

Kentucky Interagency
Groundwater
Monitoring Network

Annual Report
2003–2004

Kentucky Geological Survey
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Kentucky Interagency Groundwater Monitoring Network:

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September 2004

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Kentucky Interagency Groundwater Monitoring Network: Annual Report 2003–2004

Executive Summary

Recognizing that groundwater is an essential natural resource but is not adequately described throughout the commonwealth, the 1998 Kentucky General Assembly directed the Kentucky Geological Survey to establish a long-term monitoring network that would characterize the quality, quantity, and distribution of Kentucky's groundwater resources. These activities were to be carried out in coordination with an Interagency Technical Advisory Committee on Groundwater. The Kentucky Geological Survey was also charged with annually reporting network activities to the governor's office and the Legislative Research Commission. This report summarizes activities during the 2003–04 State fiscal year.

From July 2003 through June 2004, 17 major data collection programs were under way, and five regional groundwater characterization reports were being prepared. Groundwater information was communicated to the scientific and regulatory communities and to the public through more than 30 presentations, publications, and postings on Web sites. Quarterly meetings of the Interagency Technical Advisory Committee provided an opportunity to coordinate groundwater-related efforts and share information among agencies. Exchange of groundwater data, including electronic transfer between State and university databases, has proceeded through close cooperation between the Kentucky Division of Water and the Kentucky Geological Survey.

The Kentucky Interagency Groundwater Monitoring Network has now been in existence for 6 years. During this time, significant progress has been made toward collecting and reporting

groundwater quality data and improving interagency cooperation. Important work remains, however. Among the major issues still to be addressed are (1) developing new long-term sampling sites in areas where there are no existing wells or springs, (2) optimizing the sampling frequency to account for natural variations in different groundwater flow systems throughout the state, (3) determining how large an area is represented by a sample at a particular well or spring, (4) investigating the existence of pathogens such as bacteria in regional groundwater flow systems, (5) standardizing reporting information about sampling methods, field measurements, and sample-site descriptions, (6) developing a water-level monitoring network to track long-term land use and climate effects on groundwater supplies, (7) standardizing laboratory reporting procedures, (8) facilitating electronic data sharing among agencies that work with groundwater measurement, and (9) providing public access to groundwater quality data via interactive Web sites.

The Kentucky Interagency Groundwater Monitoring Network will continue to address these issues. Significant advances are difficult under current staff and funding conditions, however. Most of the progress in the past has been the result of substantial agency commitment of State executive budget funds, one-time grants to the Kentucky Division of Water's Groundwater Branch and the Kentucky Geological Survey, and voluntary cooperation between agencies. Implementing an effective groundwater monitoring plan will require sustained, recurring funding to maintain the long-term effort.

Introduction

Kentucky groundwater is used extensively for domestic, agricultural, commercial, and industrial purposes. Because of its interactions with rivers, lakes, and wetlands, groundwater is also essential to the health of surface-water ecosystems. Monitoring the quality of this critical resource and protecting it from contamination are important to the future of water resources in the commonwealth and to its citizens.

Information provided by the Kentucky Division of Water indicates that more than 300,000 citizens in private households rely on water from wells and springs for drinking, cooking, and washing. An additional 254 public water systems, serving more than 1.25 million people, rely on groundwater as a source of drinking water. This dependence on groundwater resources will continue into the foreseeable future. Many public water-supply systems are considering switching from surface water to groundwater sources because the required treatment and monitoring are less extensive and less expensive. Currently, the cities of Louisville, Hardinsburg, and Salyersville, and the Greater Fleming Regional Water Supply are either considering switching to groundwater sources or are supplementing surface-water supplies with groundwater. Furthermore, many people who now rely on wells or springs for private domestic water supplies will remain dependent on groundwater because of the cost of extending public water supply systems to rural areas, and because groundwater supplies are more than sufficient in some areas of the commonwealth.

Significant quantities of groundwater are used for commercial and industrial applications, crop irrigation, livestock watering, mining, and thermoelectric power generation. Groundwater also sustains valuable ecosystems by providing base flow to streams, lakes, and wetlands. This is particularly important during droughts such as the one that occurred in 1999. In the absence of precipitation, groundwater base flow is the only natural source of water to maintain stream flow and lake levels, and to preserve riparian and wetland ecosystems.

