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Water Resources Update
Illinois District Newsletter

U.S. Department of Interior
U.S. Geological Survey
District Web Site: http://il.water.usgs.gov/

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Compiled by D.M. Ayers

Message from Robert R. Holmes, Jr., Illinois District Chief

The 10th anniversary of the Great Flood of 1993 on the Mississippi River and tributaries (fig. 1) is this summer. The awe that I felt in witnessing, as a Hydraulic Engineer for the U.S. Geological Survey (USGS) in the Missouri District, that historic flood firsthand still is fresh in my mind. The 1993 flood was both a tragedy (in the destruction of property and affect on lives), and a fascinating opportunity to collect data and conduct studies of an extreme flood (possibly a once-in-a-career opportunity). The flood occurred over approximately a 4-month period (May through August 1993 on the Middle Mississippi River), but USGS staff from across the entire country collected data and conducted studies well into calendar year 1994. Various aspects of the flood (including flow, sediment and water-quality data) are documented in multiple chapters of USGS Circular 1120. The dedication of USGS staff, including Hydrologic Technicians, Hydrologists and Hydraulic Engineers, Administrative Officers, and many others, was exceptional during the 1993 flood. The dedication of USGS staff always has been an important aspect of USGS service to the Nation. A recent example of this dedication is the USGS efforts during the 2002 flooding in Illinois. Illinois District personnel spent hundreds of hours collecting data often under difficult conditions during the flood. A short article on this flood is presented on page 5. A USGS Open-File Report thoroughly describing the 2002 flood is planned to be available in early summer.

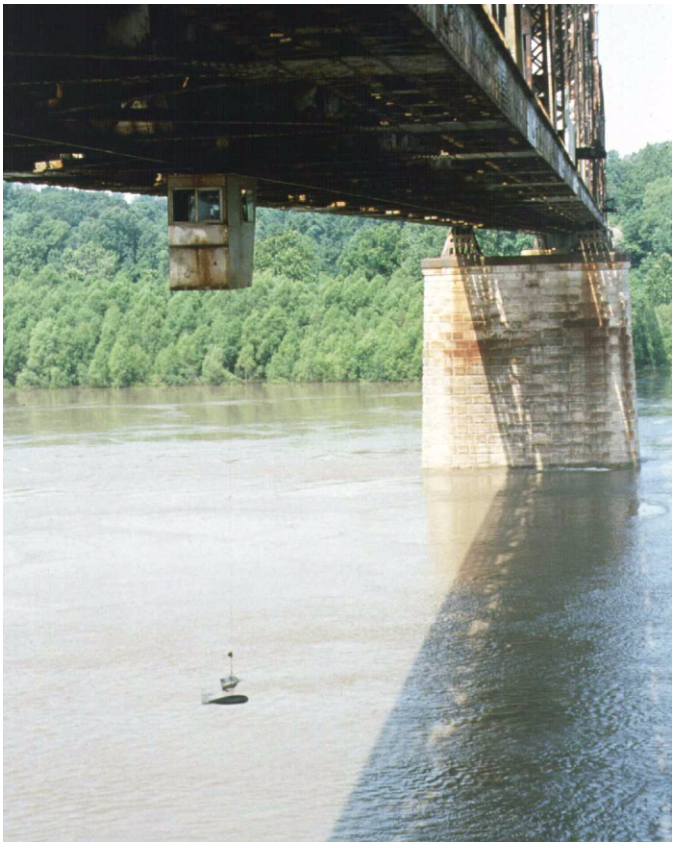

Figure 1. U.S. Geological Survey (USGS) personnel measuring flow at the Mississippi River at Thebes during the 1993 flood (USGS personnel are in the monorail system, located below the bridge deck, lowering the flow meter and 300-pound weight by cable to the river.)

