

STATE OF SOUTH DAKOTA
Nils Boe, Governor

STATE GEOLOGICAL SURVEY
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Water Information Circular 1

A HIGH-YIELD GLACIAL AQUIFER IN CLAY COUNTY,
SOUTH DAKOTA

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prepared in cooperation with the
United States Geological Survey

Science Center
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INTRODUCTION

Water Information Circular 1 is the first of a new series of publications by the South Dakota Geological Survey. It is designed to acquaint the reader with the general distribution, quantity, and quality of water available from a high-yield glacial aquifer in Clay County. A much more detailed and comprehensive report will be published at a later date. The detailed report will consist of two parts. Part I will deal with the geology and hydrology of Clay County, and will contain all available geologic and ground-water information. Part II will be reserved for basic data and will contain such information as test-hole logs, sample descriptions, and water analyses.

Copies of these publications, when available, may be obtained from the South Dakota Geological Survey at Vermillion.

The map on the facing page shows the location of wells and test holes from which information was obtained for this report. Electric logs and sample studies are available for many of the holes, while information such as formation tops and field description of materials penetrated is available for others.

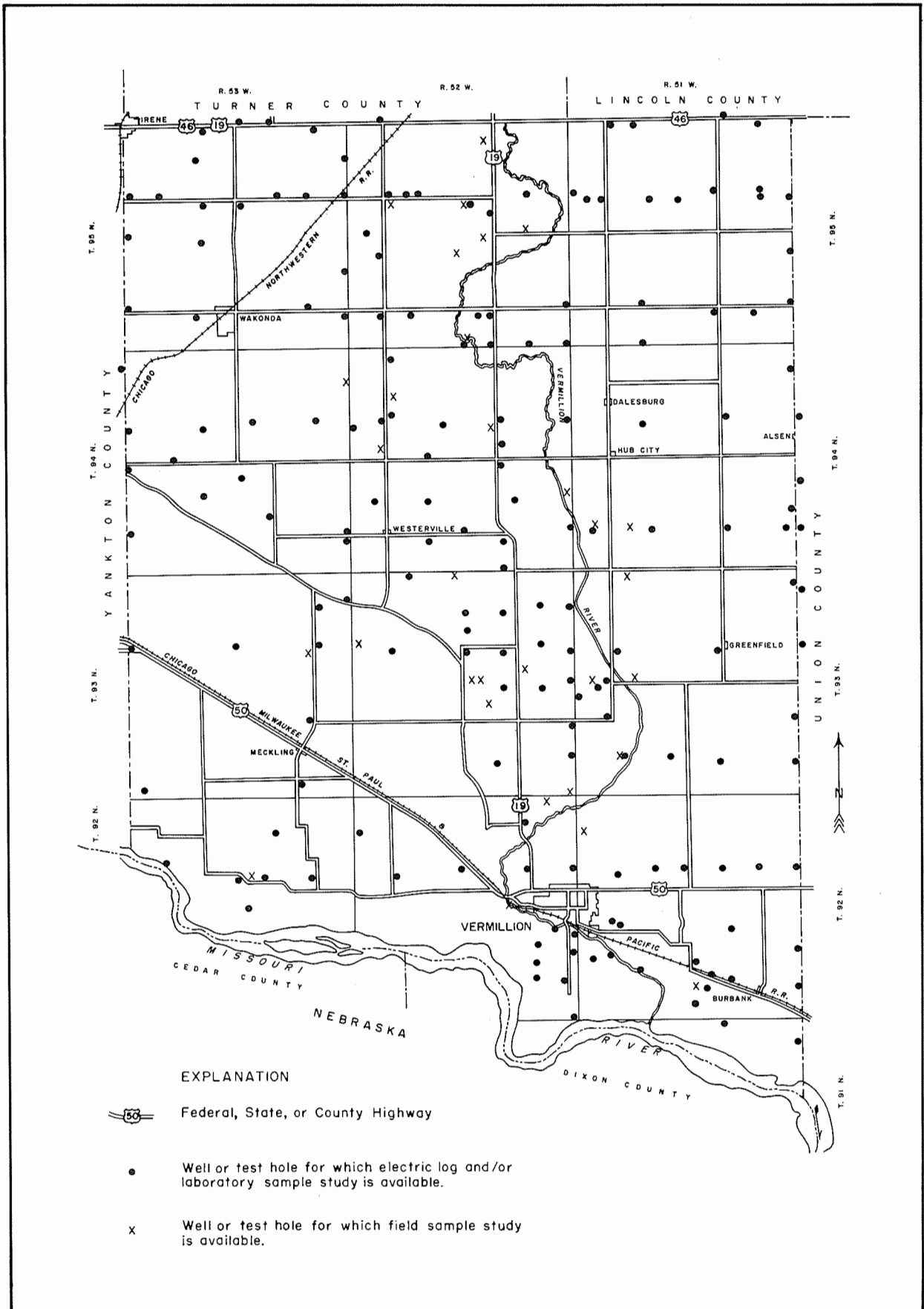
Additional information in this circular was compiled from data collected by the South Dakota Geological Survey and the United States Geological Survey during 1963, 1964, and 1965, as part of a detailed geologic and hydrologic investigation of Clay County. The ground-water investigation was requested by the County Commissioners of Clay County, and was designed to locate, map, and evaluate all the underground water supplies of the county.