Recognizing the importance of groundwater, the 1998 Kentucky General Assembly directed the

Kentucky Geological Survey to establish a long-term, interagency monitoring network to characterize the quality, quantity, and distribution of groundwater in Kentucky (Kentucky Revised Statutes [KRS] 151.620 and 151.625). The major goals of the Interagency Groundwater Monitoring Network are to (1) collect groundwater data, (2) characterize groundwater quality, (3) distribute groundwater information, (4) improve coordination between agencies that collect groundwater data, and (5) facilitate sharing of groundwater data (Interagency Technical Advisory Committee on Groundwater, 1996).

The 1998 General Assembly also established an Interagency Technical Advisory Committee on Groundwater to assist the Kentucky Geological Survey in the development, coordination, and implementation of a groundwater monitoring network (KRS 151.629). The following agencies and organizations were asked to appoint a representative to the Interagency Technical Advisory Committee on Groundwater:

- Kentucky Department for Environmental Protection
- Kentucky Department for Natural Resources
- Kentucky Department for Surface Mining Reclamation and Enforcement
- Kentucky Department of Mines and Minerals
- Kentucky Division of Conservation
- Kentucky Division of Environmental Health and Community Safety
- Kentucky Division of Forestry
- Kentucky Division of Pesticide Regulation
- Kentucky Division of Waste Management
- Kentucky Division of Water
- Kentucky Geological Survey
- Kentucky Water Resources Research Institute
- University of Kentucky College of Agriculture
- U.S. Geological Survey, Louisville office

The 1998 legislature directed the Kentucky Geological Survey to provide an annual summary of groundwater monitoring activities to the governor and the Legislative Research Commission. This is the sixth annual report of the Kentucky Interagency Groundwater Monitoring Network. Pre-

vious reports are posted at www.uky.edu/kgs/water/gnet/gnet.htm.

2003–04 Activities and Accomplishments

Brief summaries of work performed by the ITAC agencies during the 2003–04 State fiscal year are given below. Activities are organized to show how the major goals of the network are being addressed. Additional information regarding these projects can be obtained by contacting the responsible agency.

Groundwater Data Collection

Collecting and analyzing water samples from wells and springs, measuring water levels in wells, and mapping recharge and discharge areas of karst systems provide the basic data needed to determine current groundwater quality, detect changes

in quality over time, and evaluate hydrogeologic hazards. Two types of data collection programs were conducted during the reporting period. State-wide and regional monitoring programs describe the quality of groundwater that is not affected by point-source contamination and determine whether nonpoint-source chemicals such as sewage, pesticides, fertilizers, and volatile organic compounds have had an impact on the groundwater system. These regional studies are conducted in basin management units (Fig. 1) established by the Kentucky Division of Water (1997). Site-specific studies evaluate the effects of particular land uses or unique hydrologic conditions, or the quality of unregulated public water supplies such as roadside springs.

