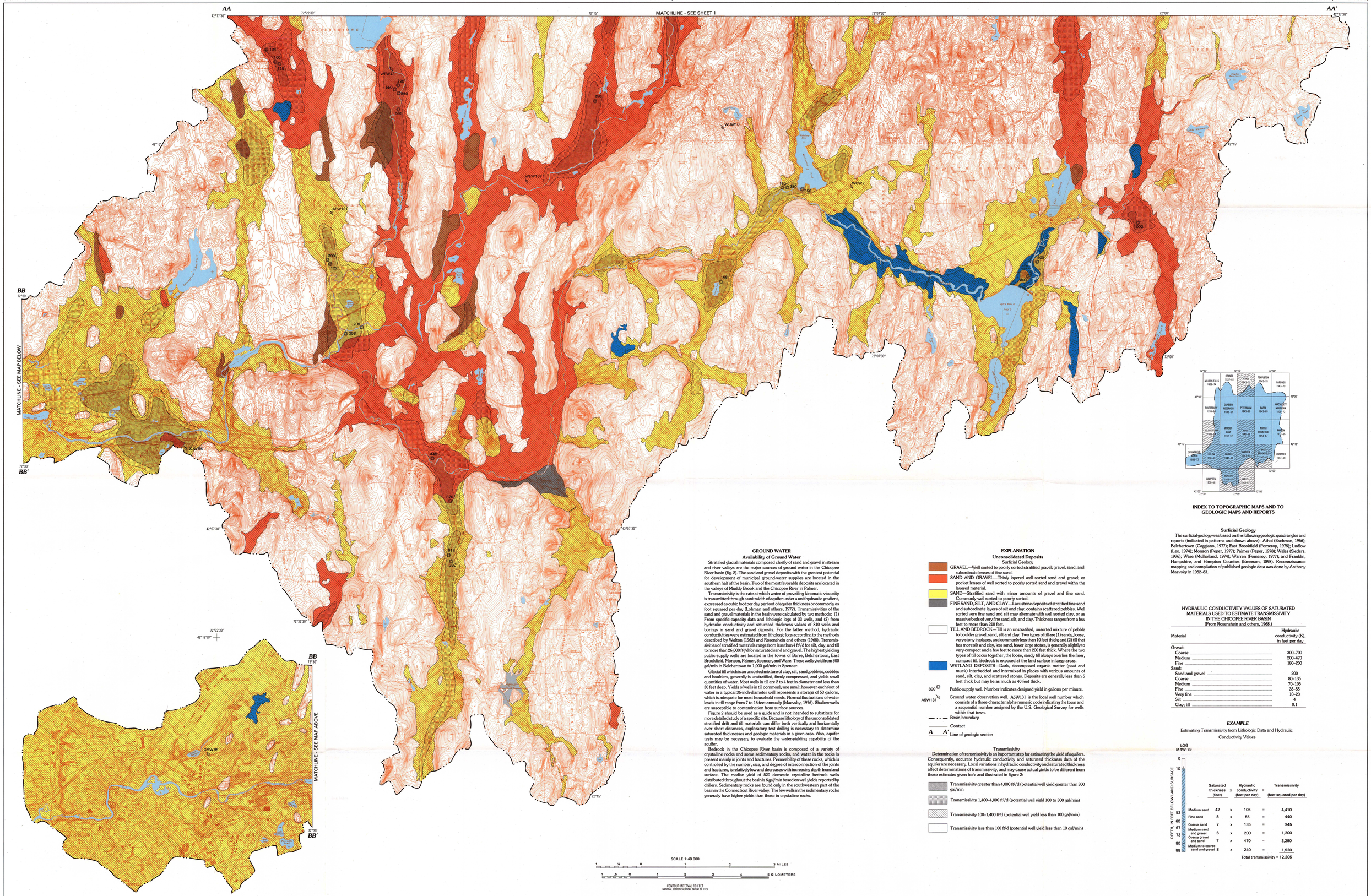

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GROUND WATER

Availability of Ground Water

Stratified glacial materials composed chiefly of sand and gravel in stream and river valleys are the major sources of ground water in the Chicopee River basin (fig. 2). The sand and gravel deposits with the greatest potential for development of municipal ground-water supplies are located in the southern half of the basin. Two of the most favorable deposits are located in the valleys of Muddy Brook and the Chicopee River in Palmer.

Transmissivity is the rate at which water of prevailing kinematic viscosity is transmitted through a unit width of aquifer under a unit hydraulic gradient, expressed as cubic foot per day per foot of aquifer thickness or commonly as foot squared per day (Lohman and others, 1972). Transmissivities of the sand and gravel materials in the basin were calculated by two methods: (1) From specific-capacity data and lithologic logs of 33 wells, and (2) from hydraulic conductivity and saturated thickness values of 810 wells and borings in sand and gravel deposits. For the latter method, hydraulic conductivities were estimated from lithologic logs according to the methods described by Walton (1962) and Rosenshein and others (1968). Transmissivities of stratified materials range from less than 4 ft²/d for silt, clay, and till to more than 26,000 ft²/d for saturated sand and gravel. The highest yielding public-supply wells are located in the towns of Barre, Belchertown, East Brookfield, Monson, Palmer, Spencer, and Ware. These wells yield from 300 gal/min in Belchertown to 1,000 gal/min in Spencer.

Glacial till which is an unsorted mixture of clay, silt, sand, pebbles, cobbles and boulders, generally is unstratified, firmly compressed, and yields small quantities of water. Most wells in till are 2 to 4 feet in diameter and less than 30 feet deep. Yields of wells in till commonly are small; however each foot of water in a typical 36-inch-diameter well represents a storage of 53 gallons, which is adequate for most household needs. Normal fluctuations of water levels in till range from 7 to 16 feet annually (Maevsky, 1976). Shallow wells are susceptible to contamination from surface sources.

