

1.5 Surficial Geology

Newark Basin Physiographic Subprovince

During the Pleistocene Epoch of the Quaternary Period, the sea level fell as much as 300 feet due to the amassing of ice sheets in the Northern Hemisphere. The advance of ice caused the erosion of hills and the deposition of various stratified and unstratified deposits (Plate 1.5.1).

Running from northwest to southeast across WMA 6 is a long, sinuous, often-interrupted mound of particularly thick accumulations of unsorted, unstratified glacial drift that formed at the terminal edge of the Wisconsinan glacier. This mound, typically thousands of feet wide (occasionally more than one mile wide), and actually crossing several states from west to east, is called the “terminal moraine.” It stands at the furthest southward extent of the Wisconsinan ice sheet. There are also recessional moraines marking where the glacier paused for a period of time during its retreat following the point of maximum glaciation. Between these moraines, unstratified glacial drift (also known as “till”) is deposited in more uniform (and typically thinner) accumulations.

As the ice advanced, sediment-laden water issued from many points along the ice front. This meltwater often reached tremendous velocities, capable of moving sand and gravel, which tended to settle out of suspension a short distance from the ice front. This coarse-grained material would partly fill local pre-existing stream valleys, to be soon overrun by the glacier, and were ultimately buried under glacial till. These “buried valley aquifers” are prolific sources of water. Their size and complexity varies with the physiographic characteristics of the area where they were deposited.

There are also surficial outwash deposits preserved south of the terminal moraine. Meltwater-fed braided stream deposited forms broad outwash plains near Dover and Madison.

As the ice front advanced, it blocked northward-flowing streams and the resultant back up formed lakes. In the Newark Basin portion of WMA 6, these lakes ranged in size and longevity. The largest and more prominent was Glacial Lake Passaic, which formerly covered the area between the Second Watchung Mountain and the Highlands Province. Remnants of its shoreline extend from Kinnelon and Wayne Townships in the north to Bernards Township in the south. The principal types include: deltas, where meltwater streams entered glacial lakes; lacustrine fan deposits, where meltwater issued directly into a glacial lake from a submerged portion of the glacier front; and lakebed deposits, where suspended silt and clay settled through the water column at distance from where the meltwater entered the lake. Other stratified drift occurs in ice-contact deposits, where water-borne deposition occurred between the ice and till (or bedrock) or within a cavity in the ice itself (Stanford *et al.* 1990).

In other areas, sheets of glacial till form a poor surficial aquifer, where sufficiently thick. Elsewhere, the till is not thick enough to provide a sustainable supply of water, but it does provide some recharge to underlying aquifers, including stratified drift and the Brunswick Group aquifers.

Highlands Physiographic Subprovince

The Wisconsinan terminal moraine divides the Highlands portion of WMA 6 roughly in half (Plate 1.5.1). The area southwest of the moraine was not glaciated during the Wisconsinan glaciation. Consequently, there is no Wisconsinan till deposited there. Small, isolated patches of Illinoian and older till may be preserved in stream valleys and other low areas. Glacial lake and fluvial deposits are found southwest of the moraine. As in the Newark Basin, glacial lakes formed as a result of the blockage of north-flowing streams by the ice sheet. All of these features are found northeast of the terminal moraine as well, but Wisconsinan till blankets the area, except for the higher elevations. Approximately 50 percent of the area northeast of the terminal moraine in the Highlands portion of WMA 6 exhibits till deposits greater than 25 feet in thickness. Although lacustrine fan, deltaic, and lake bottom deposits are found in the Highlands, these are very limited in lateral extent, relative to sediments derived from comparable depositional environments in the Newark Basin.

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