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Water Resources Update

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Table of Contents

Message from the Director
Robert R. Holmes, Jr., PhD, P.E.

For hydrologic problems, many facets of technology are often brought to bear to study and solve these problems. Twenty-five years ago, many of us knew little about computerized geographic information systems (GIS) or what it could do for us. Today, GIS and associated digital geospatial information is a crucial part of the science of hydrology. The efforts of the U.S. Geological Survey (USGS) to coordinate with State and local agencies in the geospatial arena are being spearheaded by USGS liaisons located primarily in the USGS Water Science Centers. Shelley Silch is the USGS liaison for Illinois, sitting here in the USGS Illinois Water Science Center. You can read about her activities in this newsletter issue. Two other technological areas being utilized by the hydrologic community are NEXRAD radar and the World Wide Web. NEXRAD provides rainfall at a spatial density not practical with physical rain gages. This increased rainfall information has enhanced our rainfall-runoff modeling capabilities as is shown in the USGS Illinois Water Science Center work in northern Illinois and discussed in this issue. The World Wide Web allows us to organize and share data between agencies and scientists, maximizing collaboration and time spent on science, while minimizing the time spent searching for data. The article by Audrey Ishii outlining the work we are conducting with the University of Illinois for the Salt Creek watershed is a perfect example of this collaboration.

NEXRAD Radar Precipitation Data: Studies and Use at the USGS Illinois Water Science Center

by
Thomas Over, Hydrologist

Background

In 1990, the National Weather Service (NWS) began deploying the Next Generation Radar (NEXRAD) WSR-88D weather radars around the United States and at selected military bases around the world; deployment was completed in 1997 (figure 1). In Illinois, NEXRAD radars are located at Romeoville and Lincoln, and radar data from several radars in surrounding states are also relevant for Illinois. NEXRAD radars provide information on many atmospheric parameters, including the storm motion and vertical structure, and hail and tornado indication; but the parameter of primary interest for hydrology and water resources is the precipitation rate.

NEXRAD radars are scanning radars, which means they scan radially, using different elevation angles to provide information on vertical atmospheric structure and to avoid man-made or topographic obstacles (figure 2). There are several scanning patterns from which the operators can choose; the most important distinction is between "clear-air" and "precipitation" modes. Usually the lowest valid elevation angle is the best one to use for estimating precipitation at ground level. Therefore, raw NEXRAD data follows a radial coordinate system defined by azimuth, elevation angle, and range (distance from the radar).

Initial processing of the raw radar data is performed automatically at the radar installation and includes the following steps: (1) combination of different elevation angles into the "best" single scan; (2) removal of non-precipitation returns; (3) converting reflectivity (Z) to rain rate (R) by use of a Z-R relation, $Z = aR^b$; (4) correcting for hail returns; (5) correcting for range bias; and (6) conversion from radial coordinates to the Hydrologic Rainfall Analysis Project (HRAP) grid, whose pixels are approximately 4 by 4 km in size. Execution of these steps, among others, creates the Digital Precipitation Array (DPA). This array is passed on to the river forecasting centers (RFC's) of the NWS, where DPA fields from different radars are combined together and the precipitation rates are adjusted by NWS hydrometeorologists by comparison with rain gages that report in real-time. The result is called the Multisensor Precipitation Estimate (MPE). Various NEXRAD radar precipitation estimates are available from archives maintained by the NWS and the National Climatic Data Center and are accessible via the World Wide Web.

Figure 1. NEXRAD radar sites in the continental United States (figure from *http://www.ncdc.noaa.gov/nexradinv/*)

Use of NEXRAD Data at the USGS Illinois Water Science Center

MPE fields created at the North Central RFC (NCRFC) in Chanhassen, Minnesota, are sent to the USGS Illinois Water Science Center (IWSC), processed, and made available to the Salt Creek near-real-time streamflow simulation project. The project is run cooperatively with the DuPage County Stormwater Management Division in order to supplement the available rain gage data, which may be subject to various kinds of errors or may be missing (figure 3). See the article, Salt Creek

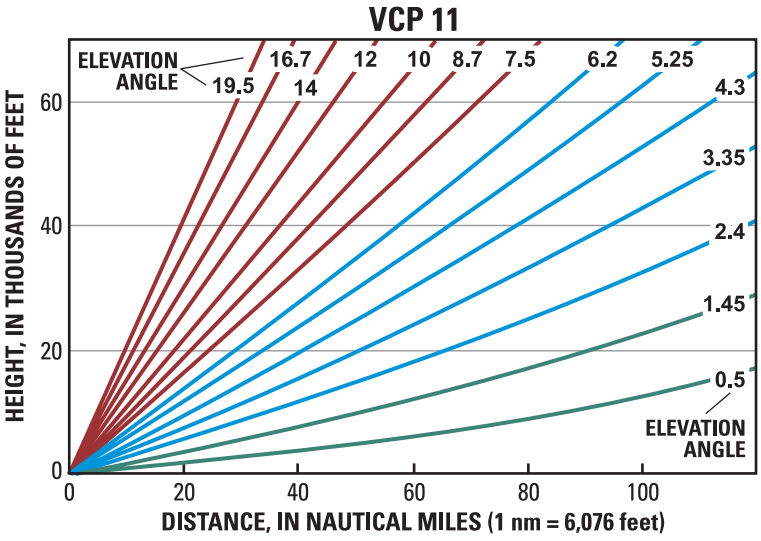


Figure 2. NEXRAD Volume Coverage Pattern (VCP) 11, used for severe and non-severe precipitation (from Federal Meteorological Handbook, No. 11, Part C, 2006).

Hydrologic Information to be Analyzed, Disseminated in an Integrated Browsable Format, on page 8 of this newsletter. The MPE data is available 2 to 12 hours after the precipitation actually fell. Before the MPE data is available, the automatically processed DPA data is available to be used as an initial estimate of the radar precipitation value.

The IWSC also provides MPE data over the whole NCRFC domain, along with IWSC rain gage totals, to the public in a precipitation mapping interface at *http://munster.er.usgs.gov/rainfall/* and has been used by IWSC hydrologists to spatially distribute the precipitation for modeling the July 1996 flood in Blackberry Creek (see report at *http://pubs.usgs.gov/sir/2005/5270*).

Comparison of MPE and Rain Gage Data in DuPage County

In order to assess the accuracy of NEXRAD data, in particular the MPE product, for Salt Creek streamflow simulation, a study was carried out at the IWSC, in cooperation with the DuPage County Stormwater Management Division, to compare the precipitation measured by the DuPage County tipping-bucket rain gage network and the NEXRAD MPE data provided by the NCRFC. The comparison was done at the daily time scale during above-freezing conditions between the amount of rain recorded at each rain gage and the MPE total in the cell in which each gage lies. The main lesson learned from this study is that the correspondence between the gage and NEXRAD rainfall values has fluctuated over time, but has been quite close, when averaged over all the gages, during the period from 2001 through 2005 (figure 4). A similar study is ongoing to compare the DPA and MPE values.

