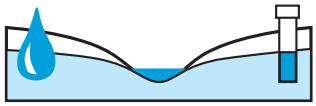

Kentucky Interagency Groundwater Monitoring Network

Annual Report
1999–2000

Kentucky Geological Survey
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Kentucky Interagency Groundwater Monitoring Network: Annual Report

Executive Summary

Ground water in Kentucky is a valuable resource that is vital to the economic development of the State and the health and well-being of its citizens. The amount of ground water available, the quality of the water, and the distribution of ground water suitable for various uses across the state must be known before responsible decisions can be made regarding resource management, water development policy, pollution prevention, and ground-water regulation. Little information about the Commonwealth's ground-water resource is currently available, however. Recognizing the importance of ground water, the 1998 Kentucky legislature directed the Kentucky Geological Survey (KGS) to establish a ground-water monitoring network and also established an Interagency Technical Advisory Committee on Groundwater (ITAC) to assist KGS in developing, coordinating, and implementing the network.

The major goals of the Kentucky Interagency Groundwater Monitoring Network are to collect ground-water data, characterize ground water throughout the state, distribute the information to all interested organizations or persons, improve coordination among the agencies that collect ground-water data, and facilitate data transfer to the Kentucky Ground-Water Data Repository, the central storage facility for all Kentucky ground-water data.

During the 1999 State fiscal year, KGS:

- Published a map and data summary of fluoride in ground water
- Updated the Kentucky Ground-Water Data Repository with the latest data from the Kentucky Division of Water
- Began extended ground-water monitoring in basins of the Upper Cumberland, Lower Cumberland, and Tennessee Rivers, and in basins of tributaries of the Mississippi River in the Jackson Purchase Region
- Began evaluating existing data from wells and springs in basins of the Upper Cumberland, Lower Cumberland, Tennessee, Tradewater, and Green Rivers, and in basins of tributaries of the Mississippi River in the Jackson Purchase
- Established a Web site for the Kentucky Interagency Groundwater Monitoring Network.

Planned future activities include:

- Produce statewide water-quality maps and data summaries
- Continue extended ground-water monitoring in basins of the Upper Cumberland, Lower Cumberland, and Tennessee Rivers, and in basins of tributaries of the Mississippi River in the Jackson Purchase Region
- Continue evaluating existing data from wells and springs in basins of the Upper Cumberland, Lower Cumberland, Tennessee, Tradewater, and Green Rivers, and in basins of tributaries of the Mississippi River in the Jackson Purchase Region
- Develop a geographic information system coverage showing all ground-water monitoring sites in Kentucky
- Expand the network's Web site to include links to relevant publications and to the Web sites of other agencies and organizations that collect or use ground-water information
- Develop a network to record water levels in strategically located wells
- Develop a common set of data elements for recording information about sample sites and sample collection procedures (metadata)
- Transfer data from paper files to the electronic database
- Develop a plan for a coordinated statewide ground-water monitoring network and estimate the resources needed to support it
- Seek sustained funding to support the Kentucky Interagency Groundwater Monitoring Network.

Brief History of the Network

In 1993 the secretary of the Kentucky Natural Resources and Environmental Protection Cabinet convened a Groundwater Consensus Committee to assist in drafting ground-water protection regulations. Committee members represented State and Federal organizations, university researchers, and local, business, industrial, and public interests that were concerned with ground-water quality and resources. The committee found that there was a general lack of information needed to manage ground-water resources or to make good management decisions to protect ground-water quality. Subsequently, a subcommittee was established to explore ways in which ground-water information could be collected, stored, and shared to support decisions regarding ground-water policy and management. This subcommittee also drafted a bill that would establish a long-term ground-water monitoring network and an interagency advisory committee on ground-water issues. The proposed legislation was not passed during the 1994 legislative session, but interest in ground-water resources persisted, as did the need for information about Kentucky's ground water.

In 1995 the director of the Kentucky Geological Survey (KGS) requested that the University of Kentucky Water Resources Research Institute (KWRRI) convene a meeting of representatives from government agencies that collect or use ground-water information in Kentucky. Each agency appointed representatives to serve on an ad hoc Interagency Technical Advisory Committee. This committee met regularly throughout 1995 and produced a report that recommended establishing a ground-water monitoring network, set forth the major goals of the network, and proposed a monitoring strategy for Kentucky (ITAC, 1996).

