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Water Resources Update
USGS Illinois Water Science Center Newsletter

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Science Center Web Site: http://il.water.usgs.gov/

Illinois Water Science Center
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Compiled by D.M. Ayers

MESSAGE FROM THE DIRECTOR

"What's in a name? That which we call a rose, by any other word would smell as sweet." (from Romeo and Juliet -- II, ii, 1-2)

With apologies to Shakespeare, I wanted to take this opportunity to both point out our Center's name change made a few months back and provide some explanation as to the reasons behind the name change. Our name has been changed from the "U.S. Geological Survey Illinois District" to the U.S. Geological Survey (USGS) Illinois Water Science Center." This change, taking place nationally, also involves changing my title from "District Chief," to "Director, USGS Illinois Water Science Center." Our two satellite offices in DeKalb and Mt. Vernon will be known as USGS Illinois Water Science Center, DeKalb Office, and USGS Illinois Water Science Center, Mt. Vernon Office, respectively.

The USGS has had a water-resources presence in Illinois since January 1903, when the first USGS Illinois office was established in Chicago. The focus of the water-resources offices in Illinois has been and continues to be water-resources data collection, investigations, and research. Around 5 years ago, USGS began a reorganization process, brought about by the need for better integration of our science across the entire spectrum of USGS activities (biology, geology, geography, and water). As such, the USGS organizational hierarchy above the water-resources District Offices had been and continues to be realigned to enable better collaboration across discipline boundaries.

As USGS continues to strive for an integration of our disciplines, we have been finding that the water offices are not working with a broader spectrum of agencies and the public. To this new broadening spectrum of partners, the name "District" does not reflect what the water offices actually do. In addition, there have been instances where the name "District" has served as a point of confusion to some as it often implies a smaller subdivision and is shared by many of the local entities we cooperate with, such as the Soil and Water Conservation Districts. Lastly, USGS senior managers realized that the name "District" can imply to some that all USGS activities occurring in a particular State fall under the oversight of the water District office, which is not the case. With this name change, USGS is more accurately portraying the role and scope that our office plays in Illinois, as well as it employs a naming convention that is consistent with other USGS centers in the country. It is also important to note that inclusion of "USGS" in the title is a critical part of this new naming convention. Leaving "USGS" out of the name could give the false implication that USGS is the only agency doing water science in Illinois; clearly, this is not the case. Please be assured that this name change will in no way adversely affect the water-resources activities carried out by the USGS in Illinois.

Robert R. Holmes, Jr., PhD, P.E.
Director, USGS, Illinois Water Science Center

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Record Flooding in Illinois During January 2005

BY

John K. LaTour, Hydrologist, and Gary P. Johnson, Supervisory Hydrologist

During the first week of January 2005, widespread flooding in many streams in central and southern Illinois resulted from persistent rain on top of saturated soils from snowmelt. During the period, the entire region received about 3 inches of rain, while in some local areas, over 6 inches of rain fell. Historically, rainfall for the month of January only averages slightly less than 2 inches.

USGS Streamgage Peaks of Record During the Flooding

The USGS streamgaging station McKee Creek at Chambersburg reported the highest flow on record. The Ohio River at Shawneetown peaked at 50.67 feet (ft) on January 17, which is the highest peak since USGS installed its automated gage in 2000. The upper reaches of the Sangamon River, Embarras River at Lawrenceville, Shoal Creek, and Silver Creek experienced the second highest flows on record. Kaskaskia River at Chesterville, Kickapoo Creek at Waynesville, and Judy's Branch at Route 157 at Glen Carbon were the 3rd highest flow on record. The Iroquois River reached the 4th highest stage on record, whereas the Kankakee, Mackinaw, and Vermilion Rivers were the 5th highest.

USGS Data-Collection Efforts During the Flooding

The USGS Illinois Water Science Center made 58 discharge measurements during the flooding in order to keep various Federal, State, and local agencies informed about conditions, including (but not limited to) the National Weather Service; the Illinois Department of Natural Resources, Office of Water Resources; and the U.S. Army Corps of Engineers (Louisville, St. Louis, Rock Island, and Chicago Districts). A partial list of sites where measurements were made that exceeded the top five measurements ever made are listed in Table 1 (rank number 1 means the highest measurement ever made and so forth).