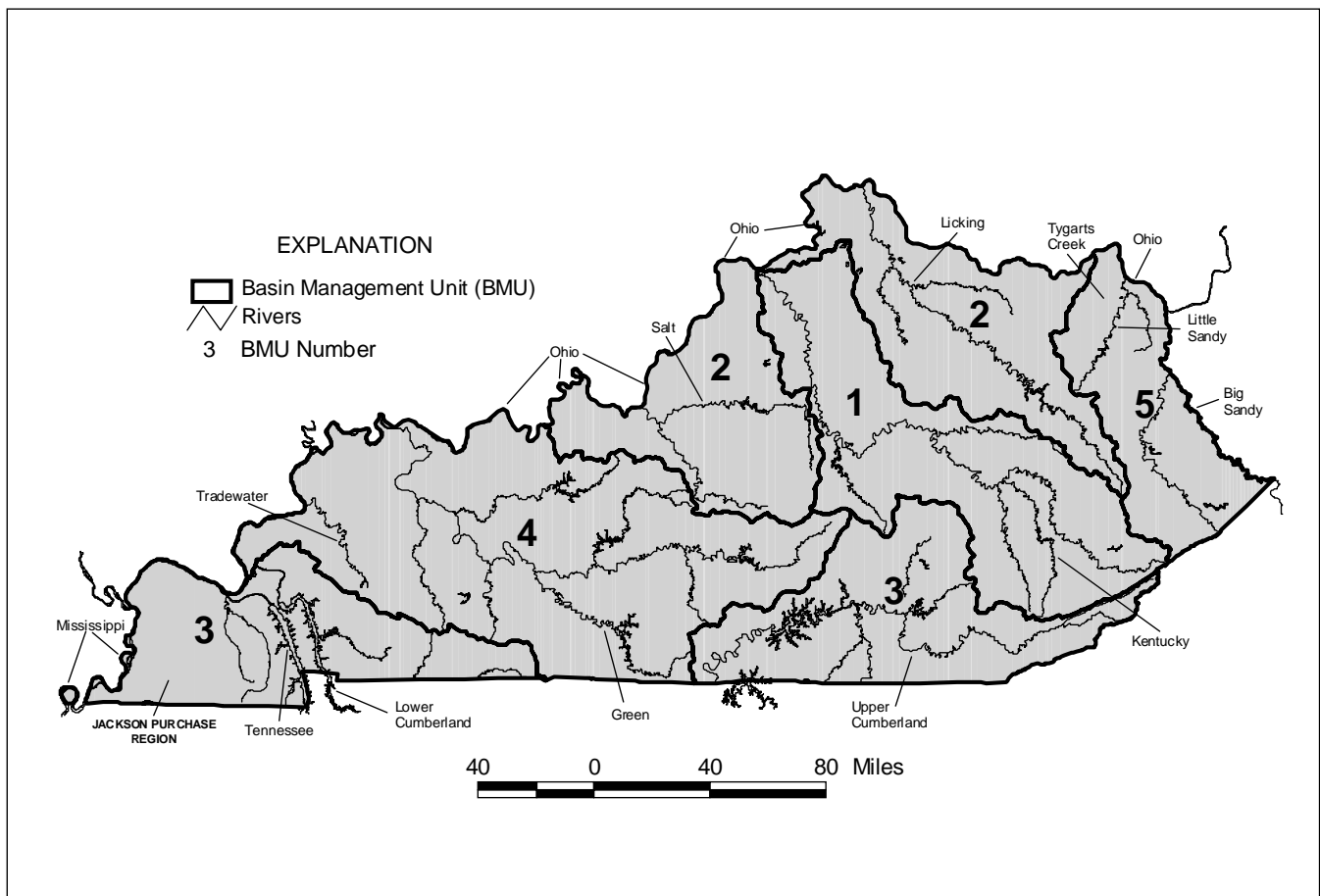


Figure 1. Major rivers and basin management units in Kentucky.

Monitoring Statewide Ambient Groundwater Quality

The Division of Water collected and analyzed more than 400 groundwater samples from the approximately 120 wells and springs that make up the ambient groundwater monitoring program. Most of these sites were sampled quarterly. The Groundwater Branch also conducted additional assessment monitoring to support targeted watershed management efforts. Temperature, pH, conductivity, major and minor solutes, metals, nutrients, pesticides, and synthetic and volatile organic chemicals were analyzed. These analyses also provide information for the Division of Water's well-head protection program and public water-supply systems. Analytical results are entered into the Division of Water database and copied to the Kentucky Groundwater Data Repository.

Expanded Groundwater Monitoring for Nonpoint-Source Pollution Assessment in the Kentucky River Watershed (Basin Management Unit 1)

The Division of Water is currently sampling approximately 30 wells and springs quarterly in the Kentucky River watershed. Expanded groundwater monitoring in this watershed was first conducted 5 years ago. Based on results from that study, current efforts are focused in the watershed of the South Fork of Elkhorn Creek. Samples are being analyzed for a full suite of water properties, inorganic constituents (including metals), nutrients, pesticides, and volatile organic compounds. This work was funded by a one-time grant from the U.S. Environmental Protection Agency, administered by the Division of Water's Nonpoint Source Section.

Expanded Groundwater Monitoring for Nonpoint-Source Pollution Assessment in the Salt River and Licking River Watersheds (Basin Management Unit 2)

The Division of Water is presently sampling approximately 30 wells and springs quarterly in basin management unit 2 (Salt and Licking River watersheds). Expanded groundwater monitoring was first conducted in this basin 6 years ago. Based on results from that study, the present effort is focused on the Beargrass and Sinking Creek water-

sheds of the Salt River Basin. Samples are being analyzed for a full suite of water properties, inorganic constituents (including metals), nutrients, pesticides, and volatile organic compounds. This work was funded by a one-time grant from the U.S. Environmental Protection Agency, administered by the Division of Water's Nonpoint Source Section.

