WATER-WELL CUTTINGS

who needs them ?

WE DO !

MINNESOTA GEOLOGICAL SURVEY
1972
University of Minnesota

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WHO NEEDS THEM?

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WHY DOES THE MINNESOTA GEOLOGICAL SURVEY COLLECT GEOLOGIC INFORMATION?

The Minnesota Geological Survey has the responsibility in the state of Minnesota for acting as the clearing house for geologic information. Most of Minnesota has inadequate subsurface geologic information. Collection of this information is needed badly.

WHY DO WE WANT WATER-WELL CUTTINGS?

We need water-well cuttings to obtain a basic knowledge of all the rocks and sediments that hold Minnesota's groundwater. Most of these rocks and sediments are not exposed at the land's surface and cuttings from well drilling provide the means for geologists to see and study them.

WHY ARE WATER-WELL CUTTINGS SO VALUABLE?

Each set of water-well cuttings provides a complete record of the subsurface rocks and sediments existing at each well site. Studying well cuttings helps us determine the location and quantity of local and regional groundwater supplies, and how best to protect it from pollution, as well as adding to our basic geologic knowledge about Minnesota.

WHY DOESN'T THE STATE DRILL ITS OWN HOLES?

It has been estimated that a minimum of some 3,000 exploration holes would have to be drilled throughout the state to provide a basic network of information points. A governmental expenditure of several million dollars would be needed, and funds of this magnitude are not available to us or to other state agencies.

About 40,000 water wells were drilled in Minnesota during the last three years. Because water wells are drilled on a state-wide basis, cuttings of rock material collected by drillers provide the most economical and the only practical means of collecting this much-needed geologic information.

HOW WILL COLLECTING CUTTINGS HELP THE WATER-WELL CONTRACTOR?

Once the geology of an area is known, water-well drillers will be better informed as to the thicknesses and distribution of water-bearing formations. This information can eliminate much of the guesswork at the outset of drilling. It enables the driller to estimate well costs more accurately and provides his customer with the best possible well. It helps keep additional costs to a minimum, particularly those costs which arise from encountering unexpected rock types.

The diagram below shows how important it is to know the depths and thicknesses of the water-bearing rock formations. Rock-type variations like these are common in local areas in Minnesota and directly affect the yield of water wells. Well 1 is a short-term producer, wells 2 and 4 are dry holes, and well 3 has a high yield for a long duration. Fewer dry holes will result where good geologic information is available.

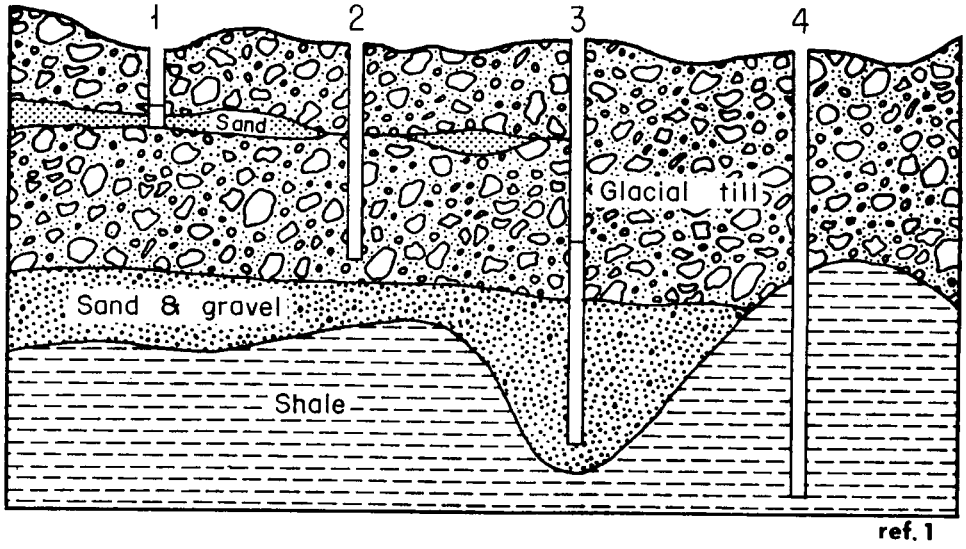


Figure 1. Variations in the common rock-types encountered in local areas in Minnesota can affect the yield of water wells.

