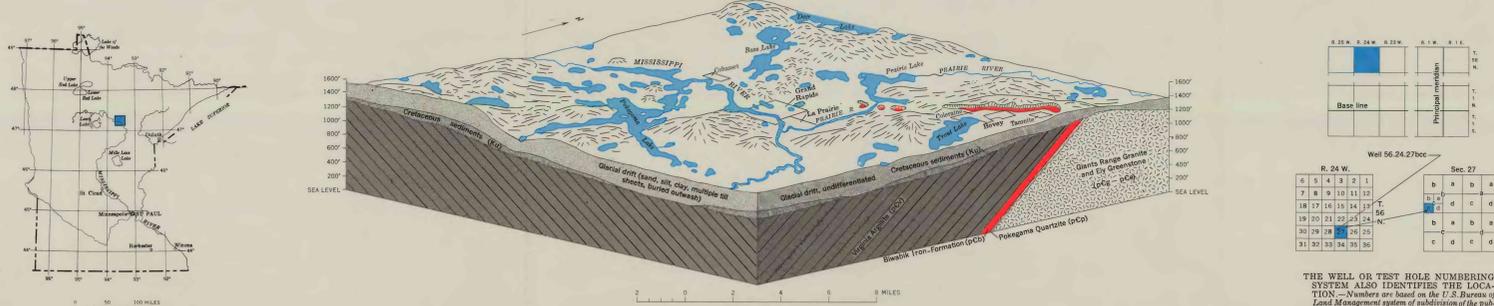
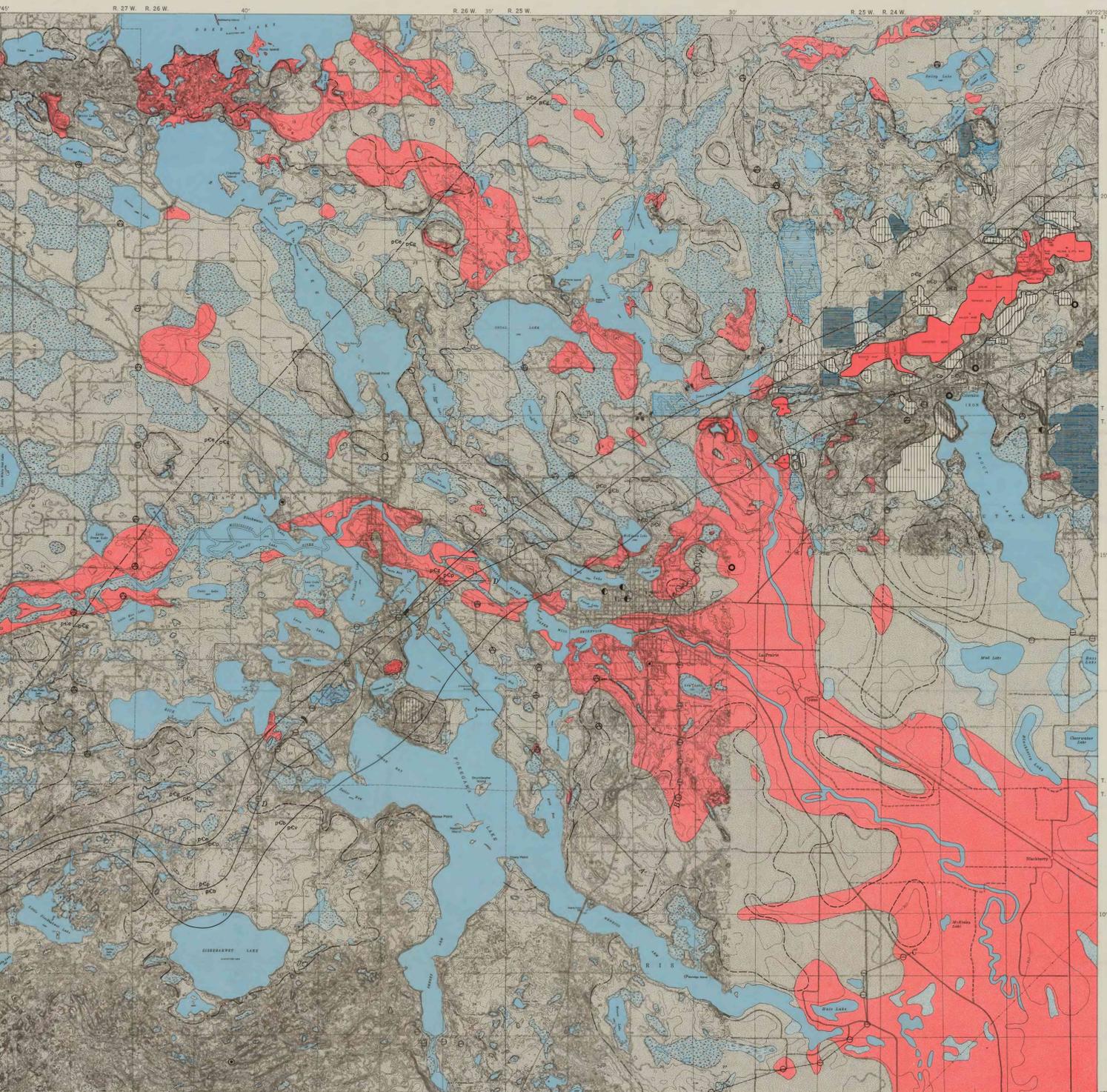