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HYDROGEOLOGIC ASSESSMENT OF CAMPTON TOWNSHIP
BY
ROBERT T. KAY, HYDROLOGIST

Campton Township in Kane County, north-central Illinois (fig. 1), has experienced substantial residential development in the past 20 years. This development is expected to continue. Water needs for this residential development have been supplied exclusively by ground water, primarily from residential-supply wells, although public-supply systems serve the needs of some residents. Ground-water withdrawals for residential use have exceeded recharge in some of the residential-supply aquifers in parts of the township, resulting in large decreases in water levels and water-supply interruptions. These interruptions have necessitated lowering of pumps and deepening of wells at substantial expense to the affected homeowners. Continued residential development will increase the demand on the ground-water resources, potentially increasing interruptions in water supply. As alternate sources of water supply are either unavailable (surface water) or would require development of expensive infrastructure (deeper aquifers), it is essential that the current aquifers used for water supply be more efficiently utilized. To this end, the Campton Township Board of Trustees has requested that the USGS, Illinois and Indiana Districts, characterize the ground-water resources in the township and, based on this assessment, develop a computer model that can be used to assess the effects of present and proposed residential development on ground-water resources. The computer model also will enable the effects of changes in climatic conditions, particularly drought, on ground-water resources to be predicted.

Previously published reports pertaining to the hydrogeology in the township and surrounding areas and drillers' logs for the township and parts of the surrounding area were reviewed. These data show that four hydrogeologic units are used for residential-water supply in Campton Township—the unconsolidated sand-and-gravel deposits composing the Shallow and Deep Glacial Drift aquifers; the shallow bedrock of the Alexandrian Series and the Maquoketa Group composing the Alexandrian-Maquoketa aquifer; the Galena and Platteville Groups composing the Galena-Platteville aquifer; and the sandstones composing the Ancell aquifer (fig. 2).

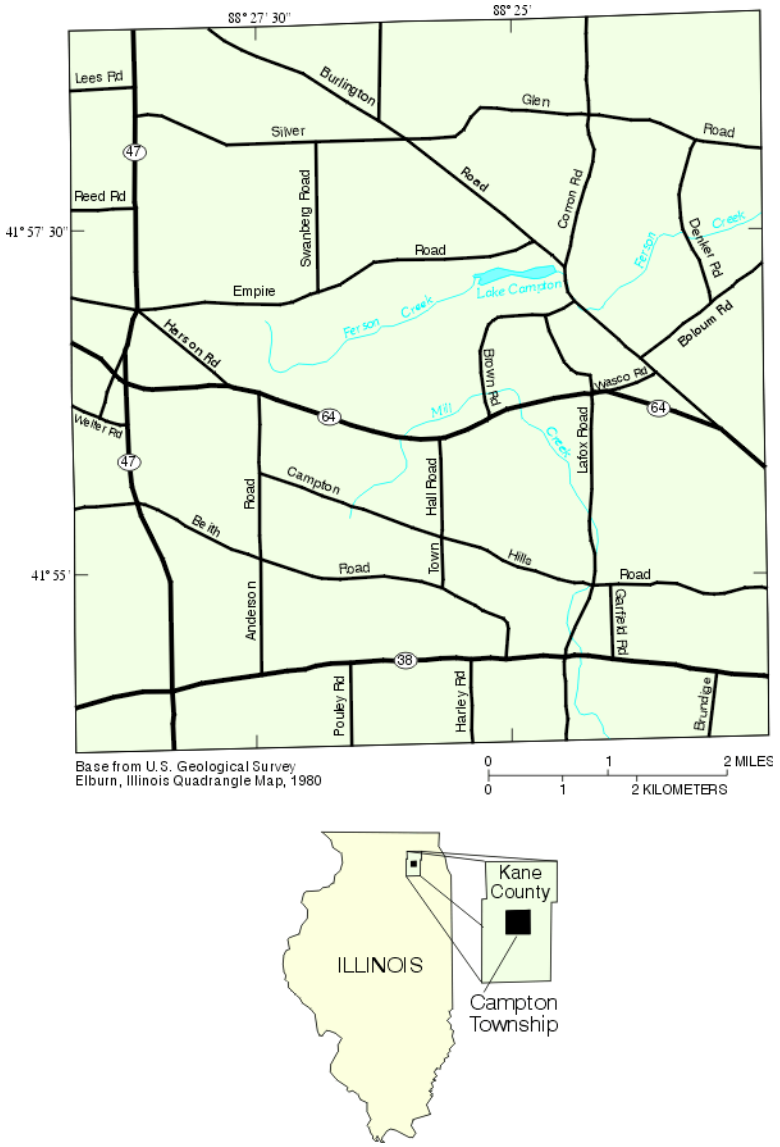

Figure 1. Location of Campton Township, Kane County, Illinois.