Legislation establishing a ground-water monitoring network and advisory committee was enacted in 1998 (KRS 151.620, 151.621, 151.625, and 151.629). KRS 151.625 directed KGS to establish a long-term groundwater monitoring network to characterize ground-water resources in Kentucky, in cooperation with an Interagency Technical Advisory Committee on Groundwater. KRS 151.629 established the Interagency Technical Advisory Committee on Groundwater (Table 1) to assist KGS in developing, coordinating, and implementing a ground-water network for the Commonwealth. The director of KWRRI was designated the chair of ITAC.

Table 1. Agencies comprising 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 Pesticides
- Kentucky Division of Waste Management
- Kentucky Division of Water
- Kentucky Geological Survey
- U.S. Geological Survey
- University of Kentucky College of Agriculture
- University of Kentucky Water Resources Research Institute

Network Goals

The goals of the Kentucky Interagency Groundwater Monitoring Network are to collect ground-water data, characterize ground-water resources, and distribute the information. Improving coordination among agencies that conduct ground-water monitoring and facilitating electronic transfer of the resulting data are needed to accomplish these goals.

Collect Ground-Water Data

Collecting ground-water data involves both gathering previously reported data and analyzing new samples from wells and springs.

Historically, organizations such as the U.S. Geological Survey, U.S. Environmental Protection Agency, Kentucky Division of Water, and KGS have sampled wells and springs for purposes other than describing regional ground-water quality or identifying long-term water-quality trends. These data nevertheless have tremendous value for the types of decisions facing policy planners, resource managers, regulators, and scientific researchers. Furthermore, the cost of resampling and analyzing these ground-water sources is prohibitive, even if it were possible to revisit the sites. Therefore, gathering existing ground-water data is a major activity of the Kentucky Interagency Groundwater Monitoring Network.

The Ambient Groundwater Monitoring Program of the Kentucky Division of Water currently selects wells and springs to monitor, collects samples quarterly, and reports the analytical results. Approximately 120 sites across the state are sampled quarterly. An additional 30 sites are targeted in one of the five Kentucky Basin Management Units (BMU) for 1 year of quarterly sam-

pling. This extended ground-water monitoring rotates to a different BMU each year and repeats every 5 years. To date the Kentucky River Basin (BMU 1) and the Salt and Licking River Basins (BMU 2) have received extended sampling. Basins of the Upper and Lower Cumberland River, Tennessee River, and tributaries of the Mississippi River in the Jackson Purchase (BMU 3) are currently being sampled. The Tradewater and Green River Basins (BMU 4), and the Big Sandy, Little Sandy, and Tygarts River Basins (BMU 5) will receive extended ground-water monitoring in 2001 and 2002, respectively.

Characterize Ground-Water Resources

The Kentucky Ground-Water Data Repository, located at KGS, was created to store all digital ground-water data collected in Kentucky. This repository provides a central location for the Commonwealth's ground-water data. Water-resource developers, water-policy planners, and the general public commonly cannot use data in this format, however. Converting these data to useful information is an important task for the ground-water monitoring network. Producing statistical summaries of ground-water data and maps of the concentrations of certain dissolved constituents in Kentucky ground water has been the first priority of the network because such information was previously not available. The network will continue to produce maps and data summaries of major, minor, and trace inorganic chemicals, nutrients, pesticides, and insecticides. In addition, interpretive reports describing ground-water quality are planned (see discussion under *1999-2000 Activities,* below).

Distribute Information

Once generated, ground-water information must reach the agencies, organizations, and persons who need it. KGS publishes maps and brochures about ground water, distributes copies to State agencies and other organizations, and posts the information on the KGS Web site (www.uky.edu/KGS/water/gnet/gnet.htm).

Improve Interagency Coordination

Coordinating ground-water investigations can reduce redundancy between various agency programs, lower costs for sampling and analyses, provide more complete information to government agencies and the public, and increase the efficiency of obtaining ground-water information. The Kentucky Interagency Ground-water Monitoring Network promotes communication among State and Federal organizations and university researchers. KGS representatives also participate in the Network Design Subcommittee, which promotes coordinated data-collection programs.

