



# WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

## U.S. GEOLOGICAL SURVEY GROUND-WATER STUDIES IN MINNESOTA

### GROUND-WATER ISSUES

Nearly 700 million gallons of ground water are withdrawn every day in Minnesota, mostly for public supply, irrigation, and domestic and commercial use. About 94 percent of the public water-supply systems in the State use ground water and 75 percent of all Minnesotans obtain their domestic supplies from ground water. The major issues related to this important resource in Minnesota are:

- Availability of ground water and effects of developing water supplies from wells in buried-drift aquifers,
- Ground-water contamination from hazardous wastes, and
- Effects of land use on ground-water quality.

### U.S. GEOLOGICAL SURVEY PROGRAMS

The U.S. Geological Survey (USGS), established in 1879, is the principal source of scientific and technical expertise in the earth sciences within the Federal government. USGS activities include research and services in the fields of geology, hydrology, and cartography. The mission of the Water Resources Division of the USGS is to develop and disseminate scientific information on the Nation's water resources. The activities of the Water Resources Division in Minnesota are conducted by scientists, technicians, and support staff in offices in St. Paul, Grand Rapids, and Montevideo.

Hydrologic-data stations are maintained at selected locations throughout Minnesota to record stream discharge and stage, reservoir and lake storage, ground-water levels, well and spring discharge, and the quality of surface and ground water. Water-resources data are stored in the USGS National Water-Data Storage and Retrieval System data base. These data are used by water planners and others involved in making decisions that affect Minnesota's water resources.

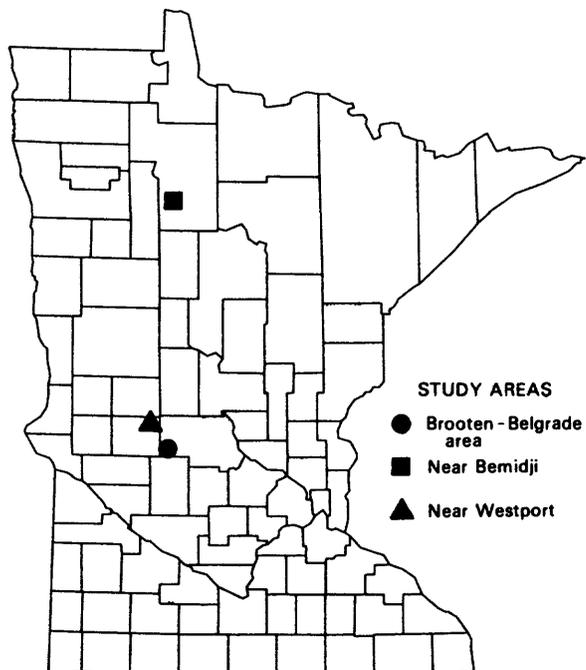
During 1987, the USGS, in cooperation with the Minnesota Department of Natural Resources (DNR), maintained a network of 170 observation wells in the State to measure fluctuations in water levels. These water-level measurements are used to evaluate changes in the amount of water stored in the 14 principal aquifers in the State. Used in conjunction with data on water use, water-level measurements also are useful in evaluating the effects of development on ground-water availability.

The USGS has conducted about 150 hydrologic investigations in Minnesota. These investigations include the preparation of a series of Hydrologic Atlases that summarize information on ground water, surface water, and water quality in each of the principal basins in the State. Results of investigations also

include detailed reports on ground-water availability and ground-water quality in most of the heavily irrigated parts of the State. Examples of three investigations designed to address specific ground-water issues in Minnesota are given below.

### Ground-water Availability from Confined Aquifers in the Brooten-Belgrade Area

Withdrawals of ground water from confined aquifers in western Minnesota have increased dramatically since 1976. State and local water-management agencies are concerned about the effects of rapid development of ground water on the long-term yields of wells, water levels, and interference between wells. In cooperation with the DNR, the USGS is studying (1) The areal extent, thickness, and hydraulic properties of confined aquifers in the area, (2) the vertical hydraulic connection between surficial and confined aquifers, (3) the long-term yield of wells in the confined aquifers, (4) the effects of continued development on water levels and streamflow, and (5) the chemical suitability of the water for irrigation and for public and domestic supplies.