The Future of NEXRAD at IL WSC

We expect continued use of NEXRAD radar precipitation data in the Salt Creek forecasting project and in rainfall-runoff studies, such as an ongoing study of Kishwaukee River headwaters in Kane County. A test of the possible value of NEXRAD-based "nowcasting" for the

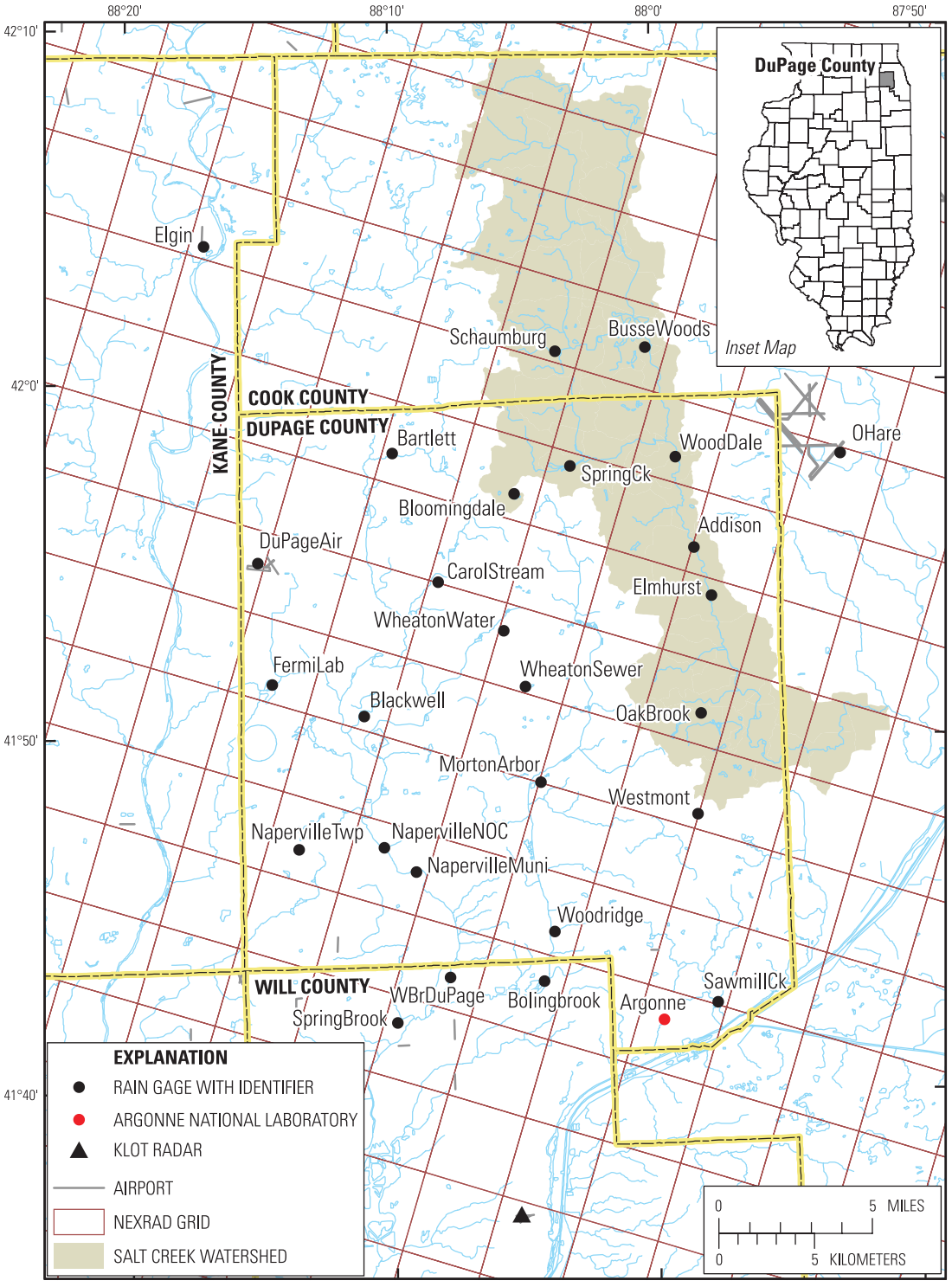


Figure 3. Salt Creek watershed in DuPage and Cook Counties, with rain gages and NEXRAD grid.

Salt Creek project. This project, which is planned for the coming year, uses the observed motion of precipitation systems over the past few hours to predict their motion over the next few hours. NEXRAD radar precipitation data will also figure prominently in a new partnership with the University of Illinois at Urbana-Champaign, Department of Civil and Environmental Engineering, and the National Center for Supercomputing Applications. Salt Creek will be used as a test-bed for the development of a "digital watershed".

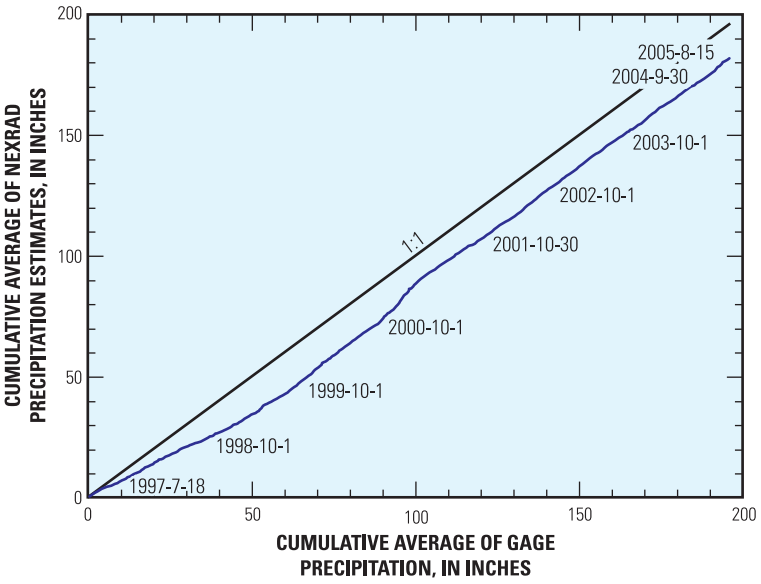


Figure 4. Double-mass curve analysis of NEXRAD versus gage precipitation in DuPage County.

