WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN ILLINOIS, 1994

U.S. GEOLOGICAL SURVEY
Open-File Report 95–391

Cover—Looking south, along Lake Shore Drive, at Belmont and Diversey Harbors, North Avenue Beach, and the Chicago skyline

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Compiled by G.O. Balding

U.S. GEOLOGICAL SURVEY

Open-File Report 95–391

Urbana, Illinois
1995

U.S. DEPARTMENT OF THE INTERIOR
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WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN ILLINOIS, 1994

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ORIGIN AND MISSION OF THE U.S. GEOLOGICAL SURVEY

The U.S. Geological Survey (USGS) was established by an Act of Congress on March 3, 1879, to provide a permanent Federal agency to conduct the systematic and scientific classification of the public lands, and examination of the geological structure, mineral resources, and products of the national domain.

Since 1879, the research and factfinding role of the USGS has grown and has been modified to meet the changing needs of the Nation. The USGS, however, has remained an impartial scientific and technical agency without developmental or regulatory responsibilities. Today's programs serve a diversity of needs and users. The current mission of the USGS is to provide geologic, topographic, and hydrologic information that contributes to the wise management of the Nation's natural resources and that promotes the safety and well-being of the public. This information is provided to the public in many forms including reports, maps, and data bases that provide descriptions and analyses of the water, energy, and mineral resources, the land surface, the underlying geologic structure, and the dynamic processes of the Earth. To accomplish its mission, the USGS:

- Performs and sponsors research in geology, hydrology, mapping, and related sciences.
- Produces and updates geographic, cartographic, and remotely sensed information in graphic and digital forms.
- Describes the onshore and offshore geologic framework and develops an understanding of its formation and evolution.
- Assesses energy and mineral resources, determines their origin and manner of occurrence, and develops techniques for their discovery.
- Collects and analyzes data on the quantity and quality of surface water and ground water, on water use, and on quality of precipitation.
- Assesses water resources and develops an understanding of the impact of human activities and natural phenomena on hydrologic systems.
- Evaluates hazards associated with earthquakes, volcanoes, floods, droughts, toxic materials, landslides, subsidence, and other ground failures, and develops methods for hazards prediction.
- Participates in the exploration of space and prepares geologic and other maps of the planets and their satellites.
- Publishes reports and maps, establishes and maintains earth-science data bases, and disseminates earth-science data and information.
- Provides scientific and technical assistance for the effective use of earth-science techniques, products, and information.
- Coordinates topographic, geologic, and land-use mapping, digital cartography, and water-data activities.

- Develops new technologies for the collection, coordination, and interpretation of earth-science data.
- Provides scientific support and technical advice for legislative, regulatory, and management decisions.
- Cooperates with other Federal, State, and local agencies, and with academia and industry.

As the Nation's largest earth-science research agency, the USGS maintains a long tradition of providing accurate and impartial information to all, which underscores its continued dedication to "Earth Science in the Public Service."

MISSION OF THE WATER RESOURCES DIVISION

The USGS has the principal responsibility within the Federal Government to provide the hydrologic information and understanding needed by others to achieve the best use and management of the Nation's water resources. To accomplish this mission, the Water Resources Division, in cooperation with other Federal, State, and local agencies:

- Systematically collects data needed for the continuing determination and evaluation of the quantity, quality, and use of the Nation's water resources.
- Performs analytical and interpretive water-resources appraisals to describe the presence, availability, and physical, chemical, and biological characteristics of surface and ground water and their interrelation.
- Performs supportive basic and problem-oriented research in hydraulics, hydrology, and related fields of science and engineering to improve the basis for field investigations and measurement techniques and to understand hydrologic systems sufficiently well to predict quantitatively their response to stress, either natural or human-caused stress.
- Disseminates water data and the results of investigations and research through reports, maps, computerized information services, and other forms of public release.
- Coordinates the activities of all Federal agencies in the acquisition of certain water data.
- Provides scientific and technical assistance in hydrologic fields to State, local, and other Federal agencies, to licensees of the Federal Energy Regulatory Commission, and, on behalf of the U.S. Department of State, to international agencies.
- Acquires, develops, and disseminates information on water-related natural hazards such as droughts, floods, landslides, land subsidence, mudflows, and volcanoes.
- Administers the provisions of the Water Resources Research Act of 1984, which includes the State Water Resources Research Institutes and the Research Grants programs.
- Supports the provisions of the National Environmental Policy Act of 1969 and manages USGS conduct of natural-resources surveys in response to the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund Act) of 1980.

The Water Resources Division is one of three program Divisions and two support Divisions within the USGS (fig. 1). The headquarters of the Water Resources Division is located at the USGS's National Center in Reston, Va., and consists of the Office of the Chief Hydrologist, the Offices of the Assistant Chief Hydrologists for Operations, Program Coordination and Technical Support, Research and External Coordination, Scientific Information Management, and Water Assessment and Data Coordination (fig. 2).