During the summer of 2002, water levels were measured in each of the aquifers used for residential supply. These water levels were, and compared to historical measurements, taken at the time of drilling and during a 1995 USGS survey. Water levels in wells open to the Alexandrian-Maquoketa aquifer showed the largest changes between 1995 and 2002, increasing by as much as 30 feet (ft) in a small area in the eastern part of

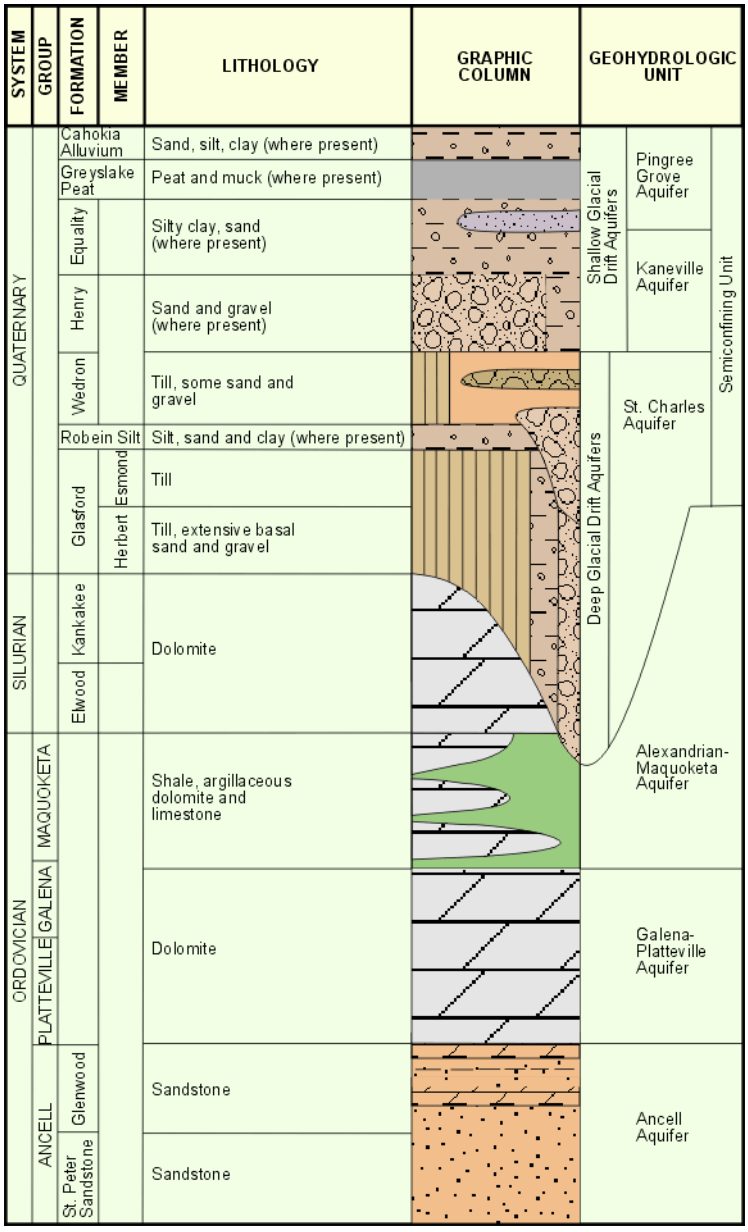

Figure 2. Generalized geohydrologic column showing stratigraphy and geohydrologic units, Campton Township, Illinois.

the township and decreasing by as much as 15 ft in part of the northeastern part of the township. Water levels in this aquifer declined by 5 ft or more in more than half of the wells measured. Wells open to the Deep and Shallow Glacial Drift aquifers showed substantially less change in water levels than wells open to the Alexandrian-Maquoketa aquifer. Water levels in 30 of 40 wells, measured in 1995 and 2000 open to the Deep and Shallow Drift aquifers were within 5 ft. Declines of 5 ft or more were measured in 8 of these 40 wells, whereas increases of 5 ft or more were measured in 2 of these wells. Water levels in wells open to the Galena-Platteville and Ancell aquifers showed no consistent trends in water levels.