## Crude-oil Contamination of Ground Water near Bemidji

About 10,000 barrels of crude oil spilled from a ruptured high-pressure pipeline in a sparsely populated area near Bemidji in August 1979. During clean up, 6,400 barrels were recovered and some oil was burned off. Spilled petroleum products contain toxic organic compounds which are a major source of ground-water contamination; about 40 percent of crude oil is composed of aromatic hydrocarbons. Proposed State standards for concentrations of aromatic hydrocarbons in potable water are as low as 2.8 parts per trillion. The USGS is conducting research at the spill site to obtain a more complete understanding of the mobilization, transport, and fate of petroleum derivatives in near-surface ground-water systems and to develop predictive models of contaminant transport. Results of the research indicate that biodegradation and volatilization are important controls on migration and fate of the contaminants. Research is continuing on the migration and fate of individual organic compounds. Results of these studies will be helpful to the Minnesota Pollution Control Agency when future spills occur.

## Effects of Agricultural Practices on Quality of Ground Water in Sand-Plain Aquifers Near Westport

Regional studies in sand-plain areas of Minnesota indicate that increased concentrations of nitrate, chloride, sulfate, and triazine herbicides in ground water commonly are found beneath and downgradient from cultivated fields. Not known, however, is how these elevated concentrations relate to the timing and rate of application of fertilizers and herbicides, to precipitation and irrigation, or to local tillage practices. The USGS, in cooperation with the University of Minnesota, is studying the fate and persistence of nitrate and specific herbicides as they move from the land surface, through the unsaturated zone, and into the ground-water system. The study site is the Rosholt Research Farm near Westport, which overlies a sand-plain aquifer typical of the central and western parts of the State. Corn or soybeans will be planted on one-acre plots and farmed, using a variety of carefully controlled tillage practices and fertilizer and herbicide applications. The movement of water, fertilizers, and herbicides will be monitored to improve the understanding of processes that control migration and fate of agricultural chemicals in ground-water systems.

## GROUND-WATER MANAGEMENT

Most of the responsibility for management of ground water and its quality in Minnesota rests with three agencies—the DNR, the Department of Health, and the Pollution Control Agency. The DNR is responsible for control of water appropriations, which can be affected by water quality; the Department of Health is responsible for health-related and domestic-supply matters;

and the Pollution Control Agency is responsible for water quality and pollution control. The State's goal in managing the ground-water resource is to assure an adequate supply of sufficient quality to meet reasonable demands for use. During fiscal year 1987, the following Federal, State, and local agencies entered into interagency or cooperative agreements with the USGS to conduct ground-water investigations in Minnesota.

Beltrami County Soil and Water Conservation District  
City of Minneapolis  
City of Rochester  
Fond Du Lac Indian Reservation  
Leech Lake Indian Reservation  
Minnesota Department of Natural Resources  
Red Lake Indian Reservation  
U.S. Environmental Protection Agency  
University of Minnesota  
White Earth Indian Reservation

## SELECTED REFERENCES

- Bruemmer, L.B., and Clark, T.P., 1984, Ground water in Minnesota: St. Paul, Minn., Minnesota Pollution Control Agency and Minnesota State Planning Agency, 64 p.
- Delin, G.N., 1986, Hydrogeology of confined-drift aquifers near the Pomme de Terre and Chippewa Rivers, western Minnesota: U.S. Geological Survey Water-Resources Investigations Report 86-4098, 90 p.
- Hult, M.F., and others, 1987, Movement and fate of crude-oil contaminants in the subsurface environment at Bemidji, Minnesota, Chapter C in U.S. Geological Survey program on toxic waste—ground-water contamination, Proceedings of the third technical meeting, Pensacola, Fla., Franks, B.F., ed.: U.S. Geological Survey Open-File Report 87-109, p. C1-C40.
- U.S. Geological Survey, 1984, National water summary 1983—Hydrologic events and issues: U.S. Geological Survey Water-Supply Paper 2250, 243 p.
- \_\_\_\_\_, 1985, National water summary 1984—Hydrologic events, selected water-quality trends, and ground-water resources: U.S. Geological Survey Water-Supply Paper 2275, 467 p.

Information on technical reports and data related to ground water in Minnesota can be obtained from:

District Chief  
U.S. Geological Survey  
Water Resources Division  
702 Post Office Building  
St. Paul, Minnesota 55101

Director  
Water Resources Research Center  
866 Biological Sciences Center  
1445 Gortner Avenue  
St. Paul, Minnesota 55108

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