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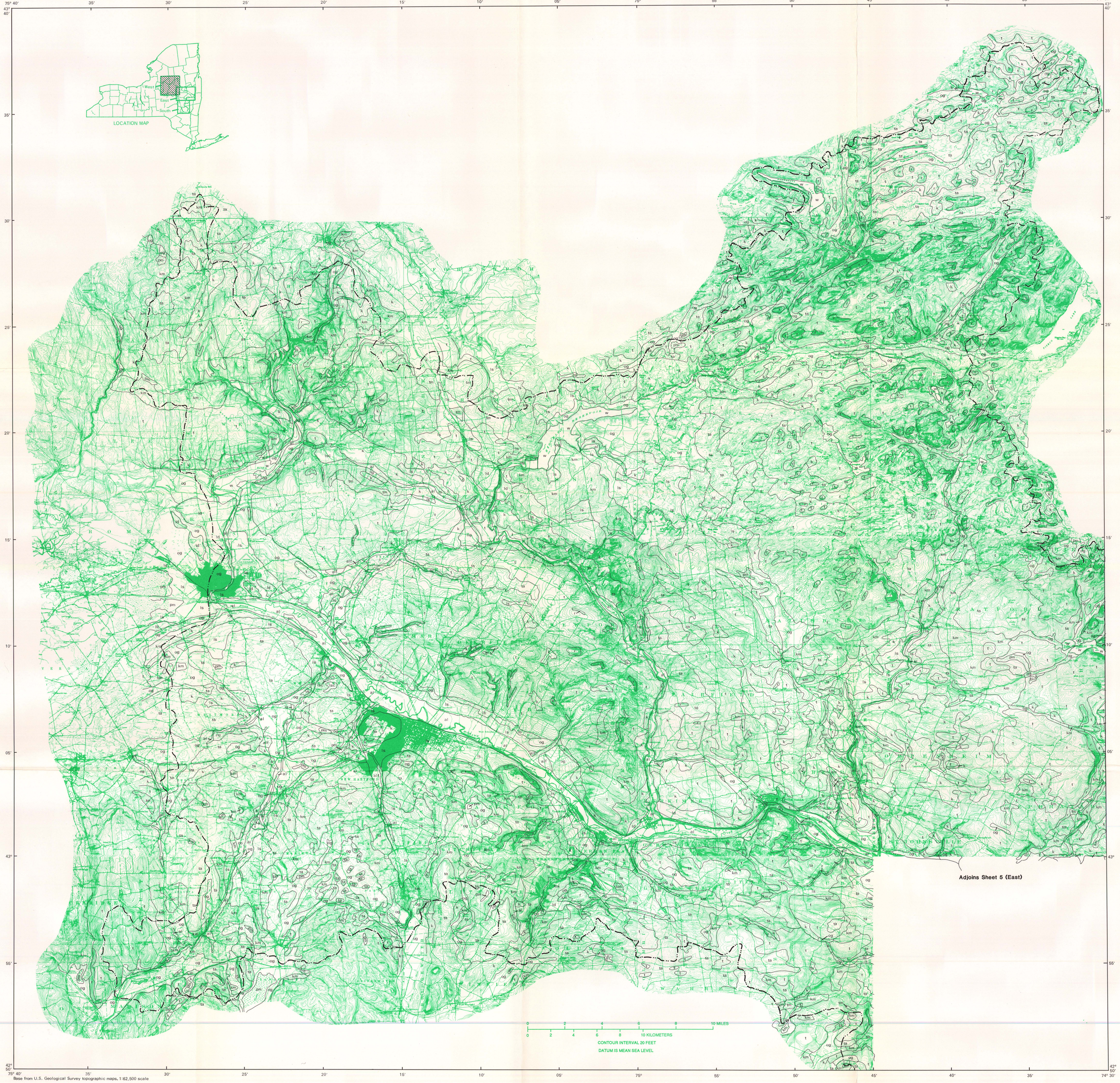
NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

WATER RESOURCES INVESTIGATIONS REPORT 88-4091
SHEET 4 (WEST)--SURFICIAL GEOLOGY



Base from U.S. Geological Survey topographic maps, 1:62,500 scale

AVAILABILITY OF GROUND WATER FROM UNCONSOLIDATED DEPOSITS IN THE MOHAWK RIVER BASIN, NEW YORK

By
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Sheet 4.--Surficial geology, West