Flow was measured at several points in each of the major streams in the township during the summer and fall of 2002 to determine the contribution of ground-water base flow to surface water so that recharge to the shallow ground-water-flow system can be estimated. Streamflow showed an overall decrease over the period of measurement and showed that the streams typically were gaining. Ground-water recharge to surface water resulted in less than 0.1 cubic feet per second (ft^3/s) of flow at Virgil Ditch in the northwestern part of the township during most of the period of measurement. As the name implies, Virgil Ditch is not a natural surface-water body. Ground-water recharge to surface water, with an apparently small contribution from wastewater, resulted in more than 1 ft^3/s at Ferson and Mill Creeks in the eastern part of the township.

To support the data already collected, additional work will be performed to complete the resource assessment. Constant-discharge aquifer tests will be performed during the spring and summer of 2003 to determine the transmissivity and storativity of the residential-supply aquifers. Geophysical logging will be conducted in residential-supply wells open to the Ancell aquifer during the summer of 2003 to further characterize the hydraulic properties of the aquifers accessed by these wells, estimate of the potentiometric surface of the Ancell aquifer, and provide an estimate of the volume of water draining out of the upper bedrock deposits into the Ancell aquifer through these open boreholes.

All of the available information then will be used to develop a ground-water-flow model of the residential-supply aquifers. The model will be used to predict the effects of current and future pumping on water levels in residential-supply aquifers and local wetlands, as well as on the amount of streamflow in Campton Township. The model will be used as a tool by local government agencies to assist in the management of water resources.

When is the Next Earthquake in Illinois?

by
William Morrow, Hydrologist

Illinois is not thought of as a State prone to earthquakes, but many people throughout the State have experienced the effects of earthquakes in 2002. An earthquake with it's epicenter in Alaska caused muddied wells in various counties in northern Illinois in November, while an earthquake with it's epicenter near Evansville in southwestern Indiana shook people in southern Illinois in June. The largest earthquakes in historical time in the continental United States occurred just south of Illinois near New Madrid, Missouri in 1811 and 1812. Earthquake effects potentially can occur in the entire State of Illinois (fig.1). What other earthquakes have occurred in Illinois, and where? When will the next earthquake occur in Illinois, and how big will it be?

Earthquakes in Illinois can originate from a number of source areas. There have been historical records since 1795 of earthquakes in Illinois, primarily in three general areas. There is potential for further earthquake activity in all three areas.

The area with the most potential for damage, in fact, the most potential for damage to the Nation east of the Rocky Mountains, is the New Madrid seismic zone that extends from Cairo, Illinois to Arkansas. This area has had repeated earthquakes since 1811–1812, but none as severe as the 1811–1812 earthquakes, which had estimated magnitudes around 8.0 (Richter scale). The largest recent (since 1900) earthquake in Illinois occurred in this area on November 9, 1968, in southern Illinois. The 5.5 magnitude earthquake caused cracked foundations, toppled chimneys, broken glass, and tipped gravestones, along with other reported damage.

The Wabash Valley seismic zone is another active seismic area located in southern Illinois and southern Indiana. Moderate earthquakes have occurred as frequently in the Wabash Valley area as the New Madrid area.

