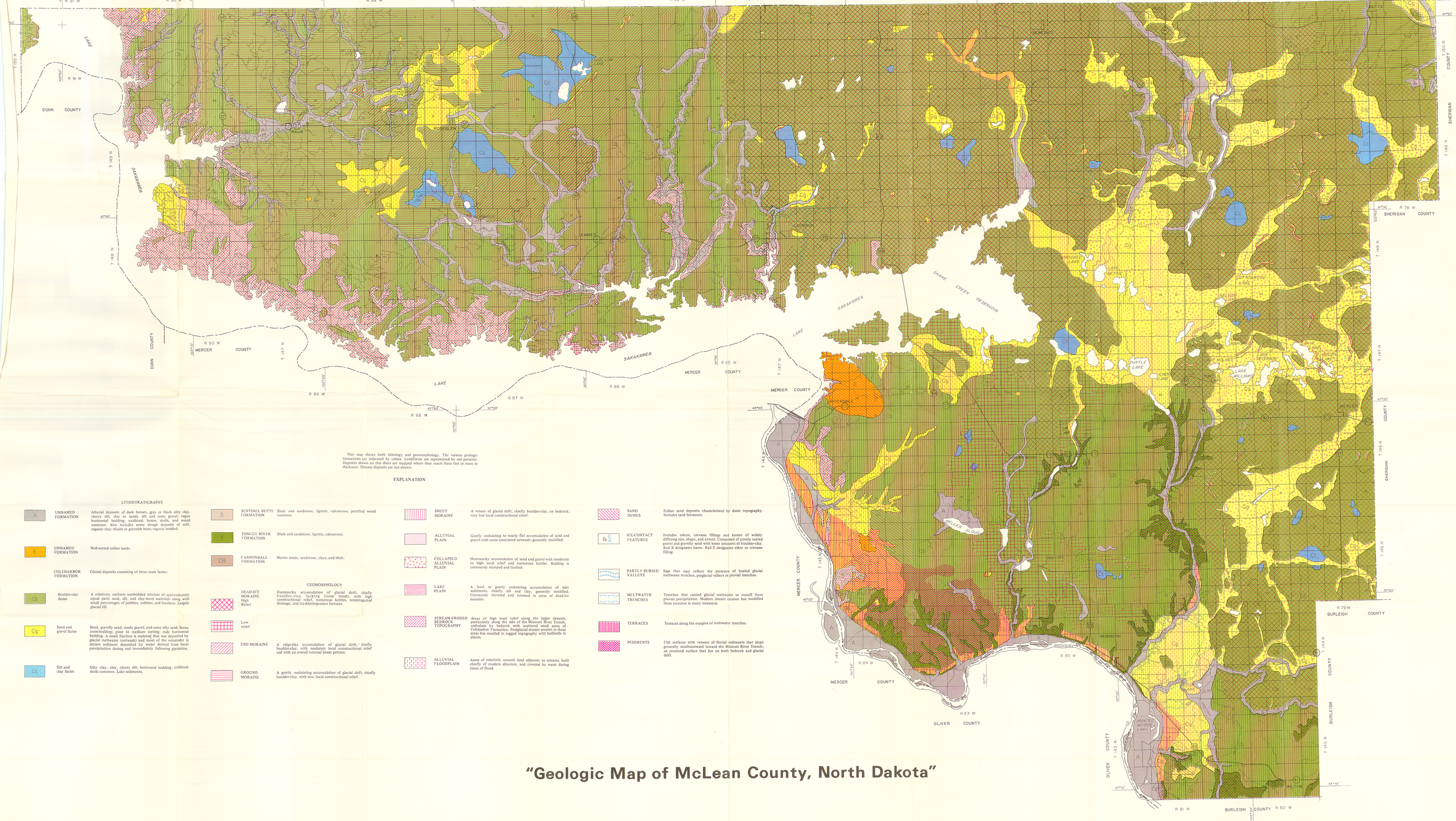
BULLETIN 60
COUNTY GROUND WATER STUDIES 19
PLATE 1

NORTH DAKOTA GEOLOGICAL SURVEY
NORTH DAKOTA STATE WATER COMMISSION



This map shows both lithology and geomorphology. The various geologic formations are indicated by colors. Landforms are represented by red patterns. Deposits shown on this sheet are mapped where they reach three feet or more in thickness. Thinner deposits are not shown.

