

Surficial Geology of the Clatonia and Pickrell 7.5 Minute Quadrangle, Nebraska

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Clatonia Quadrangle

Pickrell Quadrangle C

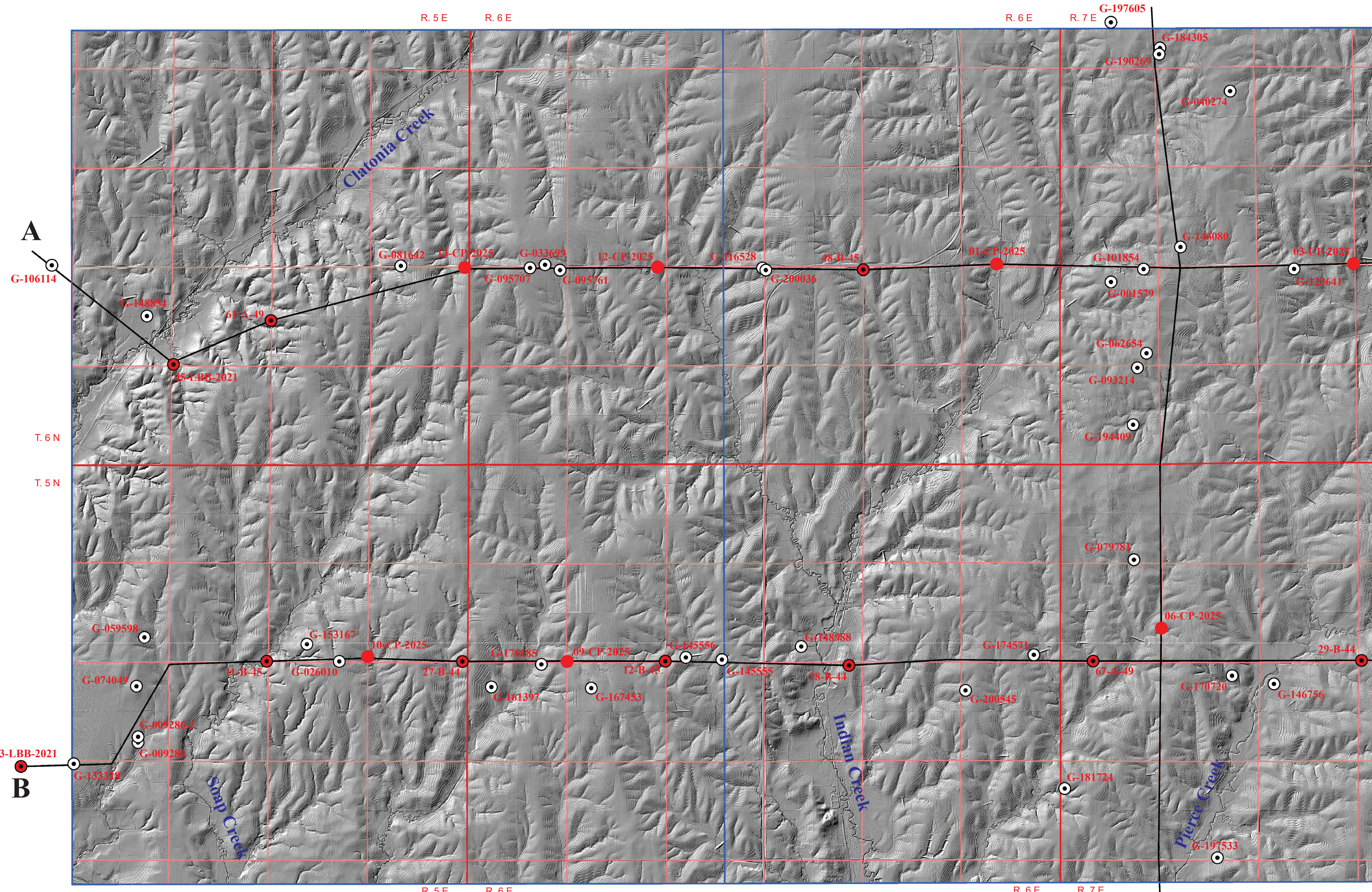
