Water-Resources Activities of the U.S. Geological Survey in Ohio, 2002

A century of water science

In November 1898, the U.S. Geological Survey (USGS) established five streamflow-gaging stations in Ohio, thus marking the first USGS involvement in water-resources investigations in the State. These stations were established in cooperation with the Ohio Board of Health to provide data needed to safeguard some of the State's first modern drinking-water supplies. More than 100 years later, the USGS is still cooperating with agencies in Ohio to provide water data needed for hazard protection and wise, safe use of the State's water resources. Certain tax-supported agencies—including the U.S. Army Corps of Engineers, the Ohio Department of Natural Resources, the Miami Conservancy District, and the City of Columbus, Division of Water—have been partners with the USGS for over 20 years.

From the small beginning of five stations, the hydrologic surveillance network operated by the USGS and cooperating agencies has grown to about 120 streamflow-gaging stations and more than 100 ground-water observation wells. Added to this network are hundreds of miscellaneous surface- and ground-water sites where short-term data have been collected for special purposes over the years.

A mission-driven program

The work of the USGS in Ohio is driven by the overall mission of the USGS. The USGS serves the Nation by providing reliable scientific information to

- describe and understand the Earth,
- minimize loss of life and property from natural disasters,
- manage water, biological, energy, and mineral resources, and
- enhance and protect our quality of life.

Throughout the Nation, the USGS works to constantly improve the base of knowledge on resource availability and potential natural hazards. The active involvement of the USGS in Ohio reflects the State's importance in the national water picture, as well as the willingness of State and local agencies to conduct cooperative water-resource investigations.

Of the many natural resources available, water has been the most crucial to Ohio's growth and economic status. Wise use of Ohio water resources for transportation, water supply, and recreation requires the kinds of data that the USGS and its partner agencies provide.

Water is also Ohio's greatest natural hazard. Nearly every year, floods cost the State thousands or even millions of dollars in damages. Data collected by the USGS have helped reduce flood-related death and damage over the years. Automated streamflow-gaging stations provide early warning of rapid floodwater rises on major streams, whereas long-term data collection and post-flood investigations at hard-hit sites provide statistical information needed to determine flood probabilities and help other agencies delineate flood-prone areas.

Program highlights

The short discussions on the inside pages highlight some of the most popular and important aspects of USGS water-resources activities in Ohio. Details on the rest of our program can be obtained from the selected contacts listed on the back page.

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Internet-accessible stream data

During the past few years, a major thrust in upgrading the Ohio stream-gaging network has been the linking of stream-stage sensing devices to satellite transmitters, which ultimately feed data to a USGS World Wide Web site. This enables those with Internet access to view recent stage or streamflow data—normally, within 4 hours of data collection—for more than 100 stream stations in Ohio. Round-the-clock availability of this "real-time" data has been a great benefit for water managers—particularly during floods—but it has also been of benefit for recreationalists who enjoy canoeing, kayaking, and fishing on Ohio's streams.

Historical data are also available by way of the World Wide Web in viewable and downloadable formats.

Flood and drought studies

Although science cannot yet prevent floods and droughts, USGS scientists provide essential information so that water planners and managers can mitigate or prevent some of the damage caused by these hydrologic hazards.

By analyzing long-term streamflow records, USGS scientists have developed statistical techniques for estimating the magnitude and frequency of flooding on streams in urban and rural areas. During floods, USGS field personnel attempt to make streamflow measurements to help refine the statistical data so that extreme flows are adequately accounted for. In situations where flooding was too sudden or too severe for measurements to be made, USGS scientists examine the flooded area after the fact to estimate maximum streamflow. Currently, several flood-related studies are in progress in Ohio, including those on modeling stormwater runoff in Summit County; predicting flood profiles in Lorain County, the City of Aurora, and the Village of Chagrin Falls; and examining effects of high flows on streambed scour around bridge piers.

Droughts, although not as sudden as floods, can be catastrophic to regional economies when prolonged and severe. With regard to drought-related studies, the USGS has an ongoing project in Ohio to measure low flows of streams to help refine the statistical database for low flows. The USGS has also recently completed an Ohio streamwater storage analysis; the objective was to determine the maximum storage required to support continuous water withdrawals of various magnitudes under drought conditions of various magnitudes for both instream and side-channel reservoirs.

Microbiological water-quality research

The sanitary quality of water for drinking and recreation is crucial to Ohio and the rest of the Nation. A recent addition to the USGS program that addresses water-related public-health concerns is a microbiological laboratory and staff housed in the USGS Columbus, Ohio, office. This laboratory works with the U.S. Environmental Protection Agency and other cooperators to study the quality of national, state, and local water resources and to develop new methods for early detection of harmful microbes in water.

Surface water and ground water are analyzed for various bacteria such as *Clostridium*, enterococci, and *E. coli*. These "indicator bacteria" have been associated with pathogenic (disease-causing) organisms responsible for disease outbreaks from fecal contamination.

In addition to bacteria, the laboratory also tests for viruses in water, including coliphage—a virus that infects *E. coli* and whose presence is an indicator of human pathogenic viruses.

Other analytical procedures also are used to detect human pathogenic viruses, including a procedure by which the virus is filtered out of a water sample, concentrated, ultracentrifuged, and then analyzed through a DNA-based procedure.

Ground-water studies

The USGS and its cooperators have operated a long-term observation-well network since 1938 and have supplemented the basic data derived from this network with numerous special studies. The focus of most special studies is description of regional ground-water characteristics—availability, quality, and flow direction—as background information for water-supply development or ground-water-resource protection. These regional ground-water studies not only help the USGS fill gaps in the national ground-water picture but also provide opportunities for developing and testing new technical and analytical methods for subsurface investigations.