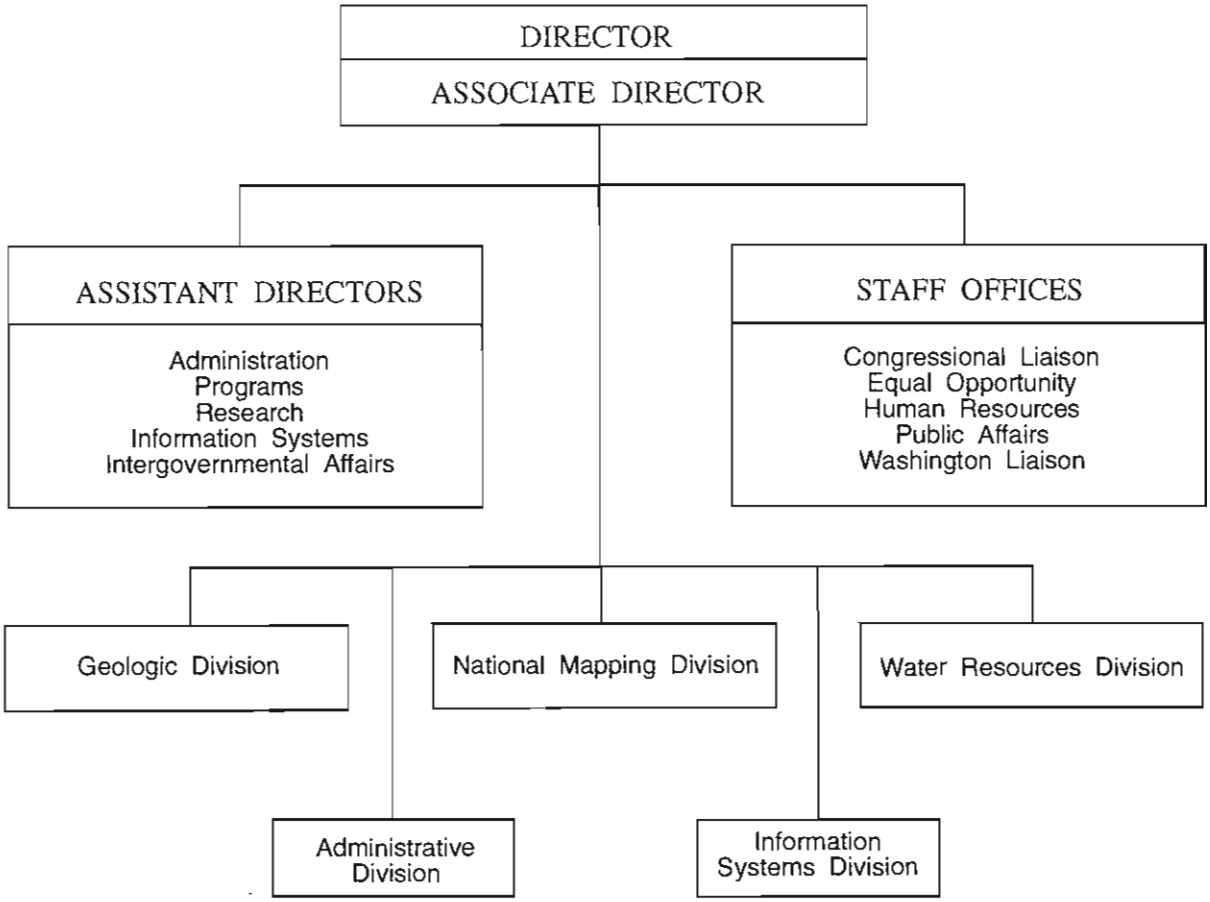


Figure 1. U.S. Geological Survey organization. Data from U.S. Geological Survey, 1992.

John Wesley Powell Federal Building, Reston, Virginia, National Center of the U.S. Geological Survey

