



# WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

## U.S. GEOLOGICAL SURVEY GROUND-WATER INVESTIGATIONS IN MICHIGAN

### GROUND-WATER ISSUES

Ground water, from both glacial and bedrock deposits, supplies almost 35 percent of Michigan's population, and virtually all domestic water supplies. In general, Michigan's ground-water quality is suitable for most uses; however, ground water has been contaminated at more than 700 locations, and many more sites have the potential for ground-water contamination. Some of the major issues related to ground water in Michigan are:

- Contamination by hazardous substances,
- Effects of land use on water quality, and
- Decreasing supplies.

### U.S. GEOLOGICAL SURVEY PROGRAMS

The U.S. Geological Survey (USGS), established in 1879, is the Nation's principal earth science agency. USGS activities include research and data collection 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. In Michigan, the activities of the Water Resources Division are conducted by scientists, technicians, and support staff in offices in Lansing, Grayling, and Escanaba.

Hydrologic-data stations are maintained at selected locations throughout Michigan to record stream discharge and stage, reservoir and lake storage, ground-water levels, and water-quality information. 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 decisions concerning Michigan's water resources.

During 1987, the USGS, in cooperation with Federal, State, and local agencies, maintained a network of 112 observation wells in Michigan to monitor fluctuations of water levels. Water-level measurements are used to monitor changes in ground-water storage and provide data for ground-water investigations.

The USGS has conducted more than 75 hydrologic investigations in Michigan. During fiscal year 1987, the USGS performed work for 47 Federal, State, and local agencies, including studies of ground-water quality and quantity. These investigations provide information needed to answer questions concerning Michigan's ground water. Some studies provide information on multistate and national hydrologic problems as well. Four examples of ground-water studies by the USGS that address specific ground-water issues in Michigan are discussed in the following sections.

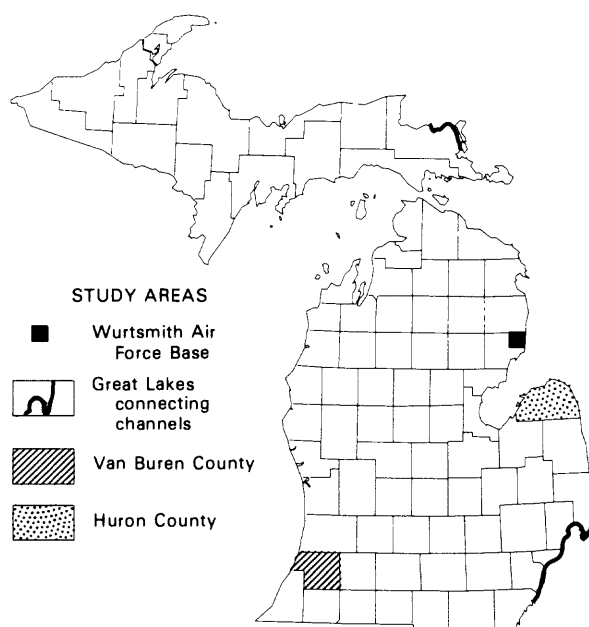
#### Ground-Water Contamination at Wurtsmith Air Force Base

Ground water at Wurtsmith Air Force Base (WAFB), in the northeastern lower peninsula of Michigan, has been contaminated by organic compounds. These compounds were detected in the

WAFB drinking water-supply system in 1977. Since then, the USGS has conducted several studies at the WAFB, in cooperation with the U.S. Air Force (USAF). These studies defined the geology and hydrology of the WAFB and located several different areas of contamination. Fuel spills, leaking underground-storage tanks, and landfills were found to be the sources of organic compounds contaminating the water. After the sources had been located and the contaminant plumes delineated, a computer model was developed to determine the most suitable sites for the installation of purge wells. Once installed, these purge wells prevented movement of contaminants to water-supply wells and off-base domestic wells. Subsequent studies identified previously undetected contamination, and confirmed that the original purge systems were working successfully. The computer model was refined and additional purge wells were installed. Continued monitoring of water-supply wells indicated that the WAFB supply was free of contaminants. The results of the studies are being used by the USAF to manage the limited potable-water supplies of WAFB and as a guide in conducting remedial actions.

#### Movement of Ground-Water Contaminants to Great Lakes Connecting Channels

In cooperation with the U.S. Environmental Protection Agency (EPA), the USGS is participating in a joint United States-Canadian project examining many environmental aspects of the



channels connecting the Great Lakes. The study is being conducted in the St. Marys River area in the northeastern upper peninsula and along the St. Clair-Detroit River reach in the southeastern corner of the lower peninsula. The rate and direction of movement of ground water in these areas has not been defined, nor has the transport of contaminants by ground water been investigated. Of principal concern are more than 200 waste sites that lie within 12 miles of the channels. Toxic materials are found at many of these sites and, at some locations, contaminants have entered the ground-water system. The results will be used to identify areas where significant problems exist, and as a guide to future remedial actions by State and Federal agencies responsible for the management and protection of the Great Lakes.

