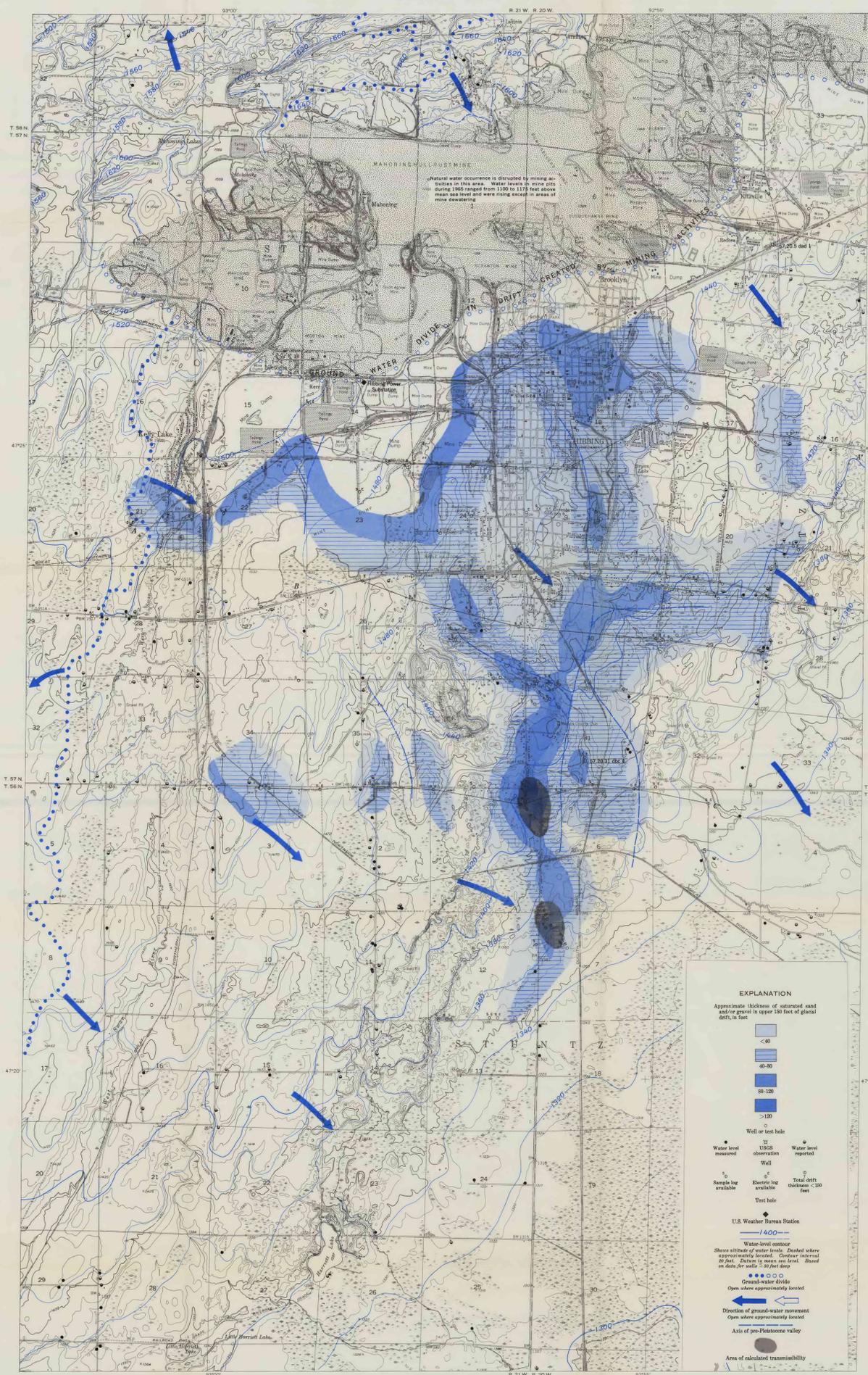


GROUND WATER



Natural water occurrence is disrupted by mining activities in this area. Water levels in mine sites during 1965 ranged from 1100 to 1175 feet above mean sea level and were rising except in areas of mine dewatering.