USGS Data Dissemination and Outreach During the Flooding

The USGS Illinois Water Science Center relied heavily upon the "Current Illinois Flooding" Web page to disseminate information and news to Federal, State, and local agencies and the public. The Web page listed all the measurements, peaks, and observations, as well as a running log of the Center's efforts, inquiries, and plans during the flooding. The Web page can be accessed at http://il.water.usgs.gov/flooddata/.

In addition, various interviews were given to the media, including AP press writers and local affiliate TV news channels. Several newspaper articles were written containing USGS data and personnel. Several members of the media and a staffer for Congressman John Shimkus accompanied USGS personnel on board the research boat M/V Iroquois while discharge measurements were made.

Hydrologist Kevin Johnson holds the boat (M/V Iroquois) steady while Dr. Robert Holmes, Director of the USGS Illinois Water Science Center, is interviewed by TV news crew on the banks of the Ohio River at Shawneetown, Illinois. In the background is the Illinois State Route 13 bridge linking Illinois and Kentucky.

Contacts for Further Information or Questions

For further questions about the January 2005 flooding in Illinois, please call Gary Johnson (Chief, Hydrologic Data Collection and Analysis Section) at (217) 344-0037, extension 3009 or Dr. Robert R. Holmes, Jr. (Director, USGS Illinois Water Science Center), extension 3005.

Table 1. Partial List of Sites Measured by USGS during the January 2005 Flooding.

Site	Rank Number	Site	Rank Number
Ohio River at Old Shawneetown	1	Kankakee River at Momence	3
Iroquois River near Iroquois	1	Kankakee River near Wilmington	3
North Fork Vermilion River near Charlotte	1	Iroquois River at Iroquois	3
Mackinaw River near Green Valley	1	Lake Fork near Cornland	3
Shoal Creek near Pierron	1	Salt Creek near Greenview	3
Silver Creek near Troy	1	Deer Creek near Chicago	4
Salt Fork near St. Joseph	2	Kickapoo Creek at Peoria	4
North Fork Embarras River near Oblong	2	Sangamon River at Monticello	4
Embarras River at Lawrenceville	2	Salt Creek near Rowell	4
Farm Creek at Farmdale	2	Judy's Branch at Route 157 at Glen Carbon	5
Sangamon River at Fisher	2	Kaskaskia River at Vandalia	5
Kickapoo Creek at Waynesville	2		

USGS Illinois Water Science Center boat underway on the Ohio River at Shawneetown. Note the telephone/light pole in the center of the photo.

Employee Spotlight

Angel Martin, Jr. (Reports Specialist)

Angel Martin, Jr. began his career at the USGS Indiana District in Indianapolis in 1976 as a hydrologist. He worked on various projects related to ground-water, surface-water, and water-quality issues, including ground-water-flow models at county scales in central and northern Indiana. Some work included simulation of ground-water flow with electric analogs. In 1982, Martin transferred to the Baton Rouge, Louisiana District Office where he was the project chief of the Louisiana portion of the Gulf Coast Regional Aquifer Systems Analysis study. Martin also worked on a variety of county-(parish) scale modeling studies in central and southern Louisiana including studies involving freshwater-saltwater interaction. Martin transferred to the USGS Illinois Water Science Center in 1990 as Chief, Investigations Section. He also served as Ground-Water Specialist for the Center until 2004. During 1990-2004, Martin supervised various hydrologists, engineers, and students on a wide variety of ground-water, surface-water, and water-quality investigations.

Presently, Martin serves as the Reports Specialist for the Center and is the Reports Specialist for the USGS/National Drilling Program Ground-Water Resources Program of the United Arab Emirates. He also is an approving official for USGS reports nationwide. This work involves reviewing and approving a wide variety of USGS technical documents prior to publication. Martin has performed other international duties as he has completed hydrologic work in Paraguay and has assisted visiting engineers from Ecuador on ground-water issues in the 1970s and 1980s, respectively. Martin is an author of over 25 reports and articles primarily dealing with ground-water flow and contamination.