### Land Use and Ground Water, Van Buren County

In Van Buren County, as in other counties in southwestern Michigan, the amount of ground water used for irrigation has increased rapidly. A major concern has been the effect of agricultural expansion on ground-water quality. The USGS conducted a study, in cooperation with Van Buren County, the Michigan Department of Natural Resources, and the Michigan Department of Agriculture, to determine the relation between ground-water quality and land use. Concentrations of nitrate in the ground water of Van Buren County were found to be significantly higher than in some other areas of Michigan. The highest nitrate concentrations occur in the southern part of the county. In this area, 22 percent of the nitrate concentrations exceeded the EPA standard of 10 milligrams per liter for drinking water. In general, nitrate concentrations decrease as the depth of wells increase. Most domestic wells in the county obtain water from glacial deposits at depths ranging from 15 to 160 feet; irrigation wells generally are about 200 feet deep. The major sources of nitrate are fertilizers, animal wastes, and septic-tanks. Southern Van Buren County receives about 25 percent more fertilizer than the northern part. Fertilizer applications contributed more than 70 percent of the total nitrogen input to the ground-water system. Information developed in this investigation is being used by county planners and State officials responsible for protecting ground-water resources.

### Ground-Water Availability, Huron County

Ground water of suitable quality is in short supply in Huron County, located in the tip of the "thumb" of the State. Ordinances have been passed in some townships that restrict the amount of water that can be pumped from wells. Ground water generally is salty in the eastern part of the county; elsewhere in the county, the silty glacial deposits yield only small amounts of freshwater. Adequate quantities of freshwater can be obtained in certain areas from bedrock. There is, however, some concern that large withdrawals by irrigators could cause underlying salty water to migrate upwards. A study by the USGS will define the hydrologic, geologic, and cultural factors that influence the quantity and quality of ground water. Data obtained during the study will be used by Huron County officials to plan future development, and as an aid in determining whether a costly withdrawal and distribution system that uses water from Lake Huron will be necessary.

### GROUND-WATER MANAGEMENT

The principal State agencies responsible for ground-water management in Michigan are the Department of Public Health and the Department of Natural Resources. The Department of

Public Health monitors the quality of all public drinking-water supplies. The Department of Natural Resources, Waste Management Division, regulates facilities that could have an effect on ground water. The Department of Natural Resources, Environmental Response Division, is responsible for remedial actions at contamination sites. Both Departments use the ground-water data and the results of studies provided by the USGS. During 1987, the following Federal, State, and local agencies supported ground-water investigations by the USGS in Michigan:

Cities of Ann Arbor, Battle Creek, Cadillac, Clare, Coldwater, Flint, Imlay City, Kalamazoo, Lansing, Mason, Norway, Portage, and Ypsilanti  
 Counties of Genesee, Huron, Kalamazoo, Macomb, and Wayne  
 Huron-Clinton Metropolitan Authority  
 Michigan Department of Agriculture  
 Michigan Department of Natural Resources  
 Geological Survey Division  
 Land and Water Management Division  
 Michigan Department of Transportation  
 Oakland County Drain Commission  
 Otsego County Road Commission  
 U.S. Air Force  
 U.S. Army Corps of Engineers  
 U.S. Coast Guard  
 U.S. Environmental Protection Agency  
 U.S. National Park Service  
 Village of Elsie

### SELECTED REFERENCES

- Cummings, T.R., 1980, Chemical and physical characteristics of natural ground waters in Michigan—A preliminary report: U.S. Geological Survey Open-File Report 80-953, 34 p.  
 Cummings, T.R., Twenter, F.R., and Holtschlag, D.J., 1984, Hydrology and land use in Van Buren County, Michigan: U.S. Geological Survey Water-Resources Investigations Report 84-4112, 124 p.  
 Cummings, T.R., and Twenter, F.R., 1986, Assessment of ground-water contamination at Wurtsmith Air Force Base, Michigan, 1982-85: U.S. Geological Survey Water-Resources Investigations Report 86-4188, 120 p.  
 Grannemann, N.G., and Twenter, F.R., 1985, Geohydrology and ground-water flow at Verona Well Field, Battle Creek, Michigan: U.S. Geological Survey Water-Resources Investigations Report 85-4056, 54 p.  
 Spicer, T.J., compiler, 1985, Water-resources activities in Michigan, 1985: U.S. Geological Survey Open-File Report 85-566, 67 p.  
 Stark, J.R., Cummings, T.R., and Twenter, F.R., 1983, Ground-water contamination at Wurtsmith Air Force Base, Michigan: U.S. Geological Survey Water-Resources Investigations Report 83-4002, 93 p.  
 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 Michigan can be obtained from:

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