WILL COLLECTING CUTTINGS BENEFIT CONTRACTORS WHO DRILL INJECTION WELLS?

The rapid increase in this country in the use waste injection wells is shown in the graph below.

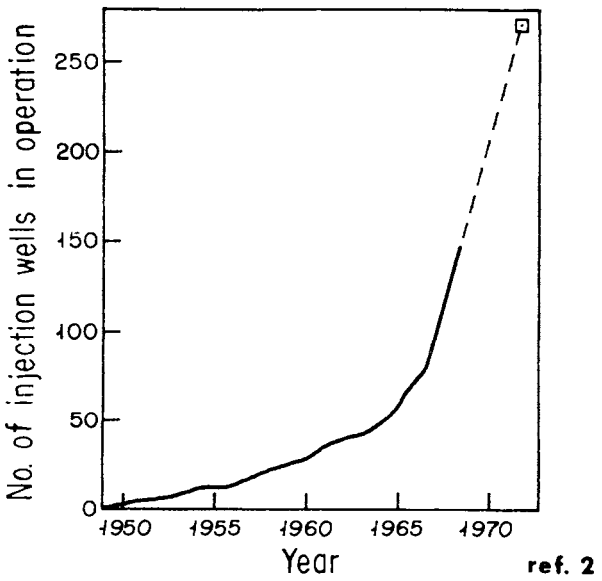


Figure 2. Increase in the use of waste disposal wells in the United States, 1950-1972.

Faced with the necessity for accurately completing injection wells in prescribed geologic formations or with the probability of cantaminating regional groundwater supplies with this waste, the well drilling industry will depend heavily on accurate regional geologic information. The illustration below shows how a waste-injection well could ruin a town's water supply if adequate subsurface geologic information is not available.

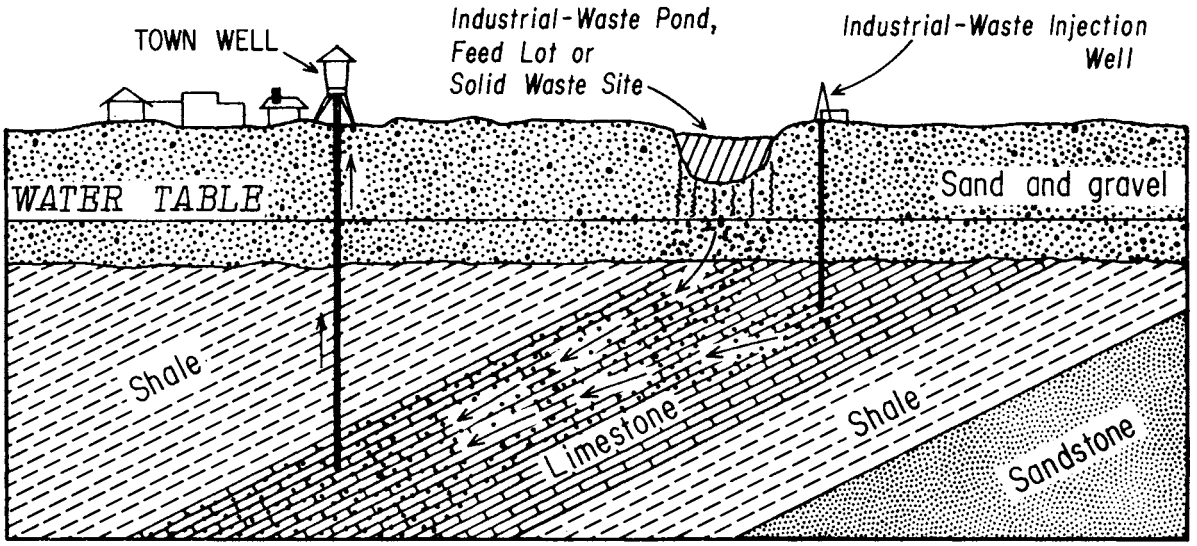


Figure 3. Contaminated town water supply resulting from poor waste disposal site and lack of use of correct geologic information.

WILL COLLECTING CUTTINGS HELP CONTROL THE GROUNDWATER POLLUTION PROBLEM IN MINNESOTA?