Martin obtained a B.A. degree in Interdisciplinary Math/Physics from the University of South Florida and an M.S. in Applied Physics from the Technical University of Valencia, Spain in the 1970s. Martin came to the United States in the early 1960s as a Cuban refugee and became a naturalized American in 1970. Martin enjoys playing soccer, softball, and tennis, and learning and speaking various languages (French, Italian, Portuguese, and Spanish).

Midwest Groundwater Conference

The golden anniversary of the Midwest Groundwater Conference will be celebrated at the annual meeting in Champaign-Urbana, Illinois, November 1-3, 2005. The Midwest Groundwater Conference began 50 years ago with a meeting in Champaign-Urbana. The focus of the group is on ground-water science in eight Midwestern States. This year the USGS, Illinois State Geological Survey, Illinois State Water Survey, Illinois Water Resources Center, Illinois Department of Agriculture, and the Illinois Groundwater Association will be organizing the conference with session topics on ground-water quality and monitoring, ground-water quantity, innovative field methods, water use, and governmental data. Abstracts for the presentation are due on June 30, 2005. Additional information about the conference can be found on the Internet at http://MidwestGroundwater.org.

Newsletter Format Preference

Beginning with our November 2005 issue, you will have a choice in how your receive the newsletter: hard copy as we have been doing, or electronically. If you wish to continue receiving a hard copy, you need to do nothing. If, however, you prefer electronic copy, please send an e-mail to Donna Ayers at dmayers@usgs.gov indicating you wish to receive the newsletter electronically. When the November 2005 issues is ready, you will receive an e-mail with the newsletter attached as a PDF along with instructions on how to access the current newsletter and back copies in PDF format from the USGS Illinois Water Science Center Web page.

Assessing the Effectiveness of Multiple Methods for Characterizing the Galena-Platteville Aquifer in Illinois and Wisconsin

by

Robert T. Kay and Patrick C. Mills, Hydrologists

Our ability to understand ground-water flow and contaminant transport in fractured-rock aquifers is limited by the complex flow through the fractures, vugs, and solution openings in these types of aquifers and the inability of many currently available investigative methods to quickly and accurately identify and assess these flow pathways under a range of hydrogeologic conditions. Investigations performed by the USGS and the U.S. Environmental Protection Agency in the fractured Galena-Platteville Aquifer at Superfund sites in Illinois and Wisconsin indicate that various investigative methods can be used to characterize fractured-rock aquifers. The effectiveness of these methods varies with the hydrogeology of the site. The completeness of the characterization improved with an increase in the amount of data available, in terms of the number of data points, the period of data collection, and the number of methods applied. The characterization also was improved by comparison of data collected with different methods.

Collection and analysis of information from government databases, previous investigations, topographic maps, aerial photographs, and outcrops and quarries prior to the initiation of any investigation is considered essential to obtaining a preliminary understanding of the hydrogeology and water quality. This understanding is essential to understanding the problems associated with the site and for planning the investigation.

The utility of surface geophysical methods for the characterization of the secondary-permeability network (fractures, vugs, and solution openings) was limited by site geology and cultural interference at the sites investigated. Surface ground-penetrating radar provided no information at the sites where it was applied. Square-array resistivity provided information on the orientation of vertical fracture sets that may or may not have been accurate. Lithologic logging was essential to the hydrogeologic characterization of every site. Core analysis typically was useful for stratigraphic interpretation and geotechnical measurements.

Geologic characterization was improved by geophysical logging. Natural-gamma logging identified lithologic variations that, in combination with other data, provided insight into the lithologic factors that affect the location of secondary-permeability features. Three-arm caliper logging was used to identify the presence and location of fractures and solution openings. Neutron logs were effective in evaluating trends in the primary porosity at sites where clay minerals or variable saturation did not substantially affect the log response. Acoustic-televiewer logs identified the largest number of secondary-permeability features, as well as the type and orientation of these features. Televiewer logging was considered the best single method for the thorough characterization of the secondary-permeability network. Borehole-camera logs provided substantial insight into the location of secondary-permeability features in boreholes with clear water. Single-borehole ground-penetrating radar (GPR) surveys identified potential lithologic and secondary-permeability features tens of feet beyond the boreholes. However, the presence of some of these features was not confirmed by other methods. Cross-borehole GPR surveys identified the location and extent of secondary-permeability features between boreholes, as well as porosity variations. Cross-hole GPR logging done in conjunction with tracer testing identified flow pathways and was used to calculate the effective porosity of the aquifer.