The field work for the Clay County project was done by members of the South Dakota Geological Survey and the United States Geological Survey. Part of the drilling was provided by the United States Bureau of Reclamation. Funds made available for the project totaled \$72,500. Of this amount, \$15,000 was contributed by Clay County, \$12,500 by the United States Bureau of Reclamation, and the remaining \$45,000 by the South Dakota and United States Geological Surveys.

GLACIAL AQUIFER

The major glacial aquifer in Clay County is composed of a vast amount of sand and gravel that was transported into the county by glacial ice and meltwater. As the ice wasted, huge quantities of meltwater carved deep, wide channels into the underlying deposits. Later, as the velocity and volume of water began to decrease, sand and gravel was deposited in the channels.

After a period of erosion, which partially destroyed the gravel-filled channels, another glacier moved into Clay County and buried most of the existing topographic features under a blanket of glacial debris. The Vermillion River, which probably began during the melting stages of the last glacier, cut through the debris and into the gravels below. Water from the



Map of Clay County showing location of wells and test holes for which data are available.

Vermillion and Missouri Rivers, as well as water from rain and melting snow, has since entered the gravel-filled valleys and filled them to saturation.

The gravel-filled valleys now constitute a major glacial aquifer in Clay County. Wells penetrating this aquifer usually range in depth from 20-180 feet, depending on the depth of the aquifer below the land surface and the depth to bedrock.

The map on the facing page shows the general distribution of the major glacial aquifer in Clay County. The surface part of the aquifer, in which wells are usually 20-120 feet deep, underlies the flood-plain areas of the Vermillion and Missouri Rivers. The buried part of the aquifer underlies the uplands adjacent to the Vermillion and Missouri River flood plains in Clay County, and is covered by an average thickness of 100 feet of glacial debris. In this buried part of the aquifer, wells are generally 80-180 feet deep. Test holes in the buried part of the aquifer have shown as much as 170 feet of aquifer material to a depth of 278 feet.

