DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
DIVISION OF WATER POLICY AND SUPPLY
NEW JERSEY DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT

MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-549

Base from U.S. Geological Survey: Caldwell, Boonton, Morristown, 1943-54; Chatham, Pompton, Plains, and Roselle, 1943-55

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

EXPLANATION

●(80)
Well or test hole
Number indicates altitude of bedrock, in feet above mean sea level; number in parentheses indicates altitude of bottom of well or test hole not reaching bedrock

▲
Seismic station

———100— — —
Bedrock contours
Show altitude of bedrock surface; dashed where inferred. Contour interval 20 feet

INTRODUCTION

Sand and gravel deposits of Pleistocene age, occurring as valley fill in stream valleys cut in Triassic consolidated rocks, constitute one of the principal aquifer systems of the eastern Morris County and western Essex County area. Yields in excess of 1,000 gpm (gallons per minute) are not uncommon from properly developed and constructed large-diameter wells penetrating the thicker portions of these aquifers. Numerous high-yield public-supply wells of many of the municipalities in the area currently tap these valley-fill materials. Because the distribution of the valley-fill aquifers is controlled by the configuration of the bedrock topography, delineation of the buried-valley system is essential for development and management of the ground-water resources of the area.

PREVIOUS STUDIES

Previous studies (Thompson, 1932; Gill and others, 1965; Gill and Vecchioli, 1965) demonstrated the existence of a deep buried-bedrock valley containing a highly productive sand and gravel aquifer which extends southeastward through Madison and Chatham to the Passaic River. Another deep buried valley trending generally south was known to exist along the Passaic River in southwestern Essex County in Millburn Township (Thompson, 1932; Bonini and Hickok, 1958; Gill and others, 1965). It also contains a highly productive sand and gravel aquifer. Results of seismic investigations in 1961 (Gill and others, 1965) suggested the presence of a buried valley in southwestern East Hanover Township in the vicinity of the Morristown airport. Subsequent investigations (Vecchioli and Nichols, 1966; Vecchioli and others, 1967) provided data on the extent of the buried valley in southwestern East Hanover Township. These studies also defined the extent and thickness of the highly productive sand and gravel aquifer.

BEDROCK TOPOGRAPHY

Contours showing the configuration of the bedrock surface are drawn on the basis of well, test hole, and seismic-refraction data presented in the previous studies mentioned above and from the files of the Trenton office of the U.S. Geological Survey. Well and test-hole data are used as the primary control. The results of seismic-refraction determinations at sites other than those confirmed by drilling have been used only as a general guide in contouring because of the uncertainty as to their accuracy. Gill and others (1965) report a mean error of 7 percent and a maximum error of 11 percent between seismic depth-to-bedrock determinations and measured depth-to-bedrock obtained from adjacent wells or test holes. Four test wells were drilled following a reconnaissance seismic-refraction survey in 1966 by the Trenton office of the U.S. Geological Survey which could be used to check the accuracy of the seismic data. The error between seismically determined and actual depth-to-bedrock at three locations was found to be 11 percent, 12 percent, and 15 percent. At the fourth location, however, the error is 52 percent. No computational errors were found in a reevaluation of the seismic record for this location. Of the several possible explanations for such a large discrepancy between predicted and observed depth to bedrock, the most plausible is provided by the geological conditions. The test hole, located within 200 feet of the seismic shot point, penetrated 70 feet of silty to clayey compact glacial till before encountering moderately weathered shale bedrock. It is probable, in this case, that the density of the compact till and the moderately weathered shale is similar enough to produce a single average elastic wave velocity and that the sediment-rock contact does not provide a sufficient density contrast to constitute a refraction interface. Since only 6 feet of rock was penetrated by the test hole, it is not possible to speculate what interface was actually recorded. However, it is obvious that unconfirmed seismic data should be used with reservation.

Interpretations shown on previous maps of parts of this area have been changed where warranted by additional data. The most significant changes and additions resulting from the present study are as follows:

1. Identification of the East Hanover valley as a separate tributary of the Chatham valley rather than the northern extension of the Millburn valley and the locating of the junction of the East Hanover and Chatham valleys in western Florham Park.
2. Extension of the East Hanover valley northward from the Chatham valley through Florham Park into East Hanover Township where it joins with the valley extending from Mountain View through Caldwell Township (Fairfield) to East Hanover Township.
3. Delineation of a previously unknown valley from west-central Livingston Township northward through East Hanover Township, where it is joined by the East Hanover valley and then through Caldwell Township (Fairfield) to Mountain View. It is believed that this valley is a northern continuation of the Millburn valley. This interpretation seems to indicate the coexistence of two south-flowing streams, but available geologic data suggest that the Millburn valley contained the original main stream and the East Hanover valley contained a north-flowing tributary. Subsequent blocking by glacial debris of the Millburn valley in northern East Hanover Township resulted in a drainage reversal in the East Hanover valley which then became a segment of the main stream draining the area north of the Chatham valley.

Vecchioli and others (1967) have presented maps and stratigraphic data concerning the extent, thickness, and interconnection of the valley-fill aquifers in the Chatham, Millburn, and East Hanover valleys. Briefly, a sand and gravel aquifer as much as 100 feet thick extends throughout the known reach of the Chatham valley. In the East Hanover valley a similar aquifer, also as much as 100 feet thick and hydraulically continuous with the aquifer in the Chatham valley, extends as far as the northern part of East Hanover Township. From northern East Hanover to Mountain View, the valley is filled dominantly with laminated silt and clay and does not contain a sand aquifer, except locally. However, a moderately productive sand and gravel aquifer is present in the tributary valley in Caldwell Township (Fairfield). The southern, well-defined reach of the Millburn valley contains a highly productive aquifer as much as 90 feet thick, which is hydraulically continuous with the aquifer in the Chatham valley. Although limited, there is sufficient information to suggest that much of the northern extension of the Millburn valley does not contain appreciable or extensive sand and gravel aquifers, except in the extreme northern end in East Hanover Township. A two-mile segment of this valley in west-central and southwestern Livingston Township has not been explored, but may contain a sand and gravel aquifer that is continuous with the highly productive aquifer in the well-defined southern portion of the Millburn valley in Millburn Township.

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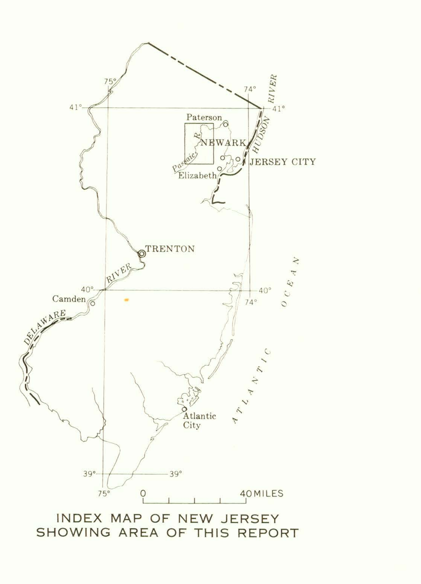

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BEDROCK TOPOGRAPHY OF EASTERN MORRIS AND WESTERN ESSEX COUNTIES, NEW JERSEY

By
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