its own weight.

Qop **Pond and slough sediment**
Organic debris, clay, and silt; obscurely bedded; dark colored; generally more than 3 feet (1 meter) thick; deposited in poorly drained depressions in the landscape.

Qor **Alluvium and overbank sediment**
Sand, silt, clay, and disseminated organic debris; obscurely bedded, dark colored; locally abundant gastropod and pelecypod shells including *Valvata tricarinata*, *Sphaerium* sp., and *Pisidium* sp.; commonly more than 3 feet (1 meters) thick.

HOLOCENE/PLEISTOCENE

Qoc **Colluvium**
Unconsolidated sediment, mostly fine sand, silt and clay; obscurely bedded, dark colored; locally abundant gastropod and pelecypod shells including *Valvata tricarinata*, *Sphaerium* sp., and *Pisidium* sp.; commonly more than 3 feet (1 meter) thick.

PLEISTOCENE

COLEHARBOR GROUP

The Coleharbor Group includes all sediments in North Dakota associated with deposition by Pleistocene glaciers.

Qccl **Collapsed glacial sediment**
Light olive-brown to olive-brown; unsorted; unbedded; calcareous; very shaly; lignite fragments common; contains abundant cobbles and surface boulders of mostly crystalline lithologies, with minor amounts of limestone, dolostone, and, more rarely, local bedrock types; undulating to rolling, hummocky surface; deposited as end moraine on a predominantly non-glacial surface by an early Late Wisconsinan glacier (Long Lake Advance).

Qcdn **Draped glacial sediment**
Light olive-brown to olive-brown; unsorted; unbedded; calcareous; shaly; lignite fragments common; contains abundant cobbles and surface boulders of mostly crystalline lithologies, with minor amounts of limestone, dolostone, and, more rarely, local bedrock types; undulating to hilly surface; discontinuous; thin; lacks hummocky topography owing to postglacial erosion; deposited on a non-glacial surface as a thin mantle draped over, and only slightly modifying, the pre-existing topography by a pre-Late Wisconsinan glacier (Napoleon Advance). May be covered by a patchy, thin (< 5 feet [1.5 meters]) veneer of windblown sediment.

Qcoh **Collapsed lake sediment**
Flat-bedded to gently folded, light olive-brown to olive-brown laminated clay, clayey silt, silty clay, silt and sand; non to moderately calcareous; iron-stained in places; small (generally less than pebble-sized) carbonate nodules and masses of gypsum, and sand-sized organic fragments common; subtle, flat to gently undulating hummocky surface, pitted by steep-sided, bowl-shaped depressions (kettle holes) formed by the melting of detached blocks of buried ice; sediment deposited in a proglacial lake floored by stagnant ice from an earlier glacial advance. May be covered by a patchy, thin veneer of windblown sediment.

Qcrf **Collapsed outwash**
Moderately well-sorted, light to dark olive brown, low-angle flat-bedded to high-angle cross-bedded silt, sand, and gravel; calcareous; shaly; bouldery in places; gently undulating to rolling surface, pitted by steep-sided, bowl-shaped depressions (kettle holes) formed by the melting of detached blocks of buried ice; deposited as outwash on stagnant ice by meltwater flowing through the Apple Creek meltwater channel. May be covered by a patchy, thin veneer of windblown sediment.

PALEOGENE SYSTEM

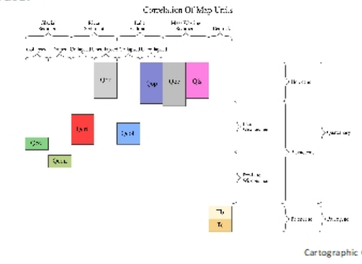
PALEOCENE

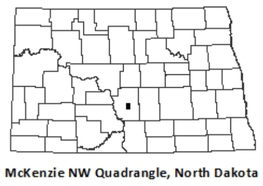
Tb **BULLION CREEK FORMATION**
Nonmarine sandstone, siltstone, claystone, and lignite; generally brightly colored yellow, brown and gray; poorly to well-cemented sandstone; unbedded to sharply bedded siltstone and claystone; non-fissile; commonly thinly laminated. Maximum thickness in the map area is about 30 feet (9 meters). The contacts between the Bullion Creek, Slope, and Cannonball Formations were inferred from elevations of contacts in adjacent quadrangles.

Tc **CANNONBALL FORMATION**
Marine sandstone and mudstone. Grayish green to yellowish brown, medium to fine grained, generally poorly cemented sandstone; contains scattered ironstone concretions and dark mineral grains that impart a "salt and pepper" appearance; commonly capped by a two- to three-foot-thick, well-cemented, lenticular sandstone. Light to dark gray to black mudstone; fissile; commonly banded with lenses of white to yellowish brown silt and very fine sand; forms smooth, rounded slopes. Maximum thickness of the Cannonball Formation is about 300 feet (91 meters) in this map area. May be covered by a thin (< 5 feet [1.5 meters]) veneer of glacial sediment.

Geologic Symbols

- Geologic contact
- Geologic contact (inferred)
- **Relict permafrost polygons –** Areas of polygonal ground in sandy material weathered from the Cannonball Formation. Polygons are mainly four- to six-sided with diameters ranging from about 20 to 60 feet (6 to 18 meters). Formed by intersecting ice wedges in permafrost and the contraction of frozen ground during, or just prior to, the Long Lake Advance. Visible only on aerial photographs.
- **Sharp-walled channel** – Established from aerial photographs and LiDAR; paired sharp scarps; lines indicate the crests of the scarps and hachures point downslope; interpreted as a meltwater channel; apparent on topographic maps and on the ground.
- **Ice margin** – Established from aerial photographs, LiDAR, and soil survey maps; marks the approximate limit of the early Late Wisconsinan Long Lake glaciation. Dashed where uncertain.
- **Gp** Gravel Pit
- **W** Water





McKenzie NW Quadrangle, North Dakota

Scale 1:24,000

0 0.5 1

Miles

Lambert Conformal Conic Projection
North American 1983 Datum
USGS 7.5 Minute Topo Map

Standard Parallels 46°52'30"N, 47°0'0"N
NGVD 1988

5°36'
MN

2019 Magnetic North
Declination at Center of Sheet

Cartographic Compilation: Navin Thapa