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DATA-BASE MAP

By
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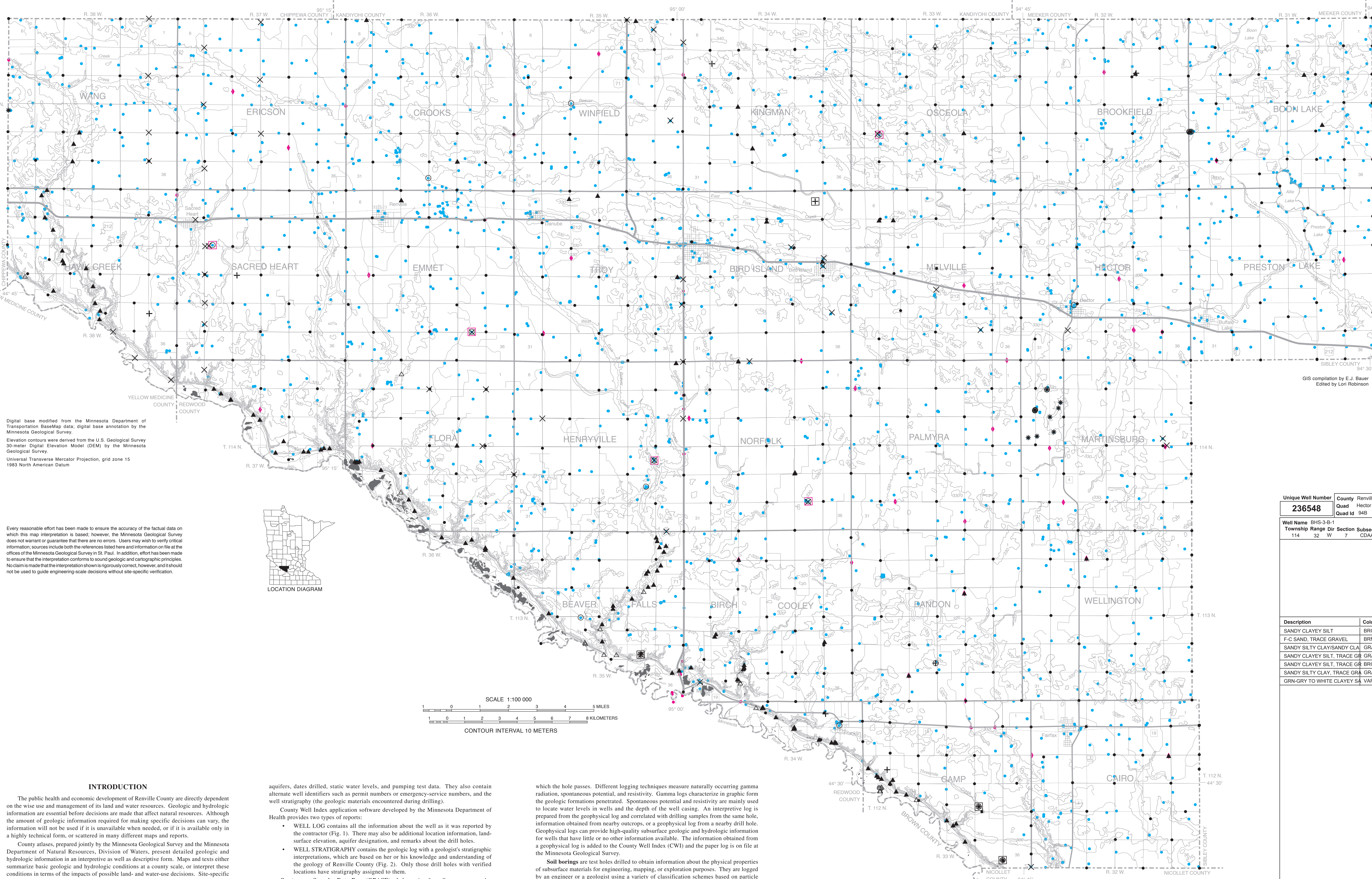
2013



Digital base modified from the Minnesota Department of Transportation BaseMap data; digital base annotation by the Minnesota Geological Survey.

Elevation contours were derived from the U.S. Geological Survey 30-meter Digital Elevation Model (DEM) by the Minnesota Geological Survey.