Characterization of ground-water flow was accomplished by a number of investigative methods. Water-level measurements and the location of contaminants and other water-quality constituents identified vertical and horizontal directions of ground-water flow over areas of tens to thousands of feet. Water-level measurements and water-quality data also provided insight into the distribution of aquifer permeability and the location of permeable fractures in some locations.

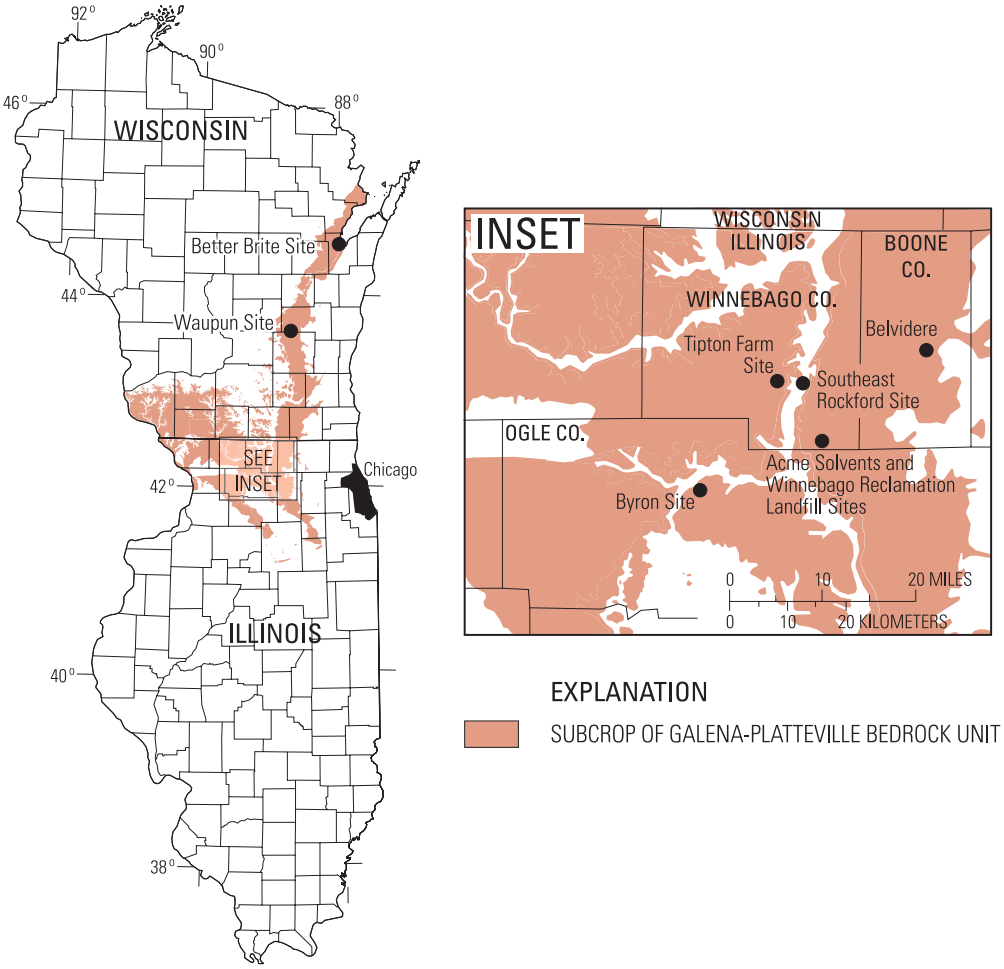
Characterization of ground-water flow was improved by lithologic, temperature, spontaneous-potential, and fluid-resistivity logging. However, the utility of these logs varied with the hydrogeologic conditions. Single-hole flowmeter logging under a combination of ambient and pumping conditions was the most cost-effective method of identifying the location of permeable features in the Galena-Platteville aquifer of any geophysical method used. The utility of the flowmeter logging was affected by uniformly low permeability, an absence of vertical hydraulic gradient, large contrasts in permeability, and the

vertical distribution of permeable features. Cross-hole flowmeter logging provided the greatest amount of insight into the location of permeable features in individual boreholes, as well as insight into the hydraulic interconnection of these features.