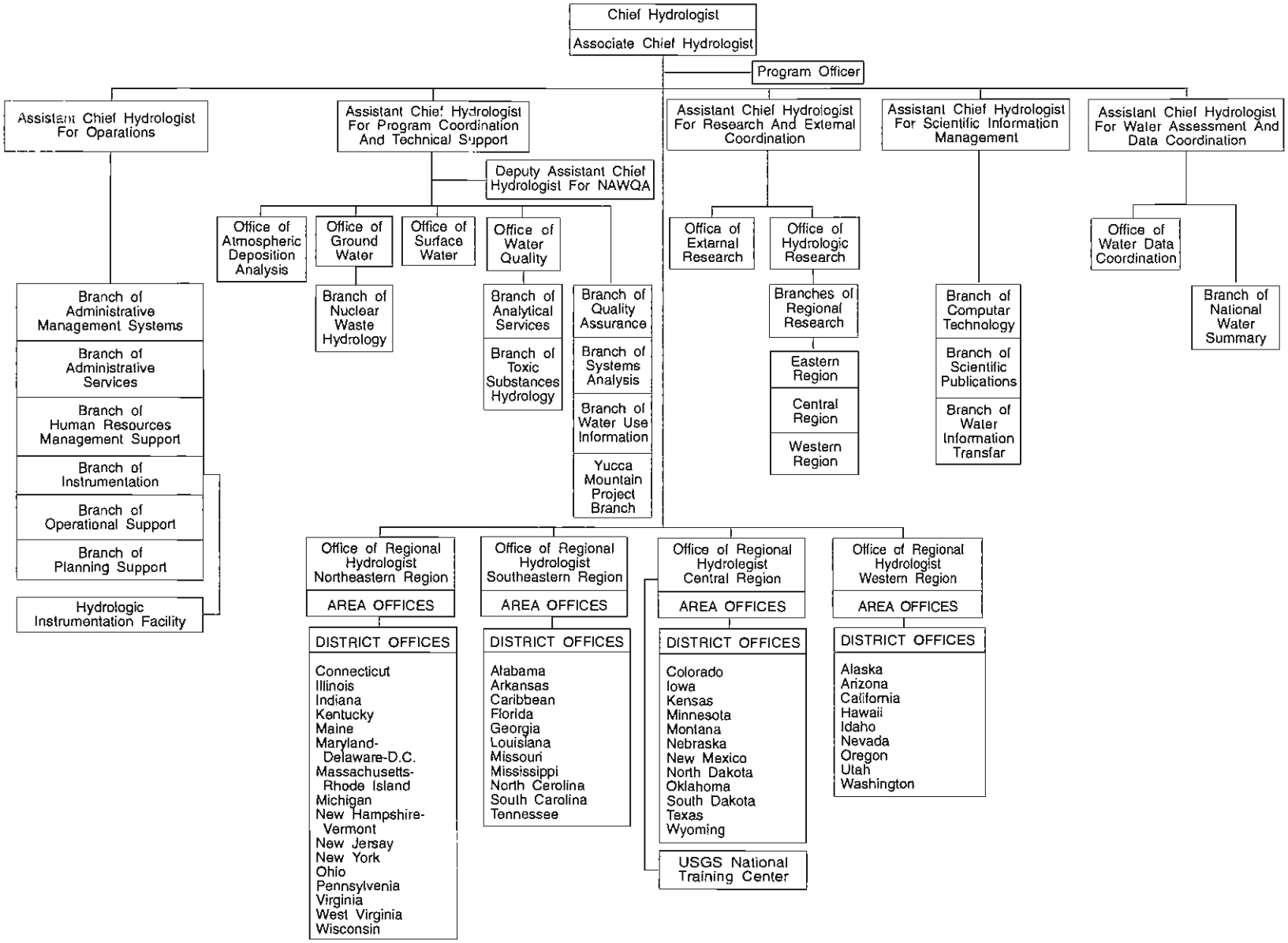


Figure 2. Water Resources Division organization. Data from U.S. Geological Survey, 1992.

ILLINOIS DISTRICT ORGANIZATION

The Illinois District Office of the USGS, Water Resources Division, is located in Urbana and consists of two support units, a special study unit, two operating sections, one Subdistrict Office in De Kalb, and a Field Headquarters office in Mt. Vernon (figs. 3 and 4). The District operates with guidance from Regional and National offices in Reston, Va. Offices for research, training, equipment development, and laboratory services, located throughout the United States, provide technical assistance and advice to the District.

Administrative Unit

The Administrative Unit is responsible for the maintenance of and compliance with Federal acquisition regulations, Department of the Interior manuals, and USGS and Water Resources Division operating policies. The Unit provides support services in the areas of administrative management, budget formulation and execution, financial planning and accounting, personnel, procurement, space management, and general office procedures.

Publications Unit

The Publications Unit assembles reports for review and prepares camera-ready copy for publication. The Unit also maintains the District's back-data files and the drainage-area map file.