Universal Transverse Mercator Projection, grid zone 15
1983 North American Datum

Every reasonable effort has been made to ensure the accuracy of the factual data on which this map interpretation is based; however, the Minnesota Geological Survey does not warrant or guarantee that there are no errors. Users may wish to verify critical information; sources include both the references listed here and information on file at the offices of the Minnesota Geological Survey in St. Paul. In addition, effort has been made to ensure that the interpretation conforms to sound geologic and cartographic principles. No claim is made that the interpretation shown is rigorously correct, however, and it should not be used to guide engineering-scale decisions without site-specific verification.

LOCATION DIAGRAM

MAP SYMBOLS

- Record of water-well construction (well driller's log)
- Exploratory boring
- Diamond drill core sample
- Rotary-sonic core sample
- Cutting sample
- Borehole geophysical log
- Soil boring
- Giddings probe hole
- Field site
- Field site with textural analysis
- Gravity reading
- Passive seismic sounding
- Bedrock outcrop

Note: More than one symbol can occur at the same location

INTRODUCTION

The public health and economic development of Renville County are directly dependent on the wise use and management of its land and water resources. Geologic and hydrologic information are essential before decisions are made that affect natural resources. Although the amount of geologic information required for making specific decisions can vary, the information will not be used if it is unavailable when needed, or if it is available only in a highly technical form, or scattered in many different maps and reports.

County atlases, prepared jointly by the Minnesota Geological Survey and the Minnesota Department of Natural Resources, Division of Waters, present detailed geologic and hydrologic information in an interpretive as well as descriptive form. Maps and texts either summarize basic geologic and hydrologic conditions at a county scale, or interpret these conditions in terms of the impacts of possible land- and water-use decisions. Site-specific information is also available at a greater level of technical detail than shown on the maps of this atlas. The data are too voluminous to present in the atlas, but have been incorporated into readily accessible files housed at the Minnesota Geological Survey.

Several sources commonly provide information about an area or an individual property, but they may use different classification schemes to describe the same geologic materials. As a result, discrepancies in interpreting the data may arise or the different sources may appear to contradict each other. For example, water-well drillers may describe glacial till as "clay," but engineering records will describe it as "clayey sand." Both descriptions are acceptable for their original purpose of describing the physical attributes of the material. "Clay," the term used by well drillers, defines the general inability of the till to yield ground water to a well. "Clayey sand," the term from the engineering record, defines the physical composition of the till relative to particle size and engineering properties. The geologist must take the analysis one step further and define the material in terms of how it formed rather than how it is to be used. In this example, till consists of an unsorted mixture of rock fragments ranging in size from clay to cobbles and boulders, and it is interpreted by the geologist as having been deposited directly by glacial ice. Understanding the process by which the material formed allows geologists to make predictions about what lies between and beyond data points.

All of the types of data described on this plate had to be interpreted by geologists or hydrogeologists before they were meaningful for mapping purposes. The 1:100,000 and 1:200,000 scales of the maps in this atlas were chosen because they can show the geologic and topical studies of the county while keeping the physical size of each plate to a manageable level. As a result, some detailed information that was gained by data interpretation and mapping cannot be shown on these maps or discussed in the texts.

Whether to use the atlas alone, or in combination with the data bases, depends on the amount of detail needed. Generally, data-base information must be used to evaluate site-specific conditions.

DATA-BASE MANAGEMENT

All of the data shown on the maps were plotted on 7.5-minute topographic quadrangle maps or highway alignment maps and assigned inventory numbers. Automated data bases and a few manual files were developed to provide easy access and rapid retrieval of these site-specific data. The data may be obtained from the Minnesota Geological Survey.

Computer storage and retrieval systems are better than manual files for manipulating large amounts of data because automated geologic data bases can be designed to interact with other computer files, such as land-use data. Such interaction permits more efficient assessment of cause-and-effect relationships concerning natural resources than is commonly possible with manual files.

RENVILLE COUNTY DATA BASES

Computerized files were developed for point-source data such as wells and borings in Renville County. They use Public Land Survey descriptions, Universal Transverse Mercator (UTM), and latitude-longitude coordinates as location criteria; thus, they are compatible with the natural-resource data bases housed at the Minnesota Land Management Information Center (LMIC). The computerized data bases developed for Renville County by the Minnesota Geological Survey are County Well Index (CWI) and Quaternary Samples Data Base (QBASE).