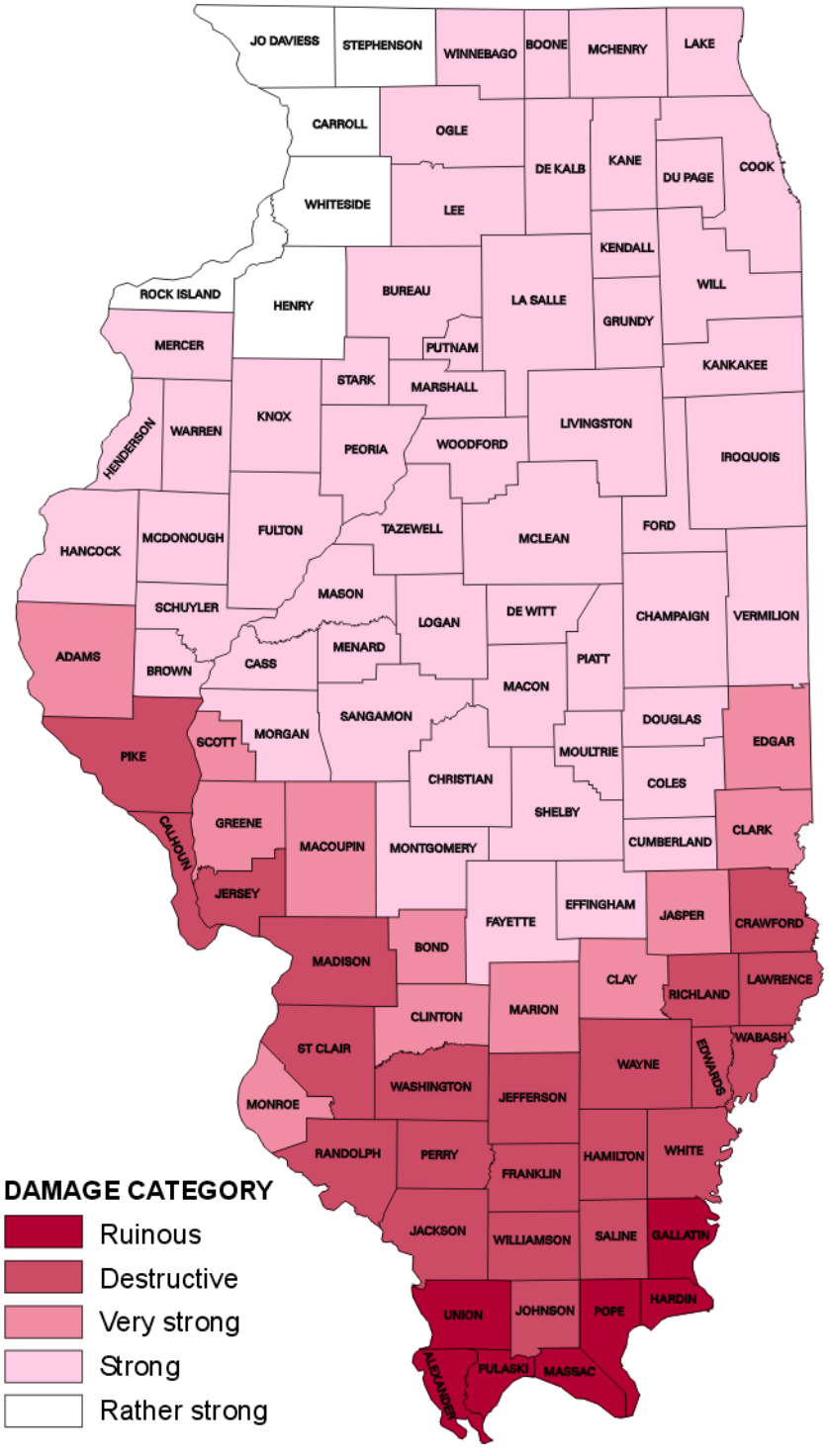

Figure 1. Potential damage from earthquake effects in Illinois. Modified from Illinois Emergency Management Agency, "Illinois Earthquake Zones" Web site, last accessed February 18, 2003: http://www.state.il.us/iema/Prep/earth_zonemap.htm.

The last major earthquake in this area was on June 18, 2002, when a 5.0 magnitude earthquake cracked chimneys and broke glass in Evansville, Indiana. The earthquake was felt in Illinois, but caused no reported damage.

Northern Illinois also is an area of seismic activity. The largest fault structure in the area is the Sandwich fault, trending approximately northwest from Kendall County to Ogle County, with up to an 800-foot displacement. The fault has not been historically active. However, nearby geological structures, such as the La Salle Anticline and the Peru Monocline, are likely related to earthquake origins. In 1999, a 3.5 magnitude earthquake occurred near Dixon, Illinois. No damage was reported, but past earthquakes in the 20th century in the area have caused cracked chimneys and wall plaster, along with other damage.