Facilitate Electronic Data Transfer

In the past, different reporting procedures were used by the various ground-water sampling and analysis programs, and each agency maintained its records separately. These diverse databases make it difficult to integrate data in the Kentucky Ground-Water Data Repository, even when the data are already digital. A foundation of common reporting methods, compatible database structures, and quality assurance/quality control protocols is essential to maximize the usefulness of ground-water data to all users. KGS staff meet with representatives of the various State and Federal agencies to facilitate data transfers. In addition, KGS representatives participate in the Data Format Subcommittee to promote the use of standard methods and reporting procedures among ground-water data collectors and users.

1999–2000 Activities

A map and data summary of fluoride in ground water was published during the past 12 months. Other significant events over the past year were the incorporation of new data into the KGS database and receipt of two EPA 319 grants that will support additional sampling and evaluation of ground-water data. The amount of information concerning ground-water in Kentucky will increase substantially over the next several years now that the most recent data are in the KGS database and two funded projects are focusing on collecting new data, evaluating existing data, and preparing reports.

Map of Fluoride Data

A map and data summary of fluoride in ground water was published as KGS Information Circular 1 (series 12). This report is available on the KGS Web site at ftp://128.163.49.71/pub/web/wrs/IC1_12.PDF.

Database

KGS received a database update from the Kentucky Division of Water. These new data represent samples collected and analyzed for various State programs. The additional records were added to the Kentucky Ground-Water Data Repository, bringing the number of well and spring records in the repository to more than 41,000. KGS and the Groundwater Branch of the Kentucky Division of Water are discussing ways to facilitate future data transfers.

Ground-Water Monitoring

KGS and the Groundwater Branch, Kentucky Division of Water, were awarded a grant from the U.S. Environmental Protection Agency (319 funds) to perform extended ground-water monitoring in the Upper Cumberland, Lower Cumberland, and Tennessee River

basins, and in basins of tributaries of the Mississippi River in the Jackson Purchase. KGS is in the process of selecting 30 wells and springs to be sampled quarterly for 1 year to supplement the Ambient Groundwater Monitoring Program. All resulting data will be added to the Kentucky Ground-Water Data Repository and incorporated in future reports. Two reports will be produced: a summary of ground-water quality based on existing data, and a report on ground-water quality that will be coordinated with surface-water activities of the Kentucky Division of Water's Watershed Management program. Similar extended ground-water monitoring programs were conducted by the Division of Water for wells and springs in the Kentucky, Salt, and Licking River drainage basins, in addition to the Division of Water's ongoing statewide Ambient Groundwater Monitoring Program. The Division of Water also regularly collects samples for the Kentucky Division of Pesticides.

Evaluation of Ground-Water Data

KGS and the Groundwater Branch, Kentucky Division of Water, were awarded a second grant from the U.S. Environmental Protection Agency (319 funds) to evaluate ground-water data from basins of the Upper Cumberland, Lower Cumberland, Tennessee, Tradewater, and Green Rivers, and in basins of tributaries of the Mississippi River in the Jackson Purchase. The evaluations will consist of maps of concentrations of major, minor, and trace inorganic species and dissolved organic chemicals, and data summaries for the major and minor river basins (six- and eight-digit Hydrologic Unit Codes, respectively). Completion of this project will provide a comprehensive ground-water quality report for the western portion of Kentucky. A second proposal to perform an equivalent analysis of ground-water data for the eastern portion of Kentucky has been submitted to the U.S. Environmental Protection Agency.

Web Site

KGS established a Web site to make ground-water network information readily available to anyone with Internet access. The site also has links to other KGS ground-water information, and to the reports on nitrate and fluoride concentrations in Kentucky ground water:

KGS Ground-Water Network: *http://www.uky.edu/KGS/water/gnet/gnet.htm*

Map of nitrate in ground water: *ftp://128.163.49.71/pub/web/wrs/IC60.PDF*

Map of fluoride in ground water: *ftp://128.163.49.71/pub/web/wrs/IC1_12.PDF*

The KGS Web site also contains links to publications dealing with ground-water in Kentucky: *www.uky.edu/KGS/pubs/kgspublications.html.*

Publications and Presentations

Personnel of the KGS Water Resources Section and the Ambient Groundwater Monitoring Program of the Division of Water are actively conducting investigations and presenting results of regional ground-water investigations at meetings and conferences. These presentations and publications provide sources of ground-water information to interested agencies, organizations, and persons. The following references, presented or published during the past 2 years, are pertinent to the understanding of ground water in the Commonwealth.