County Well Index (CWI)—Information from water-well records and exploration holes is entered into this statewide data base. Each well log is assigned a six-digit unique number and each exploration drill hole is assigned either a five- or six-digit unique number. These reference numbers are also used by state agencies and the Water Resources Division of the U.S. Geological Survey. Elevations, expressed in feet above sea level, were determined from topographic maps (see the index to 7.5-minute quadrangles) and are generally accurate to plus or minus five feet (1.5 meters). The street address of each well is also included wherever possible to provide data users with a well-location system that is compatible with local regulatory programs. Software at the Minnesota Geological Survey is used to display and tabulate many of the data elements contained on the original well log.

The County Well Index is currently stored in a data base that consists of nine related tables. These tables contain information such as well depths, well construction, addresses, aquifers, dates drilled, static water levels, and pumping test data. They also contain alternate well identifiers such as permit numbers or emergency-service numbers, and the well stratigraphy (the geologic materials encountered during drilling).

County Well Index application software developed by the Minnesota Department of Health provides two types of reports:

- WELL LOG contains all the information about the well as it was reported by the contractor (Fig. 1). There may also be additional location information, land-surface elevation, aquifer designation, and remarks about the drill holes.
- WELL STRATIGRAPHY contains the geologic log with a geologist's stratigraphic interpretations, which are based on her or his knowledge and understanding of the geology of Renville County (Fig. 2). Only those drill holes with verified locations have stratigraphy assigned to them.

Quaternary Samples Data Base (QBASE)—Information from Quaternary samples collected and analyzed is entered into this data base. QBASE contains locations, the name of the sample collector, elevations, depths from where the samples were collected, proportions of sand, silt, and clay, and proportions of crystalline, carbonate, and shale fragments. Information pertaining to borings obtained from the Minnesota Department of Transportation also can be found in this database.

FUTURE DATA COLLECTION

A data-base map is out of date even before it is printed because additional information is continually generated as new water wells are drilled, construction activities expose more bedrock, or additional wells are tested for water quality. The library of geologic information prepared for Renville County is flexible so that old data can be reevaluated in light of new information, and new forms of data can be added if required. The need to manage ground water and other natural resources wisely will never become outdated. Future demands on these resources will require current data to assess the impacts.

THE DATA-BASE MAP

The types, locations, and density of information used to prepare the Renville County atlas are shown on this map. The data are described below to aid the user in assessing what types may be useful for a particular information need. The Data-Base Map serves as a guide to the precision of the other maps in the atlas. It shows where data are sparse or lacking and interpretation and extrapolation were required to prepare the maps. All data were collected by Minnesota Geological Survey staff unless otherwise specified.

DRILL-HOLE INFORMATION

A **record of water-well construction (well driller's log)** is a water-well contractor's description of the geologic materials penetrated during drilling and the construction materials used to complete the well. Not all wells extend to bedrock. In areas of thick, unconsolidated Quaternary deposits, drillers commonly do not need to drill through the entire thickness of overburden to find sufficient ground water. Hydrologic data, such as the static water level and test-pumping results, are commonly included. Before any driller's log can be used, the location of the well must be verified, and a geologist must interpret the log. Driller's logs are the primary source of subsurface geologic and hydrologic data for Renville County; about 1,850 logs were used for this atlas; they can be found in the County Well Index.

An **exploratory boring (exploration hole)** is an explorationist's description of the geologic materials penetrated during mineral exploration. Exploratory work may include the collection of core or cuttings samples of the bedrock encountered for descriptive and analytical purposes. In Minnesota, these core or cuttings are eventually transferred to the Minnesota Department of Natural Resources, Division of Lands and Minerals and are available for public inspection at their offices.

Core samples were collected at various sites throughout Renville County as a means to establish the nature of the subsurface material. Some core samples were collected by exploration companies and the Minnesota Geological Survey using diamond core drilling. This method uses a diamond bit rotating at the end of a drill rod. A column of rock moves up the drill pipe and is recovered at the surface for study. Rotary-sonic cores were collected by the Minnesota Geological Survey and an environmental consulting firm from five sites in the county to aid the interpretation of the Quaternary deposits. The coring technique enables recovery of a continuous core, 3.5 inches (8.9 centimeters) in diameter, from glacial deposits and bedrock (if intersected). It provides excellent subsurface samples for detailed study and comparison with cuttings, geophysical logs, and driller's logs from surrounding sites. The core is available for inspection at the Minnesota Department of Natural Resources, Division of Lands and Minerals offices.

