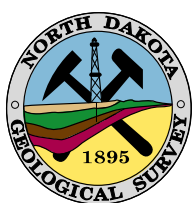


Geology of the Norman Quadrangle, North Dakota



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GEOLOGY OF THE NORMAN QUADRANGLE

The surficial geology in the Norman quadrangle consists of flat-lying offshore sediments of glacial Lake Agassiz along with recent and ancient fluvial and overbank sediments from the Sheyenne River and older tributary drainages. Between the lake sediments, fluvial deposits incised the former glacial lake floor and were covered with younger lake sediments, eventually creating compaction ridges like the Sheyenne Ridge, which can be seen from its slightly elevated topographic expression trending subparallel with the Sheyenne River. Beneath the lake sediments, Pleistocene subglacial sediments (diamicton) mantle Cretaceous shale bedrock and Precambrian granitic basement rock in the subsurface. The Sheyenne River flows from the southwest to the north across the quadrangle along a highly circuitous meandering path of 24.9 river miles (40.1-km) along a 14.8 mile (23.8-km) reach and drops approximately 25-ft (7.6-m) from an elevation of 930-ft (283-m) in the southwest to an elevation of 905-ft (275.8-m) in the north. The Sheyenne River in this quadrangle has a sinuosity ratio of 1.68 indicative of a highly meandering river.