GEOLOGY AND GROUND-WATER OCCURRENCE



THE WELL OR TEST HOLE NUMBERING SYSTEM ALSO IDENTIFIES THE LOCATION—Numbers are based on the U.S. Bureau of Land Management system of subdivision of the public lands. Number 56 24 27bc locates a well or test hole in the SW 1/4 of the SW 1/4 of sec 27, Township 56 north, Range 24 west.

THE BEST SOURCE OF GROUND WATER IN THE GRAND RAPIDS AREA IS THE BURIED OUTWASH IN THE GLACIAL DRIFT THAT COVERS THE AREA.
Ground-water supplies may also be obtained from other glacial sand and gravel deposits and from the Virginia Argillite and Biwabik Iron-Formation. Ground-water movement through glacial drift toward lakes and streams maintains uniform water levels in the many large lakes of the area.



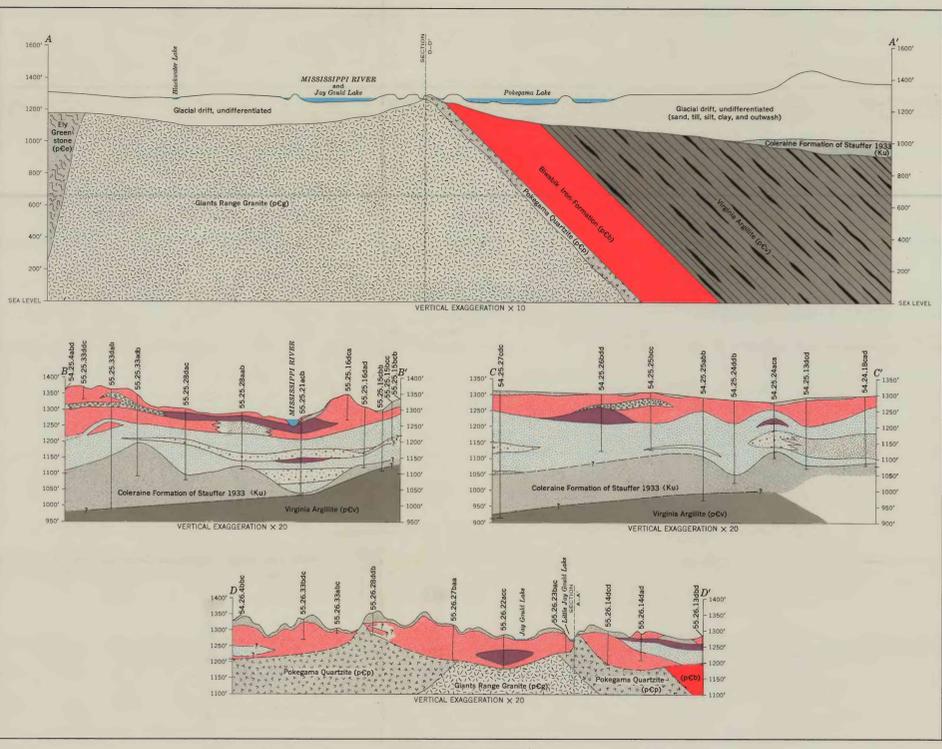
Base from U.S. Geological Survey, 1:24,000 Bony, 1962; Colwell, 1953; Colwell and West, 1953; Grand Rapids, 1951; Sombroff and Lake, 1953 and Hibbing, 1954, 1:250,000.
SCALE: 1:48,000
CONTOUR INTERVALS 10 AND 50 FEET (DATA IS MEAN SEA LEVEL)
GEOLOGIC MAP