Expanded Groundwater Monitoring for Nonpoint-Source Pollution Assessment in the Big Sandy River, Little Sandy River, and Tygarts Creek Watersheds (Basin Management Unit 5)

The Kentucky Geological Survey, in cooperation with the Division of Water, sampled 33 wells and springs quarterly in basin management unit 5 between fall 2002 and summer 2003. Samples were analyzed for general water properties, major and minor solutes, metals, nutrients, pesticides, and synthetic and volatile organic chemicals. Analytical results were added to the Division of Water's groundwater-quality database and copied to the Kentucky Groundwater Data Repository. This work was funded by a one-time grant from the U.S. Environmental Protection Agency, administered by the Division of Water's Nonpoint Source Section.

Evaluating High-Yield Well Potential in the Eastern Kentucky Coal Field

The Kentucky Geological Survey has begun study of the hydrologic properties of the Corbin Sandstone in Magoffin County to help the city of Salyersville locate a field of high-yield wells to supplement the city's water supply. Water samples were collected from four wells for analysis, and a 24-hour pump test was performed to determine hydrologic properties of the sandstone. Additional sampling and well tests will be performed in 2004. This work is partially funded by the Kentucky Infrastructure Authority.

Assessing Water-Quality Effects of Coal Mining in Eastern Kentucky

The Kentucky Geological Survey continued to gather and compile water-quality, flow, discharge, and rainfall data from monitoring sites at the Star Fire Mine in Perry, Breathitt, and Knott

Counties. This is a continuation of work that started more than 10 years ago, and so provides long-term monitoring of groundwater at a large coal-mining operation.

Monitoring Impacts of the University of Kentucky Animal Research Center on Surface-Water and Groundwater Quality

The Kentucky Geological Survey and the University of Kentucky Department of Biosystems and Agricultural Engineering are monitoring streams, springs, and wells at the UK Animal Research Center in Woodford County to determine how farm practices affect water quality. This work is funded by Kentucky Senate Bill SB-271, administered through the University of Kentucky College of Agriculture.

Assessing Pesticides, Nutrients, and Suspended Sediments in the Little River Basin

The Kentucky Department of Agriculture and the U.S. Geological Survey's Kentucky District office are evaluating nutrients, pesticides, and suspended sediment in the Little River watershed, Crittenden and Trigg Counties. Major objectives of this project are to describe the seasonal and spatial variability of nutrients, pesticides, and suspended sediment, and relate nutrient, pesticide, and suspended sediment concentrations to streamflow conditions and varying land-use activities, including pesticide use. During 2003, 10 herbicides, seven insecticides, and three fungicides were detected in water samples collected from nine sites in the Little River watershed. Other cooperators contributing to the Sinking Creek Basin project include the Kentucky Department of Fish and Wildlife Resources, the Sinking Creek Watershed Council, the Salt River Basin Team, the Salt River Watershed Watch, the U.S. Department of Agriculture-Natural Resources Conservation Service, and the U.S. Army Corps of Engineers in Louisville. This work is funded by a one-time grant from the U.S. Environmental Protection Agency, administered by the Division of Water's Nonpoint Source Section.

Mapping Cover-Collapse Sinkholes in Karst Regions

The Kentucky Geological Survey has completed data compilation and analysis for a pilot study to determine the frequency of occurrence of cover-collapse sinkholes. Potential cover-collapse features were identified by comparing aerial photography from 1971 of an area in Christian County with a second set of images of the same area taken in 1991. Each suspected cover-collapse site was then visited to determine whether it was in fact a cover-collapse sinkhole.

Protecting Community Water Quality for Georgetown, Ky.

The city of Georgetown depends on Royal Spring for its water. The groundwater basin for this spring receives drainage from southern Scott County and northern Fayette County, which are largely urbanized areas. With funding from the Georgetown Water and Sewer Service, the Kentucky Geological Survey conducted dye traces and performed surface-runoff modeling to develop a set of maps that show the time it would take a pollutant to reach Royal Spring, and thus reach the intakes for the water treatment plant in Georgetown.