Cutting samples collected during drilling provide physical evidence of subsurface geologic materials. Cuttings are the samples generated as the drill bit cuts through the subsurface material and are used to interpret and verify driller's logs. They are logged and stored at the Minnesota Geological Survey.

Borehole geophysical logs are created by lowering instruments down a well or drill hole and measuring the physical and chemical properties of the geologic materials through which the hole passes. Different logging techniques measure naturally occurring gamma radiation, spontaneous potential, and resistivity. Gamma logs characterize in graphic form the geologic formations penetrated. Spontaneous potential and resistivity are mainly used to locate water levels in wells and the depth of the well casing. An interpretive log is prepared from the geophysical log and correlated with drilling samples from the same hole, information obtained from nearby outcrops, or a geophysical log from a nearby drill hole. Geophysical logs can provide high-quality subsurface geologic and hydrologic information for wells that have little or no other information available. The information obtained from a geophysical log is added to the County Well Index (CWI) and the paper log is on file at the Minnesota Geological Survey.

Soil borings are test holes drilled to obtain information about the physical properties of subsurface materials for engineering, mapping, or exploration purposes. They are logged by an engineer or a geologist using a variety of classification schemes based on particle sizes, penetration rate, moisture content, and color. Soil-boring data were collected by the Minnesota Department of Transportation. They are limited in distribution: in Renville County they are concentrated along the U.S. Highway 71 and Minnesota Highway 19 corridors. These data are most useful in determining the composition of unconsolidated deposits. The geologic materials penetrated are entered into the Quaternary Samples Data Base (QBASE); all other information collected is contained in paper files.

OTHER INFORMATION

Giddings probe holes are continuous cores of glacial materials, 2 inches (5.1 centimeters) in diameter, collected by a truck-mounted hydraulic auger. A description was generated at every site and a sample or samples were taken for textural analyses. Samples were generally taken about every 5 feet (1.5 meters), at unit contacts, or where the geologist believed it was important.

Field sites are natural and artificial exposures of unconsolidated Quaternary deposits that were described in detail; many sites were texturally analyzed. Field sites include stream and river cuts, gravel pits, and road cuts.

Textural analyses express the proportion of sand-, silt-, and clay-size particles that make up a sample. They are helpful in identifying and mapping unconsolidated materials like Quaternary glacial deposits. The samples analyzed were taken from natural and artificial exposures, Giddings holes, and the rotary-sonic cores.

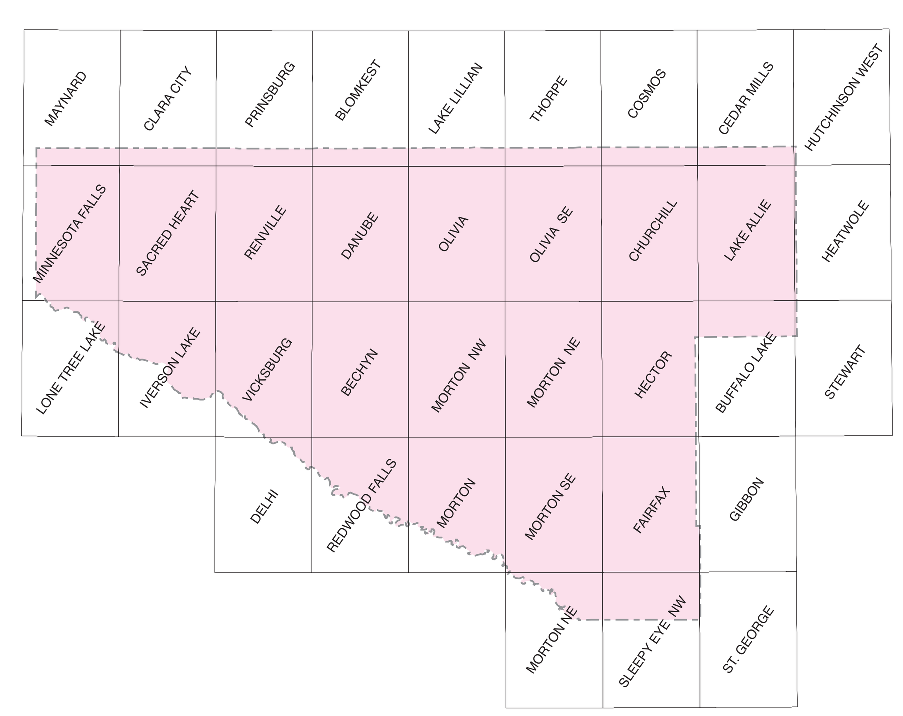
Gravity data can be used to help map bedrock depth and the thickness of overlying glacial deposits. The application of this method relies primarily on the strong density contrasts that exist between bedrock and unconsolidated deposits. The method also relies on the ability to separate the gravity effect associated with the bedrock topography and glacial fill from that of density variations occurring within the underlying Precambrian bedrock. Unfortunately, no suitable means of isolating the two effects could be achieved in Renville County; the Precambrian bedrock signature is too strong, and its wavelength characteristics overlap those that are associated with bedrock topography and glacial fill. Thus, the gravity data in Renville County were primarily used to help map structures within the Precambrian bedrock, which sub-crops extensively beneath most of the county.

