

Baseline Water Quality of Minnesota's Principal Aquifers: Region 3, Northwest Minnesota

GWMAP, March 1999

What was the baseline study?

Between 1992 and 1996, the Minnesota Pollution Control Agency's (MPCA) Ground Water Monitoring and Assessment Program (GWMAP) sampled 954 primarily domestic wells across Minnesota. The goal of this study, called the baseline study, was to determine ambient water quality in Minnesota's principal aquifers.

What parameters were sampled?

Each well was sampled for 48 inorganic chemicals, such as nitrate, chloride, arsenic and metals; 68 volatile organic compounds (VOCs), such as benzene; other parameters, such as pH and temperature; total dissolved solids and total organic carbon. In addition, the water in selected wells was tested for tritium, which is an indicator of water less than 50 years old.

What is Region 3?

The MPCA has divided Minnesota into six regions. Region 3 encompasses the northwestern portion of the state and includes the counties of Becker, Beltrami, Clay, Clearwater, Douglas, Grant, Kittson, Lake of the Woods, Marshall, Mahnomen, Norman, Otter Tail, Pennington, Pope, Red Lake, Roseau, Stevens, Traverse and Wilkin. The regional office is in Detroit Lakes.

How many wells were sampled and in which aquifers?

Between 1993 and 1995, 182 wells were sampled in Region 3. Of these 182 samples, 29 were collected from wells completed in surficial sand and gravel aquifers, 148 were collected from wells completed in buried confined sand and gravel aquifers, and five were collected from wells completed in Cretaceous aquifers.

What is the quality of ground water in Region 3?

Median concentrations of most chemicals in sand and gravel aquifers were slightly higher than concentrations in similar aquifers statewide. Iron and sulfate were much higher. Concentrations of most dissolved chemicals were much higher in the Cretaceous aquifers than in the drift aquifers. The concentrations of most dissolved chemicals in the Cretaceous aquifers of Region 3 were higher than in Cretaceous aquifers statewide. Concentrations of most dissolved solids were highest in Cretaceous aquifers, intermediate in buried drift aquifers and lowest in surficial aquifers. The number of exceedances of drinking water criteria are shown in the table on page 2 of this fact sheet. Two factors control ground water quality in Region 3. The first is the presence of Cretaceous bedrock.





Water quality of the Cretaceous aquifer is poor. Overlying sand and gravel aquifers are impacted by water flowing upward from the Cretaceous deposits. In areas where Cretaceous bedrock occurs, boron concentrations are very high. The second factor is related to location. Arsenic concentrations are very high in buried sand and gravel aquifers along

stagnation moraines. The source of the arsenic is uncertain, but arsenic concentrations appear to be higher in certain types of till deposits. VOCs were found in nine (4.9 percent) of the wells. The primary VOC was chloroform, which is associated with well disinfection. All VOC concentrations were below drinking water criteria.

Parameter	Number of exceedances of drinking criteria		
	Cretaceous	Buried sand and gravel	Surficial sand and gravel
Arsenic (As)	0	6	0
Barium (Ba)	0	0	1
Boron (B)	5	12	0
Manganese (Mn)	0	1	0
Molybdenum (Mo)	1	0	0
Nitrate (NO ₃)	0	0	1
Selenium (Se)	0	1	1

What are the primary research needs in Region 3?

The primary research needs for Region 3 include:

1. identifying and mapping important surficial aquifers, particularly those found in stagnation moraines;
2. obtaining a better understanding of the relationship between surface water and ground water in the stagnation moraine areas;
3. evaluating the distribution of arsenic in buried drift aquifers and
4. determining the extent of Cretaceous aquifers.

What are the primary monitoring needs for Region 3?

Monitoring needs for Region 3 include:

1. collecting an additional 20 samples from the Cretaceous aquifers and analyzing the data to establish background concentrations;

2. establishing ambient monitoring networks in surficial aquifers that are used for municipal supply; and
3. establishing sampling, data-management and data-analysis protocol.

What is the role of GWMAP in addressing these research and monitoring needs?

GWMAP discontinued baseline sampling in 1997. We feel the emerging ground water issues are identifying aquifer and regional water quality as impacted by human activity, assessing the effectiveness of environmental policies and programs, and establishing long-term monitoring networks to determine whether water quality is changing in response to human activity. We will strive to work with other ground water programs that deal directly with ground water problems and effectiveness monitoring, and attempt to secure funding for establishing long-term monitoring