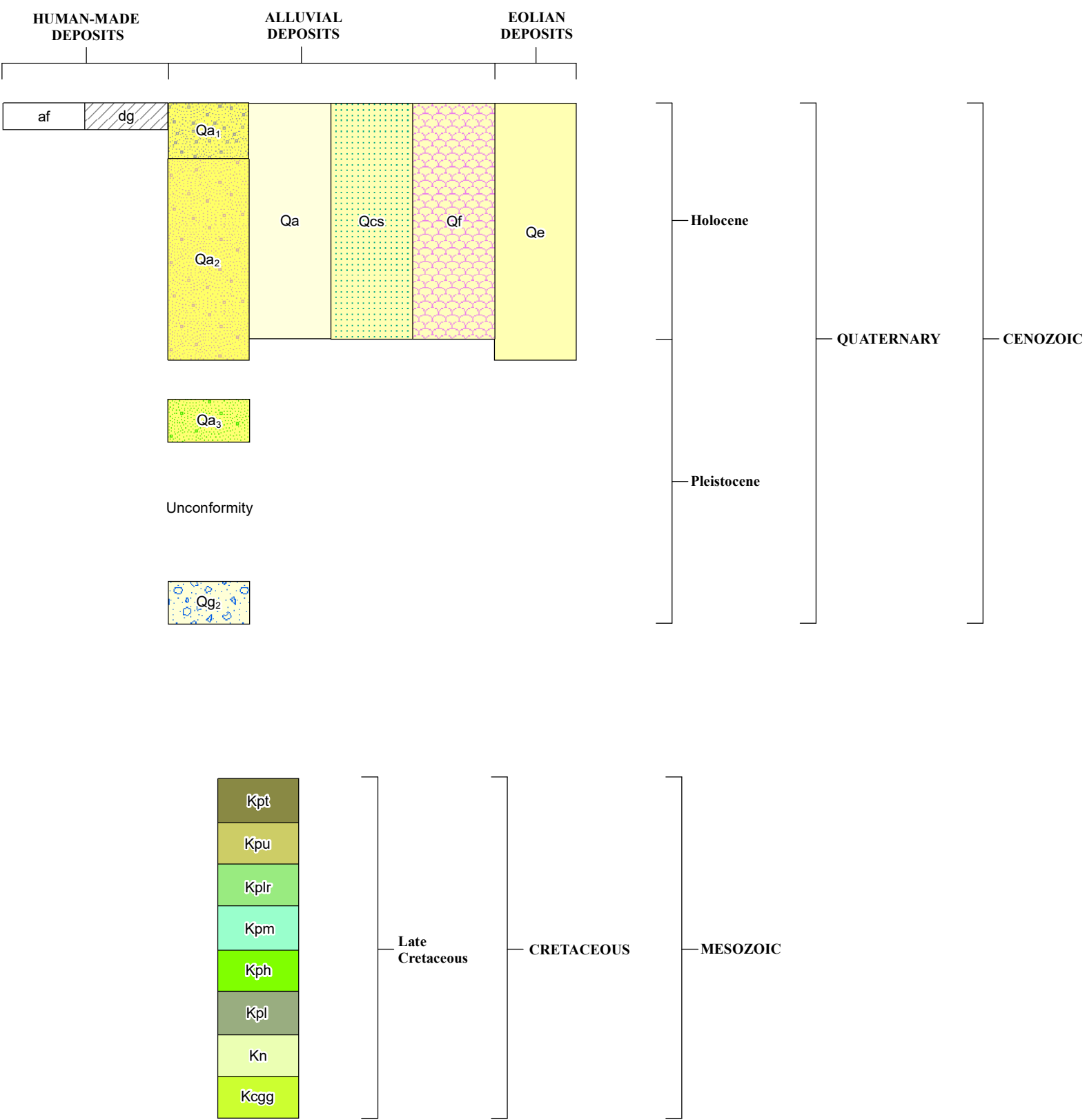