Passive seismic depth to bedrock soundings provide information based on measurement and analysis of shear- and surface-wave energy in the ground that allow a calculation of the depth to bedrock beneath that point. The measurements employ a recording geophone system that is implanted into the ground surface and records ambient ground vibrations in 2 horizontal and 1 vertical directions over a 16-minute interval. The method is called passive because no energy is directly input into the ground at the time of measurement; the unit measures background (ambient) vibrations from a variety of natural and artificial sources including wind and traffic. Calculations of depth to bedrock are made after the major resonant frequency peak is calculated by taking the combined horizontal components and dividing by the vertical component. This peak frequency is fitted to a calibration curve of frequency (H/V) versus known depth to determine the depth to bedrock at the location of measurement. The calibration curve is constructed experimentally by making at least 30 measurements of H/V frequency at wells with known depths, plotting the results, and fitting a curve to the data. In general, depth to bedrock calculated by this method can have errors between 15 and 25 percent of the depth; however, in areas with little or no data, this is a good result and many soundings can be collected over a short period of time with one or two operators.

Bedrock outcrops are exposures of solid rock at the land surface. The areas shown typically represent multiple, closely spaced exposures. Most are natural outcrops in the Minnesota River valley; however, some may be exposures created during construction. They serve as reference points for mapping and for checking the accuracy of subsurface data. Bedrock at or near the surface must be considered in land-use planning decisions such as pipeline routing, sewage-system design, and excavation.

ACKNOWLEDGEMENTS

The staff from the Renville County Water and Household Hazardous Waste Management Department contributed greatly to the development of the County Well Index (CWI) data base. We thank Ervin Well Company, other local water-well contractors, and landowners for their valuable assistance.



INDEX TO 7.5-MINUTE QUADRANGLES

Unique Well Number **236548** | County Renville | Quad Hector | Quad Id 94B

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
MINNESOTA STATUTES CHAPTER 1031

Entry Date 1988/04/17 | Update Date 2009/09/03 | Received Date

Well Name BHS-3-B-1
Township 114 | Range 32 | Dir W | Section 7 | Subsection CDAAAB | Field Located MGS | Elevation 1100.00 ft.

Well Depth 400.00 ft | Depth Completed 400.00 ft | Date Well Completed 1982/01/21

Drilling Method
Drilling Fluid | Well Hydrofractured? YES NO | From ft. to
Use Test well
Casing Type | Diameter | Drive Shoe? YES NO | Depth | Hole Diameter (in.)

Description	Color	Hardness	From	To (ft.)
SANDY CLAYEY SILT	BROWN		0	2
F-C SAND, TRACE GRAVEL	BRN/GRY		2	26
SANDY SILTY CLAY/SANDY CLA	GRAY		26	79
SANDY CLAYEY SILT, TRACE GR	GRAY		79	220
SANDY CLAYEY SILT, TRACE GR	BROWN		220	260
SANDY SILTY CLAY, TRACE GRA	GRAY		260	310
GRN-GRY TO WHITE CLAYEY SA	VARIED		310	400

Screen | Open Hole(ft.) From to
Make | Type
Diamter | Slot | Length | Set

Static Water Level
0.00 ft. | Date measured

Pumping Level (below land surface)
ft. after | hrs. pumping | g.p.m.