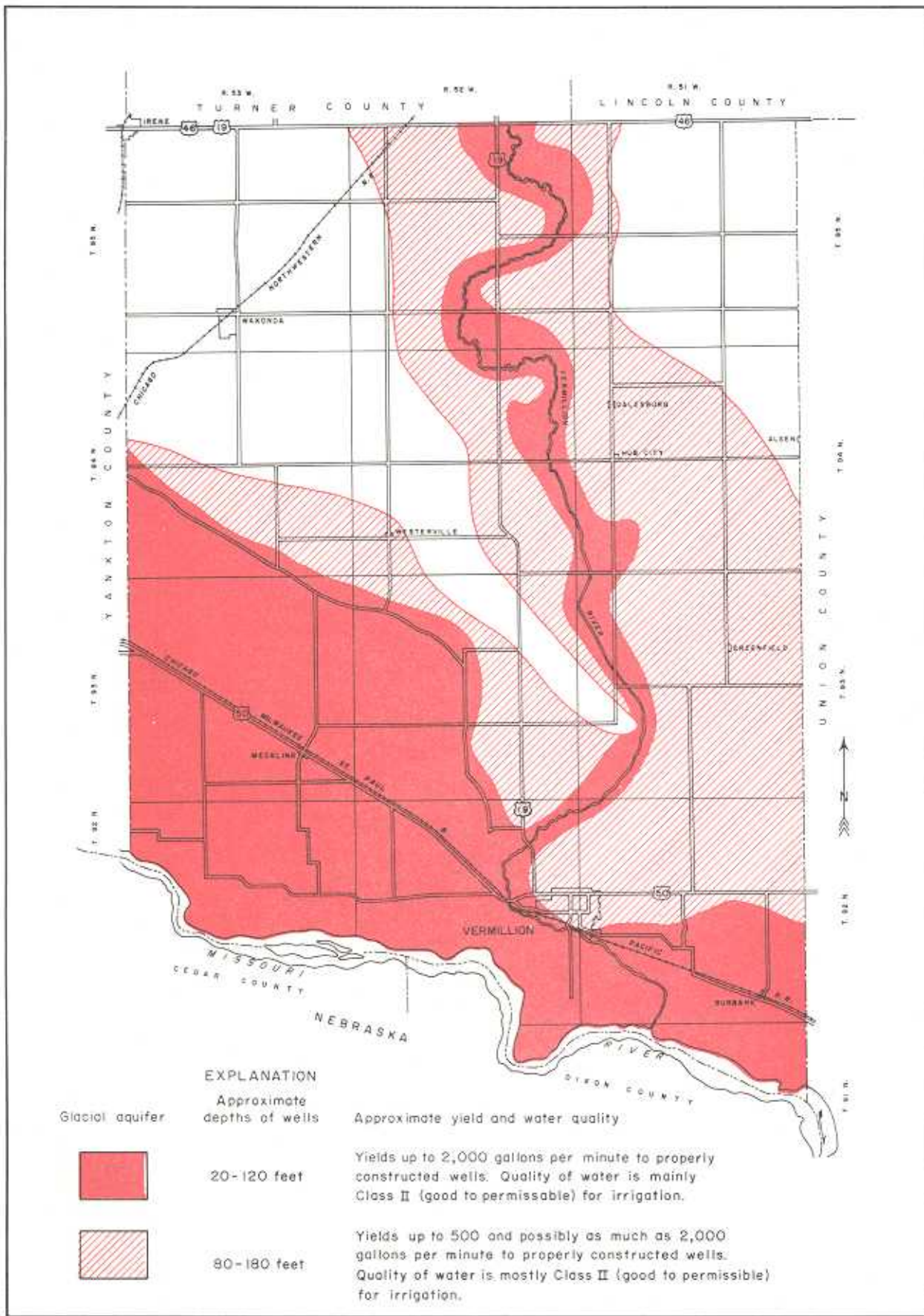
The water from both the surface and buried parts of the aquifer is usually hard and when considered for domestic purposes, contains more than the desirable amounts of total solids, sulfate, and iron.

From an irrigation standpoint, the quality of water in both parts of the aquifer is usually Class II (good to permissible). A small number of samples from the surface part of the glacial aquifer has been classified as Class I (excellent to good) and Class III (doubtful to unsuitable).

The glacial aquifer is the best source of ground water in Clay County. It is capable of yielding sufficient quantities of water for any predictable type of irrigation, industrial, municipal, and domestic use. Properly constructed irrigation wells may yield as much as 2,000 gallons of water per minute from both the surface and buried parts of the glacial aquifer.

High-yield wells such as those generally needed for irrigation should never be constructed without preliminary test drilling. Once a well site is located, a test well should be installed and pumped to determine yield, drawdown, and recovery, and quality of water should be determined. Various other preliminaries such as analyses of soil and subsoil conditions and topographic mapping are also desirable in order to choose the most suitable type of irrigation system to be used; this may vary from farm to farm.

Persons wishing additional information about the geology and hydrology of Clay County are urged to contact the South Dakota Geological Survey in Vermillion, or the United States Geological Survey in Huron.



Map showing distribution of the major glacial aquifer in Clay County (including approximate depth of wells and general water quantity and quality.)