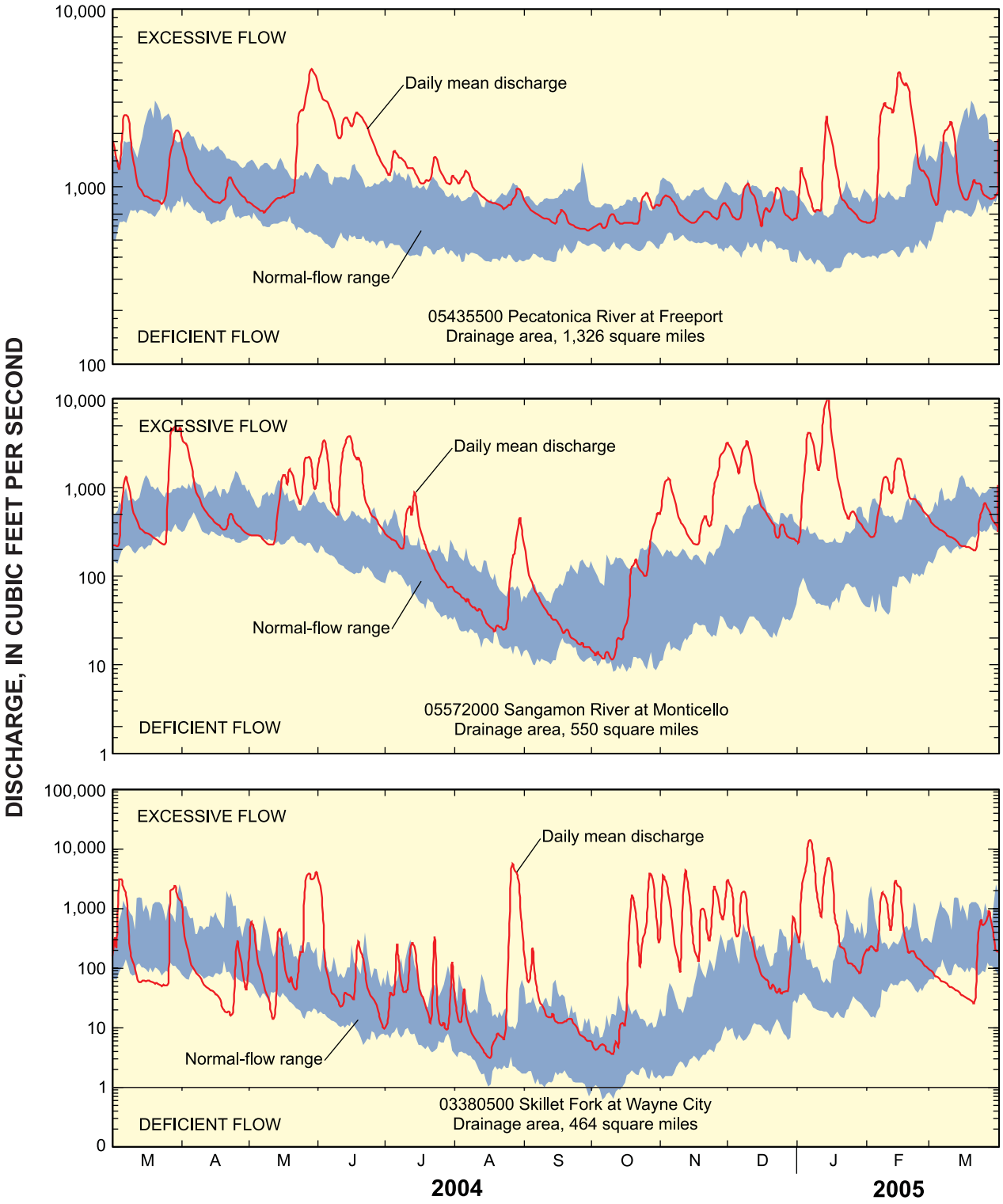
Characterization of ground-water flow also was improved by performance of aquifer tests. Slug tests provided insight into permeability variations with location and stratigraphy and are the only method that could quantify the horizontal hydraulic conductivity of the entire aquifer. Slug tests performed by use of a packer assembly provided the most complete characterization of the location of permeable (or impermeable) intervals in the aquifer, but are expensive in comparison to flowmeter logging.