EMPLOYEE SPOTLIGHT

Jon Hortness

(Hydrologist)

Jon Hortness is a Hydrologist/Engineer in the USGS Illinois Water Science Center's DeKalb Office. As part of the Hydrologic Data Collection and Analysis Section, Jon's current duties include oversight of streamflow, sediment, ground-water, and rainfall data collection efforts at over 80 locations in northern Illinois, as well as assisting with data collection and analysis efforts for specific hydrologic investigations in the area.

Jon holds BS and MS degrees in Civil Engineering from the South Dakota School of Mines and Technology in Rapid City. He also is a registered Professional Engineer in Illinois, Idaho, and Wisconsin. Jon began his career with the USGS in 1996 in the South Dakota Water Science Center while pursuing his MS degree. Following that, he spent 8 years with the Idaho Water Science Center in the Scientific Investigations Section as project chief for various surface water projects. This work included flood modeling, surface-water/ground-water interactions, analyses of low-flow and droughts, regionalization of streamflow estimates, and analysis of in-stream aquatic habitats. Jon also served as the Western Region specialist for Hydroacoustics and Cableways, and provided and assisted with training in these areas.

Jon, his wife Nicole (also a Civil Engineer who previously worked for DuPage County) and children, Brooke (11), Bradley (6), and Kyle (1), moved to Illinois in the summer of 2006 to be closer to family. Jon worked a short time for an engineering consulting firm on various water resources type projects. A majority of the work was being performed for the Illinois Department of Transportation and Metropolitan Water Reclamation District of Greater Chicago. In March 2007, Jon accepted the position in the DeKalb Office.

Although Jon's previous experience dealt mainly with specific project work, he understands the importance of quality water resources data. He said, "Whenever I was working on a project, I would collect the necessary data myself or make sure that the people who were collecting the data knew exactly what it was going to be used for. The final result of any analysis is only as good as the data that went into it." Jon feels that quality data that is collected consistently across the Nation and is readily accessible to the public is key to the USGS mission. "In my short career, I've seen a huge increase in the public's awareness and use of our data. I think it's important that we continue to try to improve our data collection techniques with new methods and technology so we can be as accurate and efficient as possible."

Statewide Geospatial Coordinating Activities
by
Shelley L. Silch, Physical Scientist

The National Spatial Data Infrastructure (NSDI)[1] Cooperative Agreements Program (CAP) is an annual program to assist the geospatial data community through funding and other resources in implementing the components of the NSDI. This program is open to Federal, State, local and tribal governments, academia, commercial, and non-profit organizations. This program provides small seed grants to initiate sustainable on-going NSDI implementations. The program emphasizes partnerships, collaboration and the leveraging of geospatial resources in achieving its goals. The State of Illinois is a recipient of a 2007 CAP grant for $50,000 in the Fifty States Initiative[2] category.

The Fifty States Initiative is a partnership between the National States Geographic Information Council (NSGIC)[3] and the Federal Geographic Data Committee (FGDC)[4]. This initiative is designed to bring all public and private stakeholders together as Statewide GIS coordination bodies that help to form effective partnerships and lasting relationships. Illinois has been an active member of NSGIC for a number of years. In addition to the initiative, NSGIC has published nine criteria that members believe are essential for effective Statewide coordination of geospatial information technologies. These nine criteria include: (1) A full-time, paid coordinator position is designated and has the authority to implement the State's business and strategic plans; (2) a clearly defined authority exists for Statewide coordination of geospatial information technologies and data production; (3) the Statewide coordination office has a formal relationship with the State's Chief Information Officer (or similar office); (4) a champion (politician or executive decision maker) is aware and involved in the process of coordination; (5) responsibilities for developing the NSDI and a State Clearinghouse are assigned; (6) the ability exists to work and coordinate with local governments, academia, and the private sector; (7) sustainable funding sources exist to meet projected needs; (8) coordinators have the authority to enter into contracts and become capable of receiving and expending funds; and (9) the Federal Government works through the Statewide coordinating authority.

As a recipient of the 2007 CAP grant, Illinois is interested in revitalizing the activities of the Illinois Geographic Information Council (ILGIC), revise the existing State strategic plan, and develop a business plan to support geospatial activities in Illinois. The strategic planning process will build on the existing administrative foundation of ILGIC. Two of the primary goals of this process will be to provide strategic direction to ILGIC and to strengthen its effectiveness as the principal geospatial oversight group in Illinois. The Strategic and Business Plans for Illinois will identify the needs for enhanced geospatial coordination and integration among all levels of government, the private sector, and stakeholders. By using the NSGIC FiftyStates Initiative as a model, the core project team will focus on the development of practical strategies to hasten a successful outcome. The revised 5-year strategic and business plans will serve as roadmaps that will guide future efforts concerning the fiscal, administrative, and technical requirements of an integrated geospatial technology infrastructure for Illinois.

The first Statewide stakeholder meeting was held in Champaign, Illinois on July 25, 2007. There were over 140 attendees at this first gathering. Two primary goals of this meeting were: (1) explain the current status of coordination and collaboration throughout the State, and (2) garner input from stakeholders for the purpose of crafting the strategic and business plans. An additional goal of this meeting was to recruit nominations for a smaller group to begin work on the strategic and business plans. Nominations were accepted and a core group of stakeholders was selected to work on the second step of the process. This second step encompasses the work needed to outline and draft the strategic and business plans. This core stakeholder group had their first meeting in Springfield on August 28, 2007. Future meetings are planned for October and November 2007. The final phase of this project will be to publicize the plans and to incorporate comments and suggestions. For aditional information and to keep up-to-date with the activities of this project, please visit: *http://www.ilgisa.org/GIS_Initiative_2007/index.html*.

[1] The NSDI is a means to assemble geographic data Nationwide to serve a variety of users.

[2] Initiative that identifies the criteria, characteristics, and activities that will identify effective coordination councils.

[3] NSGIC is an organization committed to efficient and effective government through the prudent adoption of geospatial information technologies.

[4] FGDC is an interagency committee that promotes the coordinated development, use, sharing, and dissemination of geospatical data on a National basis.

Kendall County is located on the fringe of the Chicago Metropolitan area in northeastern Illinois (figure 1). The population of Kendall County has increased steadily since about 1950, reaching an estimated 66,565 people in 2003. This population growth is expected to continue and by 2030, the population of Kendall County is projected to be about 170,000—nearly 10 times the population in 1950.

As a result of population growth, water use in Kendall County also has increased from about 1.2 million gallons per day in 1957 to more than 5 million gallons per day in 2000. Water use in Kendall County will increase substantially in the future as the population continues to increase. To help meet future demands for clean drinking water, the USGS and the County made a preliminary assessment of the water resources in Kendall County. This assessment is presented in USGS Scientific Investigations Report 2005-5122, available at *http://il.water.usgs.gov/pubs/sir2005-5122.pdf*.