INTRODUCTION

This report is one of a series of studies of geology and ground-water availability conducted in and near selected communities on the Mesabi Iron Range, north-central and northeastern Minnesota. This report describes the geology and ground-water conditions in the 303 square-mile Grand Rapids area. Sheet 1 of this report is designed for use by anyone interested in the geology and occurrence of ground water in the geologic units of the area. Sheet 2 is designed to be used by hydrologists and engineers who have the responsibility for major ground-water development in the area. The Grand Rapids area is drained by the Mississippi and Prairie Rivers. In times past these rivers were important to logging and sawmill operations. Today the rivers are used for power generation and paper manufacturing. Pokegama Lake is a reservoir formed by a dam on the Mississippi River. Prairie Lake is formed by a dam on the Mississippi River. The area also contains many natural lakes and swamps which provide excellent fish and wildlife habitat. Tourism, resort operation, and in winter, skiing, are important commercial enterprises in the area. Iron mining is a major industry. The Grand Rapids area is located at the west end of the famous Mesabi Range, one of the principal iron-mining districts of North America. The oldest bedrock in the area is the Ely Greenstone. This consists of unknown thickness of metamorphosed lower Precambrian rocks which were intruded by Precambrian granite. Overlying these older rocks is a middle Precambrian series of metamorphosed rocks termed the Anisite Group of which the Biwabik Iron-Formation is the most economically important. Anisite rocks dip to the southeast. Where the uppermost edge of the Biwabik Iron-Formation is truncated by erosion, open-pit iron mines are located. During Cretaceous time, marine clays and sands were deposited over the Precambrian rocks. Erosion has removed most of the Cretaceous sediments, and only scattered outcrops remain.

