

**DATA-BASE MAP**

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2012

**MAP SYMBOLS**

- Record of water-well construction (well driller's log)
  - Rotary-sonic core sample
  - Cutting sample
  - Borehole geophysical log
  - Soil boring
  - Giddings probe hole
  - Field site
  - Soil auger boring
  - Gravity reading
  - Passive seismic sounding
  - Minnesota Department of Natural Resources site
  - Bedrock outcrop
- Note: More than one symbol can occur at the same location

**THE DATA-BASE MAP**

The types, locations, and density of information used to prepare the Nicollet 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.

**INTRODUCTION**

The public health and economic development of Nicollet 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.

**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 Nicollet County; about 1,400 logs were used for this atlas; they can be found in the County Well Index (CWI).

**Rotary-sonic cores** were collected at three sites in Nicollet County as a means to help establish the nature of the subsurface material. 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. A detailed geologist's log is entered into the County Well Index (CWI) and any sampling results are entered into the Quaternary Samples Data Base (QBASE). 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 characteristic 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. Most terminate at very shallow depths or where bedrock is encountered. 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 from the Minnesota Department of Transportation and the Nicollet County Highway Department. They are limited in distribution; in Nicollet County they are concentrated along the U.S. Highway 169 and U.S. Highway 14 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 almost always 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; some sites were texturally analyzed. Sites include gravel pits, river or stream cuts, and outcrops. Soil-boring data were collected from the Minnesota Department of Transportation and the Nicollet County Highway Department. They are limited in distribution; in Nicollet County they are concentrated along the U.S. Highway 169 and U.S. Highway 14 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.

**Gravimetric data** are 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. This peak frequency is fitted to a calibration curve of frequency (HV) 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 HV 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 to 20 percent of the depth; however, in areas with little to no data, this is a good result and many samples can be collected over a short period of time with one or two operators.

**Minnesota Department of Natural Resources sites** are the locations of field observations made by Minnesota Department of Natural Resources staff that were used for mapping the aggregate resources of Blue Earth County. The data and maps are available from the Minnesota Department of Natural Resources, Division of Lands Minerals Aggregate Resource Mapping webpage ([http://www.dnr.state.mn.us/lands\\_minerals/aggregate\\_maps/index.html](http://www.dnr.state.mn.us/lands_minerals/aggregate_maps/index.html)).

**Bedrock outcrops** are exposures of rock at the land surface. Most are natural outcrop; however, some are exposures created during excavation. 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.

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 assorted 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.

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 scale of the maps in this atlas was chosen because it can show the geologic and topographic 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.

**NICOLLET COUNTY DATA BASES**

Computerized files were developed for point-source data such as wells and borings in Nicollet 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 Nicollet 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 is entered into this statewide data base. Each well log is assigned a 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. 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).

CWI 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 Nicollet 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. Information pertaining to borings obtained from Minnesota Department of Transportation and the Nicollet County Highway Department also can be found in this data base.

