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DEPARTMENT OF THE INTERIOR
Geological Survey

Memorandum on ground-water conditions in Haddam, Connecticut

By

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UNPUBLISHED DATA; SUBJECT TO REVISION

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This memorandum was prepared at the request of the Connecticut State Water Commission. It is based mainly on data gathered during reconnaissance ground-water studies in Connecticut in former years, most of which have been published, 1/ and in part on the writer's general knowledge of the region. The data are sufficient only to provide general information on ground-water conditions in the town of Haddam. Additional investigation would be necessary to determine the quantity of water available at any particular site.

Location and physiographic features

The town of Haddam is in south-central Connecticut on the west side of the Connecticut River about 20 miles above the mouth. It comprises 29,375 acres. Most of this area is a rolling, dissected plateau whose summit elevations range from about 300 feet above sea level near the Connecticut River to 500 to 600 feet above sea level in the western part of the town. The Connecticut River at Haddam is tidal, though normally fresh, even at high tide, and occupies a narrow, steep-sided valley or gorge cut into the plateau. Along both sides of this gorge are remnants of narrow terraces, or benches, which occur at two general levels — one about 85 to 100 feet above river level and the other 10 to 20 feet above river level. (See plate 1.)

1/ See references at end of report.

Geology

The occurrence of ground water in any area is controlled largely by the character of its geologic formations. In Haddam, these consist of generally hard consolidated rock, overlain nearly everywhere by a cover of unconsolidated glacial deposits of varying thickness.

Except in the areas shown in color on the accompanying map, the bedrock is within 40 feet of the land surface in the entire town, and locally it crops out in exposed ledges. This bedrock consists of crystalline rocks, chiefly coarse-grained gneiss or granite-gneiss, and one or two small bodies of fine-grained traprock. All the bedrock is dense and compact, but it is broken by numerous joints and other fractures that store and transmit water from the land surface.

The unconsolidated deposits that cover the bedrock in most parts of Haddam are almost entirely glacial drift, but in part alluvium. The glacial drift is of two types; (1) till or hardpan and (2) outwash. The alluvium is essentially material deposited by the Connecticut River in flood.

Except for the terraces along the Connecticut River and a few small areas along tributary streams west of the river, till immediately underlies the land surface of most of the town. The till consists of boulders, pebbles, sand, silt, and clay mixed together with little sorting or bedding. It lies directly on the bedrock surface and underlies the outwash and alluvium where they are present. It ranges from less than 1 foot to about 40 feet thick, being thickest on broad hilltops. Till has a low permeability owing to its compactness and lack of sorting.

Outwash underlies and forms the higher (85- to 100-foot) terrace remnants along the Connecticut River, and also occurs in several upland valley areas such as along Ponset Brook. Its distribution in Haddam is shown on the accompanying map, plate 1, after map in Flint (1930). It overlies till, and beneath the

10- to 20-foot terrace along the Connecticut River it is in turn overlain by alluvium. The outwash consists of rock materials that have been reworked and deposited by glacial melt-water streams. It is composed essentially of sorted and stratified gravel, sand, and silt. No well logs or borings are available that show the characteristics of the outwash at any site in Haddam. However, on the basis of exposures in other parts of the Connecticut River valley, and of wells and test borings drilled on similar terraces at Maromas, about 6 miles upstream from Haddam, the outwash probably consists of alternating and discontinuous beds of reddish to yellow gravel and sand and silt. Individual beds are lenticular, and may pinch out within a relatively short distance. Some of the gravel lenses have hydraulic continuity with the Connecticut River. As the outwash in the Haddam area was deposited farther downstream from the melting glacial ice front, it probably is generally somewhat finer grained than at Maromas. The fact that the drilled wells near Tylerville (pl.1 and table 1) are cased through a considerable thickness of the outwash of the upper terrace and obtain water from bedrock suggests that the deposit may have contained a large percentage of fine grained material and yielded little water. It is also possible, however, that these wells were initially planned to obtain water from the bedrock.