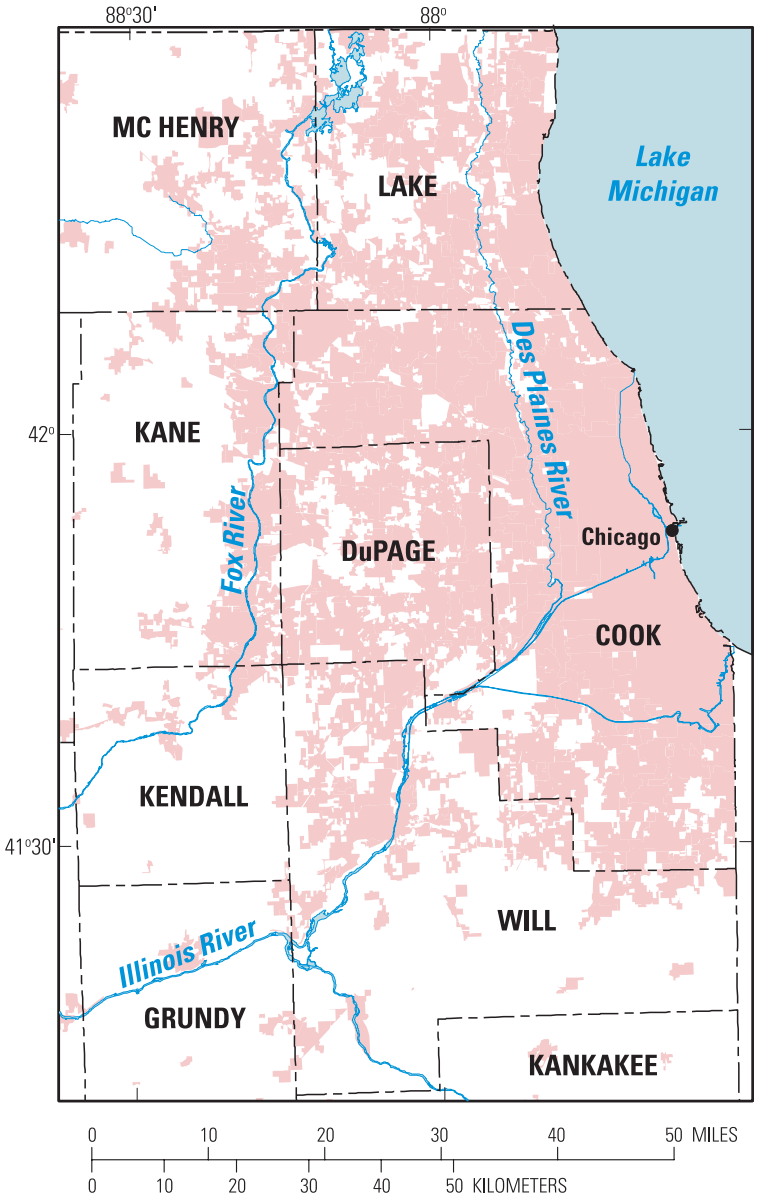


Figure 1. Location of Kendall County and the Chicago Metropolitan area (pink shading) in northeastern Illinois.

The Fox River is the primary surface-water body in Kendall County and is used for both wastewater disposal and as a drinking-water supply upstream of the county. Water from the Fox River requires treatment for use as drinking water, but the river is a potentially viable additional source of water for the county.

Water supply needs in Kendall County are met exclusively from ground water derived from glacial drift aquifers and bedrock aquifers open to Silurian, Ordovician, and Cambrian age formations (figure 2).

The full extent of glacial drift aquifers capable of yielding sufficient water for municipal supply is not know, but they are likely present in northern Kendall County along the Fox River, and in the Newark Valley and its tributaries (figure 3). Known glacial drift aquifers capable of yielding sufficient water for residential supply are present in most of the county, with the exception of the southeastern portion. Volatile organic compounds and trace metals and pesticides have been detected at concentrations below levels of concern in glacial drift aquifers near waste-disposal sites. Agricultural-related chemical constituents have been detected infrequently in glacial drift aquifers near agricultural areas. However, widespread problems with water quality are not apparent in these aquifers. These aquifers are a viable source for additional water supply, but require further study to determine their full extent and potential prior to full development.

The shallow bedrock aquifer is composed of the sandstone units of the Ancell Group, the Prairie du Chien Group, and Galena-Platteville dolomite, the Maquoketa Group, and the Silurian dolomite where these units are the bedrock surface under the glacial drift. The availability of water from the shallow bedrock aquifer depends primarily on the geologic formation used. The Silurian dolomite,

Galena-Platteville dolomite, and Ancell Group can yield sufficient water for residential and municipal supply in at least some parts of the county.

The Cambrian-Ordovician aquifer system comprises the most widespread, productive aquifer in northen Illinois and its use for municipal-water supply has increased within the county in the past several years. Water levels in the Cambrian-Ordovician aquifer system have declined by as much as 600 feet in Kendall County since the late 1800s and the aquifer frequently contains concentrations of radium above established health guidelines, necessitating treatment of this water.

References

Schicht, R.J., Adams, J.R., and Stall, J.B., 1976, Water resources availability, quality, and cost in northeastern Illinois: Illinois State Water Survey Report of Investigation 83, 90 p.

SYSTEM	GROUP	FORMATION	REGIONAL AQUIFER OR CONFINING UNIT	LOCAL HYDROGEOLOGIC DESIGNATION	THICKNESS (feet)	DESCRIPTION
Quaternary		Cahokia	Sand and gravel aquifers and till, silt, and clay confining units	Glacial drift aquifers and confining units	0-400	Alluvial silt, sand, gravel
	Mason	Equality				Lacustrine silt, clay, sand
		Peoria and Roxanna Silt				Eolian silt
		Henry				Glacial alluvial silt, sand, gravel
	Wedron	Lemont				Glacial till
Silurian		Kankakee	Silurian aquifer	Shallow bedrock aquifer: Units of Maquoketa Group less than 160 feet below bedrock surface part of shallow bedrock aquifer. Units more than about 160 feet below bedrock surface part of upper confining unit. Galena-Platteville part of shallow bedrock aquifer where unit is at bedrock surface, part of upper confining unit where overlain by Maquoketa Group.	0-100	Dolomite
		Edgewood				
Ordovician	Maquoketa	Neda	Upper confining unit		0-150	Shale, locally argillaceous dolomite or limestone
		Brainard				
		Fort Atkinson				
		Scales				
	Galena				0-350	Dolomite and limestone
	Platteville					
	Ancell	Glenwood	Cambrian-Ordovician aquifer system	Ancell aquifer. Part of shallow bedrock aquifer where at bedrock surface. Part of Cambrian-Ordovician aquifer system where overlain by Galena-Platteville unit	200-300	Sandstone, shale at top
		St. Peter				Sandstone. Basal shale (Kress Member)
	Prairie du Chien	Shakopee		Middle confining unit: Upper part of Prairie du Chien part of shallow bedrock aquifer where at bedrock surface. Parts of Prairie du Chien Group and sandstones are aquifers locally where not at bedrock surface.	0-200	Dolomite
		New Richmond			0-65	Sandstone
		Oneota			0-250	Dolomite
		Gunter			0-15	Sandstone
Cambrian		Eminence			100	Dolomite and sandstone
		Potosi			100-150	Dolomite
		Franconia			100	Dolomite, sandstone, and shale
		Ironton				
		Galesville		Ironton-Galesville aquifer	175-200	Sandstone, fine-to-medium grained, well sorted, upper part dolomitic
		Eau Claire	Lower confining unit	Lower confining unit	300-400	Shale, siltstone, dolomite
			Mt. Simon aquifer	Mt. Simon aquifer		Sandstone (Elmhurst Member)
		Mt. Simon			2500-2800	Sandstone