Not only does the well-drilling contractor and his customer benefit from the use of quality geologic information but there are additional benefits to the general health and safety of the community. Groundwater pollution is not a new problem, but it is becoming more common in Minnesota each year. Figure 3 also shows how the siting of sanitary landfills, feedlots, and industrial waste ponds can contribute to groundwater contamination of nearby groundwater supplies if accurate geologic information is lacking. Even though there is an adequate amount of groundwater available in the limestone formation, it is contaminated. The town well should have been completed in the underlying sandstone or the feedlot/waste disposal site should have been located on the other side of town.

WHY ARE MANY GEOLOGIC LOGS SUBMITTED TO THE MINNESOTA GEOLOGICAL SURVEY BY DRILLERS INADEQUATE?

Well drillers cannot be expected to have a complete understanding of the rock types that they encounter. Often, they are uncertain as to how to describe the rocks adequately. Therefore, some driller's logs can lead to incorrect geologic conclusions because the geologist misinterprets the rock types. It is not uncommon for logs from different drillers to differ considerably even in a small area. Figure 6 on the next page shows actual logs from four different water-well drillers operating in one ten acre area and the log prepared by a geologist. Only logs from drillers A and D would be partially useful for the geologist. Driller A did not recognize the shale layer. Driller B mistook a limestone boulder and a lens of sand in the clay, sand, and gravel layer for bedrock. Driller C's log is useful however did not penetrate bedrock. Driller D did not recognize the shale layer and identified the limestone only as "rock".