**FUTURE DATA COLLECTION**

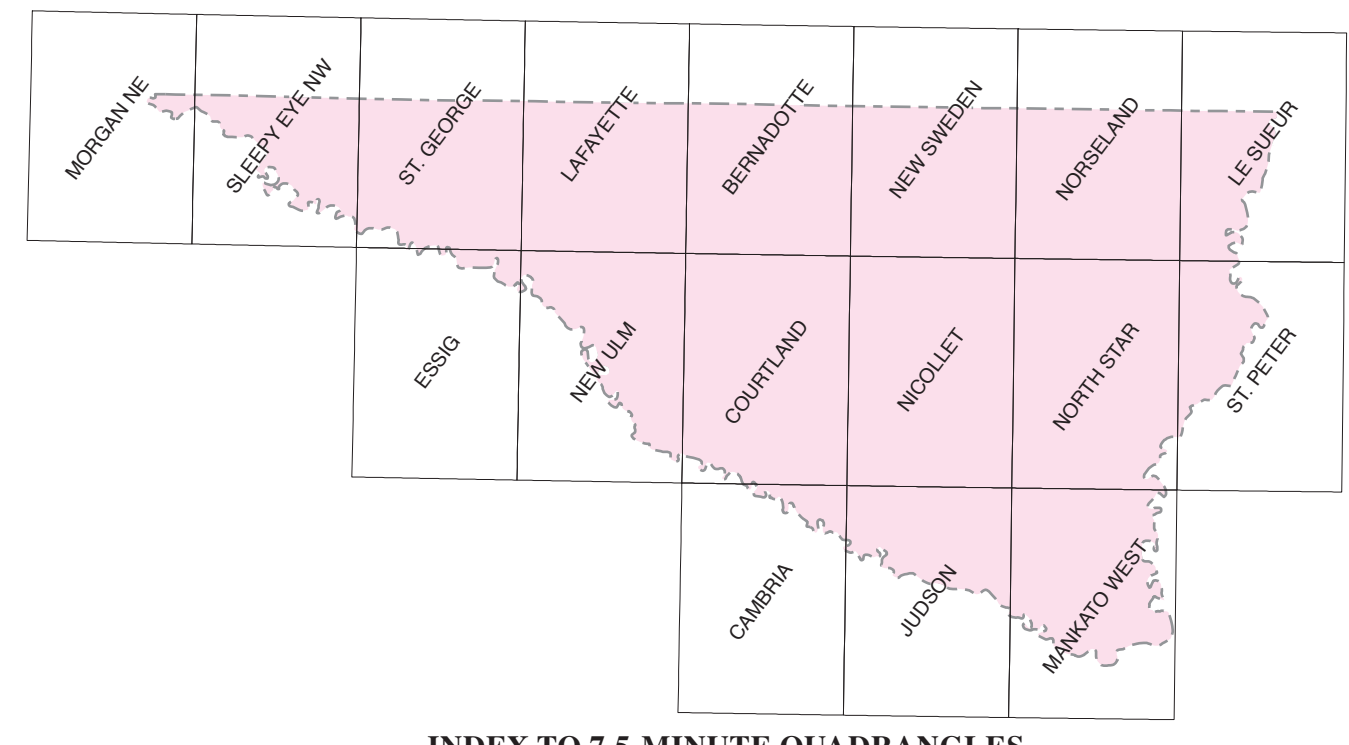
A data-base map is out of date even before it is printed because additional information is continually generated as new water wells are drilled, construction activities expose more bedrock, or additional wells are tested for water quality. The library of geologic information prepared for Nicollet County 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.