EXPLANATION

LITHOSTRATIGRAPHY

A	UNNAMED FORMATION	Alluvial deposits of dark brown, gray or black silty clay, clayey silt, clay or sandy silt and some gravel; vague horizontal bedding; oxidized; bones, shells, and wood common. Also includes some slough deposits of soft, organic clay; bluish or greenish hues; vaguely bedded.
E	UNNAMED FORMATION	Well-sorted eolian sands.
	COLEHARBOR FORMATION	Glacial deposits consisting of three main facies:
Cb	Boulder-clay facies	A relatively uniform nonbedded mixture of approximately equal parts sand, silt, and clay-sized materials along with small percentages of pebbles, cobbles, and boulders. Largely glacial till.
Cg	Sand and gravel facies	Sand, gravelly sand, sandy gravel, and some silty sand. Some cross-bedding; poor to medium sorting; rude horizontal bedding. A small fraction is material that was deposited by glacial meltwater (outwash) and most of the remainder is stream sediment deposited by water derived from local precipitation during and immediately following glaciation.
Cc	Silt and clay facies	Silty clay, clay, clayey silt; horizontal bedding; oxidized; shells common. Lake sediments.
S	SENTINEL BUTTE FORMATION	Shale and sandstone, lignitic, calcareous, petrified wood common.
T	TONGUE RIVER FORMATION	Shale and sandstone, lignitic, calcareous.
CB	CANNONBALL FORMATION	Marine sands, sandstone, clays, and shale.

GEOMORPHOLOGY

	DEAD-ICE MORAINE High Relief	Hummocky accumulation of glacial drift, chiefly boulder-clay lacking linear trends, with high constructional relief, numerous kettles, nonintegrated drainage, and ice-disintegration features.
	Low relief	
	END MORAINE	A ridge-like accumulation of glacial drift, chiefly boulder-clay, with moderate local constructional relief and with an overall internal linear pattern.
	GROUND MORAINE	A gently undulating accumulation of glacial drift, chiefly boulder-clay, with low, local constructional relief.
	SHEET MORAINE	A veneer of glacial drift, chiefly boulder-clay, on bedrock; very low local constructional relief.
	ALLUVIAL PLAIN	Gently undulating to nearly flat accumulation of sand and gravel with some associated outwash; generally stratified.
	COLLAPSED ALLUVIAL PLAIN	Hummocky accumulation of sand and gravel with moderate to high local relief and numerous kettles. Bedding is commonly slumped and faulted.
	LAKE PLAIN	A level or gently undulating accumulation of lake sediments, chiefly silt and clay, generally stratified. Commonly elevated and trimmed in areas of dead-ice moraine.
	STREAM-ERODED BEDROCK TOPOGRAPHY	Areas of high local relief along the larger streams, particularly along the side of the Missouri River Trench, underlain by bedrock with scattered small areas of Colebarbor Formation. Postglacial stream erosion in these areas has resulted in rugged topography with badlands in places.
	ALLUVIAL FLOODPLAIN	Areas of relatively smooth land adjacent to streams, built chiefly of modern alluvium, and covered by water during times of flood.
	SAND DUNES	Eolian sand deposits characterized by dune topography. Includes sand blowouts.
	ICE-CONTACT FEATURES	Includes eskers, crevasse fillings and kames of widely differing size, shape, and extent. Composed of poorly sorted gravel and gravelly sand with lesser amounts of boulder-clay. Red K designates kame. Red E designates esker or crevasse filling.
	PARTLY BURIED VALLEYS	Sags that may reflect the presence of buried glacial meltwater trenches, preglacial valleys or pluvial trenches.
	MELTWATER TRENCHES	Trenches that carried glacial meltwater or runoff from pluvial precipitation. Modern stream erosion has modified these trenches in many instances.
	TERRACES	Terraces along the margins of meltwater trenches.
	PEDIMENTS	Flat surfaces with veneers of fluvial sediments that slope generally southeastward toward the Missouri River Trench; an erosional surface that lies on both bedrock and glacial drift.

"Geologic Map of McLean County, North Dakota"

Section A

Sec. 4, T. 147 N., R. 89 W.

Till
Sandstone ledge
Siltstone, as below, but less banded
Sandstone ledge
Siltstone, brownish orange, cordoroy appearance, very hard and shaly
Sandstone, light gray
Sandstone, chocolate brown, ironstone banding, highly carbonaceous, lot of petrified wood
Siltstone, orange banded, clayey, hard
Lignite, 2 feet thick
Sand, 2-inch orange bands in bottom 3 feet, hard
Concretions
Sand, fine to medium grained, harder than below (scoria)
Lignite, 2 feet thick
Sand, medium grained, looser than below
Sand, medium grained, brownish gray, soft, loose
Section missing; scoria covers the surface
Claystone, light gray, shaly, flaky, soft
Lignite, 2½ feet thick
Sand, medium grained, soft, looser than below
Sand, medium to fine grained, greenish gray with orange bands, light overall aspect, gypsiferous

2000
1950
1900
1850
1800

12 miles

Section B, B and W Coal Mine

Sec. 16, T. 148 N., R. 86 W.