The thickness of outwash in the Haddam area is variable. That in the upland valleys is probably thin. The outwash beneath the terraces along the Connecticut River rests upon an inclined bedrock floor that slopes steeply toward the river, and its thickness increases in the same direction. As shown by the included table and map, wells near the hillside edge of the 85- to 100-foot terrace reach rock at depths of 18 to 30 feet, whereas drilled wells near the river edge of the terrace encounter rock at much greater depths. For example, wells 1, 7, and 9 penetrate 90, 160, and 161 feet of outwash, respectively. The bedrock surface at wells 7 and 9 is then about 80 feet below sea

Table 1.—Records of representative wells in Haddam, Conn.

Map no. (1)	Well no. 1/ (2)	Elevation above mean sea level (feet) (3)	Type of well and diameter (inches) 2/ (4)	Depth (feet) (5)	Depth to bedrock (feet) (6)	Elevation of bedrock surface above or below sea level (feet) (7)	Water level: Altitude of water surface above sea level (feet) (8)	Water level: Date of measurement (9)
1	Hd 266	80	Dr-6	150	90	-10	62	7-20-35
2	Hd 273	110	Dr-6	135	18	92	92	7- 2-35
3	Hd 274	80	Dr-6	81	28	52	67	6-28-35
4	Hd 275	75	Dr-6	400	55	20	-	
5	Hd 283	80	Dr-6	48	30	50	62	7-11-35
6	Hd 285	60	Dr-6	80	30	30	-	
7	Hd 317	80	Dr-6	177	160	-80	-	
8	Hd 410	80	Dg-30	26	-	-	63	4-12-37
9	Hd 336	80	Dr-6	261	161	-79	-	
10	Hd 335	75	Dg-30	12	-	-	68	7-30-35
11	Hd 340	20	Dg-24	20	-	-	17	7-30-35

1/ Number as listed in Connecticut Ground Water Survey Bulletin GW-2 (1938), pp. 153-191

2/ Dr, drilled well; Dg, dug well

level and, as these wells are situated about in the center of the gorge, this figure may be approximately the maximum depth of the bedrock surface below sea level. Outwash deposits are the most permeable materials in Haddam and as such they form valuable catchment areas for the interception and storage of precipitation. They also yield water readily to wells.

The alluvium underlies and forms the lower or 10- to 20-foot river terrace, and it rests upon the outwash. Its distribution in Haddam is shown on the attached map. Most of the alluvial deposits were laid down by the present Connecticut River when it overflowed its banks during floods. Where seen in the sides of drainage ditches the alluvium consists of grayish fine sand, silt, and clay and is similar to that penetrated by borings at Maromas. No information is available on the thickness of the alluvium, but at Maromas it is thought to be not more than about 30 feet. Thus, the alluvium constitutes a thin veneer over the outwash. Accordingly, at a place where the maximum depth to bedrock is on the order of 100 feet, the outwash between the veneer of alluvium and the bedrock surface is on the order of 70 feet thick.

Occurrence and availability of ground water

The two important water-bearing units in Haddam are the crystalline bedrock and the outwash. Because of the low permeability of the till and alluvium these deposits yield water slowly to wells and, although they furnish small supplies for domestic and other minor uses, they are relatively unreliable as sources for larger uses.

The crystalline bedrock is so compact that little or no water occurs in or can be obtained from the intergranular spaces. Wells drilled into these rocks obtain their supply from the water-filled fractures. Because appreciable water is yielded to a bedrock well only when a sufficient number of these fractures are encountered, and as their location is not known in detail, the success or failure of a rock well cannot be predicted with certainty. The yield of rock wells is ordinarily sufficient for the needs of rural homes, farms, and small industries. Records of 25 bedrock wells are available for the Haddam area. Their yields range from an estimated 2 gallons per minute to about 15 gallons per minute, and the average yield is about 6 gallons per minute. These wells are from 42 to 400 feet deep, and the average depth is 130 feet. Most wells in bedrock are less than 200 feet deep and few fail to find some water.