EXPLANATION

Geologic unit	Symbol	Description	Distribution and thickness	Water-bearing characteristics
Swamp deposits	[Symbol]	Post, organic silt.	Chiefly in low-lying areas near ponds and streams. Range of thickness, 0-25 ft.	Not a source of ground water.
Till, silty, brown	[Symbol]	Brown silty calcareous till. Contains shale.	Widespread thin veneer over upland areas. Range of thickness, 0-40 ft.	Does not yield water to wells.
Sand, sand and gravel (includes ice-contact sand and gravel in sections.)	[Symbol]	Sand and sandy gravel. Surficial outwash and valley-train deposits. May include ice-contact sand and gravel. Also includes lacustrine silt and sand and Holocene alluvium.	Chiefly along major streams. Range of thickness 0-8 ft.	A source of domestic ground water supplies where water table is near surface and a shallow well points may be driven. Surficial sand generally too fine to supply water. Exposed ice-contact sand may furnish much greater supplies.
Ice-contact sand and gravel	[Symbol]	Sand and gravel of recessional features associated with brown, sandy till. Includes kames, kame terraces, and local outwash.	Occurs in moraine and ice-contact features. Range of thickness, 0-100 ft.	A fair source of ground water. Yields as much as 150 gpm to wells. Ice-contact sand and gravel has yielded as much as 30 gpm per ft. of drawdown.
Silt, sandy or clayey (not shown on map. Occurs in subsurface only.)	[Symbol]	Silt, sandy or clayey. Lake deposits.	Distribution unknown. Occurs at many levels throughout the glacial drift. May grade laterally into sand or clay. Range of thickness, 0-80 ft.	Does not yield water to wells.
Clay, silty or sandy (not shown on map. Occurs in subsurface only.)	[Symbol]	Clay, silty or sandy. Lake deposits and lake-washed till.	Distribution unknown. Occurs at many levels throughout the glacial drift. May grade laterally into silt or till. Range of thickness, 0-50 ft.	Does not yield water to wells.
Till, sandy, brown (not shown on map. Occurs in subsurface only.)	[Symbol]	Brown sandy noncalcareous till. Contains much gravel and many cobbles and boulders.	Occurs in moraine (outlined on map). Elsewhere is buried beneath and, gravel, clay, or younger till. Range of thickness, 0-140 ft.	Does not yield significant amounts of water to wells.
Till, sandy, gray (not shown on map. Occurs in subsurface only.)	[Symbol]	Gray sandy clayey calcareous till. Contains limestone pebbles.	Occurs as a horizon, fairly continuous till sheet. Buried beneath and, gravel, clay, or younger till. Range of thickness, 25-80 ft.	Does not yield water to wells.
Buried outwash (not shown on map. Occurs in subsurface only.)	[Symbol]	Calcareous sand and gravel.	Occurs as an outwash sheet beneath gray sandy till. Inferred distribution shown on sheet 2. Range of thickness, 0-112 ft.	A good source of ground water for an industrial or municipal supply. Furnishes supplies up to 1200 gpm. Wells finished in buried outwash have yielded as much as 62.8 gpm per ft. of drawdown.
Coleraine Formation of Stauffer (1933) (not shown on map. Occurs in subsurface only.)	[Symbol]	Shale, clay, lignite, iron-formation conglomerate, unconformably sand.	Occurs as isolated patches on the Virginia Argillite surface buried beneath glacial drift. Range of thickness, 0-500 ft.	Not used as a source of ground water.
Virginia Argillite	[Symbol]	Argillite, dense, fine, black, metamorphic.	Forms the substrate surface under the SE half of the area. Range of thickness, 0-3000+ ft.	A source of ground water usually used in conjunction with underlying Biwabik Iron-Formation. Wells finished in argillite alone have yielded as much as 10 gpm with 6.2 gpm per ft. of drawdown.
Biwabik Iron-Formation	[Symbol]	Ferruginous chert. Also called taconite. Subdivided into the following members: upper slaty; upper cherty; lower slaty; and lower cherty.	Forms a SE dipping subunit belt which trends NE across the area. Range of thickness, 350-500 ft.	A fair source of ground water for an industrial or municipal supply where the iron formation is fractured and leached. Furnishes supplies up to 500 gpm. A well finished in argillite and iron formation has yielded 2.8 gpm per ft. of drawdown. Mine pits in the area have been dewatered at rate up to 8500 gpm.
Pokegama Quartzite	[Symbol]	Quartzite, dense, hard, thin bedded, conglomeratic at base.	Forms a SE dipping subunit belt which trends NE across the area. Thickness is about 75 ft.	Not used as a source of ground water.
Giants Range Granite	[Symbol]	Granite, intrusive.	Forms the base on which Anisite rocks were deposited. Thickness unknown.	A poor source of ground water. Granite furnishes a few low yield domestic supplies where glacial drift is too thin to furnish water.
Ely Greenstone	[Symbol]	Greenstone, green schist.	Occurs north of Anisite rocks in the west half of the area. Thickness unknown.	Not used as a source of ground water.



IRON MINING: Mine pit, Stripping dump or stockpile, Clarification pond or tailings basin.
TEST HOLES AND WELL LOGS: U.S.G.S. (rotary), Domestic well, U.S.G.S. (auger), Public-supply well, Other test hole, Commercial or industrial well.
GEOLOGIC SECTIONS

GEOLOGY AND GROUND-WATER RESOURCES OF THE GRAND RAPIDS AREA, NORTH-CENTRAL MINNESOTA

By
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1970