Till
Sandstone, medium grained, orange bands, massive
Claystone, gray
Lignite, 1½ feet thick
Claystone, light gray, carbonaceous near top
Lignite, 7 feet thick, mine

1950
1900

15 miles

Section C, Garrison Dam Spillway

Sec. 8, T. 146 N., R. 84 W.

Siltstone, orange bands, gastropod shells
Sandstone, salt and pepper appearance
Siltstone, orange bands, gastropod shells
Claystone, gray
Lignite, 8 feet thick, clay bands near top
Silt to sand, gray to buff colored, a few concretions
Siltstone, buff with orange bands
Lignite, 6 inches thick
Sandstone, gray, soft, massive
Sandstone, buff, shells near base, 4 inches of lignite locally at top
Sandstone, light gray, carbonaceous band in middle
Claystone, buff, silty, abundant shells
Lignite, 3 feet thick
Siltstone, sandy, carbonaceous
Siltstone, grayish orange, sandy, bentonitic
Sandstone, salt and pepper appearance, smooth
Siltstone, grayish orange, hard
Lignite, 1 foot thick
Claystone, gray
Claystone, orange bands, abundant ironstone, bentonitic, concretions near top
Claystone, gray car
Claystone, gray, carbonaceous
Lignite, 8 feet thick
Water level below spillway, 1695 feet

1850
1800
1750
1700

13 miles

Section D

Sec. 24, T. 144 N., R. 84 W.

Siltstone, iron-stained, soft, gypsiferous
Claystone, grayish orange, silty, massive, soft, white gypsum on surface
Siltstone, lignitic, shaly, good marker bed
Claystone, silty, soft, flaky, bentonitic
Sand, ironstone-stained, fine
Sandstone, as below, a few shells
Concretions
Sandstone, harder than below, crossbedded
Sandstone, salt and pepper appearance, jointed, iron-stained
Sandstone, hard, massive and prominent, forms ledges and vertical cliffs, (probably only a local channel sand)
Concretions
Sandstone, as below but better exposures, a little harder than below
"Tubes"
Sand, gray with a greenish caste, soft, a few shells, poorly exposed
Siltstone, hard ledge-former
Siltstone, yellow to buff (good marker), ironstone-stained
Lignite, 6 inches thick
Siltstone, brownish, shaly, blocky, lot of iron
Claystone with a 6-inch-band of lignite
Sand, medium to coarse, highly fossiliferous
Sand, buff, banded, cemented in places
Sand, medium-grained, harder than below, may be slump
Sand, medium-grained, may be slump

Sentinel Butte
Tongue River

1950
1900
1850
1800
1750
1700
1650

3 miles

Section E, Underwood Coal Co. Mine

Sec. 23, T. 146 N., R. 82 W.

Silt, orange bands, lignitic band at base
Clay
Clay, massive, hard
Sand, lot of clay, fine-grained
Lignite, 8 to 10 feet thick, mine

1950
1900

14 miles

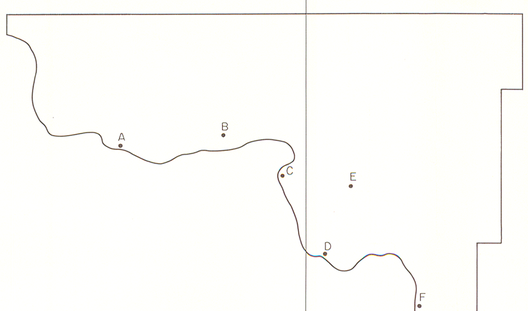
Section F

Sec. 33, T. 143 N., R. 81 W.