Maps

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Currens, J.C., and Ray, J.A., 1998, Mapped karst groundwater basins in the Harrodsburg 30 x 60 minute quadrangle: Kentucky Geological Survey, ser. 11, Map and Chart Series 16, scale 1:100,000.

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Pena-Yewtukhiw, E.M., Grove, J.H., Dinger, J.S., Beck, E.G., Conrad, P., Taraba, J.L., and Secrist, G.L., 1998, Geostatistical characterization of the nitrate generating potential of an old feedlot: Proceedings, American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America annual meeting, unpaginated.

Conference Proceedings

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Williams, R.M., Dinger, J.S., Powell, A.J., and Edwards, E.R., 1998, Turfgrass best management practices for protection of water resources: Proceedings, 1998 Kentucky Nonpoint Source Conference, p. 61–62.

Technical Publications

Barfield, B.J., Blevins, R.L., Fogle, A.W., Madison, C.E., Inamdar, S., Carey, D.I., and Evangelou, V.P., 1998, Water quality impacts of natural filter strips in karst areas: Transactions of the American Society of Agricultural Engineers, v. 41, no. 2, p. 371–381.

Presentations

Andrews, R.E., Use of remote sensing and drilling techniques for high-capacity wells for water supply [poster]: Kentucky Geological Survey 39th annual seminar, Lexington, Ky., May 14, 1999.

Andrews, R.E., Wunsch, D.R., and Dinger, J.S., Hydrogeologic evaluation of high-yield well potential in the Eastern Kentucky Coal Field: Kentucky Water Resources Research Institute Symposium, Lexington, Ky., February 26, 1999.

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Cumbie, D.H., Underground coal mines as potential municipal water supplies in the Eastern Kentucky Coal Field: Indiana Society of Professional Geologists, Henderson, Ky., January 21, 1999.

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Webb, J., and Goodmann, P.T., Results of monitoring pesticides, nitrate, and MTBE: Kentucky Ambient Groundwater Monitoring Program: 44th Annual Midwest Ground Water Conference, St. Paul, Minn., October 13-15, 1999; 2000 Kentucky Water Resources Symposium, Lexington, Ky., February 25, 2000.

Webb, J., and Goodmann, P.T., The Kentucky Interagency Groundwater Monitoring Network and the Kentucky Division of Water Groundwater Monitoring Program: National Water Quality Monitoring Conference, Austin, Tex., April 25-27, 2000.

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Williams, R.M., Ground water and pesticide movement: Turf and Landscape Management Field Day, University of Kentucky College of Agriculture and Kentucky Turfgrass Managers Association short course, Lexington, Ky., July 8, 1998.

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Future Activities

The lack of information needed to support groundwater resource allocation and protection decisions noted in 1993 still exists. The need for this information is greater than ever because of population growth and demand for water resources in rural areas, and for continued economic development. In addition, droughts such as the one that occurred in 1999 call attention to the importance of reliable water supplies. The network plans the following activities to address this information need.

Statewide Water-Quality Maps and Data Summaries

KGS will continue to produce statewide maps and statistical summaries of ground-water quality data. Over the next several years we will map and summarize concentrations of major, minor, and trace dissolved inorganic species as well as pesticides and other dissolved organic compounds. Maps and statistical summaries will be based on records stored in the Kentucky Ground-Water Data Repository.

Ground-Water Monitoring

KGS will conduct quarterly water-quality monitoring of approximately 30 wells and springs in the Upper Cumberland, Lower Cumberland, and Tennessee River basins, and in basins of tributaries of the Mississippi River in the Jackson Purchase. These new data will be combined with data from the Kentucky Ground-Water Data Repository and recently collected water-quality data from the Ambient Groundwater Monitoring Program to produce the reports described above.