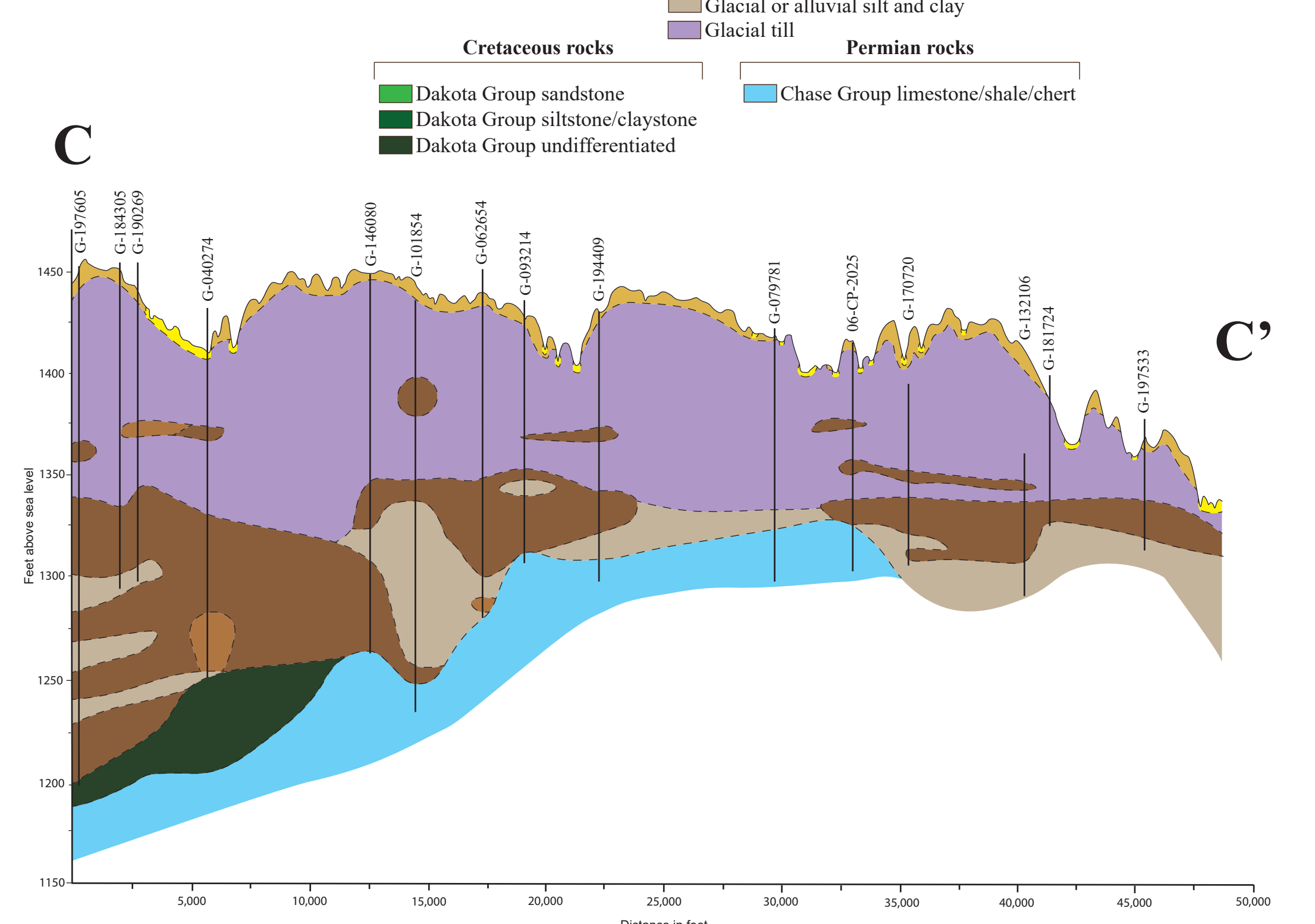
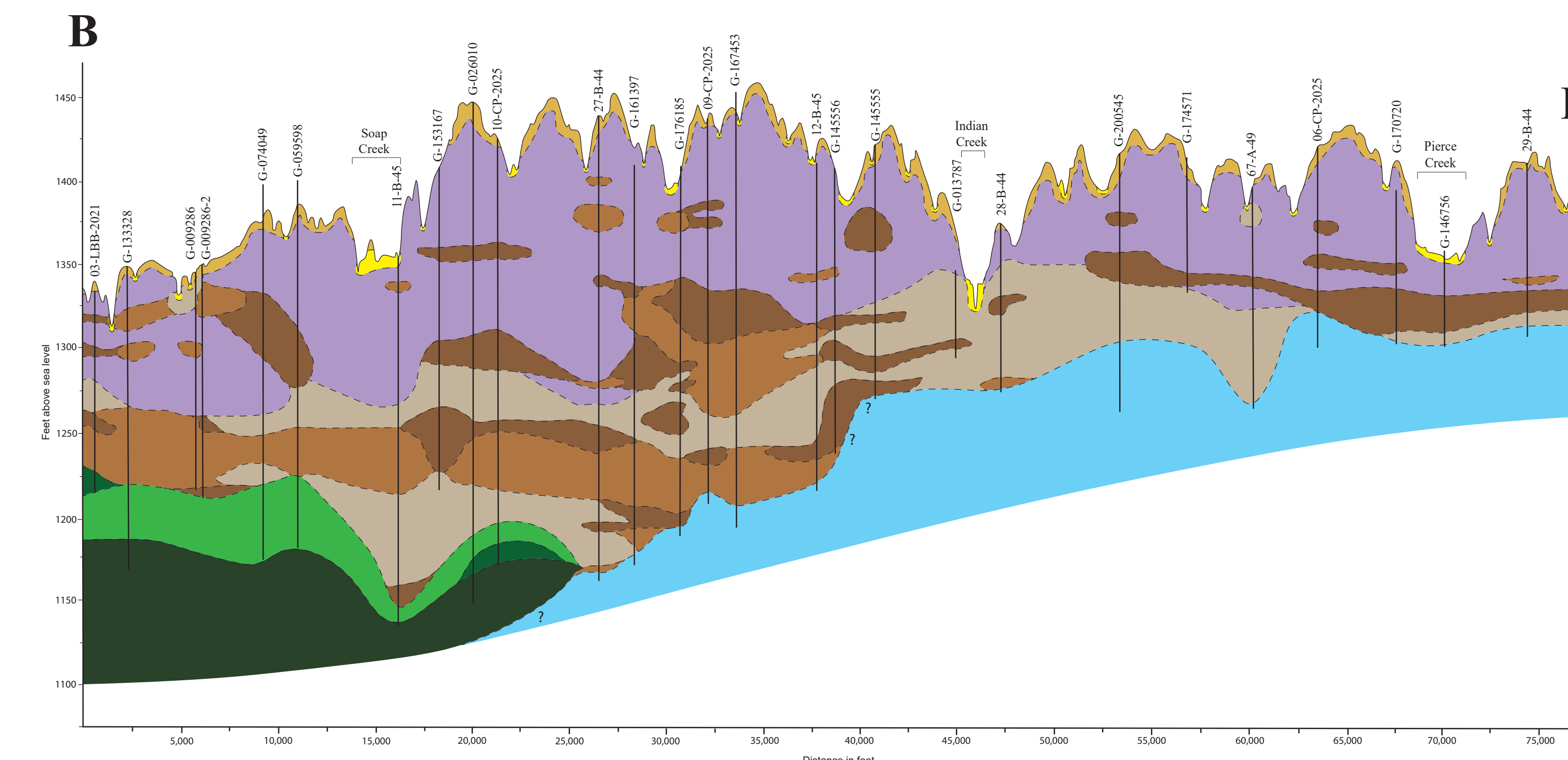
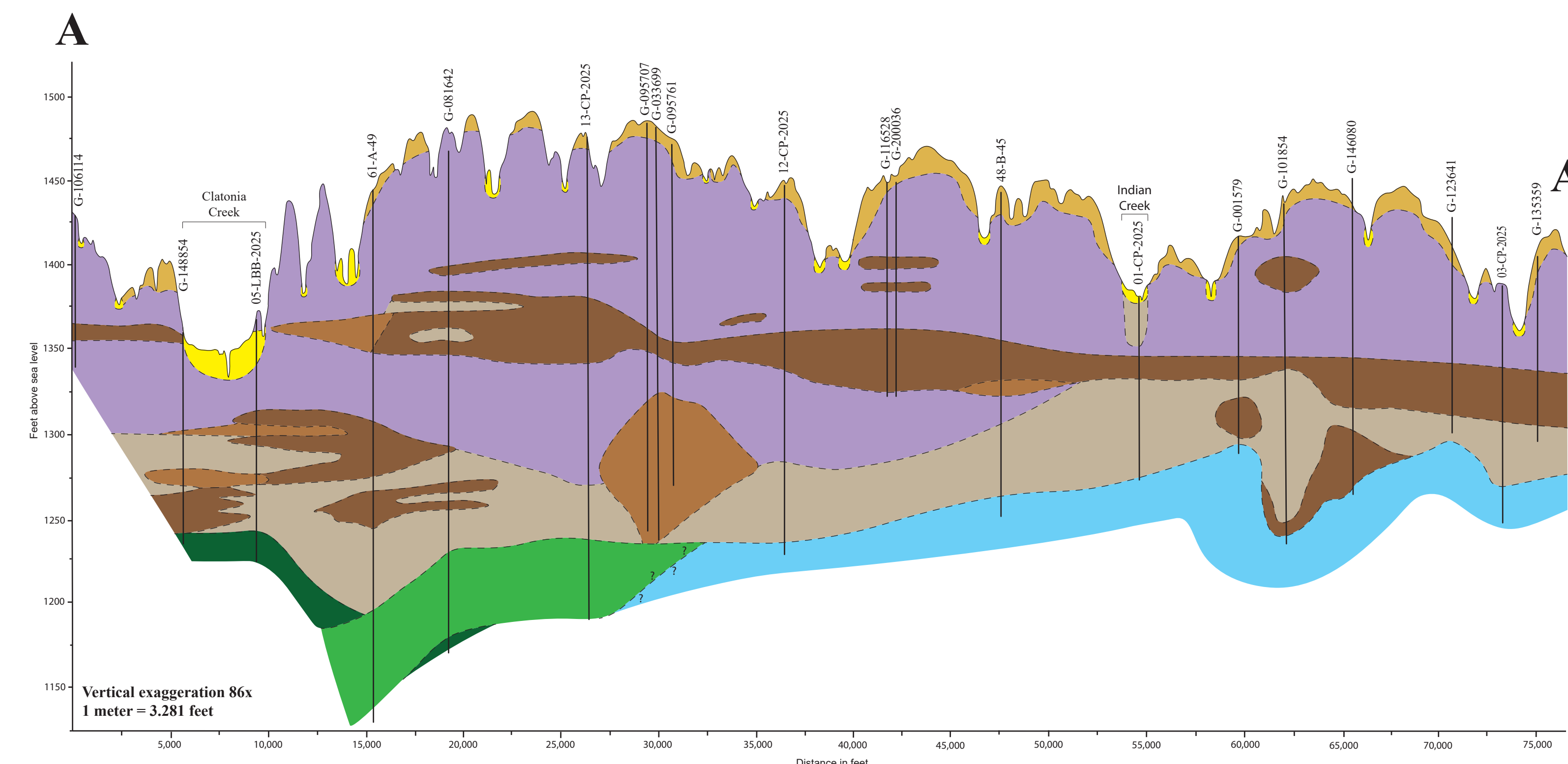