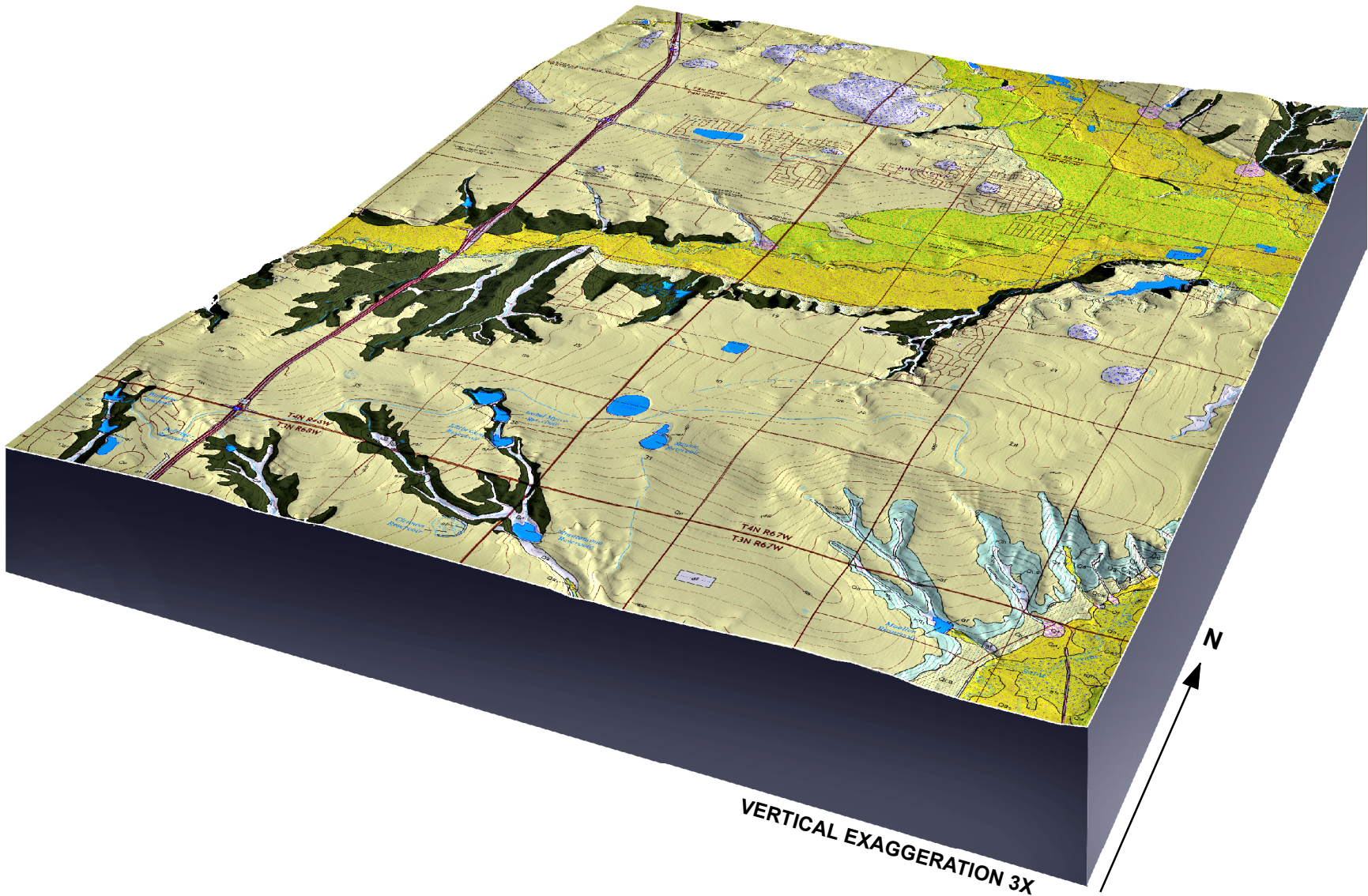