Investigating Groundwater Contamination from Abandoned Feedlots

Kentucky Geological Survey hydrogeologists previously discovered that a well in Henderson County, western Kentucky, produced groundwater that contained 4.5 times the U.S. Environmental Protection Agency's maximum contaminant level of nitrate-nitrogen. Investigations showed that an abandoned feedlot was the source of the nitrate. A remediation plan was developed and implemented. Subsequent testing has shown that nitrate-nitrogen levels in both groundwater and the soil are decreasing. This work is funded by Kentucky Senate Bill SB-271, administered through the University of Kentucky College of Agriculture.

Measuring Nitrate Contamination of Domestic Wells

More than 75 percent of residents in the Jackson Purchase Region rely on groundwater. Many private wells there yield water with nitrate-nitro-

gen concentrations that exceed the U.S. Environmental Protection Agency's maximum contaminant level. The Kentucky Geological Survey completed land-use and well-construction surveys to determine the possible sources of the elevated nitrate concentrations, sampled wells, and analyzed groundwater from domestic wells to determine if they were leaking. Results showed that 11 of 17 wells that had a diameter of 24 inches leaked, but only two of 28 wells with a diameter of 4 inches or less leaked. Continuing work is focusing on the role of 24-inch-diameter wells on shallow groundwater quality in the Jackson Purchase Region. This work is funded by Kentucky Senate Bill SB-271, administered through the University of Kentucky College of Agriculture.

Evaluating Water Quality at Kentucky Army National Guard Training Facilities

The Kentucky Geological Survey is assisting the Kentucky Department of Military Affairs in the assessment of water quality at Kentucky Army National Guard training facilities in Muhlenberg, Powell, and Knox Counties. Research staff assessed the impact of current activities on surface water at the site as well as the impact on water exiting from each site, and measured groundwater quality at the Wendell H. Ford site in Muhlenberg County. Where applicable, the Kentucky Geological Survey developed long-term plans to monitor surface and groundwater. This work is funded by the Kentucky Department of Military Affairs.

Monitoring Water Levels at Fort Knox

The U.S. Geological Survey, in cooperation with the U.S. Army Corps of Engineers in Louisville, monitored groundwater levels in the public-supply well field for the Fort Knox Military Reservation, Hardin County, to support development of a numerical groundwater-flow and solute-transport model. Three wells in the field are equipped with recorders to measure continuous changes in groundwater levels. In addition, water levels are measured quarterly in 22 wells in the field and nearby West Point, Ky. Nine wells in this area were sampled for chloride concentrations in October 2003 and June 2004.

Monitoring Groundwater in Ohio River Alluvium

The U.S. Geological Survey, in cooperation with the Louisville Water Company, monitored changes in groundwater conditions in the Ohio River alluvial aquifer as a result of withdrawal of 16 million gallons per day by a horizontal collector well located near the Zorn Avenue water treatment plant. An observation network of 31 wells, located along the river from downtown Louisville to Prospect, Ky., is being used to track changes over time in groundwater levels in the alluvium. Activities also include measuring changes in the potentiometric surface in the alluvial aquifer beneath the Ohio River, and tests to determine the rate at which surface water infiltrates the river bed. Currently, 11 wells are equipped with continuous recorders in order to monitor water-level changes during the start-up period for the collector well. In March 2004, two observation wells were also sampled for metals and radon.

Monitoring Groundwater at a Superfund Site

The U.S. Geological Survey, in cooperation with the U.S. Environmental Protection Agency Region 4 and the Environmental and Public Protection Cabinet's Division of Waste Management, conducted hydrologic monitoring and groundwater-quality sampling at the former Distler Brickyard Superfund Site in Hardin County. The present focus of activities at the site is to determine the effectiveness of pilot-scale bioremediation being implemented by private consultants. The U.S. Geological Survey provided assistance by collecting continuous water-level data from seven on-site monitoring wells, soil-moisture data, and rainfall data. Ten monitoring wells (eight on-site, two off-site) were sampled twice for volatile organics and other water-quality indicators. Monitoring and sampling activities at the site were suspended indefinitely in February 2004 because of lack of funding.