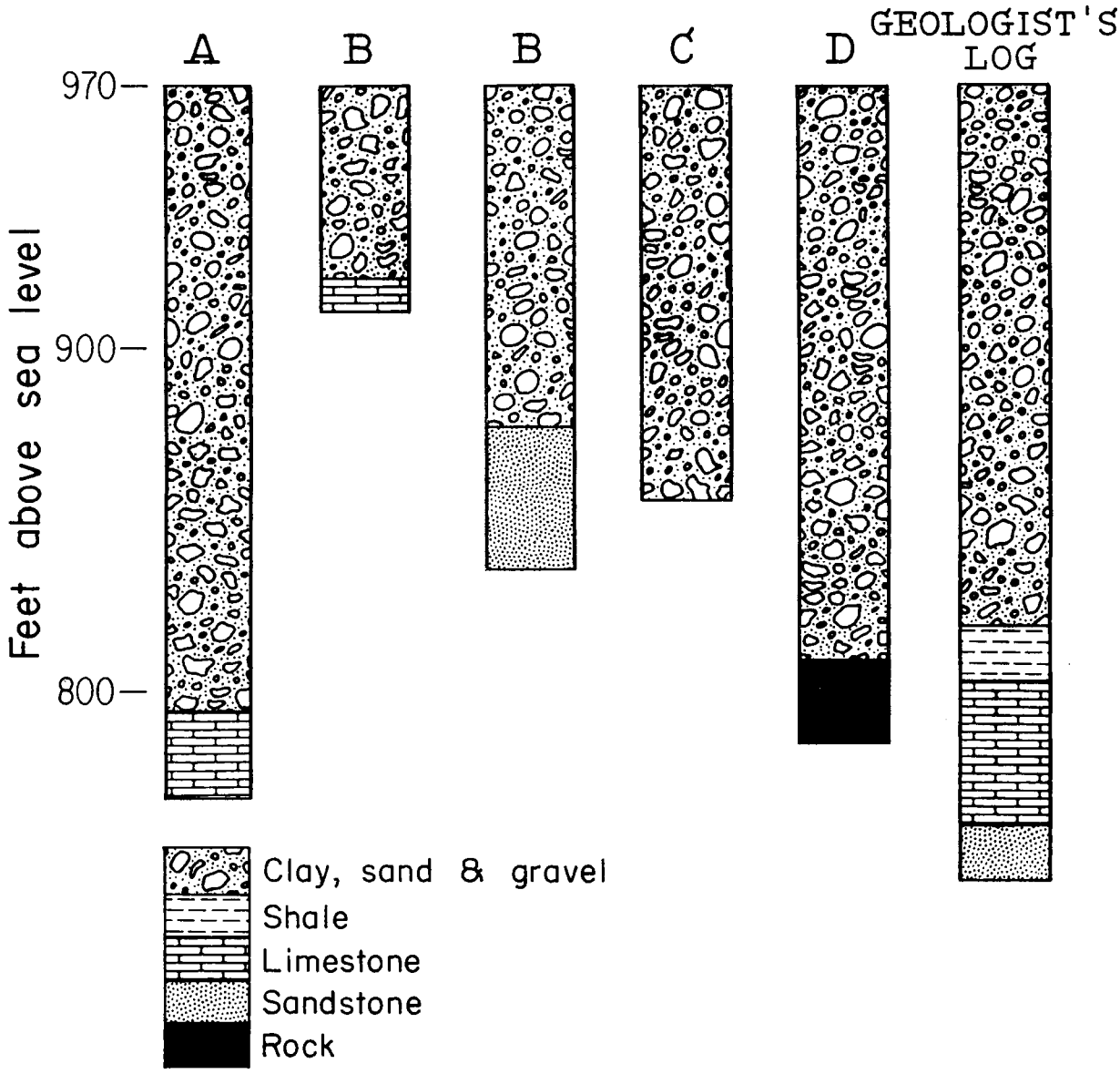


Figure 4. Comparison of four driller's logs with a geologists log.

HOW MANY SETS OF WATER-WELL CUTTINGS DOES THE MINNESOTA GEOLOGICAL SURVEY HAVE ON FILE?

Cuttings from only 750 Minnesota wells have been collected and are available for study. The map on the following page shows how spotty the state-wide distribution is; 24 counties lack any coverage and 275 sets of water-well cuttings come from the seven county metropolitan area.

Many geologists in Minnesota believe that an initial goal of collecting one set of water-well cuttings per township in rural areas (one set per 36 square miles), and one set of water-well cuttings per section in urban areas (one set per square mile) will provide a minimum geologic framework for Minnesota.