SURFICIAL GEOLOGY

This map (sheets 4, 5, 6) depicts the generalized surficial geology of the Mohawk River basin. The location and distribution of surficial materials were determined primarily from reconnaissance mapping on 1:24,000 scale (7.5-minute) topographic maps by the New York State Geological Survey and other geologists working independently within New York State. The level of detail on the original maps varies significantly from quadrangle to quadrangle as well as among investigators. As a result, some areas of the Mohawk basin, primarily the eastern part, have been mapped in detail, whereas others have received only cursory reconnaissance. In general, the mapping in the valleys has been more detailed than mapping in the uplands.

The primary source of data is unpublished field maps, at scales of 1:24,000 (7.5 minute) and 1:62,500 (15-minute) that are on file with the New York State Geological Survey. Other sources include published reports containing surficial geologic maps of one or more quadrangles, unpublished Master's and Doctoral theses, and unpublished or published surficial maps by independent workers. The major contributors to mapping of surficial geology in various parts of the Mohawk basin have been:

Western part	- D. A. Franzi, J. C. Ridge, E. H. Muller, and F. M. Wright III (Syracuse University), and Marshall Kay (Columbia University).
Central Mohawk	- J. M. Whipple, (U.S. Geological Survey) and E. H. Muller (Syracuse University).
Lower Mohawk	- D. H. Cadwell and R. J. Dineen (New York State Geological Survey), R. G. LaFleur (Rensselaer Polytechnic Institute), and A. P. Brigham (New York State Geological Survey).
Schoharie basin	- D. H. Cadwell and J. L. Rich (New York State Geological Survey) and R. G. LaFleur (Rensselaer Polytechnic Institute).

Other contributors are listed in the "References" section. Compilation of data from these sources and the resolution of discrepancies in the mapping of units in adjacent areas was done by D. H. Cadwell of the New York State Geological Survey.

Western Mohawk River Basin

The glacial drift in the western Mohawk lowland represents a complex history of deposition left by four ice lobes that repeatedly moved in and out of the region from the west, northwest, northeast, and east during the last (Wisconsin) glaciation. These ice lobes where (1) the Oneida lobe, which advanced from the west and was active in the Oneida Lowland and Tug Hill Plateau, (2) the Black River lobe, which was active in the Black River Lowland and advanced from the northwest, (3) the Mohawk lobe, which advanced up the Mohawk valley from the east, and (4) the Adirondack ice sheet, which advanced from the northeast as either continental ice flowing across the Adirondack uplands or from local outflow centers in the Adirondack high peaks (Ridge, 1985, p. 5). The western Mohawk lowland thus served as a depositional center for several glacial advances and retreats from different directions, which resulted in the deposition of a variety of glacial sediments and morphostratigraphic units. Thick sequences of glacial-lake sediments, primarily within the Mohawk valley proper, are the result of sediment deposition and ice advance into a succession of proglacial lakes ponded between one or more ice lobes, the Appalachian escarpment, and(or) the Adirondacks.

Morphostratigraphic units in this area that may represent significant unconsolidated aquifers (where saturated) include (1) outwash sand and gravel deposited in major tributary valleys to the Mohawk valley, (2) ice-contact deposits of kames and kame moraines, and (3) coarse-grained recent alluvium within major stream valleys. In addition, large areas of ablation till that cover bedrock uplands can serve as moderately productive aquifers for domestic wells. Significant glacial-drift deposits in this area include a large belt of kames and kame moraines that trend northwest-southeast through the center of the area from north of Delta Reservoir to a point approximately 14 miles north of Herkimer, approximately parallel to West Canada Creek. The upper reaches of the West Canada Creek valley are floored with significant deposits of outwash sand and gravel that grade westward to a large outwash delta just east of Hinckley Reservoir. Ninemile Creek valley, just east of Rome, is similarly floored with outwash sand and gravel that terminates in an outwash delta. West Canada Creek, its major tributaries downstream from Hinckley Reservoir, and Nine Mile Creek have incised entirely through the surficial outwash sand and gravel into underlying lake-bottom deposits, till, and bedrock, however, (Ridge and others, 1984) so that these surficial gravels remain largely unsaturated, have little or no hydraulic connection with modern streams, and thus, can be expected to yield little ground water to wells.