Thick deposits of saturated outwash sand and gravel are present in the Hibbing area. Their areal distribution approximates the trend of pre-Platonic valleys. The thickest and usually most restricted sand and gravel occurs south of the village where preglacial channels were deepest. The vertical distribution of aquifer materials is shown on the geologic cross sections. Sand and gravel is most prevalent in the upper 100 feet of the drift.

EXPLANATION

Approximate thickness of saturated sand and gravel in upper 100 feet of glacial drift, in feet

- < 25
- 25-50
- 50-75
- > 75

Well or test hole

- Water level measured
- USGS observation well
- Water level reported
- Sample log available
- Electric log available
- Total drift thickness < 100 feet
- Test hole

U.S. Weather Bureau Station

Water-level contour

Shows altitude of water level. Dashed where approximately located. Contour interval 20 feet. Datum is mean sea level. Based on data for wells < 50 feet deep.

Ground-water divide

Open where approximately located

Direction of ground-water movement

Open where approximately located

Axis of pre-Platonic valley

Area of calculated transmissibility

SATURATED SAND AND GRAVEL DEPOSITS ARE THICKEST SOUTH OF HIBBING AND THE REGIONAL GROUND-WATER MOVEMENT IS TO THE SOUTHEAST IN A MAJOR PART OF THE AREA

Areas of thick stratified sand and gravel outside with or beneath the trend of pre-Platonic valleys and are thickest where the deepest channels were developed. The greatest thickness of saturated sand and gravel occurs in the Hibbing area. The thickness of saturated sand and gravel is limited and precludes the development of large ground-water supplies.

In the mining activities, a ground-water divide has been formed in the drift. Recharge in the pit areas, both direct and from adjacent drift lands, is to the ground. The Hibbing Formation is exposed in mine pits, where the Hibbing Formation is exposed. T values of approximately 10,000 might be expected for the Hibbing Formation.

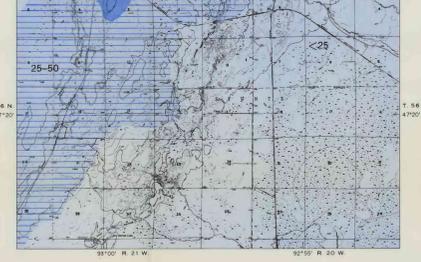
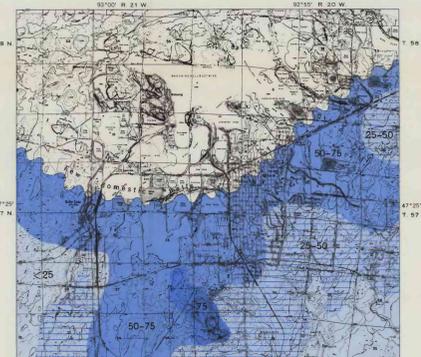
Thick deposits of saturated outwash sand and gravel are present in the Hibbing area. Their areal distribution approximates the trend of pre-Platonic valleys. The thickest and usually most restricted sand and gravel occurs south of the village where preglacial channels were deepest. The vertical distribution of aquifer materials is shown on the geologic cross sections. Sand and gravel is most prevalent in the upper 100 feet of the drift.

Ground-water levels in the drift fluctuate during the year in response to precipitation, evapotranspiration, and pumping as shown on the hydrograph of well 57.20.5 d(1).

Regional ground-water movement is to the southeast. In the northern portion of the area recharge to the drift is limited because the area is proximate to the ground-water divide and water movement is disrupted by the open-pit mines. The area of relatively thick (50+ feet) sand and gravel between Kelly Lake and Hibbing is thereby limited in its ground-water potential. Recharge potential increases southward, in the direction of ground-water movement, making the area of permeable channel fill deposits south of the village favorable for the development of large ground-water supplies.

The effect on ground-water levels in the area caused by pumping a well at 100 gallons per minute is shown on distance-drawdown curves. Approximate coefficients of transmissibility (T) for the Hibbing outwash aquifers were determined from specific capacity data. Transmissibilities of 15,000 and 50,000 gallons per day per foot are indicative of the escape of transmissibilities which might be anticipated for buried sand and gravel aquifers in the area.