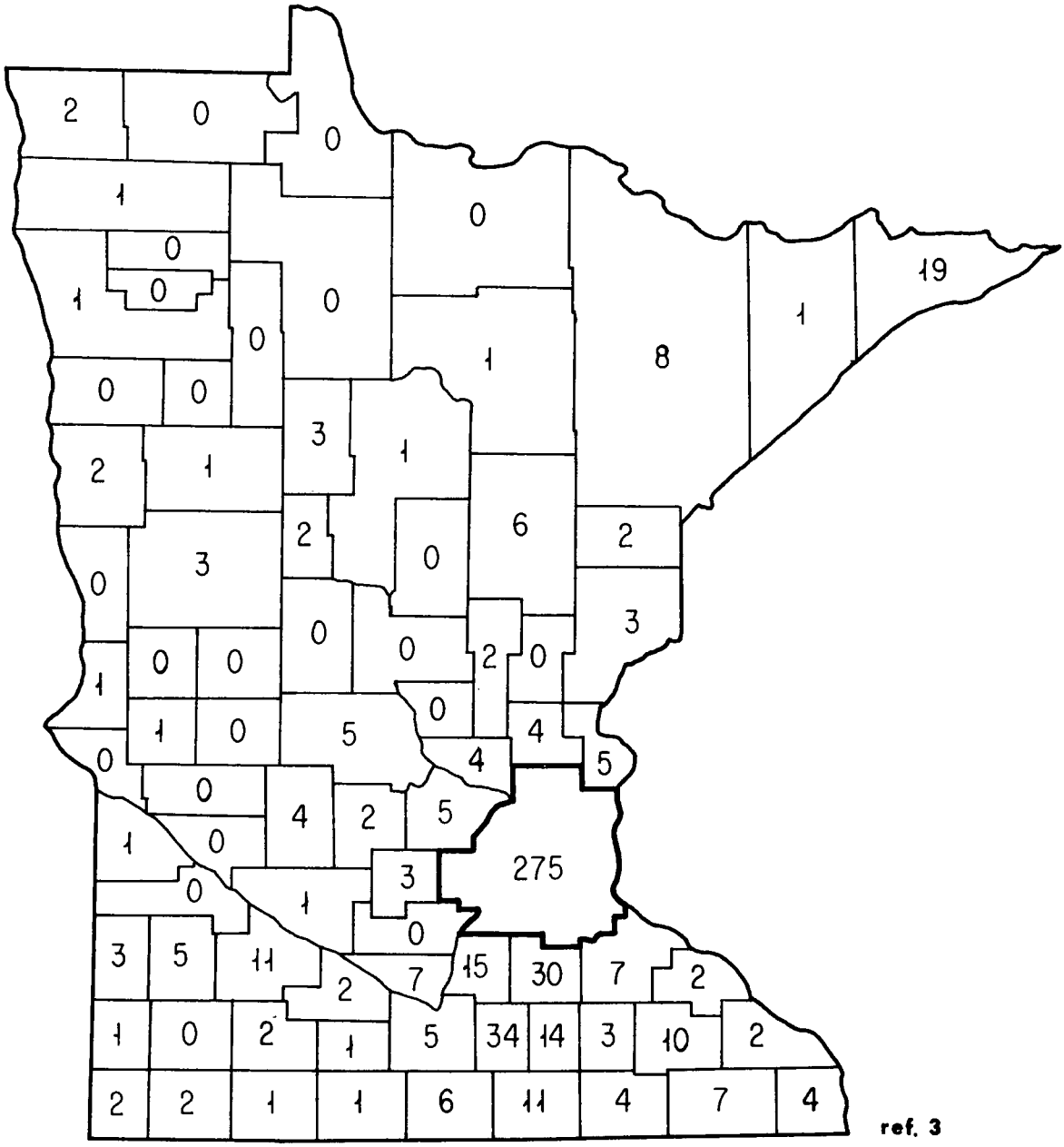


Figure 5. Number of sets of water-well cuttings per county on file at the Minnesota Geological Survey as of March, 1972.

HOW DOES MINNESOTA COMPARE WITH SURROUNDING STATES?

Not very well, as can be seen from the map below. In fact, we are far behind, and even if we should start an accelerated collection program now, it will be many years before we will approach the present coverage in adjacent states.

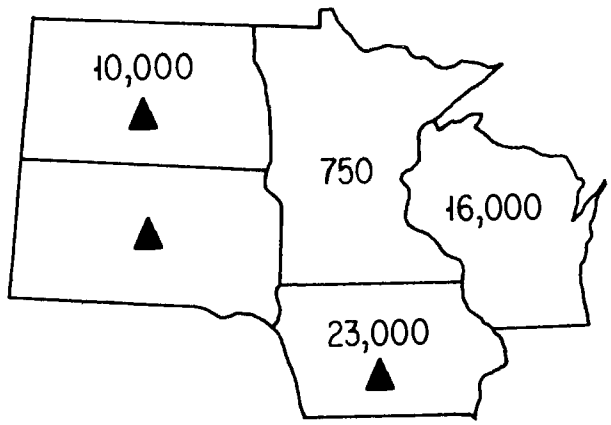
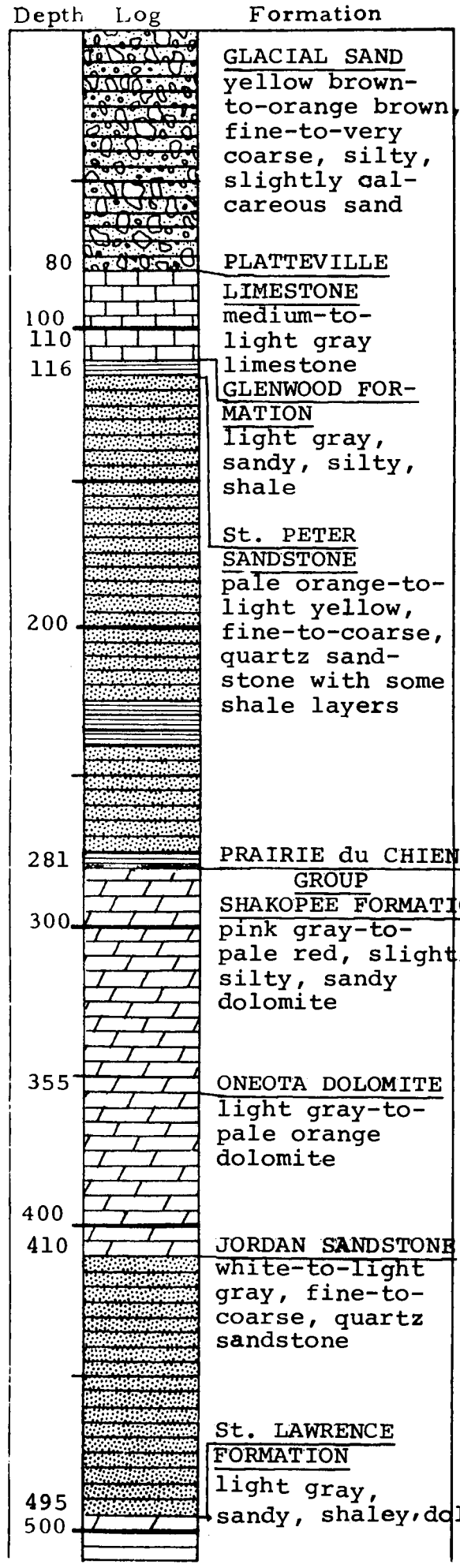