Figure 1- Hillshade created from 1m resolution LiDAR imagery. Heavy black line represents paths of cross-sections. Red dots show the locations of new test-holes drilled as part of this mapping project in 2025. Red and black dots are historic test-holes drilled by the Conservation and Survey Division, the last digits of the hole identifier represents the year drilled. White and black dots are registered wells used to create cross sections. Red lines show section boundary lines. Blue lines are quad boundaries.



Local setting

The Clatonia and Pickrell Quadrangles are located in Southeast Nebraska, roughly midway between the cities of Lincoln (pop. 300,619) and Beatrice (Pop. 12,290). These quadrangles primarily contain tributaries associated with the Big Blue River which runs through Beatrice except for Soap Creek in the extreme northeast edge of the Pickrell Quadrangle which drains into the Middle Branch of the Big Nemaha River near Adams, Nebraska in the neighborhood of Adams Quadrangle to the east (Fig. 1). These maps are centered around US HWY 77, which provides a convenient transportation link between smaller communities and larger population centers. Due to the proximity to Lincoln and Beatrice, small acreages in this region have become increasingly popular with commuting residents. This increasing population in rural areas has placed an increasing demand on local resources.

Geologic setting

This region has had a long and complex geologic history including glaciation, stream dissection, and multiple episodes of loess deposition. These events resulted in the accumulation of 30 or more meters of sediment that directly overlie Cretaceous or Permian aged bedrock. Subsequent modification of these sediments during the Pleistocene and Holocene have resulted in a landscape dominated by dissected till, with loess covered uplands. Stream valleys of Clatonia Creek, Big Blue River, Indian Creek and Pierce Creek tend to be wide and flat, with modern valley floors up to half a mile wide at some locations.