Wellhead Completion
Pitless adapter manufacturer | Model
Casing Protection | 12 in. above grade
At-grate (Environmental Wells and Borings ONLY) | Basement offset

Grouting Information | Well grouted? YES NO

Nearest Known Source of Contamination
feet | Direction | Type
Well disinfected upon completion? YES NO

Pump
Not Installed | Date Installed
Manufacture's name
Model number | HP | Volts
Length of drop pipe | Material | Capacity | g.p.m
Type

Abandoned Wells
Does property have any not in use and not sealed well(s)? YES NO

Variance
Was a variance granted from the MDH for this well? YES NO

Remarks
ADDITIONAL GLACIAL INTERPRETATIONS ON ORIGINAL LOG. M.G.S. NO. 1797. SP & ELECTRICAL RESISTIVITY LOGS RUN 1-19-1982.

Well Contractor Cerfication
Minnesota Geological Survey | MGS
License Business Name | Lic. or Reg No.

First Bedrock KREG | Aquifer
Last Strat KREG | Depth to Bedrock 310.00 ft.

County Well Index v.5 | REPORT | Printed on 11/15/2011 | Name of Driller | Date | HE-01205-07 (Rev. 2/99)

Figure 1. An example of a WELL LOG record, showing all the information about the well as reported by the well driller.

Unique Well Number **236548** | County Renville | Quad Hector | Quad Id 94B

MINNESOTA DEPARTMENT OF HEALTH
WELL AND BORING RECORD
MINNESOTA STATUTES CHAPTER 1031

Entry Date 1988/04/17 | Update Date 2009/09/03 | Received Date

Well Name	Township	Range	Dir	Section	Subsection	Depth Drilled	Depth Completed	Date Completed	Lic/Reg. No.	Driller Name
BHS-3-B-1	114	32	W	7	CDAAAB	400 ft	400 ft	1982/01/21	MGS	

Elevation 1100.00 ft. | Method 7.5 minute topographic | Aquifer | Depth to Bedrock 310 ft. | Screen/Open Hole | SWL

Field Located Minnesota Geological Survey | Location Method | Universal Transverse Mercator(UTM) - NAD83 - Zone 15 - Meters
Program | Input Source | UTM Easting (X) 361977 | UTM Northing (Y) 4950124
Uni No.Verified Information from owner | Input Date 1990/01/01
Geologic Interpretation Howard Hobbs | Agency MGS | Interpretation Method Geologic study 1:24k to 1:100k

Geological Material	Color	Hardness	DEPTH From	DEPTH To	Thick	ELEVATION From	ELEVATION To	Stratigraphy	LITHOLOGY Primary	LITHOLOGY Secondary	LITHOLOGY Minor
SANDY CLAYEY SILT	BROWN		0	2	2	1100	1098	Recent deposit-brown	Soil	Organic Deposits	Silt
F-C SAND, TRACE GRAVEL	BRN/GRY		2	26	24	1098	1074	sand +larger	Sand	Gravel	
SANDY SILTY CLAY/SANDY CLAYEY SI	GRAY		26	79	53	1074	1021	till w/calc.pebbles-gry	Clay	Silt	Sand
SANDY CLAYEY SILT, TRACE GRAVEL	GRAY		79	220	141	1021	880	till w/calc.pebbles-gry	Silt	Clay	Sand
SANDY CLAYEY SILT, TRACE GRAVEL	BROWN		220	260	40	880	840	till w/calc.pebbles-brn	Silt	Clay	Sand
SANDY SILTY CLAY, TRACE GRAVEL	GRAY		260	310	50	840	790	till w/calc.pebbles-gry	Clay	Silt	Sand
GRN-GRY TO WHITE CLAYEY SAND	VARIED		310	400	90	790	700	Cretaceous regolith	Regolith		

Figure 2. Example of a WELL STRATIGRAPHY record, which contains a geologist's interpretation of the geologic materials listed by the driller in the WELL LOG record (Fig. 1).

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