Significant deposits of saturated outwash sand and gravel interbedded with silt and clay floor the Sauquoit and Oriskany Creek valleys south and southwest of Utica, respectively. Their inferred saturated thickness of 20 to 40 feet would seem sufficient to support moderate ground-water pumpage on the order of 100 gallons per minute or more from properly developed wells.

Stratified drift in the Mohawk River valley proper generally consists of alluvium of Holocene age underlain by silty outwash sand and gravel, which is in turn underlain by thick lacustrine silt and clay. A discontinuous buried aquifer is believed to underlie some parts of the Mohawk valley. Limited drillhole data for the area between Utica and Ilion show that coarse sand and gravel is overlain by a considerable thickness of till, which in turn is overlain by the lacustrine silt and clay. This buried sand and gravel probably was deposited during drainage from the glacial Great Lakes. Ridge and others (1984) concluded that at least two episodes of eastward drainage from the glacial Great Lakes caused the fluvial aggradation of this sand and gravel. The large volumes of water that were presumably released reworked this sediment and removed much of the fine material,leaving a clean, coarse gravel deposit behind. Subsequent glaciation in the Mohawk valley covered this deposit with a sequence of till, lake silt and clay, and, later on, outwash.

The surficial outwash unit within the Mohawk River valley is coarsest between Utica and Frankfort and appears to be in good hydraulic connection with the river. Several high-capacity industrial wells tap this unit near the villages of Frankfort, Ilion, and Mohawk. This unit may consist entirely of outwash or, possibly remnants of glaciofluvial deltaic deposits derived from the proglacial Moyer, Steele, and Fulmer Creeks (A. D. Randall, U.S. Geological Survey, written commun., 1986). In the river reach between Utica and Mohawk, outwash gravel is emplaced as terraces along both valley walls at relatively high elevations above modern river level; accordingly, they are probably drained or at best only thinly saturated.

Moderately permeable deposits of ablation till over bedrock in the western Mohawk River basin can provide adequate water for domestic wells where the saturated thickness is sufficient to support pumping. Ablation till in most of this region is loosely consolidated and, although unsorted, has a larger percentage of sand and gravel than silt and clay. In a quantitative study of lodgment and ablation tills in the Chenango and Susquehanna River basins to the south, Caprio (1979) found that the ablation tills in this region contain a considerably higher ratio of sand to silt and clay than lodgment tills and also tend to be stonier and more coarse-grained. Moreover, because till in any given locality generally contains rock fragments of mostly local origin that were transported by glacial ice, till that overlies metamorphic and igneous rock (such as in the area northeast of the Mohawk valley in the Adirondack foothills) can be expected to consist mostly of sand, gravel, and boulders but little silt or clay. Tills in these areas, especially ablation tills, can therefore be expected to be more permeable than lodgment till and to be able to provide local sources of ground water for domestic drilled wells.

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EXPLANATION

HOLOCENE

al — ALLUVIUM--Postglacial alluvial deposits of silt, sand, and some gravel generally confined to flood plains within a valley. Locally overlain by silt of variable thickness in larger valleys that are subject to frequent flooding. Relatively low permeability. Thickness variable but generally less than 30 feet.

alf — ALLUVIAL FAN--Fan shaped, fluvially deposited accumulations of poorly stratified silt, sand, and gravel deposited by tributary streams at the foot of steep slopes. Relatively high permeability.

alt — ALLUVIAL TERRACE--Postglacial stream terraces composed of stratified silt, sand, and gravel produced by continued or renewed downcutting of the flood plain or valley floor by a stream. Moderately permeable but thinly saturated.

co — COLLUVIUM--A recently deposited, unconsolidated, unsorted mixture of sediments ranging from clay and silt to boulders that accumulates at the base of steep slopes from rainwash, sheetwash, or slow continuous downslope creep. Permeability relatively low to moderate.

pm — SWAMP DEPOSITS--Postglacial to recent deposits of peat, muck, organic silt, and sand that accumulated in poorly drained areas and localized depressions. Locally overlies marl and lake silts. Thickness generally less than 60 feet.