The dissected till landscape

Southeast Nebraska was glaciated during the pre-Illinoian between ~2,000,000 and 600,000 years ago when much of eastern Nebraska was covered by glacial ice (Roy et al., 2004; Balco et al., 2005). As the glaciers receded, large quantities of poorly sorted glacial till were deposited. Locally, the till is blue to brown in color and dominated by clay with silt, sand, gravel, and boulders. Locally, till may contain a high concentration of sand, a feature not typical of southeast Nebraska. Deposits of dense, structureless blue to brown silts and clay also exist at depth. Due to the lack of coarse particles, these deposits are interpreted as alluvial or lacustrine silts and clays likely sourced from glacial meltwater. Locally, sand deposits in the till provide important sources of groundwater for some domestic wells (eastern portion of Cross Section A and east end of Cross Section B; test holes: 12-CP-2025, 01-CP-2025 and 03-CP-2025, 06-CP-2025 and 29-B-44). Glacial deposits in the mapping area are either deposited directly on Cretaceous or Permian aged bedrock or deposited over pre-Pleistocene alluvial sands and gravels known locally as paleo channels. Since the glaciers receded about 600,000 years ago, a dense network of smaller streams and tributaries have deeply dissected the till landscape, creating more than 30 meters of relief along some drainages. During the mid to late Pleistocene, the landscape was subsequently draped with multiple layers of windblown dust, known as the Loveland (Q1) and Peoria Loesses (Qp). Much of the loess deposited on steep slopes and valley walls has since been eroded away exposing the underlying glacial till (Q1). Larger stream valleys have remnants of flat terrace trends (Qal2) 10-15 meters above modern stream level. Terrace trends may or may not be covered with Peoria Loess. Land use in the dissected till landscape depends on local relief and availability of groundwater, but is generally pasture, irrigated or sub-irrigated row-crop agriculture. Over the last several decades, the number of small acreages and residences have been increasing on this landscape.

Broad stream valleys

Several stream valleys tributary to the Big Blue River were deeply incised during the late Pleistocene, with the valley floor continuing to be shaped through the Holocene. Several of these streams (including Clatonia Creek, Indian Creek, Soap Creek and Pierce Creek) have broad flat valleys up to a kilometer across despite the small size of the streams within them. The upper portion of the alluvial fills within the valley are largely silts and clays sourced from a combination of silty loess and clayey glacial sediments (See Young et al., 2014, Geopros 1 and 2). The lower portion of these fills (below 5-10 meters depth) are generally glacial till or occasionally sand and gravel bodies. Due to historical downstream river modifications, these streams have been entrenched in a narrow valley to a depth of up to 4 meters. During large-scale flooding events, the valley floors can be inundated with flood water. Alluvial sediments deposited in the broad stream valleys are fertile and farmed extensively. Groundwater beneath the valleys varies, and land use generally consists of irrigated or sub-irrigated row-crop agriculture.

Natural resources

Soils

Soils formed in the dissected till landscape range from highly fertile Mollisols generally developed in loess deposits to thin less fertile Entisols developed in glacial sediments. Soil fertility tends to be less on steep or eroded slopes where the uppermost soil horizons are absent or thin. Although no glacial outwash was mapped on the Clatonia or Pickrell Quadrangles, small (less than 10 meters diameter) patches of sandy glacial outwash are occasionally present in areas mapped as glacial till. Areas of glacial outwash are often identifiable in fields as areas with stunted crop growth.

Soils formed in floodplains of the broad stream valleys tend to be Entisols formed in alluvium. These soils generally consist of nutrient-rich silt and clay sediments eroded from fertile upstream loess and glacial till deposits. Although Entisols are generally classified as prime farmland by the NRCS, infiltration rates of soils throughout the mapping area are low and are particularly low in areas mapped as Loveland Loess (Q1) or glacial till (Q1). Generally, soils in the Clatonia and Pickrell Quadrangles have infiltration rates from 40 to greater than 60 minutes per inch. Where soil infiltration rates are greater than 60 minutes per inch, wastewater lagoons or other engineered systems must be used for onsite wastewater disposal. Some locations have a seasonal high-water table of less than 2 meters, which requires additional engineering for onsite wastewater disposal systems. For those seeking to locate housing developments, purchase land for a rural residence, or plan other developments in this region, performing percolation tests and ensuring proper lot sizing to accommodate an appropriate onsite wastewater treatment system should be considered.