Also part of the USGS ground-water history in Ohio has been a technical and advisory role for the Department of Defense, which continues to seek information on the hydrogeology of military installations and technical solutions for ground-water conservation issues. Currently, ground-water personnel housed in the Columbus office provide technical and programmatic assistance for Air Force bases nationwide.

Recent ground-water studies in Ohio include (1) investigation of complex ground-water/surface-water interactions along the Great Miami River in Cincinnati and along Chapman Creek near Tremont City, (2) analysis of ground-water quality and geochemistry in Geauga County and the Berlin Lake area, (3) creation of a database containing metadata for ground-water information available for Ohio, and (4) mapping of ground-water levels around Mill Creek near Evendale.

National Water-Quality Assessment (NAWQA)

The long-term goals of the NAWQA program are to describe the status and trends in the quality of a large, representative part of the Nation's surface- and ground-water resources. The building blocks of NAWQA are studies of hydrologic systems, called study units, that include parts of many major river basins and aquifer systems. In the NAWQA design, sites visited during one cycle of study will be revisited in future cycles in order to track water-quality trends. Discerning the effects of natural processes and human activities on stream water, ground water, and aquatic organisms is a major focus of NAWQA studies.

Two study-unit investigations are operated from the Columbus office. The Lake Erie-Lake St. Clair Basin (LERI) study unit covers 22,300 square miles across parts of five states. The study unit represents all the streams that flow into Lake Erie and Lake St. Clair from the United States. The Great and Little Miami River Basins (MIAM) study unit covers approximately 7,350 square miles of southwestern Ohio and southeastern Indiana; all streams in these basins ultimately drain into the Ohio River.

The LERI study, established in 1994, completed its first cycle and published its findings. The MIAM study, established in 1997, has finished its intensive data-collection phase, and will spend the next 2 years on data analysis and completion of study reports. In addition, watersheds in the MIAM study area have been combined with those in the White River Basin in Indiana to form a new study unit—the White and Great and Little Miami River Basins (WHMI). The WHMI study unit began work in late 2001 and is one of 42 studies that will be done as part of Cycle II of the NAWQA Program.

Recent publications

The following is a selected list of publications produced by the Ohio District since January 2000. A full "Bibliography of USGS Publications on Geology and Water in Ohio" can be found by way of the Publications link on the Ohio District World Wide Web page. (See Additional Information section.)

Covert, S.A., Haltuch, M., Wilson, T., 2001, What is the Ohio Gap Analysis Program (GAP)?: U.S. Geological Survey Fact Sheet FS-093-01, 4 p.

Debrewer, L.M., Rowe, G.L., Reutter, D.C., Moore, R.C., Hambrook, J.A., and Baker, N.T., 2000, Environmental setting and effects on water quality in the Great and Little Miami River basins, Ohio and Indiana: U.S. Geological Survey Water-Resources Investigations Report 99-4201, 98 p.

Dumouchelle, D.H., 2001, Evaluation of ground-water/surface-water relations, Chapman Creek, west-central Ohio, by means of multiple methods: U.S. Geological Survey Water-Resources Investigations Report 01-4202, 13 p.

Dumouchelle, D.H., Ground-water levels and flow directions in glacial sediments and carbonate bedrock near Tremont City, Ohio, October-November 2000: U.S. Geological Survey Water-Resources Investigations Report 01-4224, scale 1:24,000.

Francy, D.S., Helsel, D.R., and Nally, R.A., 2000, Occurrence and distribution of microbiological indicators in groundwater and stream water: Water Environment Research, v. 72, no. 2, p. 152-161.

Francy, D.S., Myers, D.N., and Helsel, Dennis R., 2000, Microbiological monitoring for the U.S. Geological Survey National Water-Quality Assessment Program: U.S. Geological Survey Water-Resources Investigations Report 00-4018, 34 p.

Hambrook, J.A., and Eberle, Michael, 2000, What makes a healthy environment for native freshwater mussels?: U.S. Geological Survey Fact Sheet 124-00, 4 p.

Jagucki, M.L., and Darner, R.A., 2001, Ground-water quality in Geauga County, Ohio—Review of previous studies, status in 1999, and comparison of 1986 and 1999 data: U.S. Geological Survey Water-Resources Investigations Report 01-4160, 61 p.

Koltun, G.F., 2001, Hydrologic considerations for estimation of storage-capacity requirements of impounding and side-channel reservoirs used for water Supply in Ohio: U.S. Geological Survey Water-Resources Investigations Report 01-4256, 418 p.

Koltun, G.F., and Kunze, A.E., 2002, Trends in selected streamflow and stream-channel characteristics for the Chagrin River at Willoughby, Ohio: U.S. Geological Survey Water-Resources Investigations Report 02-4017, 14 p.

Myers, D.N., and Metzker, K.D., 2000, Status and trends in suspended sediment discharge and conservation tillage in the Maumee River Basin, Michigan, Indiana, and Ohio: U.S. Geological Survey Water-Resources Investigations Report 00-4091, 71 p.

Schalk, C.W., 2000, Descriptions of selected digital spatial data for former Air Force Plant 36, Evendale, Ohio: U.S. Geological Survey Open-File Report 00-91, 39 p.

Shaffer, Kimberly, 2000, The history of stream gaging in Ohio: U.S. Geological Survey Fact Sheet 050-00, 4 p.

Straub, D.E., 2001, Low-flow characteristics of streams in Ohio through water year 1997: U.S. Geological Survey Water-Resources Investigations Report 01-4140, 415 p.

Thomas, M.A., 2000, Ground-water quality and vulnerability to contamination in selected agricultural areas of southeast Michigan, northwestern Ohio, and northeastern Indiana: U.S. Geological Survey Water-Resources Investigations Report 00-4146, 24 p.

Additional information

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