Compiling Historical Groundwater-Level Records

The U.S. Geological Survey began to compile and synthesize historical water-level data obtained from previously monitored observation wells, and use these data to generate statistical hydrographs

Cumberland, and Tennessee River Basins, and the Jackson Purchase Region. In cooperation with the Division of Water's Watershed Management Framework, the Kentucky Geological Survey sampled approximately 30 wells and springs quarterly, and the samples were analyzed for major and minor inorganic chemicals, nutrients, pesticides, and volatile organic chemicals. These wells and springs were in addition to the sites normally sampled as part of the Division of Water's Ambient Groundwater Monitoring Program.

Evaluation of Existing Groundwater Quality Data from Wells and Springs in Watersheds of the Kentucky, Salt, Licking, Big Sandy, and Little Sandy Rivers, and Tygarts Creek (Basin Management Units 1, 2, and 5)

The Kentucky Geological Survey is summarizing existing groundwater quality data for samples taken from sites in the Kentucky River, Salt River, Licking River, Big Sandy River, Little Sandy River, and Tygarts Creek watersheds. The Kentucky Groundwater Data Repository is the source of the analytical records. Results of analyses for water properties, major and minor inorganic ions, nutrients, pesticides, and volatile organic compounds are summarized for each basin management unit, physiographic region, and major river basin.

Karst Geologic Hazards

Kentucky Geological Survey researchers continue to add text and illustrations to the Web site explaining karst geologic hazards (www.uky.edu/kgs/water/general/karst/kgeohazard.html). The Web site provides information to the public about sinkhole flooding, groundwater contamination, and definitions of karst features.

Karst Potential Index Map

Kentucky Geological Survey researchers developed an index that evaluates the potential of different bedrock types throughout Kentucky to develop karst features. This index can be used to develop map coverages for digital maps, and can be used by the public to evaluate potential problems associated with development in various parts of Kentucky.

Distribution of Groundwater Information

One of the most important functions of the Kentucky Interagency Groundwater Monitoring Network is converting analytical data from groundwater analyses to readily available, useful information. During the past fiscal year, groundwater information was communicated via published reports, oral and poster presentations at meetings and conferences, and Web sites.

Publications

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- Presentations**
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- Web Site Information**
- The Kentucky Geological Survey provides online access to public information about water wells and springs at kgsweb.uky.edu/DataSearching/Water/WaterWellSearch.asp. During the past year the Division of Water's Groundwater Branch imaged all its water-well records and provided digital files of the images to

the Kentucky Geological Survey, which placed them on its Web site. The images are useful to the public, well drillers, consultants, and researchers.

The Kentucky Geological Survey maintains and annually updates a Web site for the Kentucky Interagency Groundwater Monitoring Network (www.uky.edu/kgs/water/gnet/gnet.htm). This site contains maps and data summaries of nitrate and fluoride concentrations, maps of pH and hardness, a map showing the locations of wells and springs that have been analyzed for various water-quality parameters, and previous annual reports of the network. The site also has links to the Web sites of the other ITAC agencies and organizations. The Kentucky Geological Survey has compiled information about hydrology, geology, topography, water supply, and water quality from maps, reports, and data collected from 1940 to 2000 and posted it for public access at www.uky.edu/kgs/water/library/webintro.html.

The Kentucky Geological Survey completed maps of locations of water wells and springs in the Paducah, Pikeville, Huntington, and Tompkinsville 30 x 60 minute quadrangles. This completed map coverage for the state, and all the water well and spring maps are now available online at kgsweb.uky.edu/PubsSearching/PubsSimpleSearch.asp.

All water-quality analyses stored in the Kentucky Groundwater Data Repository are available on the Kentucky Geological Survey Web site at kgsweb.uky.edu/DataSearching/watersearch.asp. This repository was established to archive all groundwater data collected throughout Kentucky by State and federal agencies, university researchers, and others.

Interagency Coordination

Cooperation among agencies and research organizations that collect, analyze, and use groundwater data is essential to reduce monitoring costs, improve program efficiency, and promote data sharing. The Kentucky Interagency Technical Advisory Committee on Groundwater provides a forum for organizations that participate in the Interagency Technical Advisory Committee to meet quarterly and discuss groundwater issues.