Water levels in the Hibbing Formation fluctuate in response to precipitation and mine pumping as shown on the hydrograph of well 57.20.5 d(1). As determined from water level recovery data in mine pits, where the Hibbing Formation is exposed, T values of approximately 10,000 might be expected for the Hibbing Formation.

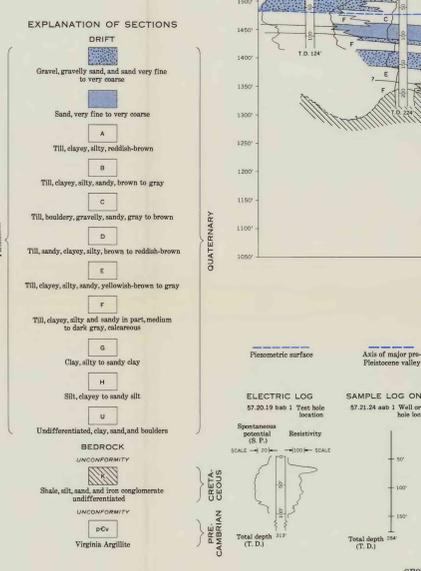
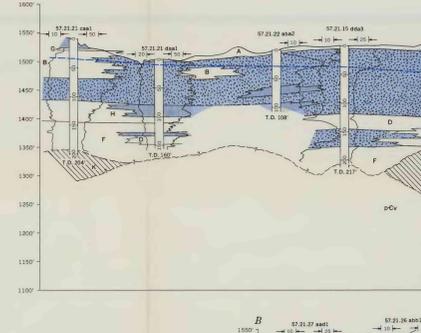


EXPLANATION

Depth of domestic wells, in feet below land surface

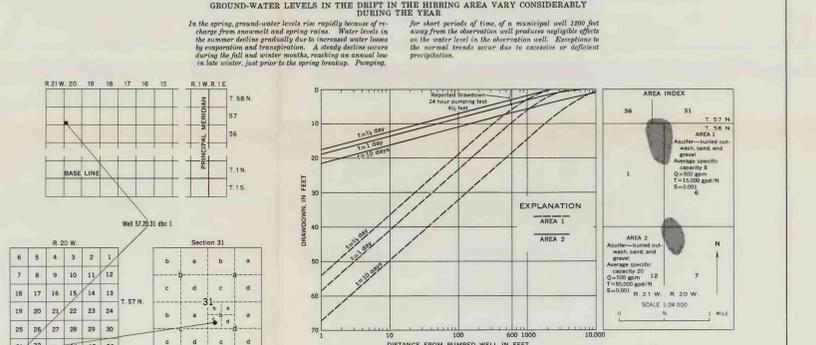
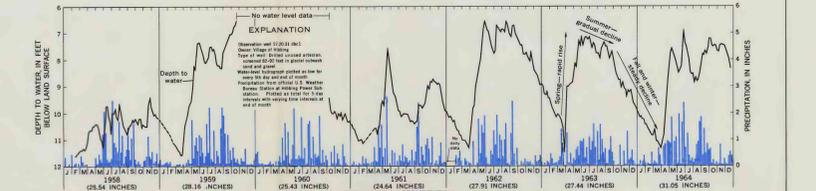
- < 25
- 25-50
- 50-75
- > 75

AN ADEQUATE WATER SUPPLY FOR DOMESTIC USE CAN BE OBTAINED IN MOST AREAS FROM WELLS COMPLETED IN THE GLACIAL DRIFT AT A DEPTH OF LESS THAN 75 FEET



GEOLOGIC SECTIONS ILLUSTRATE THE DISTRIBUTION OF DRIFT MATERIALS VERTICALLY

The thickest drift deposits and correspondingly thickest deposits of saturated sand and gravel occur in the Hibbing area. The thickness of saturated sand and gravel is limited and precludes the development of large ground-water supplies.