Figure 2. Generalized hydrogeologic column showing stratigraphy and hydrogeologic units in Kendall County.

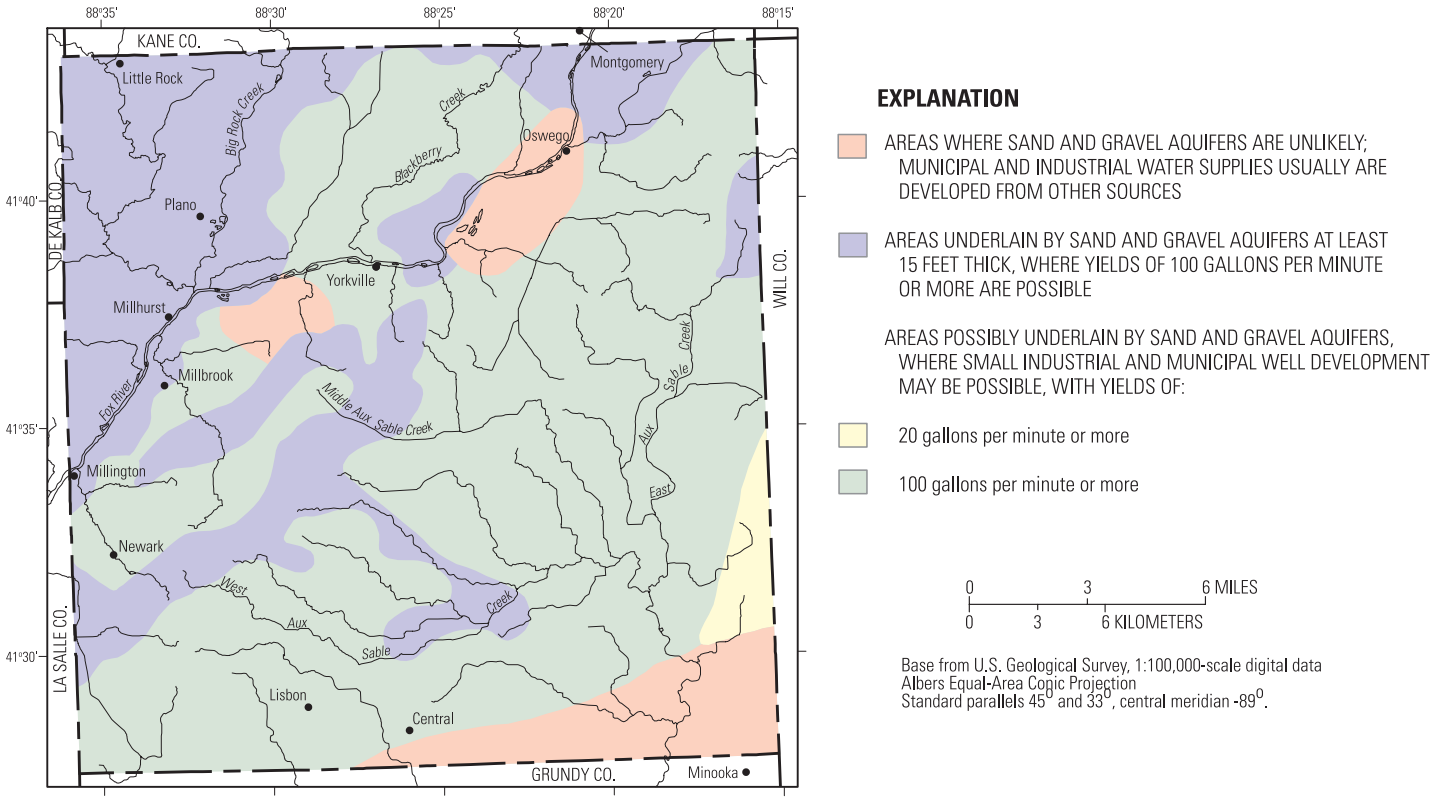


Figure 3. Well yields of glacial drift in Kendall County (modified from Schicht and others, 1976).

Salt Creek Hydrologic Information to be Analyzed, Dissemination in an Integrated Browsable Format

by
Audrey L. Ishii, Chief, Surface-Water Investigations Section

Located in the Greater Chicago Metropolitan Region (GCMR), the Salt Creek Watershed drains from Lake County, through Cook and DuPage Counties to the Des Plaines River. In August 1987, the GCMR experienced heavy flooding resulting in 4 deaths and damages in excess of $62.4 million (Curtis, 1990), the most severe of which was in the communities along the Des Plaines River and Salt Creek (Balding et al., 1992). Subsequently, with expanded authority from the State, DuPage County (DPC) strengthened its development of a stormwater management program including the construction and management of two operational flood control facilities with hydrologic data collection by the U.S. Geological Survey - Illinois Water Science Center (USGS-IWSC) as one of its cornerstones.

Over the next two years (August 2007-May 2009) the DuPage County Stormwater Management Division (DPCSMD) and the USGS-IWSC will be working with researchers funded by the University of Illinois at Urbana-Champaign (UIUC) through the Adaptive Environmental Sensing and Information Systems (AESIS) initiative. One of the five projects the AESIS initiative will be funding is—An Urban Digital Watershed—Real-time Hydrological Data Dissemination and Analysis using an Integrated Stormwater Management Information System in and near the Salt Creek watershed.

This cooperative work is to enhance the Salt Creek Real-Time Streamflow Simulation System, developed by the DPCSMD and the USGS. This project will incorporate real-time streamflow, NEXRAD precipitation estimates, and precipitation gage information collected by DPCSMD, the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC), the National Weather Service (NWS), the USGS, and other agencies.