Can these earthquakes be predicted? There is no reliable way today to predict exactly when and where earthquakes will occur, or how large these earthquakes will be, but the USGS has calculated long-range earthquake probability forecasts in seismically active areas. The USGS and the Center for Earthquake Research and Information at the University of Memphis have examined the New Madrid seismic area and have estimated that the probability of a 7.5–8.0 magnitude earthquake, or as large as the earthquakes of 1811–1812, occurring in the next 50 years is from 7 to 10 percent. The probability of an earthquake of a magnitude of 6.0 or larger occurring in the next 50 years is from 25 to 40 percent. The potential for damage to man-made structures likely to be affected by earthquakes of these magnitudes is high because the New Madrid seismic area overlies thick unconsolidated sediments, which can amplify shaking motion as the earthquake travels from hard bedrock to the thick unconsolidated sediments.

For more information on earthquake hazards in the central United States, the USGS Fact Sheet FS-131-02, "Earthquake Hazard in the Heart of the Homeland," is available on the Web at http://pubs.usgs.gov/fs/fs-131-02/fs-131-02.pdf. Other earthquake information sources available on the Web are the Center for Earthquake Research and Information at the University of Memphis at http://www.ceri.memphis.edu/ and the USGS National Earthquake Information Center at http://neic.usgs.gov/.

Flooding in Illinois, April—June 2002

by

Charles F. Avery, Hydrologist

Widespread flooding occurred throughout most of Illinois in spring 2002 as a result of multiple, intense rainstorms that moved across the State during an extended period from the third week in April through the month of May in central and southern Illinois, the first week in June in northern Illinois, and the second week in June in west-central Illinois. Because the flooding resulted from multiple rainfall events stretched along successive frontal boundaries, many of which stalled as they passed over Illinois, the scale of flooding was highly variable in time and intensity throughout the State.

Total amounts of rain for the 2-month period from mid-April to mid-June 2002 ranged from less than 8 inches in extreme northeastern Illinois to over 23 inches in the central part of the State. During the flooding, numerous highways and bridges were washed out, inundated, or threatened by high water, levees were breached, agricultural land and low-lying residential areas were inundated for extensive periods of time, and several deaths were attributed to lightning strikes, tornado damage, and drownings in the floodwaters.

The USGS operates discharge or stage-recording streamflow-gaging stations throughout Illinois, in drainages just upstream of the State, and on the Mississippi, Ohio, and Wabash Rivers. Most of the stations have 10 or more years of record and, subsequently, have an established flood-frequency distribution relating annual maximum instantaneous peak flows to recurrence intervals at the station.

New maximum instantaneous discharge was recorded at 12 streamflow-gaging stations during this flood period, and new maximum stage was recorded at 15 stations. Flood stage was exceeded for at least 1 day during this 2-month period at 67 of the 82 stations with established flood-stage elevations determined by the National Weather Service. Of the 162 streamflow-gaging stations for which flood-frequency distributions have been determined, a 5-year or greater flood discharge was recorded at 87 stations. A 100-year or greater flood discharge was recorded at six stations.

A Federal Disaster Declaration was issued May 21, 2002, by President George W. Bush that provided aid to individuals, families, and businesses in 30 counties in southern Illinois affected by storms, tornadoes, and flooding that began April 21. An amendment to that Declaration issued May 30, 2002, expanded the area to include 68 counties of central and southern Illinois. On June 6, 2002, disaster assistance was expanded to include aid for local governments in 33 counties. The aid to local governments later was expanded on June 21, 2002, to 38 counties. By June 28, 2002, the amount of disaster assistance to individuals and businesses had exceeded $10.3 million.

Cooperator Spotlight

Winnebago County
Emergency Service and Disaster Agency, Sheriff's Office

Winnebago County covers an area of approximately 520 square miles in north-central Illinois. The county, with a total population of approximately 275,000, is located approximately 90 miles west of Chicago and 90 miles east of the Mississippi River at the Iowa State line. The city of Rockford (second largest city in Illinois by population, approximately 175,000) is the county seat.