PLEISTOCENE

lb — LACUSTRINE BEACH--Wave-deposited and sorted, stratified sand and gravel at the former shoreline of a proglacial or postglacial lake that has since drained. Well sorted and well drained. Relatively high permeability. Locally includes wave-winnowed deposits of gravel. Variable thickness.

ld — LACUSTRINE DELTA--Fluvially deposited stratified, coarse to fine gravel and sand. Generally well sorted. Relative permeability moderate. Deposited by meltwater streams that entered a proglacial lake. Variable thickness.

lsc — LACUSTRINE SILT AND CLAY--Silt and clay deposited as bottom sediment in proglacial lakes. Generally composed of calcareous, thinly bedded laminated beds of silt but can be massive. Variable thickness, ranging up to 300 feet. Relative permeability very low.

ls — LACUSTRINE SAND--Sand, well sorted, stratified, deposited into proglacial lakes in a nearshore, shallow-water environment. Variable thickness. Relative permeability moderate.

og — OUTWASH SAND AND GRAVEL--Glaciofluvial stratified sand and gravel deposited by meltwater streams as valley train or as outwash plains and terraces. Well-sorted coarse to fine gravel with sand. Grain-size generally becomes finer with distance from ice front. Variable thickness. Relative permeability high to very high.

k — KAME DEPOSITS--Includes kames, eskers, kame terraces, and kame deltas. Ice-contact sand and gravel deposits consisting of fluvially sorted coarse to fine gravel and(or) sand. Extreme variability in sorting, grain size, and thickness of individual beds. May be locally cemented with calcium carbonate. Variable thickness and permeability. Relative permeability high in coarse, well-sorted beds.

km — KAME MORAINES--Ice-contact, poorly sorted to moderately well-sorted deposits of sand and gravel that may also contain considerable amounts of silt, clay, and boulders. Generally composed of the slumped remnants of a formerly continuous outwash plain built up over the foot of rapidly wasting or stagnant ice. Indicative of a temporary location of the ice during deglaciation. Thickness and grain size variable; is locally cemented with calcium carbonate. Relative permeability low to moderate but generally high in coarse, well-sorted beds.

t — TILL (GROUND MORAINE)--Ice-contact, unsorted, unstratified mixture of clay, silt, sand, gravel, and boulders deposited beneath advancing glacial ice. Relatively impermeable with moderate to large clay content. Tends to be sandy and, thus, more permeable in areas underlain by igneous and metamorphic rock. Thickness variable (up to 150 ft) but generally less than 20 feet on upland hills. Generally yields adequate amounts of water for domestic use to large-diameter dug wells.

tm — TILL MORAINE--Ice-contact deposits of till that mark a stillstand or retreat in the ice front at the terminus of an ice lobe (end moraine), flanking an ice lobe (lateral moraine), or between two ice lobes (interlobate moraine). Much like ground moraine but more variable in sorting. Relative permeability low. May show ice-shove deformation features. Grain size ranges from boulder to clay.

ta — ABLATION TILL--A morainal or sheet deposit of nonstratified till that was deposited from a rapidly wasting ice margin. Ablation till is composed of rock debris that were formerly imbedded in or atop glacial ice and were rapidly deposited as the ice melted. Ablation till typically is loose and uncompacted and, therefore, much more permeable than till moraine or ground moraine. Permeability is also enhanced by the general absence of the silt and clay fraction, which was carried off by meltwater. Yields of wells that terminate in saturated ablation till in this region may approach those of wells screened in stratified material such as kame sand and gravel.

r — BEDROCK--Areas where bedrock is exposed or close to land surface. Bedrock ranges from ignieous and metamorphic rock of Precambrian age to shale and siltstone of Devonian age and includes carbonate rocks of Devonian to Silurian age.

w — OPEN WATER--Areas of open water such as lakes, large ponds, and reservoirs.

——— GEOLOGIC CONTACT--Denotes contact between adjacent surficial geologic units. Appoximately located.

—··— BASIN BOUNDARY--Indicates approximate location of the surface-water divide that separates the Mohawk River basin from adjacent river basins.