The real-time data presentation will be accessible as a map interface overlaying aerial photograph images with hydrologic data that will improve public access and understanding of streamflow-related conditions such as flooding and potential flooding in the Salt Creek watershed. The real-time data analysis, especially the data summaries and the improved detection of anomalous data, and data gaps will assist DPCSMD engineers and other emergency and flood control agencies in operational decision-making regarding reservoir management and other flood-control measures.

The USGS, together with DPCSMD, operates 36 rainfall gages throughout and near DuPage County. Stream elevations are monitored at more than 15 locations, and streamflows at 11 sites are monitored, computed, and published by the USGS. NWS NEXRAD estimates of precipitation data for 4-kilometer by 4-kilometer areas are formatted for streamflow simulation models and made available through the Internet (see the related article in this issue). Meteorological data collected by Argonne National Laboratory are reviewed annually, missing periods estimated, and made available in an hourly format for use in long-term simulations.

For the Salt Creek watershed, a near real-time streamflow simulation system has been developed that incorporates real-time sensor data, including stage, computed streamflow, precipitation (including the Quantitative Precipitation Forecast [QPF] produced by the National Weather Service) data and NEXRAD precipitation estimates, temperature, wind, dew point, and solar radiation into a continuous hydrologic model (HSPF). The resulting runoff is then routed through the dynamic wave model Full-Equations (FEQ), to determine water elevations at key locations along the lower Salt Creek. Selected hydrologic and meteorologic data collection stations in the Salt Creek area are shown in the figure below.

The Digital Watershed project will graphically present the NEXRAD data and provide comparison with the precipitation-gage and streamgage data in real time. The forecast elevations determined through the computer models operated by the DPCSMD will be improved by the access to the analyzed and displayed data. The computer model results will be also incorporated into the interface for operational decision support.

Also funded through the AESIS initiative, several other research projects focus on aspects of water-use decisions, optimization of data-collection networks, water detention basin effects on West Nile virus outbreaks, human impacts on watershed management, and stormwater management optimization.

According to Barbara Minsker, University of Illinois professor of Civil and Environmental Engineering and director of AESIS, "…the Salt Creek watershed provides an excellent test bed for prototyping the Digital Watershed in supporting both research and decision making, given the large investments made in data collection networks and modeling infrastructure by the SMD and other agencies."

AESIS is funded by the University of Illinois Urbana Champaign Vice Chancellor for Research, National Center for Supercomputing Applications, and Dept. of Civil and Environmental Engineering. According to James F. Zay, Chairman of the DuPage County Stormwater Management Planning Committee, "This research study recognizes the people of DuPage County who have made a tremendous investment in proactive stormwater management and flood damage prevention."

References

Balding, G.O., Ishii, A.L., 1992, Floods of September 26–October 4, 1986, and August 14–17, 1987, in Illinois: U. S. Geological Survey Water-Resources Investigations Report 92-4149, p. 25.

Curtis, G.W., 1990, Storm and floods of August 13 to 15, 1987, in Cook and Du Page Counties, Illinois, in National Water Summary 1987—hydrologic events and water supply and use: U.S. Geological Survey Water-Supply Paper 2350, p. 50.

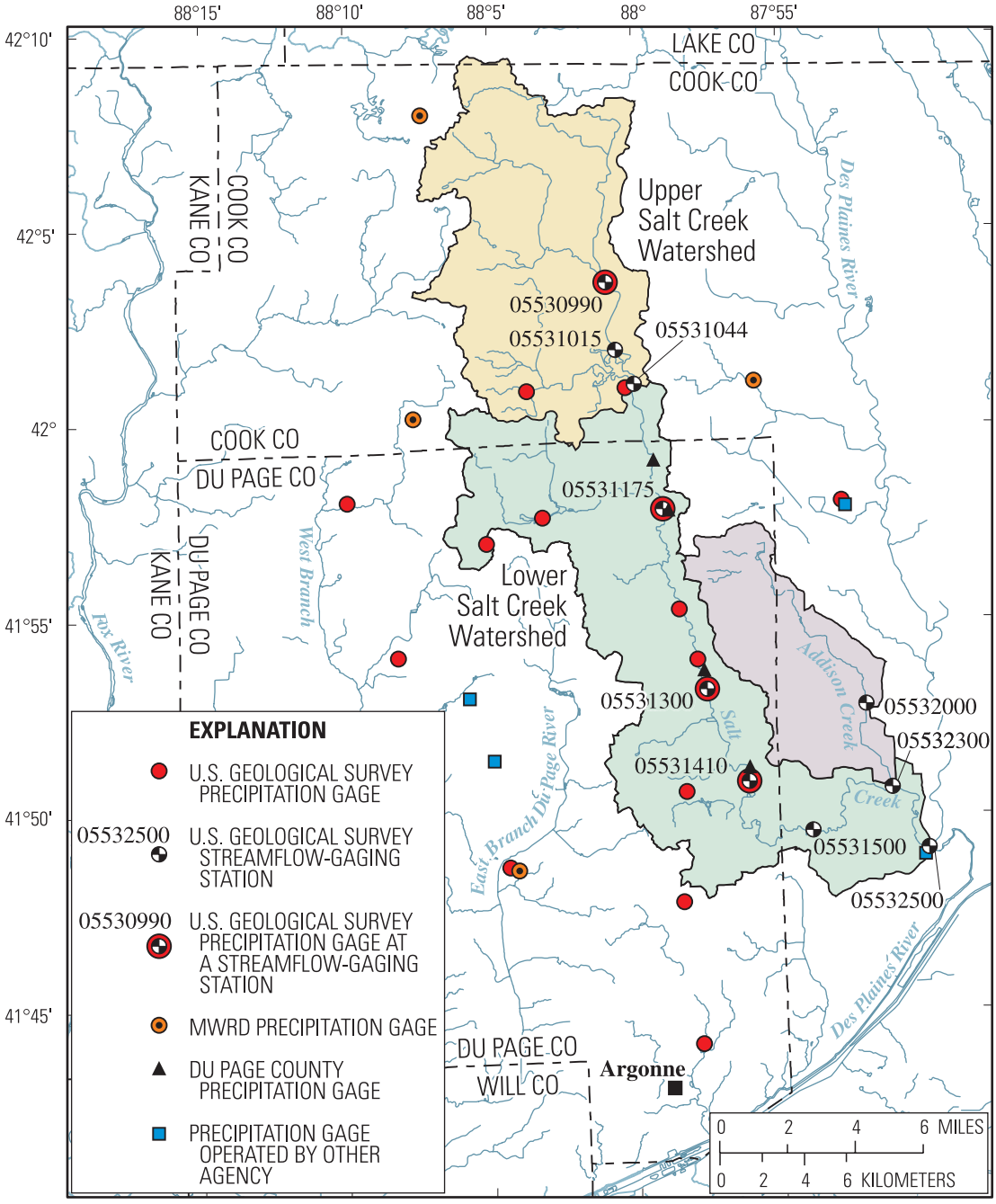


Figure 1. Locations of precipitation gages and streamflow-gaging stations in vicinity of the Salt Creek Watershed, DuPage and Cook Counties.