Cooperation and interaction within the ITAC agencies and between ITAC agencies and other groups and organizations is routine. Many programs benefit from the Division of Water's willingness to collect and analyze groundwater samples to support various projects. Recent examples include the Division of Water coordinating with the Kentucky Geological Survey to collect groundwater samples at a drilling site in Salyersville, and the Division of Water's regular sampling of Royal Spring, the focus of a Kentucky Geological Survey travel-time study. The Division of Water also samples ground and surface water for nonpoint-source constituents in support of projects for the Division of Pesticide Regulation. The Division of Water and the Kentucky Geological Survey regularly answer inquiries from the public and communicate with staff of the Kentucky Rural Water Association. Staff from the Kentucky Geological Survey have been meeting with County Extension Service agents and Area Development District staff throughout the commonwealth to promote awareness of hydrogeologic issues. Many of the ITAC agencies are also members of the Kentucky Agricultural Water Quality Authority, or cooperate with the authority and participate in their meetings. Members of both the Division of Water and the Kentucky Geological Survey regularly participate in meetings of State and federal agencies and citizens' groups that have interests in groundwater resources.

Groundwater Data Sharing

Sharing groundwater data is an essential function of the Kentucky Interagency Groundwater Monitoring Network. Data transfers between agencies provide each group access to a larger database than any agency could develop independently, thereby improving evaluations of groundwater quality and suitability for various uses, threats to groundwater quality, and the effects of mining, logging, agricultural practices, urbanization, waste disposal, and oil and gas production. Sharing data also reduces the overall expense and increases the efficiency of monitoring efforts.

Data have been transferred electronically between the Division of Water groundwater database and the Kentucky Groundwater Data Repository, and between the Kentucky Geological Sur-

vey analytical laboratory and the Groundwater Branch, since 1992. There has also been a high level of collaboration and data sharing between the Kentucky Geological Survey and the Groundwater Branch during the reporting period, as the agencies are jointly reporting on groundwater quality throughout the state.

Future Activities

Preparing and distributing reports that summarize the results of groundwater investigations in terms that are readily understood by the public will remain an important function of the Kentucky Interagency Groundwater Monitoring Network. Reports summarizing expanded groundwater monitoring activities in basin management unit 1 (Kentucky River watershed) and basin management unit 3 (watersheds of the Upper and Lower Cumberland Rivers, Tennessee River, and the Jackson Purchase Region) will be completed and distributed within the next year. Expanded groundwater monitoring in watersheds of the Big Sandy River, Little Sandy River, and Tygarts Creek (basin management unit 5) will be completed in 2005, and a report will be prepared. Quarterly sampling of the wells and springs that make up the Division of Water's ambient groundwater monitoring network will continue.

In addition to continuing these existing projects, the following activities are urgently needed and will be initiated as funding becomes available:

- Evaluating the optimal sample collection frequency for wells and springs in different flow systems so that the efficiency of monitoring programs can be increased
- Developing a network to record water levels in strategically located wells
- Developing a common set of data elements for recording information about sample sites, sample collection procedures, and field-measured water-quality parameters
- Transferring groundwater-level and -quality data from paper files to the electronic database

- Expanding the number of sampled wells and springs to improve coverage of the state
- Using groundwater-quality data to help delineate groundwater basins and well-head protection areas
- Delineating areas where different groundwater flow systems prevail. Distinguishing between shallow intermediate, and deep flow systems and between the laminar flow conditions that occur in porous media and the turbulent flow that can occur in karst systems is essential, so that best management practices for controlling nonpoint-source pollution and protecting vulnerable groundwater can be better assessed.

Summary

The Kentucky Interagency Groundwater Monitoring Network was very active during the reporting period. Programs to collect statewide ambient groundwater quality data, as well as to investigate specific problems of karst hydrology and aquifer sensitivity, potential nonpoint-source contamination of groundwater supplies, and the effects of agricultural practices on groundwater resources, were completed or are in progress. One major report and one information circular were completed, and four summary reports on ambient groundwater quality are in preparation.

Most of the activities conducted during the reporting period were largely investigations of identified or suspected groundwater-quality problems and were possible only because the agencies involved were able to obtain funding from outside sources. As noted in previous annual reports, the availability of these funds is decreasing. A stable source of recurring funding is essential if groundwater issues are to be addressed on a proactive basis. This will best serve the needs of citizens, resource managers, and environmental regulators.

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