Characterization of Ground-Water Quality

KGS will continue to map and statistically summarize concentrations of major, minor, and trace dissolved inorganic species as well as nutrients, pesticides, and insecticides from wells and springs in the Upper Cumberland, Lower Cumberland, Tennessee, Tradewater, and Green River basins, and in Mississippi River tributary basins in the Jackson Purchase. Data will be summarized by major and minor river basins so that results can be combined with reports by the Kentucky Division of Water's Watershed Management Program.

KGS and the Groundwater Branch, Kentucky Division of Water, submitted a proposal to perform similar data evaluations for wells and springs in basins of the Salt, Licking, Kentucky, Big Sandy, Little Sandy, and Tygarts Rivers. If funded, these evaluations will begin in late 2001 or early 2002. Completion of both these projects will help provide an up-to-date evaluation of Kentucky ground-water quality.

Coverage of Ground-Water Monitoring Sites

To promote cooperation among agencies that collect and analyze ground-water samples, KGS will develop geographic information system coverages of monitoring locations and constituents being measured by KGS and the Kentucky Divisions of Water, Waste Management, and Surface Mining Reclamation and Enforcement. These maps will show areas where monitoring activities can be streamlined, as well as areas where additional sampling is needed. KGS is also work-

ing with the Division of Water's Groundwater Branch to determine efficient sampling intervals for the different ground-water systems in Kentucky.

Network Web Site

KGS will expand the ground-water network Web site to enable it to function as a central location for ground-water information. The site will contain links to the various KGS ground-water maps and publications, and to State and Federal Web sites related to ground-water issues. By making reports, maps, and links to other Web sites available to Internet users, the data can be quickly updated to better provide information in a form that will be useful to a wide audience.

Common Data Elements

Transfers from various ground-water databases to the Kentucky Ground-Water Data Repository currently require extensive processing because field names and data structures are not uniform. There will be a continued effort to standardize names and file structures to permit more rapid and frequent sharing of data. In particular, there is a great need for a set of common data elements to record information about the sample site and sampling conditions (metadata).

Transfer of Data from Hard Copy to Electronic Files

A significant amount of previously collected data exists only as records on paper. In many cases, the wells and springs from which the data were collected no longer exist and could not be resampled even if there were resources to do so. It is imperative that this information be entered into the database so it can be included in reports and analyses.

Long-Term Water-Level Monitoring Network

Trends in water levels over time are valuable records of the amount of water that may be available from ground-water sources, how different watersheds and ecosystems respond to normal, rainy, and dry periods, and the hydrologic connection between ground water and surface water. KGS is working with the U.S. Geological Survey and the Groundwater Branch, Kentucky Division of Water, to establish a statewide network of wells for which water levels would be recorded and samples collected to provide a long-term record of both water quality and quantity.

Integration of Monitoring Activities

The ad hoc Interagency Technical Advisory Committee on Groundwater proposed a statewide monitoring strategy in 1996 (ITAC, 1996). This plan should be reconsidered in light of current information needs, and the monetary and personnel resources to perform statewide monitoring should be estimated.

Sustained Funding for Ground-Water Network

The Kentucky Interagency Groundwater Monitoring Network will ultimately require financial support for its operations. This network, in cooperation with the Interagency Technical Advisory Committee on Groundwater, must begin planning a strategy to obtain support for the needed investigations.

Summary

Ground water makes up over 95 percent of the water resources in Kentucky. It accounts for more than 30 percent of the public and domestic water supplies in the Commonwealth, and as much as 90 percent of all rural domestic supplies. Furthermore, ground water is the major source of water in Kentucky's rivers and streams, and is particularly important during periods of drought. For these reasons, it is imperative that this resource be adequately assessed and evaluated. Only when the availability and quality of ground water is known can informed decisions be made regarding developing community and private water supplies, addressing resource allocation issues, setting boundaries on wellhead protection areas, and recognizing groundwater degradation.

Initial activities of the Kentucky Interagency Groundwater Monitoring Network focused on characterizing ground-water quality using data currently stored in the Kentucky Ground-Water Data Repository and assisting the Kentucky Division of Water in monitoring wells and springs. The network, assisted by the Interagency Technical Advisory Committee for Groundwater, is also actively promoting improved coordination among the various agencies and organizations that collect and use ground-water data, and facilitating data transfer from State agencies to the Kentucky Ground-Water Data Repository.

Reference

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