Figure 2 should be used as a guide and is not intended to substitute for more detailed study of a specific site. Because lithology of the unconsolidated stratified drift and till materials can differ both vertically and horizontally over short distances, exploratory test drilling is necessary to determine saturated thicknesses and geologic materials in a given area. Also, aquifer tests may be necessary to evaluate the water-yielding capability of the aquifer.

Bedrock in the Chicopee River basin is composed of a variety of crystalline rocks and some sedimentary rocks, and water in the rocks is present mainly in joints and fractures. Permeability of these rocks, which is controlled by the number, size, and degree of interconnection of the joints and fractures, is relatively low and decreases with increasing depth from land surface. The median yield of 520 domestic crystalline bedrock wells distributed throughout the basin is 6 gal/min based on well yields reported by drillers. Sedimentary rocks are found only in the southwestern part of the basin in the Connecticut River valley. The few wells in the sedimentary rocks generally have higher yields than those in crystalline rocks.

EXPLANATION

Unconsolidated Deposits

Surficial Geology

- GRAVEL—Well sorted to poorly sorted stratified gravel; gravel, sand, and subordinate lenses of fine sand.
- SAND AND GRAVEL—Thinly layered well sorted sand and gravel; or pocket lenses of well sorted to poorly sorted sand and gravel within the layered material.
- SAND—Stratified sand with minor amounts of gravel and fine sand. Commonly well sorted to poorly sorted.
- FINE SAND, SILT, AND CLAY—Lacustrine deposits of stratified fine sand and subordinate layers of silt and clay; contains scattered pebbles. Well sorted very fine sand and silt may alternate with well sorted clay, or as massive beds of very fine sand, silt, and clay. Thickness ranges from a few feet to more than 210 feet.
- TILL AND BEDROCK—Till is an unstratified, unsorted mixture of pebble to boulder gravel, sand, silt and clay. Two types of till are (1) sandy, loose, very stony in places, and commonly less than 10 feet thick; and (2) till that has more silt and clay, less sand, fewer large stones, is generally slightly to very compact and a few feet to more than 200 feet thick. Where the two types of till occur together, the loose, sandy till always overlies the finer, compact till. Bedrock is exposed at the land surface in large areas.
- WETLAND DEPOSITS—Dark, decomposed organic matter (peat and muck) interbedded and intermixed in places with various amounts of sand, silt, clay, and scattered stones. Deposits are generally less than 5 feet thick but may be as much as 40 feet thick.

800 — Public-supply well. Number indicates designed yield in gallons per minute.

A5W131 — Ground water observation well. A5W131 is the local well number which consists of a three-character alpha-numeric code indicating the town and a sequential number assigned by the U.S. Geological Survey for wells within that town.

- Basin boundary
- Contact
- A A′ Line of geologic section

Transmissivity

Determination of transmissivity is an important step for estimating the yield of aquifers. Consequently, accurate hydraulic conductivity and saturated thickness data of the aquifer are necessary. Local variations in hydraulic conductivity and saturated thickness affect determinations of transmissivity, and may cause actual yields to be different from those estimates given here and illustrated in figure 2:

- Transmissivity greater than 4,000 ft²/d (potential well yield greater than 300 gal/min
- Transmissivity 1,400–4,000 ft²/d (potential well yield 100 to 300 gal/min)
- Transmissivity 100–1,400 ft²d (potential well yield less than 100 gal/min)
- Transmissivity less than 100 ft²d (potential well yield less than 10 gal/min)

SCALE 1:48 000

1 ½ 0 1 2 3 MILES

1 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Surficial Geology

The surficial geology was based on the following geologic quadrangles and reports (indicated in patterns and shown above): Athol (Eschman, 1966); Belchertown (Caggiano, 1977); East Brookfield (Pomeroy, 1975); Ludlow (Leo, 1974); Monson (Peper, 1977); Palmer (Peper, 1978); Wales (Sieders, 1976); Ware (Mulholland, 1974); Warren (Pomeroy, 1977); and Franklin, Hampshire, and Hampton Counties (Emerson, 1898). Reconnaissance mapping and compilation of published geologic data was done by Anthony Maevsky in 1982–83.

HYDRAULIC CONDUCTIVITY VALUES OF SATURATED MATERIALS USED TO ESTIMATE TRANSMISSIVITY IN THE CHICOPEE RIVER BASIN
(From Rosenshein and others, 1968.)

Material	Hydraulic conductivity (K), in feet per day
Gravel:	
Coarse	300–700
Medium	200–470
Fine	180–200
Sand:	
Sand and gravel	200
Coarse	80–135
Medium	70–105
Fine	35–55
Very fine	10–20
Silt	4
Clay; till	0.1

EXAMPLE

Estimating Transmissivity from Lithologic Data and Hydraulic Conductivity Values

	Saturated thickness (feet)		Hydraulic conductivity (feet per day)		Transmissivity (feet squared per day)
Medium sand	42	x	105	=	4,410
Fine sand	8	x	55	=	440
Coarse sand	7	x	135	=	945
Medium sand and gravel	6	x	200	=	1,200
Coarse gravel and sand	7	x	470	=	3,290
Medium to coarse sand and gravel	8	x	240	=	1,920

Total transmissivity = 12,205

***Figure 2.*—Unconsolidated deposits and availability of ground water**

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1986—WRI/295

Base from U.S. Geological Survey
1:24,000 topographic quadrangles

WATER RESOURCES OF THE CHICOPEE RIVER BASIN, MASSACHUSETTS

by

Bruce E. Krejmas and Anthony Maevsky

1986