The outwash is the most important water-bearing deposit in Haddam. As no wells other than domestic dug wells obtain water from outwash, little specific information is available regarding its water-bearing characteristics in the town. The outwash in the upland valleys underlies small areas (see Pl. 1) and is believed to be thin, and thus can be expected to yield relatively small supplies to wells. The outwash underlying the terrace remnants along the Connecticut River has a considerable thickness. It is 18 to 30 feet thick near the hillside edge of the upper terrace and attains a recorded maximum thickness of 161 feet near the riverside edge of the upper-terrace remnant at Tylerville (well 9, table 1) and 90 feet beneath the upper terrace remnant at Haddam village (well 1, table 1). The outwash beneath the alluvium of the lower terrace between Red Store Landing and Walkley Hill is on the order of 70 feet thick.

The water table in the outwash forming the upper terrace remnants is generally within 30 feet of the surface. The water table slopes toward the riverside terrace face. Thus, the deposit is saturated for a considerable part of its thickness. The water table beneath the lower terrace is probably somewhat above river level and as the top of the outwash is probably below river level, this material probably is saturated for its full thickness. It is probable that some beds of outwash underlying all the terrace remnants are in hydraulic continuity with the river. Thus, conditions are favorable for the development of substantial yields.

Where the saturated outwash consists of coarse sand and gravel it may be expected to yield sizable quantities of water to properly constructed wells. At Harcmas, 8-inch test wells screened in the coarser layers of outwash have yielded water at rates as high as 400 gallons per minute. These wells have a specific capacity of about 35 gallons per minute per foot of drawdown. At places where wells would tap strata hydraulically connected with the river, they would induce infiltration from the Connecticut River. If so, the water from the wells might eventually become similar in chemical quality to the water in the stream.

Analysis of samples collected recently by the U.S. Geological Survey from the Connecticut River at Middletown, during high and low flow are as follows:

(Concentrations in parts per million)

	High flow	Low flow
Date of collection	May 1, 1952	September 17, 1953
Silica (SiO_2)	4.2	1.0
Iron (Fe) Total	.25	.6
Calcium (Ca)	7.2	17
Magnesium (Mg)	1.2	2.0
Sodium (Na)	2.6	7.0
Potassium (K)	.9	2.2
Bicarbonate (HCO_3)	20	42
Carbonate (CO_3)	0	0
Sulfate (SO_4)	8.8	22
Chloride (Cl)	2.2	7.5
Fluoride (F)	.2	.1
Nitrate (NO_3)	.6	1.4
Dissolved solids	45	82
Hardness as $CaCO_3$		
Total	23	52
Noncarbonate	-	17
Specific conductance (Micromhos at 25°C)	61.8	144
Color	15	15
pH	6.6	7.1

Average concentrations of several chemical and organic constituents in samples collected by the Connecticut State Water Commission from the Connecticut River at the East Haddam bridge are given below:

(In parts per million except temperature, BOD, color, and pH; analyses by Connecticut State Department of Health.)

Temperature (°F)	68
Dissolved oxygen at average saturation of 80%	7.0
Biochemical oxygen demand (BOD)	2.0
Total dissolved solids	95
Total suspended solids	8.0
Chloride (Cl)	5.0
Alkalinity as C_aCO_3	30
Turbidity	5.5
Color	36
p H	6.9
Most probable number of coliform organisms per 100 ml.	3500

The analysis is furnished by the State Water Commission and represents a composite of monthly samples taken from May to October, inclusive over the period from 1946 to 1950, inclusive.

Natural filtration by the outwash and alluvial material between the stream and the well probably would remove most suspended matter and bacteria.

In conclusion, reliable domestic water supplies may be obtained from bedrock at most places in the town of Haddam at depths generally less than 200 feet. Adequate supplies for domestic use may be obtained also in most areas underlain by alluvium and outwash. The available data indicate also that a body of outwash of considerable thickness underlies the terraces along the Connecticut River. The coarser strata of this outwash are probably capable of yielding water to wells at rates on the order of several hundred gallons per minute. Test-well drilling and pumping tests would be necessary to locate the best well sites, and determine the yields specifically. Where the tapped strata are in hydraulic continuity with the river, substantial yields can be sustained indefinitely under existing conditions. The water, however, would tend to become chemically similar to the river water, which contains only very small amounts of salts.

REFERENCES

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