Claystone, silty, fossiliferous, poorly exposed at top
Lignite, 6 inches thick
Siltstone, buff to orange buff, carbonaceous, gypsiferous
Claystone, carbonaceous, fossiliferous
Sand, salt and pepper appearance, loose, uniform
Part of section missing
Sand, medium-grained, harder than below
Sand, medium-grained, light colored, soft
Sandstone ledge, salt and pepper appearance, jointed
Sand, light gray, lot of iron stains, soft in places
Claystone, olive gray with orange bands, hard, shaly uniform
Part of section missing
Sandstone ledge, salt and pepper appearance
Sand, orange, soft
Siltstone, ochre to orange brownish gray, clayey, soft, sandy near top

Tongue River
Cannonball

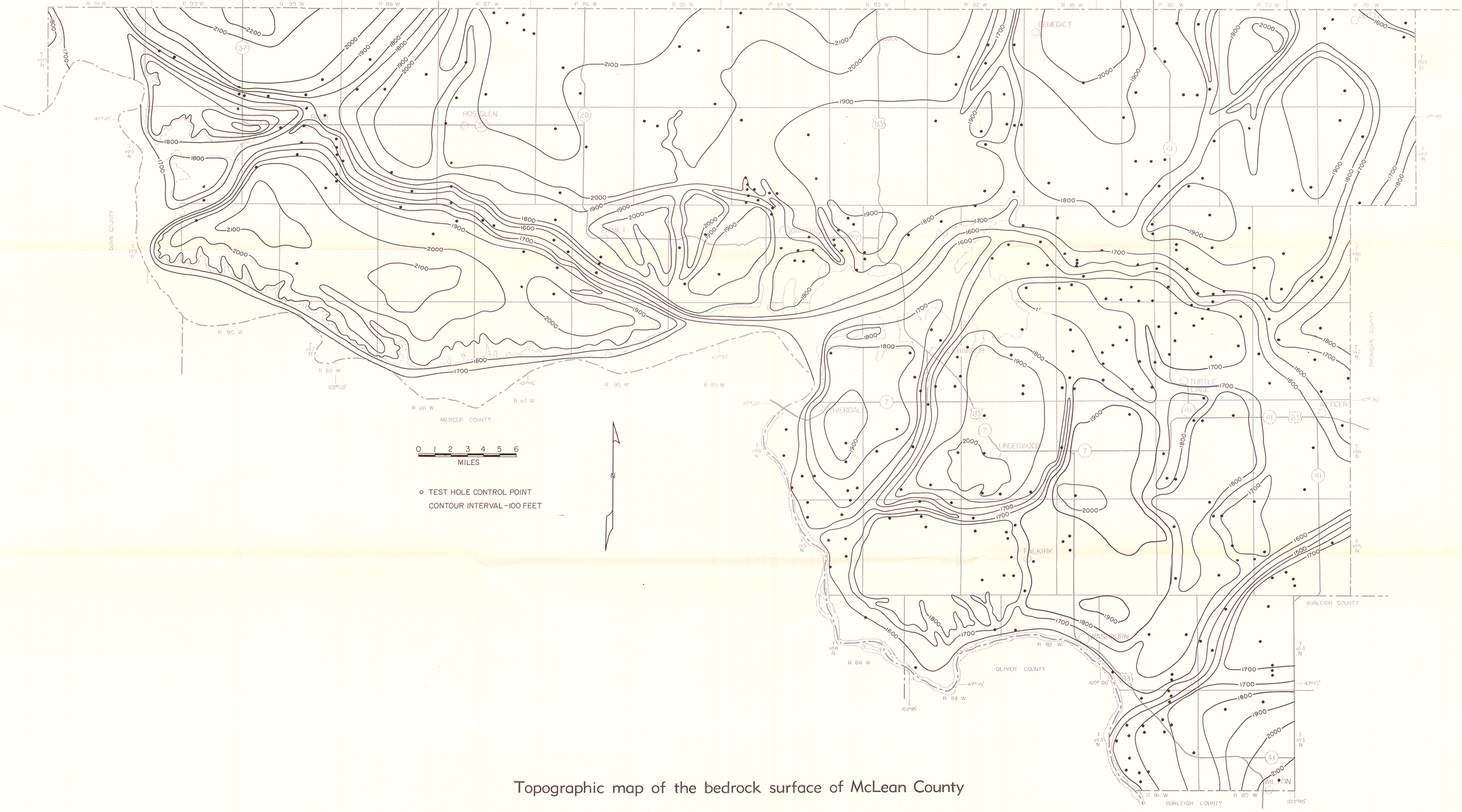
1950
1900
1850
1800
1750
1700
1650



Geologic sections of exposed bedrock in McLean County

NORTH DAKOTA GEOLOGICAL SURVEY
NORTH DAKOTA STATE WATER COMMISSION

BULLETIN 60
COUNTY GROUND WATER STUDIES 19
PLATE 3



Topographic map of the bedrock surface of McLean County