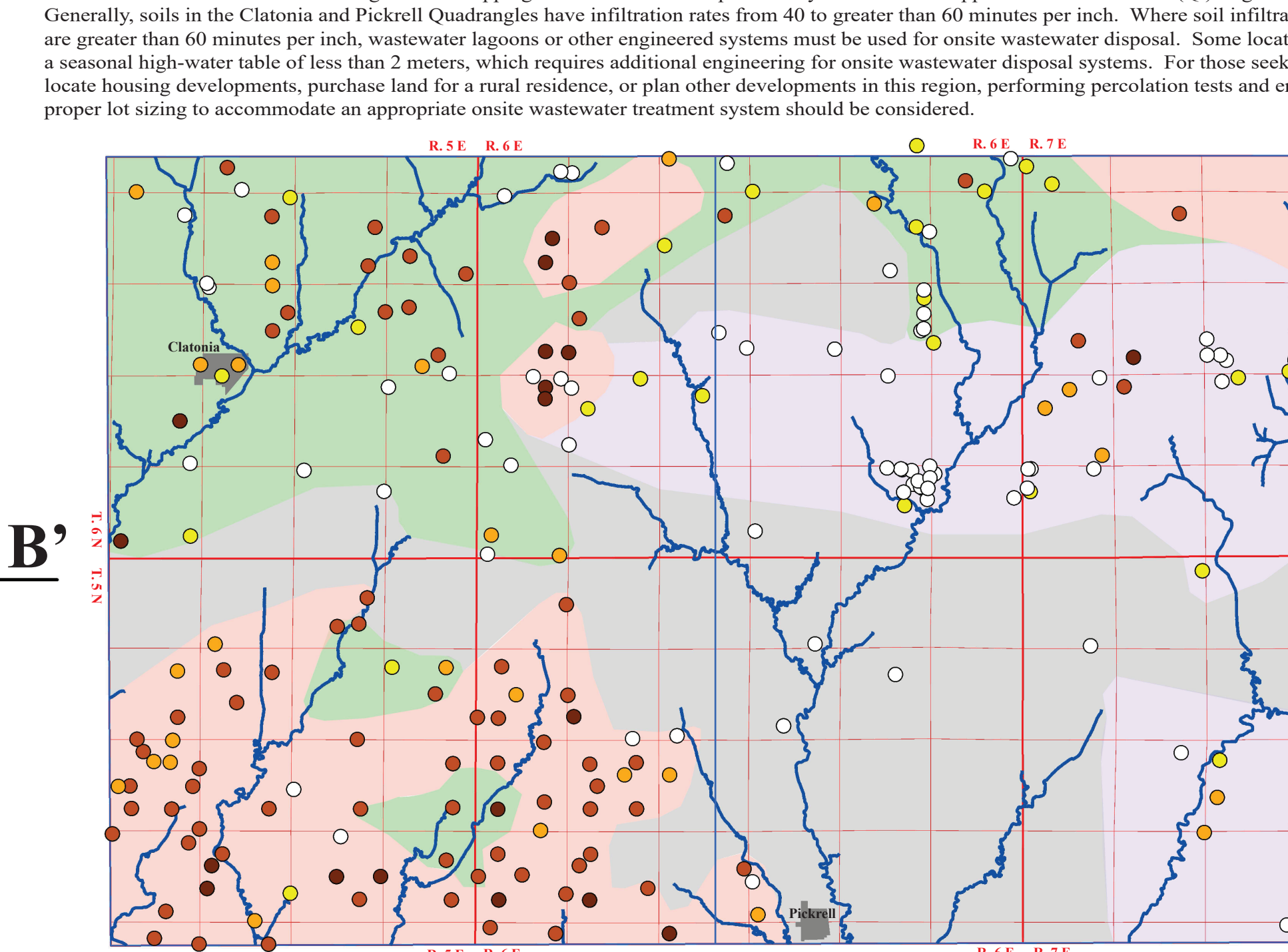


Figure 2- Registered well locations showing well pump rates and associated aquifers. Dark gray shaded areas represent the towns of Clatonia and Pickrell. Dashed black lines are Nebraska Natural Resources District boundaries. Red lines are section lines and blue lines are quadrangle boundaries.

Pumping rate in gallons per minute

- 0-15
- 15-100
- 100-500
- 500-1000
- 1000-1600

Primary groundwater source

- Aquifer thin or bedrock high
- Glacial sand
- Paleo channels
- Dakota sandstone

Quaternary sediments

- Alluvium
- Peoria loess
- Sand (undifferentiated)
- Sand and gravel (undifferentiated)
- Glacial or alluvial silt and clay
- Glacial till

Cretaceous rocks

- Dakota Group sandstone
- Dakota Group siltstone/claystone
- Dakota Group undifferentiated

Permian rocks

- Chase Group limestone/shale/chert