CORRELATION OF MAP UNITS



3-D OBLIQUE



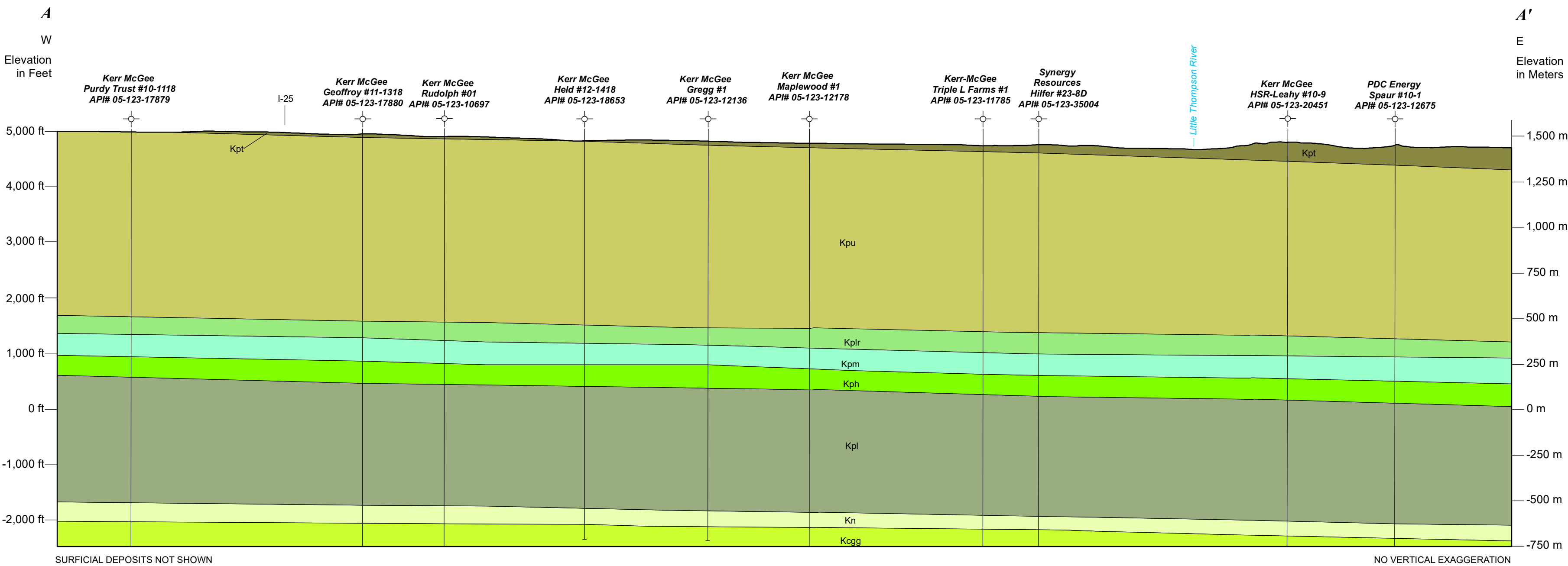
GEOLOGIC HISTORY

The Johnstown quadrangle lies in the northern Front Range urban corridor, located approximately 40 miles (64 km) north of metropolitan Denver and approximately 20 miles (32 km) southeast of Fort Collins. The area is located within the Colorado Piedmont physiographic province, an erosional area devoid of Neogene rocks that is bounded by the Foothills to the west and the High Plains to the east and north (Fenneman, 1931; Leonard, 2002; Smith and others, 2016). Two regionally expansive unconformities may define onset of Piedmont deformation and uplift: a late Eocene unconformity concurrent with the end of the Laramide orogeny, and an early Miocene unconformity that separates the Ogallala Formation from older strata below (Leonard, 2002). Bedrock within the Johnstown quadrangle consists of Upper Cretaceous (100-66 Ma) sedimentary rocks that were deposited during transgressive and regressive episodes of the Western Interior Seaway (WIS), a large epicritic sea that existed in the Late Cretaceous. The beginning of the Laramide orogeny at ~70 Ma (Weimer, 1996) is roughly coeval with the final regression of the WIS in Colorado. This final regressive pulse of the WIS defines the near-surface stratigraphy in the quadrangle and is comprised of the Niobrara Formation, Pierre Shale and Fox Hills Sandstone. As the Laramide orogeny progressed, sediments eroded off of the uplifting Rocky Mountains, filling the downwarped foreland basin to the east with detritus. This structural basin, known as the Denver Basin, is strongly asymmetric, with steeply dipping strata along its western flank and gently dipping strata along its eastern flank.

Bedrock exposure in the quadrangle is primarily limited to the flanks of the Little Thompson River, as well as the gullies of intermittent streams that feed these systems during heavy rains. When exposed, the bedrock is primarily composed of the Upper Transition Member of the Pierre Shale (Kpt), a Late Cretaceous, massive, buff-tan sandstone serving as a gradational member between the thick shales of the Pierre and the Fox Hills Sandstone. The Fox Hills Sandstone (Kfh), a white-beige, friable, massive sandstone, is also exposed on the quadrangle in the southeast corner of the map, in the intermittent gullies of St. Vrain Creek. In the subsurface, the Johnstown Wrench fault zone (JWFZ) (Weimer, 1996) runs through the quadrangle, creating an anticline in the north, and a graben in the south. The JWFZ is covered by quaternary sediments and the shallow bedrock (Kpt) in the area, and can only be seen on geophysical logs. Many of the strata are important aquifers for communities along the Front Range in addition to being productive oil and gas.

In the Johnstown quadrangle, upper (126 ka-11.7 ka) Pleistocene gravel (Qg<sub>2</sub>) caps hills, ridges and terraces, and were deposited by a paleochannel of the Big Thompson River. The gravel deposits of Johnstown exist due to a phenomenon known as topographic inversion. Through this process, former stream channels of the Big Thompson River became terraces. A well-defined example of this occurs roughly parallel to the Big Thompson River, trending northwest-southeast throughout the area. Over half of the Johnstown quadrangle is covered by eolian sediment (mainly loess and sand) deposited during the late Pleistocene (126 ka-11.7 ka) and continued through the Holocene (<11.7 ka). During the Pinedale Glaciation (~30 ka-10 ka), strong northwesterly winds were responsible for the vast eolian deposition in the northern Front Range (Madole, 2016), and covered most of the upper and middle Pleistocene alluvial gravels, leaving only the highest terraces exposed in the area. After widespread eolian deposition, incision of the windblown deposits and subsequent alluvial deposition (Qa<sub>1</sub>, Qa<sub>2</sub>, and Qa<sub>3</sub>) by the Little Thompson River, Big Thompson River, and St. Vrain Creek began in the Late Pleistocene/early Holocene and has persisted through present time. Clasts of crystalline rock, found in greatest abundance in Alluvium three, were transported to the area during glaciation events. In addition to sediment derived from crystalline rocks in the Front Range, alluvial deposits contain lesser amounts of detritus derived from sedimentary rocks in the Denver Basin, as well as reworked eolian sediment.

CROSS SECTION A-A'



GEOLOGIC MAP OF THE JOHNSTOWN QUADRANGLE, LARIMER AND WELD COUNTIES, COLORADO  
CORRELATION OF MAP UNITS, 3-D OBLIQUE, AND CROSS SECTION

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2017