Figure 6. Number of sets of water-well cuttings filed with the geological surveys of Minnesota and adjacent states. The ▲ indicates those states which, in addition to collecting water-well cuttings, conduct their own drilling programs.

HOW CAN WATER-WELL CONTRACTORS HELP?

The Minnesota Geological Survey urges the water-well contractors operating in Minnesota to submit cuttings from wells drilled into bedrock or from wells which reach a depth of 200 feet or greater. When the Minnesota Geological Survey has one set of cuttings per township in rural areas and on set of cuttings per section in urban areas on file, a basic framework of highly accurate geologic information will be available for Minnesota's geologic and groundwater quality needs.

A well driller who submits a set of cuttings to the Minnesota Geological Survey will receive in return a log like the one in figure 7 on the following page. If this log were prepared by a private geologic consultant it would cost several hundred dollars.



Minnesota Geological Survey Minneapolis, Minnesota	
Name John Jones	State Minnesota
Town St. Paul County Ramsey	Loc.
Contractor Driller Smith Well Drilling	Sec. 31cbab
Drilling Dates completed Dec., 1971	T. N., R. W 29 22
Casing Record	
S.W.L. 81' G.P.M. 250 D.D. 100'	
Remarks	Elev. 880±5
	T.D. 500'
Logged by B. Olsen	M.G.S. No. 716

Explanation of Symbols*

- Soil
- Loess, Silt on Siltstone
- Drift
- Sand & Gravel
- Shale
- Sandstone
- Limestone
- Dolomite
- Clay
- N/S No. Samples

*logs are usually color coded

Figure 7. Geologic Log Prepared by Geologists from Water-Well Cuttings.

Our suggested procedure for the submission of water-well cuttings is as follows:

1. Contractor determines the location of the well to be constructed.

2. Contractor estimates if the well will encounter bedrock or reach a depth of at least 200 feet.

   Only if the conditions of step 2 are met should steps 3 through 7 be followed.

3. Contractor telephones the Minnesota Geological Survey collect to see if cuttings are required. (Area code 612 373-3591)

4. The Minnesota Geological Survey will determine if cuttings are required. Total state-wide requirements are one set per township in rural areas and one set per section in urban areas. (Rural and urban areas are defined by the 1969 State of Minnesota Land-Use Map.)

5. If cuttings are required, sample bags will be sent free of charge to the driller. Samples should be taken at five-foot intervals and at every change in rock or sediment type. Each sample bag has an attached tag on which the name of the well and depth interval (example: 65 to 70 ft.) must be written.

6. Upon completion of the well the driller telephones the Minnesota Geological Survey collect to notify them that the cuttings are ready for pick-up.

7. Cuttings will be processed by the Minnesota Geological Survey and a geologic log will be sent gratis to the driller.

References

1. Anon., 1971, Nov.-Dec., Basic geology...Another valuable business asset: The Johnson Driller's Jour., p. 4-7.

2. Ballentine, R. K. et al, 1972, Subsurface pollution problems in the United States: U. S. Environ. Protection Agency Tech. Studies Report TS-00-72-02, 24 p.

3. Twin City Geologists, 1972, Recommendations for the improvement of Minnesota's subsurface geologic information system: 17 p.

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