Topography is minimal in this quadrangle with local relief of 39-ft (11.9-m) over 10.5 miles (16.9-km) from the southwest corner to the northeast corner and is essentially flat to the ground observer.

In the shallow subsurface (i.e. the uppermost 100 feet (30.5 m) the Sherack and Brenna Formations are the two dominant glaciolacustrine units in the quadrangle. The Sherack Formation commonly consists of tan to gray laminated silts and clays which overlay the dark gray, soft and expansive clays of the Brenna Formation. The Brenna Formation contains smectitic clays which have the capacity to incorporate water into their mineralogic structure resulting in a soft and expansive clay which is capable of flow when placed under load. Slumping along rivers and creeks is common within these units and within the slopes of man-made channels.

Depth and isopach (thickness) contours drawn on the Brenna Formation are also depicted on this map. The Brenna Formation is generally between 20 to 30 feet (6.1 to 9.1 m) below land surface (bls), and is deeper in the central portions of the quadrangle ranging from 40 feet bls (12.2 m) in the north to as much as 50 feet bls (15.2 m) in the south. The thickness of the Brenna Formation generally ranges from 30 to 50 feet (9.1 to 15.2 m) across the quadrangle and is thinnest at around 30 feet (9.1 m) in the central portion of the quadrangle and as thick as sixty feet (18.2 m) in a small area in the southwestern portion of the quadrangle.

Underlying the offshore glaciolacustrine deposits of Lake Agassiz are multiple glacial till (diamicton) units from multiple advances of glacial ice in the Red River Valley (Harris, et. al, 2020). The uppermost till is most likely the Red Lake Falls Formation which contains a sandy, silty, clay mix with carbonate and metamorphic very-coarse sand lithologies. Bedrock of Cretaceous shale or Precambrian