Specific-capacity tests allowed for quantification of aquifer transmissivity where resources were insufficient for detailed aquifer testing. Multiple-well, constant-discharge aquifer tests identified the presence and location of hydraulically interconnected features in the Galena-Platteville aquifer, as well as the presence and orientation of heterogeneity and anisotropy. The amount of information that could be obtained from the multiple-well aquifer tests was increased by the amount of aquifer that could be tested discretely. However, reliable estimates of transmissivity and storage coefficient could not always be obtained. Tracer tests allowed estimation of the effective porosity of parts of the aquifer and indicated the presence of hydraulic interaction between the fractures and matrix. Tracer testing done in conjunction with cross-borehole GRP identified discrete flow pathways within the aquifer.

A detailed description of the various methods used for characterization of the Galena-Platteville aquifer, the effectiveness of each method, and the hydrogeologic processes that affect the methods is available in Scientific Investigations Report 2004-5136, "A Cross-Site Comparison of Methods used for Hydrogeologic Characterization of the Galena-Platteville Aquifer in Illinois and Wisconsin, with Examples from Selected Superfund Sites."



Location of Superfund site overlying the Galena-Platteville aquifer in Illinois and Wisconsin investigated by the U.S. Geological Survey and the U.S. Environmental Protection Agency.



Daily mean discharge from March 1, 2004 through March 31, 2005 compared with percentile distribution of mean daily discharges for the 30-year period, 1961-90, for 3 representative streamgaging stations. A daily mean discharge is in the deficient-flow range if its value is less than or equal to the 25th percentile, in the normal-flow range if its value is between 25th and 75th percentiles, and in the excessive-flow range if its value is equal to or greater than the 75th percentile.

USGS Illinois Water Science Center Open House

The USGS Illinois Water Science Center hosted an open house on April 14, 2005. USGS Deputy Director Robert Doyle and University of Illinois Chancellor Richard Herman spoke at the dedication ceremony. Several talks were held with speakers from the USGS Illinois Water Science Center, USGS Michigan Water Science Center, USGS National Geospatial Program Office, USGS Eastern Region Geology, and the USGS Office of Surface Water.

U.S. Geological Survey Publication Changes

Recently, the USGS changed some publications series. Changes were made because: some of the previous series were redundant; some series were not clearly defined; some series titles indicated ownership by specific USGS Discipline (for example, the Water-Resources Investigations Report series); of inconsistent series titles and numbering USGS-wide; interdisciplinary science requires series that are broadly usable by all USGS Disciplines (Biological Resources, Geography, Geology, and Water Resources). The new series (for example, the Scientific Investigations Report series) eliminates "formal" and "informal" report designations. Information concerning USGS publications series can be found at the USGS "Publications Warehouse" at http://infotrek.er.usgs.gov/pubs/.

USGS Illinois Water Science Center Publications

Listed below are publications that were published recently. Federal Fiscal Year (FY) covers October 1 through September 30. Our policy is to provide copies of our publications to requestors at no cost as long as the publication is in stock in the USGS Illinois Water Science Center. To obtain copies of the following, or any other USGS Illinois Water Science Center publication, you may contact Donna Ayers at (217) 344-0037, extension 3053 or by e-mail at dmayers@usgs.gov. Reports also can be found at: *http://il.water.usgs.gov/pubs/search.html.*

FY 2005

SIR 2004-5103, Estimating Flood-Peak Discharge Magnitudes and Frequencies for Rural Streams in Illinois, by D.T. Soong, A.L. Ishii, J.B. Sharpe, and C.F. Avery

SIR 2004-5136, A Cross-Site Comparison of Methods Used for Hydrogeologic Characterization of the Galena-Platteville Aquifer in Illinois and Wisconsin, with Examples from Selected Superfund Sites, by R.T. Kay, P.C. Mills, C.P. Dunning, D.J. Yeskis, J.R. Ursic, and M. Vendl

OFR 2005-1020, Comparison of Potential Evapotranspiration Calculated by the LXPET (Lamoreux Potential Evapotranspiration) Program and by the WDMUtil (Watershed Data Management Utility) Program, by E.A. Murphy