EXPLANATION

Observation well 57.20.5 d(1)

Depth to water in feet below land surface

1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965

PRECIPITATION IN INCHES

0.54 0.48 0.44 0.46 0.51 0.50 0.51 0.52 0.53 0.54 0.55 0.56 0.57 0.58 0.59 0.60 0.61 0.62 0.63 0.64 0.65 0.66 0.67 0.68 0.69 0.70 0.71 0.72 0.73 0.74 0.75 0.76 0.77 0.78 0.79 0.80 0.81 0.82 0.83 0.84 0.85 0.86 0.87 0.88 0.89 0.90 0.91 0.92 0.93 0.94 0.95 0.96 0.97 0.98 0.99 1.00 1.01 1.02 1.03 1.04 1.05 1.06 1.07 1.08 1.09 1.10 1.11 1.12 1.13 1.14 1.15 1.16 1.17 1.18 1.19 1.20 1.21 1.22 1.23 1.24 1.25 1.26 1.27 1.28 1.29 1.30 1.31 1.32 1.33 1.34 1.35 1.36 1.37 1.38 1.39 1.40 1.41 1.42 1.43 1.44 1.45 1.46 1.47 1.48 1.49 1.50 1.51 1.52 1.53 1.54 1.55 1.56 1.57 1.58 1.59 1.60 1.61 1.62 1.63 1.64 1.65 1.66 1.67 1.68 1.69 1.70 1.71 1.72 1.73 1.74 1.75 1.76 1.77 1.78 1.79 1.80 1.81 1.82 1.83 1.84 1.85 1.86 1.87 1.88 1.89 1.90 1.91 1.92 1.93 1.94 1.95 1.96 1.97 1.98 1.99 2.00 2.01 2.02 2.03 2.04 2.05 2.06 2.07 2.08 2.09 2.10 2.11 2.12 2.13 2.14 2.15 2.16 2.17 2.18 2.19 2.20 2.21 2.22 2.23 2.24 2.25 2.26 2.27 2.28 2.29 2.30 2.31 2.32 2.33 2.34 2.35 2.36 2.37 2.38 2.39 2.40 2.41 2.42 2.43 2.44 2.45 2.46 2.47 2.48 2.49 2.50 2.51 2.52 2.53 2.54 2.55 2.56 2.57 2.58 2.59 2.60 2.61 2.62 2.63 2.64 2.65 2.66 2.67 2.68 2.69 2.70 2.71 2.72 2.73 2.74 2.75 2.76 2.77 2.78 2.79 2.80 2.81 2.82 2.83 2.84 2.85 2.86 2.87 2.88 2.89 2.90 2.91 2.92 2.93 2.94 2.95 2.96 2.97 2.98 2.99 3.00 3.01 3.02 3.03 3.04 3.05 3.06 3.07 3.08 3.09 3.10 3.11 3.12 3.13 3.14 3.15 3.16 3.17 3.18 3.19 3.20 3.21 3.22 3.23 3.24 3.25 3.26 3.27 3.28 3.29 3.30 3.31 3.32 3.33 3.34 3.35 3.36 3.37 3.38 3.39 3.40 3.41 3.42 3.43 3.44 3.45 3.46 3.47 3.48 3.49 3.50 3.51 3.52 3.53 3.54 3.55 3.56 3.57 3.58 3.59 3.60 3.61 3.62 3.63 3.64 3.65 3.66 3.67 3.68 3.69 3.70 3.71 3.72 3.73 3.74 3.75 3.76 3.77 3.78 3.79 3.80 3.81 3.82 3.83 3.84 3.85 3.86 3.87 3.88 3.89 3.90 3.91 3.92 3.93 3.94 3.95 3.96 3.97 3.98 3.99 4.00 4.01 4.02 4.03 4.04 4.05 4.06 4.07 4.08 4.09 4.10 4.11 4.12 4.13 4.14 4.15 4.16 4.17 4.18 4.19 4.20 4.21 4.22 4.23 4.24 4.25 4.26 4.27 4.28 4.29 4.30 4.31 4.32 4.33 4.34 4.35 4.36 4.37 4.38 4.39 4.40 4.41 4.42 4.43 4.44 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