granitic basement rocks occurs at depths ranging from 152 to 303 feet (46.3 to 92.4 m) bls. Weathered Precambrian granitic basement rocks range in depths from 199 to 303 feet (60.6 to 92.4 m) bls and is highest in structural elevation (i.e. closer to the surface) in the northwest portion of the quadrangle.

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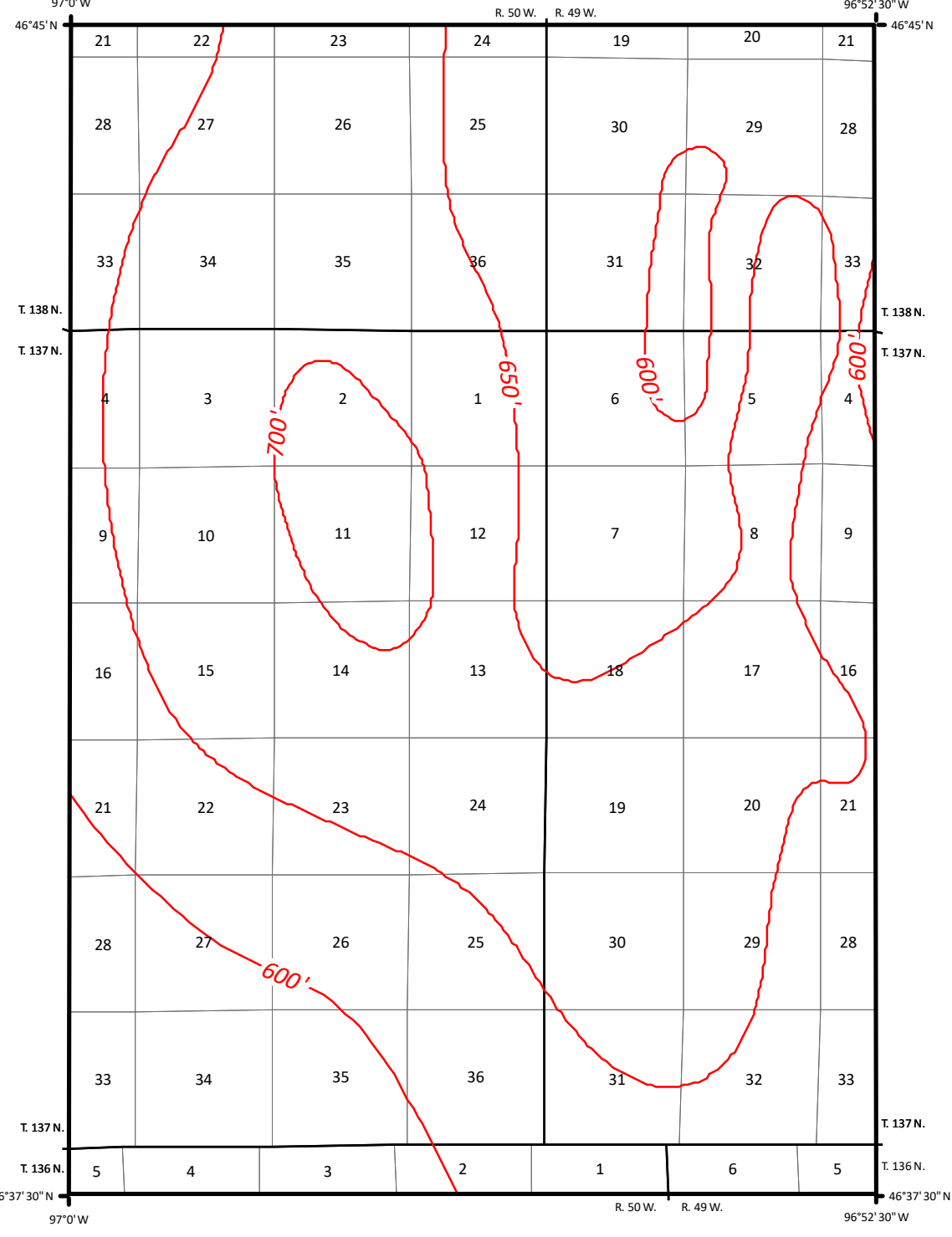
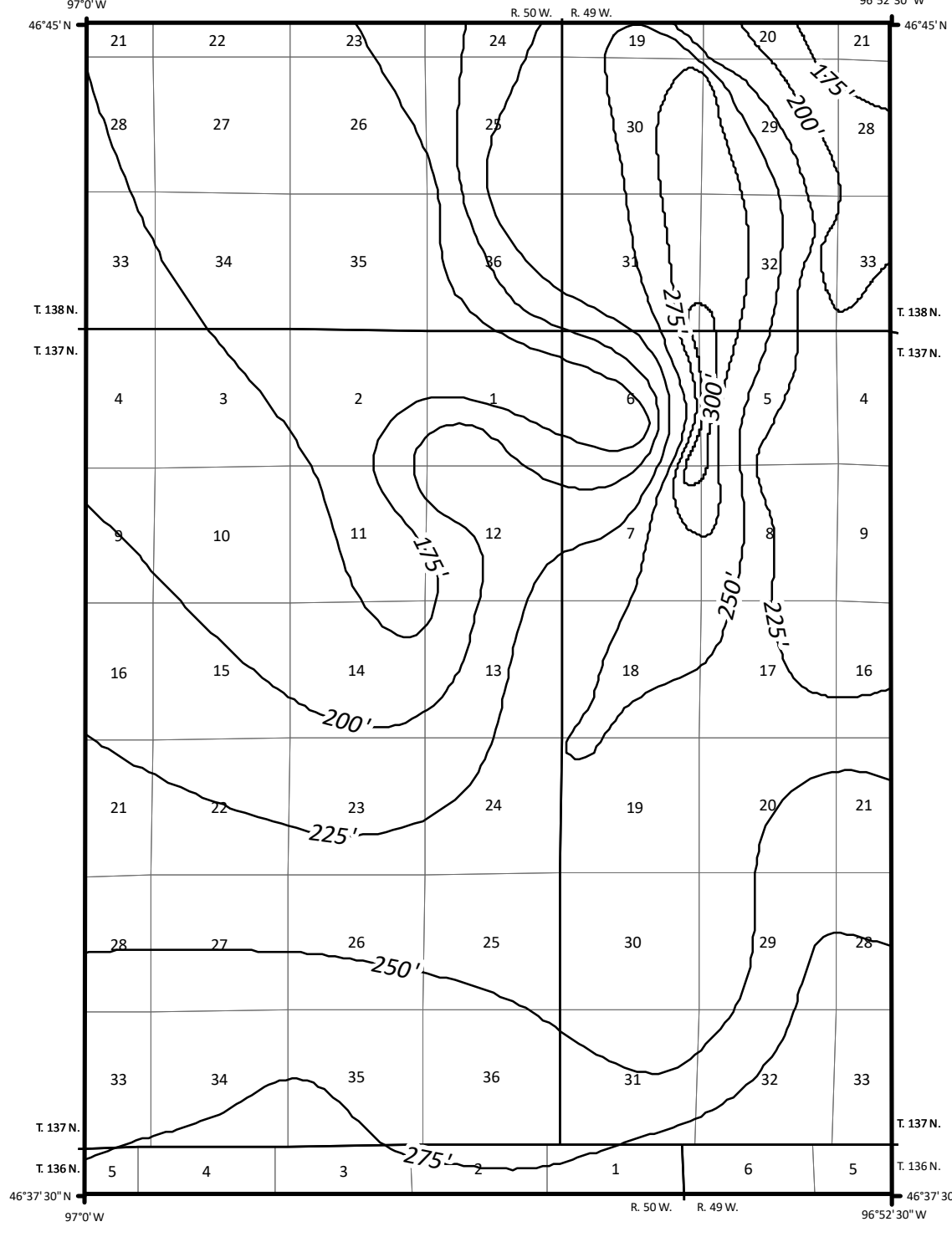
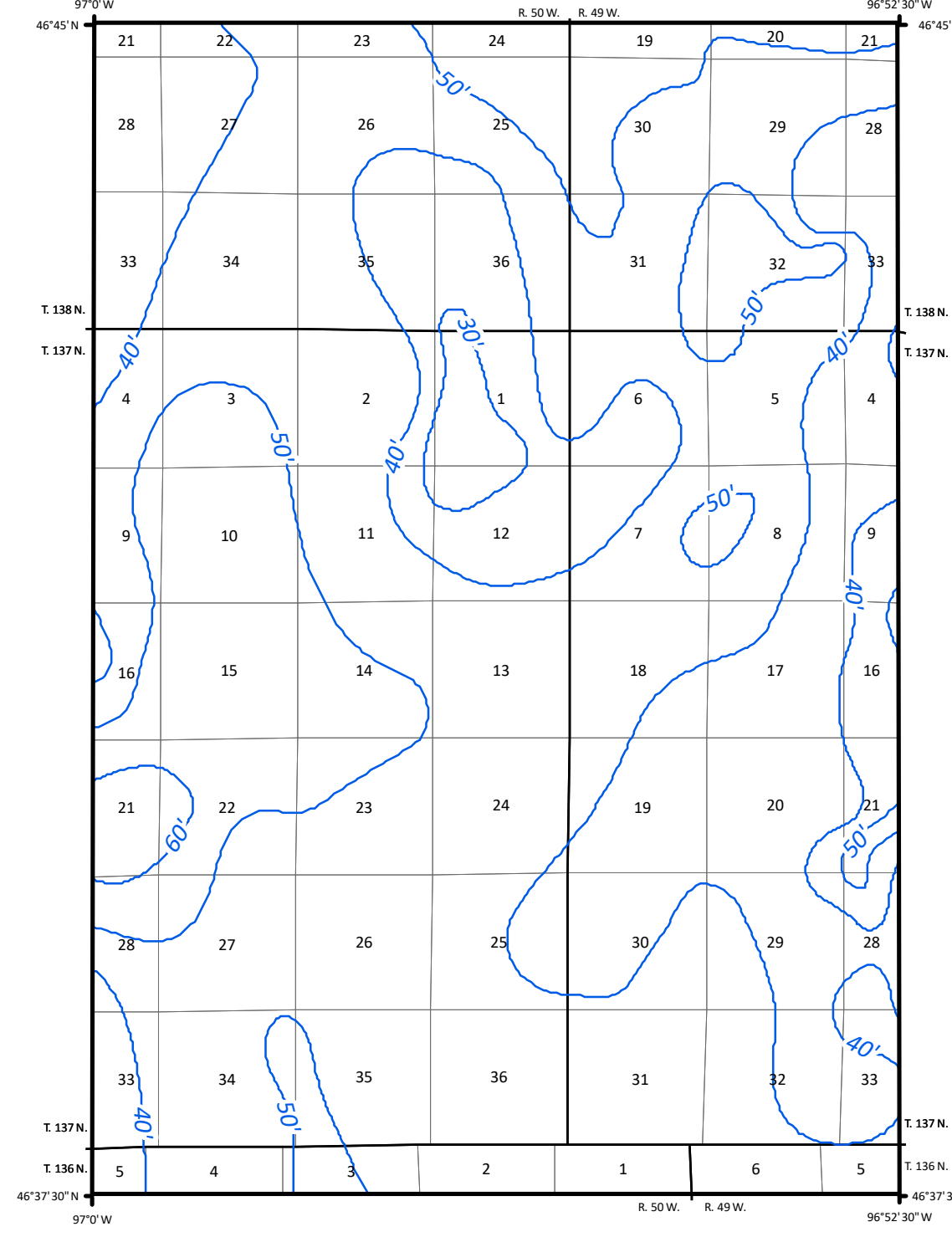
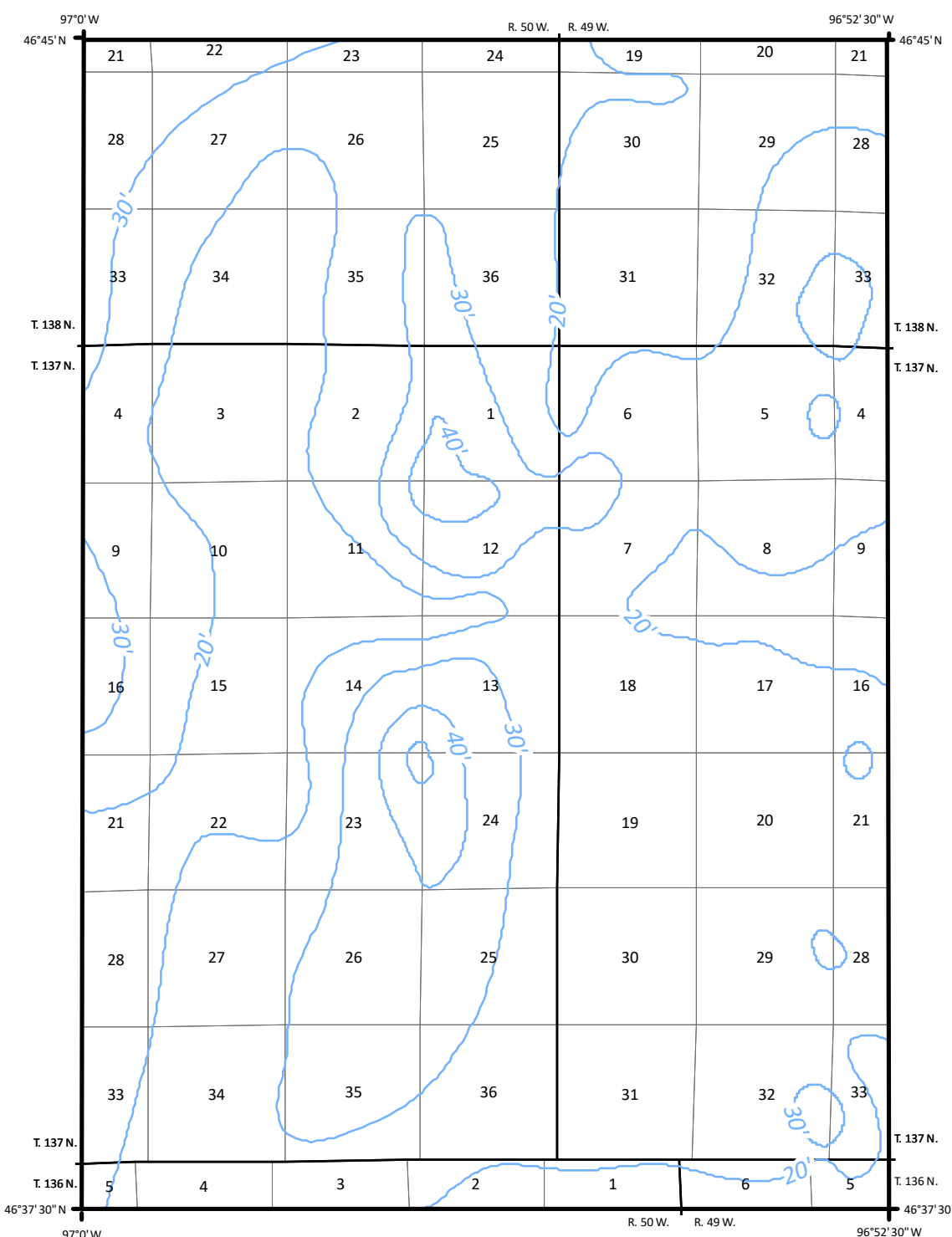
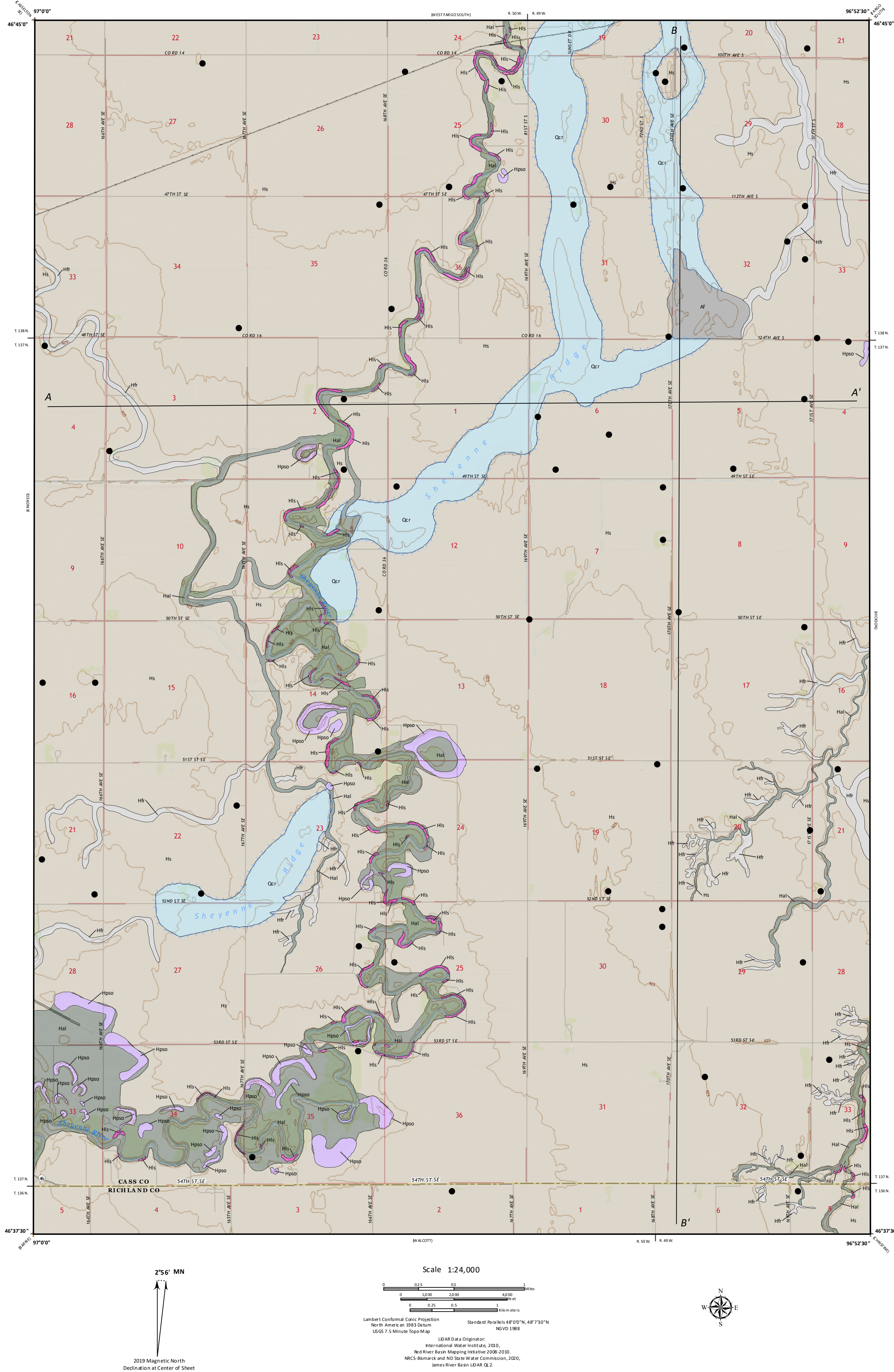
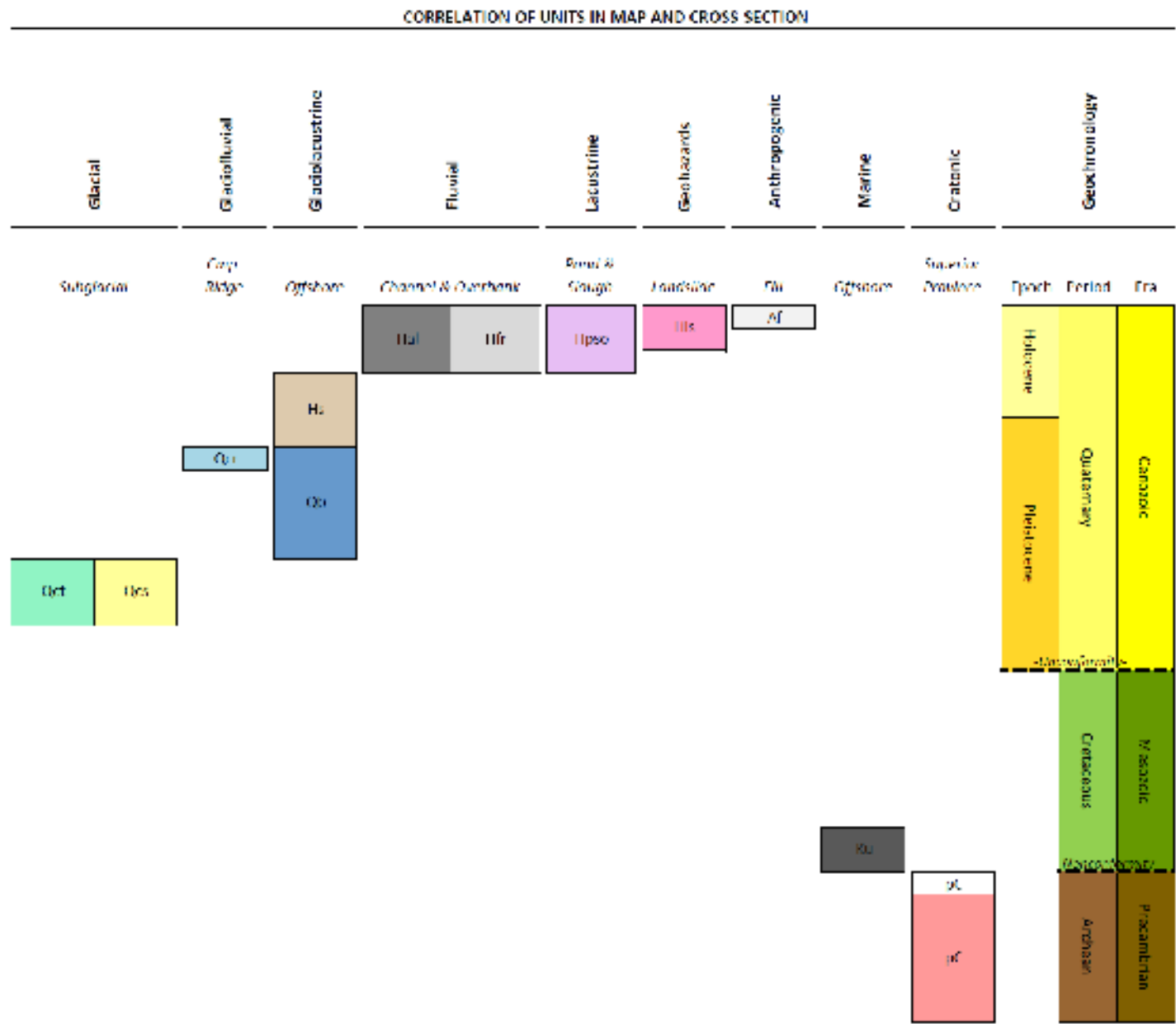
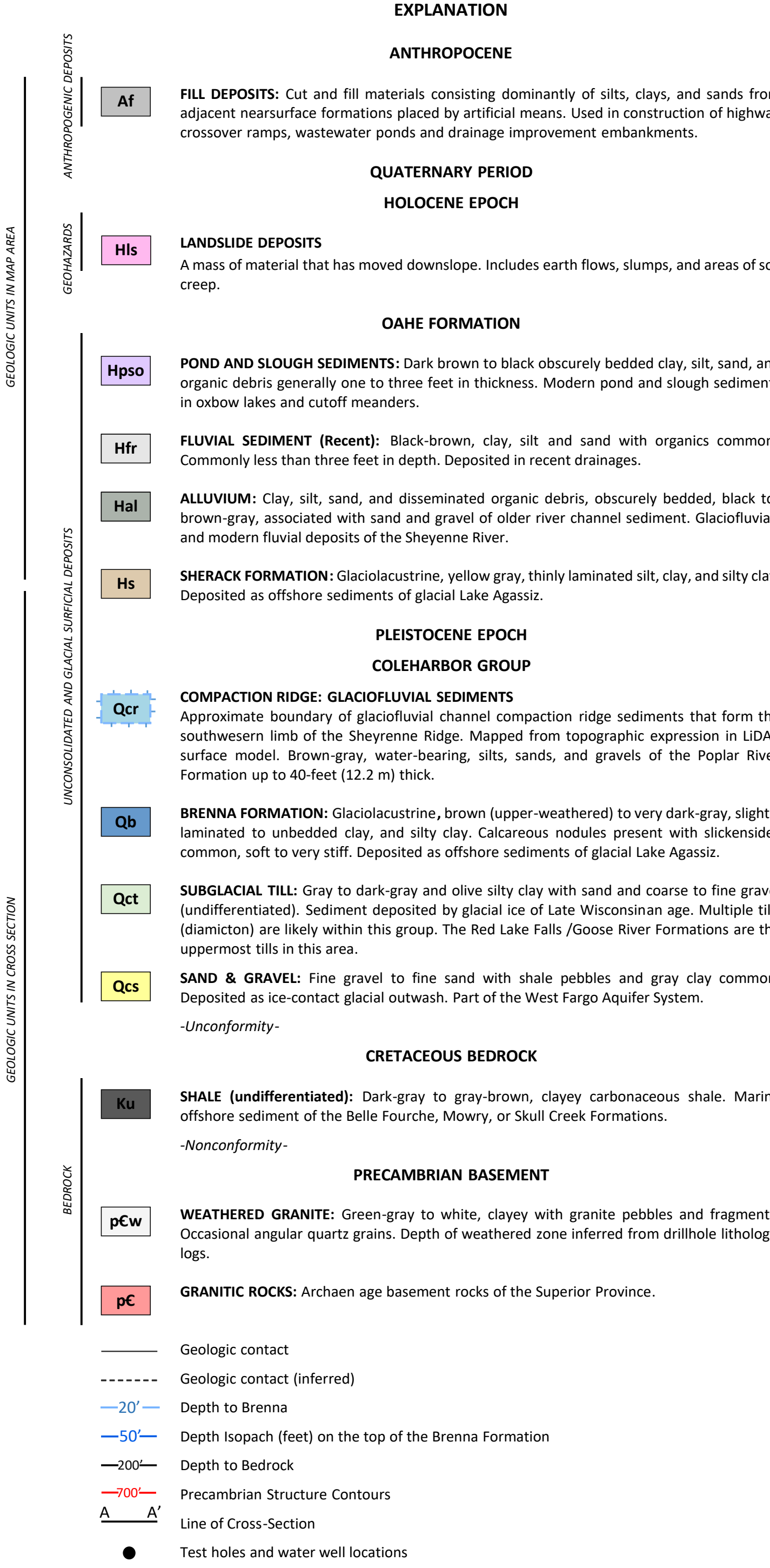