August 2007 Flooding in Northeastern Illinois
by
Marvin Harris

On August 7, 2007, intense local precipitation of 5–7 inches caused severe urban flooding in downtown Rockford. The rainfall seemed to be centered on the high ground separating the Rock River and Kishwaukee River, threatening the Alpine Dam and flooding streets and viaducts along ravines leading through both the east and west sides of the city. Although Rockford was not affected as significantly by subsequent flooding, for the city August was the wettest month in recorded history. Although the localized rainfall had little effect on over-all streamflow at the time, saturated soil conditions created by this earlier event contributed to the high discharge levels later experienced on the Rock and Kishwaukee Rivers.

On August 19, the remnants of Tropical Storm Erin began to feed moisture into a stationary front over southeastern Minnesota and southern Wisconsin. The result was catastrophic flooding in Winona, Minnesota. The stationary front persisted over southern Wisconsin for the following week, producing extended periods of heavy rainfall.

The first effects in northern Illinois were localized flooding similar to the Rockford event, with the Kishwaukee River rising again from local rainfall. Smaller streams in the Chicago area were affected by the scattered nature of the precipitation, with initial peaks occurring in separate small basins such as the Fox River tributaries in the western suburbs, the Skokie River in the north, and the Little Calumet River tributaries in the south.

The long-term effects of the August 19 precipitation began with inflow from the headwaters of larger streams originating in southern Wisconsin. Initial flooding began on the Des Plaines River, followed by the Fox River, and the Rock River.

The final storm event occurred on Aug. 23, when heavy rainfall and high winds tore through the Chicago Area. The rainfall was again highly localized. The South Branch Kishwaukee River near DeKalb, Tyler Creek near Elgin, and Deer Creek near Chicago Heights, all basins hit by the earlier precipitation on August 19, suffered 100-year floods. Larger basins such as the DuPage River were pushed up to the 50-year flood level, while the Salt Creek basin suffered flooding comparable to the 1987 levels. Local rainfall combined with main-stem inflow to push the Fox River at Algonquin to a 40-year level.

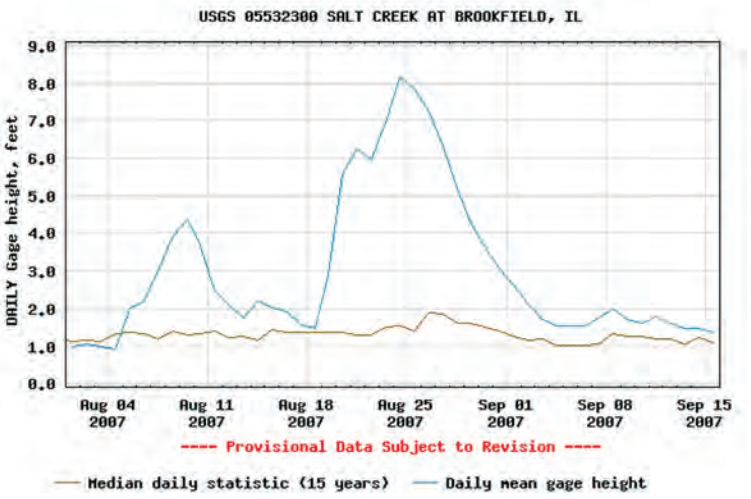
Because the rainfall occurred over an extended period of time, with several highly localized events over a large area, the greatest effect was to increase the flow of the larger basins, often at points far removed from the site of the storm events. The most pervasive flooding was therefore seen along the downstream reaches of the Rock, Fox, and Des Plaines Rivers. Although flood recurrence levels for these larger streams were only in the 5–10 year recurrence range, they remained above flood stage for several weeks.

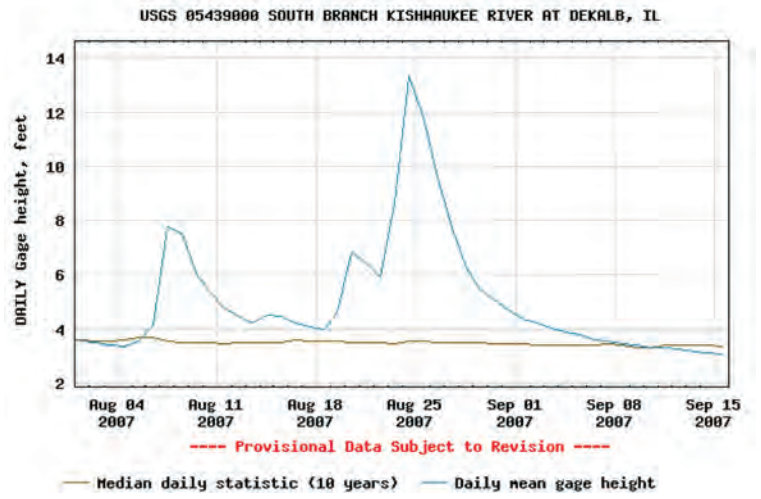
In all, over 50 streamgaging sites from the Quad-Cities to Chicago were significantly affected by the persistent flooding, and crews made over 70 discharge measurements, in many cases on rises and recessions over multiple events. More information about measurements made and the flood activities log can be found at

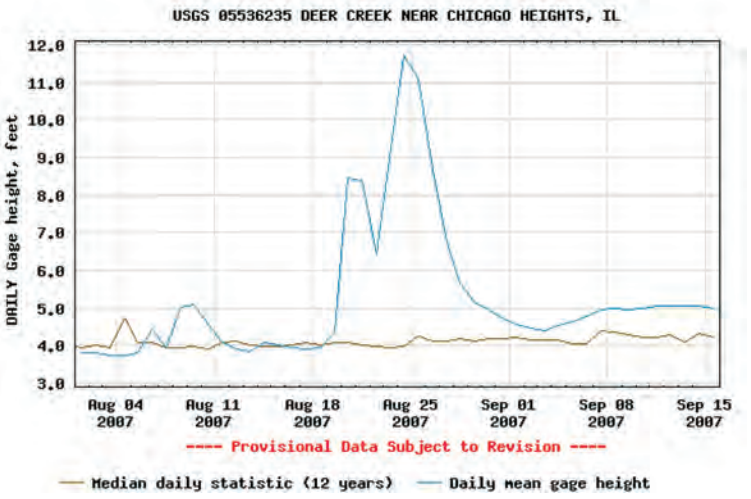
http://il.water.usgs.gov/flooddata/view.cgi?date=20070820