Various important waterways in Winnebago County are utilized for commercial, industrial, and recreational purposes. The Rock River (largest river flowing through the county) flows from north to south. The Pecatonica River flows from west to east in the western/northwestern portion of the county and empties into the Rock River at Rockton. The Sugar River flows from north to south and drains into the Pecatonica River near Harrison. In southeastern Winnebago County, the Kishwaukee River empties into the Rock River just south of Rockford. The Rock River drains approximately 7,700 square miles (calculated to the southern Winnebago County line) in northern Illinois and southern Wisconsin. Major and minor flooding has resulted in these and other county waterways, especially during the last 10-20 years.

The Winnebago County Sheriff's Office is responsible for patrolling and monitoring the waterways, and the Winnebago County Emergency Service and Disaster Agency also is responsible for monitoring and for all emergency coordination concerning the waterways. Little information was available to the county for monitoring of the waterway and other water-resources activities. Because of the need for this information, the Sheriff's Office and Disaster Agency met with the USGS-Illinois District, the U.S. Army Corps of Engineers, and the National Weather Service in 2000 to discuss improvements to streamflow monitoring and other activities. Meeting results led to the establishment of three streamgaging stations in the county. Two daily-discharge stations were established by the USGS-Illinois District in 2002 on the Pecatonica River near Meridian Road and the Rock River near Latham Road. A third stage-only station was established by the USGS-Illinois District in 2002 on the Rock River near Auburn Street Bridge at the end of the pool created by a dam maintained and operated by Commonwealth Edison, a major power supplier in the area.

Funding for the installation and maintenance of streamgaging stations was obtained from State grants awarded to the county, Commonwealth Edison, and the USGS. Also, Winnebago County provided right-of-way to county property adjacent to bridges where stations are located, and the Winnebago County Highway Department provided equipment for station construction. Data collected at the three stations, as well as approximately 180 other streamgaging stations located throughout Illinois, are available on a real-time basis at the USGS Illinois District Web site. The National Weather Service uses these data to prepare flood warnings and forecasts as well as other uses (for example, implement mitigation efforts during droughts and for safe boating and recreation). Flood warnings and forecasts allow local, State, and Federal officials to take early actions, such as evacuations and road closures.

Close cooperation among Winnebago County and various State, Federal, and private organizations has been vital to the successful installation, maintenance, and operation of the streamgaging stations.

Employee Spotlight

Perry Draper
Hydrologic Technician

Perry Draper has been a full-time employee with the USGS-Illinois District, since 1987. He began working as a student in the Mt. Vernon Field Office, while attending Rend Lake Jr. College. Perry received his B.S. in Geology from Eastern Illinois University in 1984.

Perry has installed, serviced, and worked records for many streamgaging stations throughout Illinois. His field area, over the years, has included streamgaging stations on or connected to the Mississippi, Ohio, Illinois, Kaskaskia, Embarras, Wabash, and Big Muddy river systems.

Perry transferred to the Urbana District Office in 2000 from Mt. Vernon. While continuing his streamgaging duties, he has installed, maintained, and collected data at stream rapid assessment project sites throughout the State. Recently, he has been involved with collecting and processing sediment data in the Illinois District. He has been selected to attend a USGS National Training Center course, "Sediment Data Collection Techniques," this year.

Perry and his wife, Michelle, reside with their daughter, Megan, in Champaign, Illinois. Perry enjoys spending time with his family, tennis, and scuba diving.

WATERWATCH

BY

ANGEL MARTIN, JR., SUPERVISORY HYDROLOGIST

WaterWatch is the official USGS Web site for maps and graphs, showing real-time streamflow conditions in the United States and Puerto Rico. WaterWatch maps depict current streamflow as color-coded dots at about 3,000 streamgages throughout the Nation. Only stations having at least 30 years of continuous record are used in the maps to ensure that the calculated streamflows are representative of historical conditions. The WaterWatch Web site is available at http://water.usgs.gov/waterwatch/.

WaterWatch features a point-and-click interface allowing users to retrieve maps and graphs of real-time stage and discharge data for individual stations. From the National map, you can click on a State to find State data and click further to find real-time data at an individual streamgage. This feature facilitates rapid assessment of both general and specific water-resources conditions. WaterWatch also serves as a geospatial front end to NWISWeb, the USGS online National Water Information System that provides access by home or office computer to real-time and historical surface-water, ground-water, and water-quality data. Access to data (including real-time streamflow and historical flood peaks) by NWISWeb can be obtained at http://water-data.usgs.gov/nwis/. To provide users with a broad perspective on short-term and long-term streamflow conditions and variations, WaterWatch maps and graphs are organized into three distinct categories: real-time, daily, and 7-day average streamflow. The latter category is particularly useful for identifying regions undergoing prolonged wet and dry periods.