Unique Well Number	County	Nicollet	MINNESOTA DEPARTMENT OF HEALTH WELL AND BORING RECORD MINNESOTA STATUTES CHAPTER 1031	Entry Date						
<b>770444</b>	Quad	New Sweden		2009/05/22						
	758			Update Date 2010/06/28						
				Received Date						
Well Name	DNR 09 S3007	Section	111 28 W 3	Depth Drilled	537.00 ft	Depth Completed	537.00 ft	Date Well Completed	2009/05/29	
Township	111 28 W 3	Subsection	3	Input Source	2009/05/22	Agency	MGS	Interpretation Method	Geologic study 1:24k to 1:100k	
Contact Address	MNDNR	Field Location	885ADA	Location Method	Digitization (Screen) - Map (1:2 Universal Transverse Mercator (UTM) - NAD83 - Zone 15 - Meters UTM Easting (X) UTM Northing (Y))	Input Date	2009/05/22	Agency	MGS	
800 LAFAYETTE RD	ST PAUL	55155		Location	111 28 W 3	Section	3	Subsection	885ADA	
				Depth Drilled	537.00 ft	Depth Completed	537.00 ft	Date Completed	2009/05/29	
				Lic/Reg. No.	1454	Driller Name	TONYMARK			
				Elevation	981.00 ft	Method	7.5 Minute Topographic	Aquifer	Mt. Simon-Fond du Lac	
				Depth to Bedrock	302.00 ft	Open Hole	399.537	SHL	150.7	
				File Located	Minnesota Geological Survey	Program				
				Unit No. Verified	Information from owner	Geologic Interpretation	John Mossler			
				Use	Observation well	Drilling Method	Dual Rotary	Well Hydrocatered?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
				Casing	Type Steel (Black or Low Drive Sheet) <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO Hole Diameter (in.)	Drilling Fluid	Bentonite	From		
				10.00 in. from 0.00 to 312.00 ft	3 3/8	Screen No.		Open Hole (ft.)	From 390.0 to 537.0	
				4.00 in. from 0.00 to 390.00 ft	1 1/2	Diaper	Spot Length Set	Type		
						Static Water Level	150.70 n. Land surface	Date measured	2009/05/27	
						Pumping Level (below land surface)	n. after	hrs. pumping	g.p.m.	
						Wellhead Completion	Filter screen manufacturer	Model		
						Abandoned Wells	Does property have any not in use and not sealed wells? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Basement offset		
						Grouting Information	Well grouted? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Material	Neat Cement	
						Nearest Known Source of Contamination	1000 feet S Direction	BOV	Type	
						Abandoned Wells	Well disinfected upon completion? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			
						Pump	Not installed	Date installed		
						Manufacturer				
						Model number		IP	Volts	
						Length of drop pipe		Material	Capacity	
						Type				
						Remarks	GAMMA LOGGED 5-21-2009. M.G.S. NO. 4927. LOGGED FOR DNR. NORWEGIAN GROVE SITE NO. 1. GAMMA LOGGED INSIDE THE DRILL RODS.			
						First Bedrock CEGR	Aquifer	Mt. Simon-Fond du Lac	Depth to Bedrock	302.00 ft
						Last Bedrock MAPL				
						REPORT	Printed on	11/17/2010	Name of Driller	TONYMARK
									Date	HE-01025-07 Rev. 2/06

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	County	Nicollet	MINNESOTA DEPARTMENT OF HEALTH WELL AND BORING RECORD MINNESOTA STATUTES CHAPTER 1031	Entry Date						
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800 LAFAYETTE RD	ST PAUL	55155		Location	111 28 W 3	Section	3	Subsection	885ADA	
				Depth Drilled	537.00 ft	Depth Completed	537.00 ft	Date Completed	2009/05/29	
				Lic/Reg. No.	1454	Driller Name	TONYMARK			
				Elevation	981.00 ft	Method	7.5 Minute Topographic	Aquifer	Mt. Simon-Fond du Lac	
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				File Located	Minnesota Geological Survey	Program				
				Unit No. Verified	Information from owner	Geologic Interpretation	John Mossler			
				Use	Observation well	Drilling Method	Dual Rotary	Well Hydrocatered?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
				Casing	Type Steel (Black or Low Drive Sheet) <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO Hole Diameter (in.)	Drilling Fluid	Bentonite	From		
				10.00 in. from 0.00 to 312.00 ft	3 3/8	Screen No.		Open Hole (ft.)	From 390.0 to 537.0	
				4.00 in. from 0.00 to 390.00 ft	1 1/2	Diaper	Spot Length Set	Type		
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						Wellhead Completion	Filter screen manufacturer	Model		
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						Grouting Information	Well grouted? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	Material	Neat Cement	
						Nearest Known Source of Contamination	1000 feet S Direction	BOV	Type	
						Abandoned Wells	Well disinfected upon completion? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			
						Pump	Not installed	Date installed		
						Manufacturer				
						Model number		IP	Volts	
						Length of drop pipe		Material	Capacity	
						Type				
						Remarks	GAMMA LOGGED 5-21-2009. M.G.S. NO. 4927. LOGGED FOR DNR. NORWEGIAN GROVE SITE NO. 1. GAMMA LOGGED INSIDE THE DRILL RODS.			
						First Bedrock CEGR	Aquifer	Mt. Simon-Fond du Lac	Depth to Bedrock	302.00 ft
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						REPORT	Printed on	11/17/2010	Name of Driller	TONYMARK
									Date	HE-01025-07 Rev. 2/06

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).



INDEX TO 7.5-MINUTE QUADRANGLES

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.