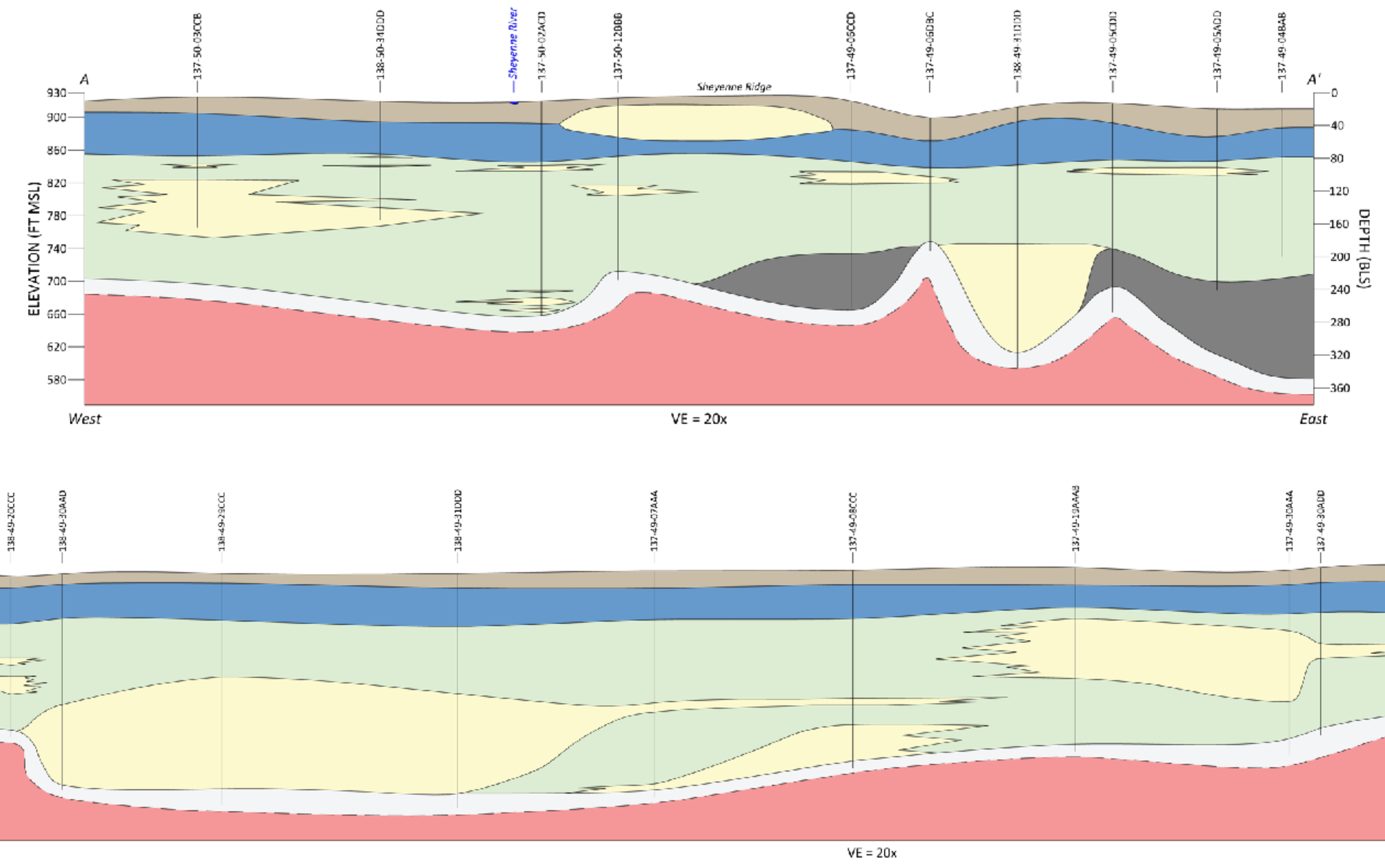
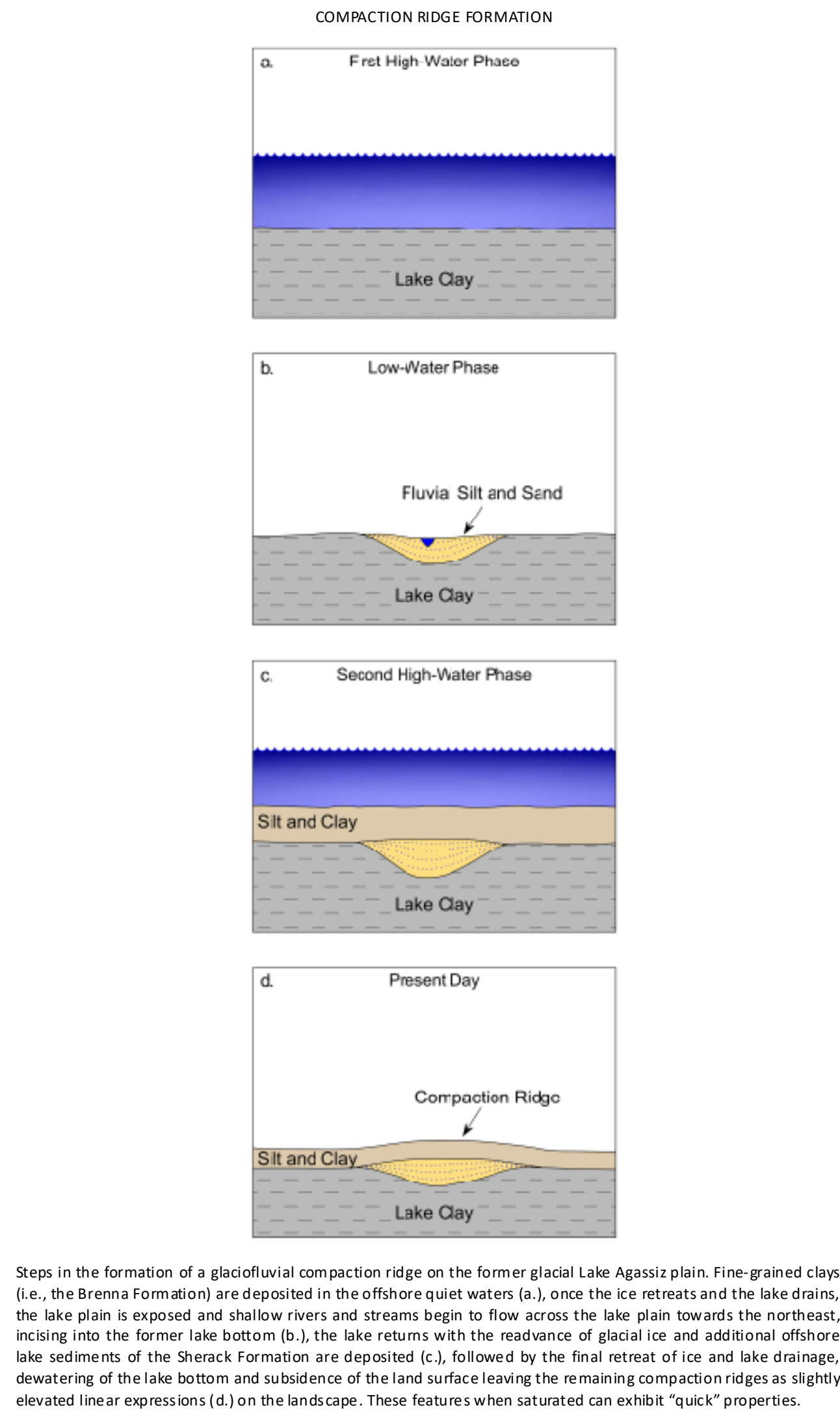


Figure 1. Depth to the top of the Brenna Formation in the Norman Quadrangle. The Brenna Formation is deepest in the central portion of the quadrangle between 30 and 50 feet (9.1 to 15.2 m) bls and is commonly 20 feet (6.1 m) deep or less in the remainder of the quadrangle.

Figure 2. Isopach of the Brenna Formation in the Norman Quadrangle. The Brenna Formation is thickest between 50 to 60 feet (15.2 to 18.3 m) in the west-central portions of the quadrangle and is commonly between 40 and 50 feet (12.2 to 15.2 m) thick in the remainder of the quadrangle.

Figure 3. Depth to bedrock in the Norman Quadrangle. Shale or granitic basement rocks occur within the quadrangle from 175 to 300 feet below land surface and are deepest along a north-south oriented bedrock valley in the northeastern part of the quadrangle.

Figure 4. Structure contours on Precambrian basement rock in the Norman Quadrangle. The Precambrian basement is generally found at 600 feet (183 m) elevation (amsl) and is commonly weathered in the uppermost 50 feet (15.2 m).



Cassellton SE	West Fargo South	Fargo South
Kindred	Norman	Hickson
Barrie	Walcott	Christine

Index to Adjacent 7.5 minute Quadrangles