USGS has provided real-time streamflow and historical streamflow data on the Web for the last 5–10 years. WaterWatch marks the first time that these data have been combined with a geospatial or map-based front end. Users also can access other types of water data including historical water-quality data from rivers and aquifers, historical ground-water-level data, and real-time water quality, precipitation, and ground-water levels.

Daily WaterWatch maps also can be viewed as animations. The daily maps are grouped into monthly animations dating back to June 1999. These animations provide a useful visual characterization of streamflow changes from day to day, particularly in showing the response of a river during a large storm. Animations also show the speed at which a drought can intensify along rivers and streams.

WaterWatch and NWISWeb are integral parts of the USGS mission to disseminate important water-quality and quantity data to the public. These data can help water managers, engineers, scientists, emergency managers, recreational water users and utilities to:

- evaluate current water supplies and plan for future supplies,
- forecast floods and droughts,
- operate reservoirs for hydropower, flood control, or water supplies; evaluate and control water quality, navigate rivers and streams,
- safely fish, canoe, kayak, or raft.

From the Mailbag

If you have comments about our newsletter or our Web site, please use the form on the back page. Comments also can be sent to dc_il@usgs.gov.

"All good news. Particularly liked info on watershed studies: Judy's branch. I'm not yet discerning or specialized enough to desire any changes, so just keep up the good work..."

"Thank you very much for your help, and those sites worked out perfectly!!"

"Thank you for your quick response to my question. It is very strange that my well problems and my neighbors happened shortly after the quake. I have been told that our water supply originates from the Alaska area. I have had my well treated. The water is fine now. I will be contacting the two other source which you provided. I appreciate your opinion and help in this matter."

"I just wanted to write and tell you how impressed I am with your CEE 398 FM lecture notes/class handouts that I found on the web yesterday. I printed out Volume 1 on surface water data collection and gave it a thorough once-over. I was hired as a tech in the ... district about a year and a half ago and have since been promoted to hydrologist... I wish I would have had something as clear, concise and up to date as what you have taken the time to put together. I feel that a new hire would be more apt to read and digest your manual as opposed to WS 2175 vols 1 and 2. I have suggested that your manual be required reading material for all new hires. Thanks again for doing such an outstanding job."

Illinois District Publications

Listed below are publications that were published recently. Federal Fiscal Year (FY) covers October 1 through September 30. District policy is to provide copies of our publications to requestors at no cost as long as the publication is in stock in the District office. To obtain copies of the following, or any other Illinois District publication, you may contact Donna Ayers at (217) 344-0037, extension 3053 or by email at dmayers@usgs.gov.

FY 2003

WRIR 01-4121, Monitoring and Analysis of Combined Sewer Overflows, Riverside and Evanston, Illinois, by A.M. Waite, N.J. Hornewer, and G.P. Johnson

WRIR 02-4062, Delineation of the Troy Bedrock Valley and Particle-Tracking Analysis of Ground-Water Flow Underlying Belvidere, Illinois, by P.C. Mills, K.J. Halford, and R.P. Cobb

WRIR 02-4213, Use of Isotopes to Identify Sources of Ground Water, Estimate Ground-Water-Flow Rates, and Assess Aquifer Vulnerability in the Calumet Region of Northwestern Indiana and Northeastern Illinois, by R.T. Kay, E. R. Bayless, and R.A. Solak

"At the Printer"

The following District publications are not yet available for distribution.

OFR 02-487, Flooding in Illinois, April–June 2002, by C.F. Avery and D.F. Smith

WRIR 02-4097, Pesticides in Surface Water in the Lower Illinois River Basin, 1996–98, by R.B. King

WRIR 02-4293, Anthropogenic Constituents in Shallow Ground Water in the Upper Illinois River Basin, by W.S. Morrow