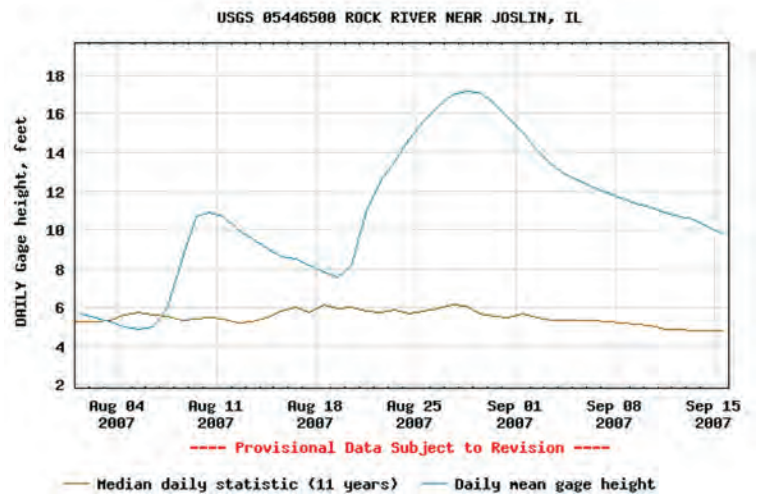
Flooded neighborhood east of the Kishwaukee River in De Kalb, Illinois.

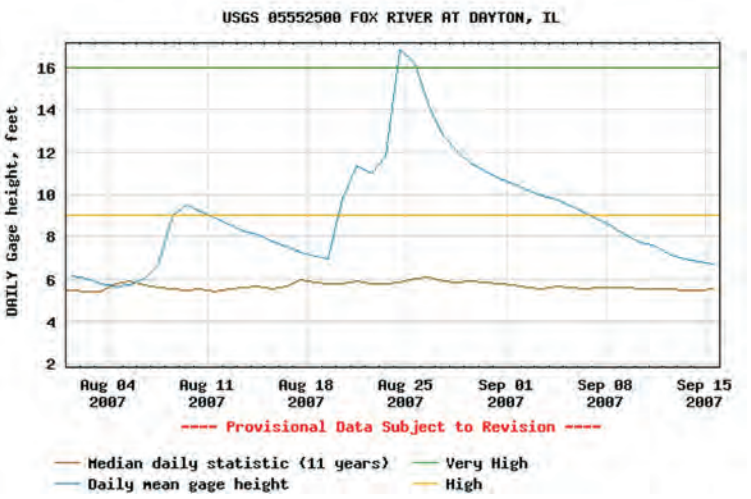
Downstream side of the U.S. Route 6 bridge on Aux Sable Creek, Grundy County.



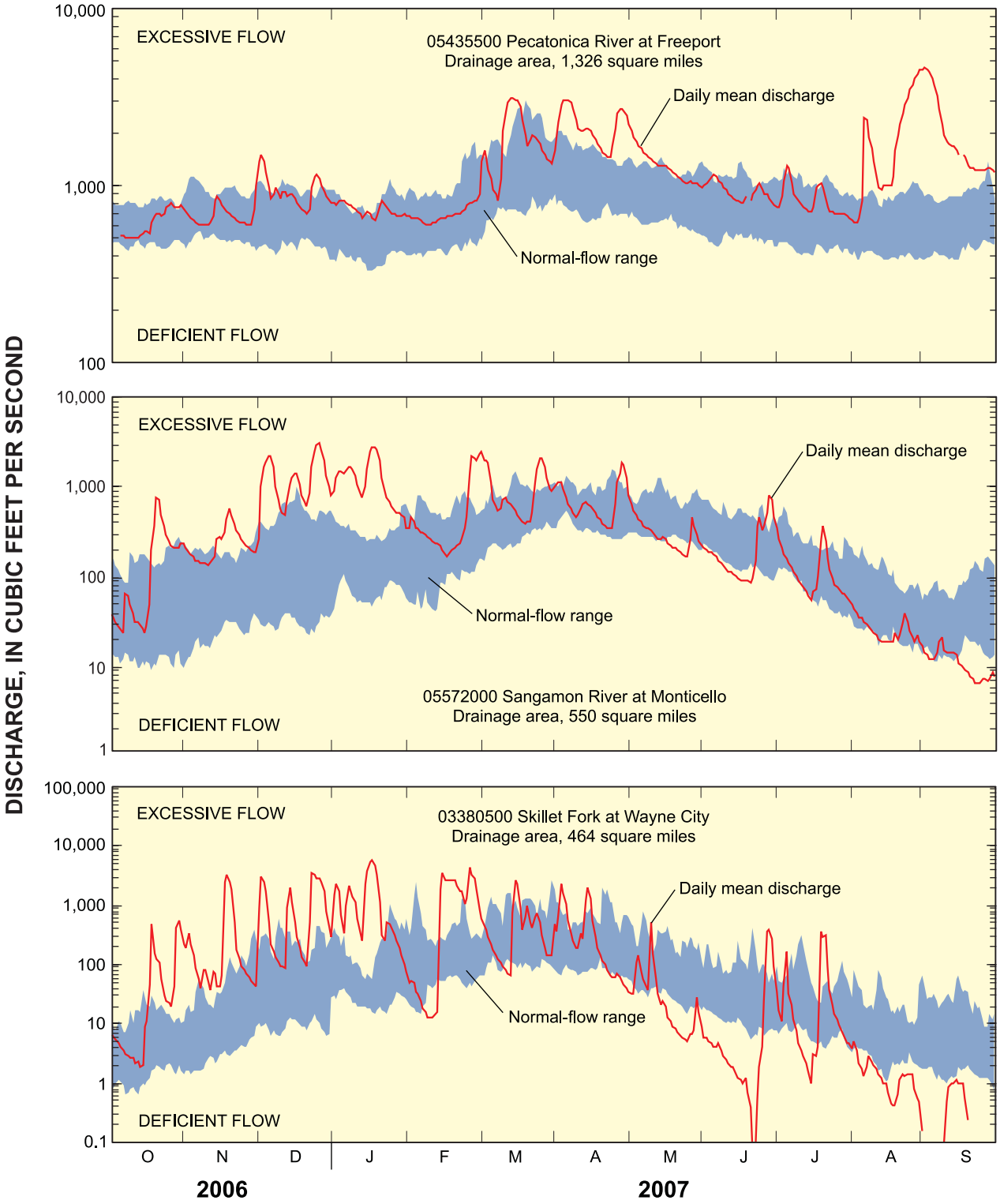








Graphs developed at *http://nwis.waterdata.usgs.gov/il/nwis/*



Daily mean discharge from October 1, 2006 through September 30, 2007 compared with percentile distribution of mean daily discharged for the 30-year period, 1961-90, for 3 representative streamgaging stations. A daily mean discharge is in the deficient-flow 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.