Computer Unit

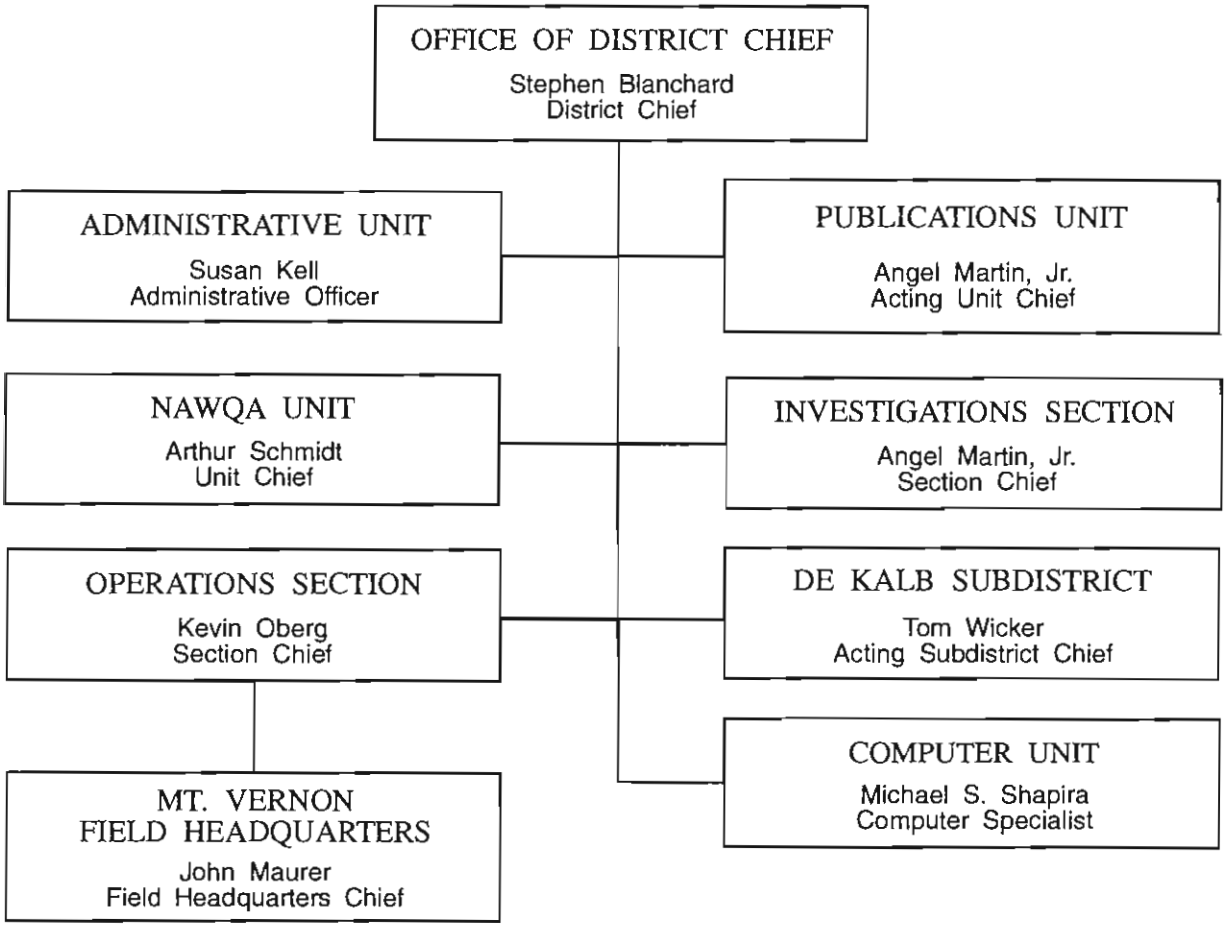
The Computer Unit maintains the District's computer system. The Unit provides data-processing services, maintains a library of computer manuals and program catalogs, does computer programming, and assists hydrologists in program selection, application, and modification.

National Water-Quality Assessment Unit

The NAtional Water-Quality Assessment (NAWQA) Unit is responsible for carrying out the goals of the NAWQA program which are to (1) describe water-quality conditions and trends and (2) identify, describe, and explain causative factors for the observed conditions and trends. The Illinois District has two NAWQA projects—the lower Illinois River NAWQA project, which began in fiscal year 1994, and the upper Illinois River NAWQA project, which began in fiscal year 1986 as a pilot study, is currently inactive, and is scheduled to restart in fiscal year 1997.

Investigations Section

The Investigations Section conducts multi-discipline hydrologic investigations to determine the quantity and quality of surface and ground water and to define and evaluate the extent and availability of water resources of drainage basins, counties, and the State. The Section performs special hydrologic research studies on current water issues such as nuclear hydrology, sedimentation and erosion, urban hydrology, land-use mapping, rainfall-runoff modeling, hydraulic unsteady-flow modeling, ground-water



District Office	(217) 344-0037	U.S. Geological Survey 102 E. Main Street, 4th Floor Urbana, IL 61801
De Kalb Subdistrict Office	(815) 756-9207	U.S. Geological Survey 1420 Sycamore Road De Kalb, IL 60115
Mt. Vernon Field Headquarters	(618) 242-4495	U.S. Geological Survey Room 231, Federal Building 105 S. Sixth Street Mt. Vernon, IL 62864

Figure 3. Illinois District organization and office addresses.

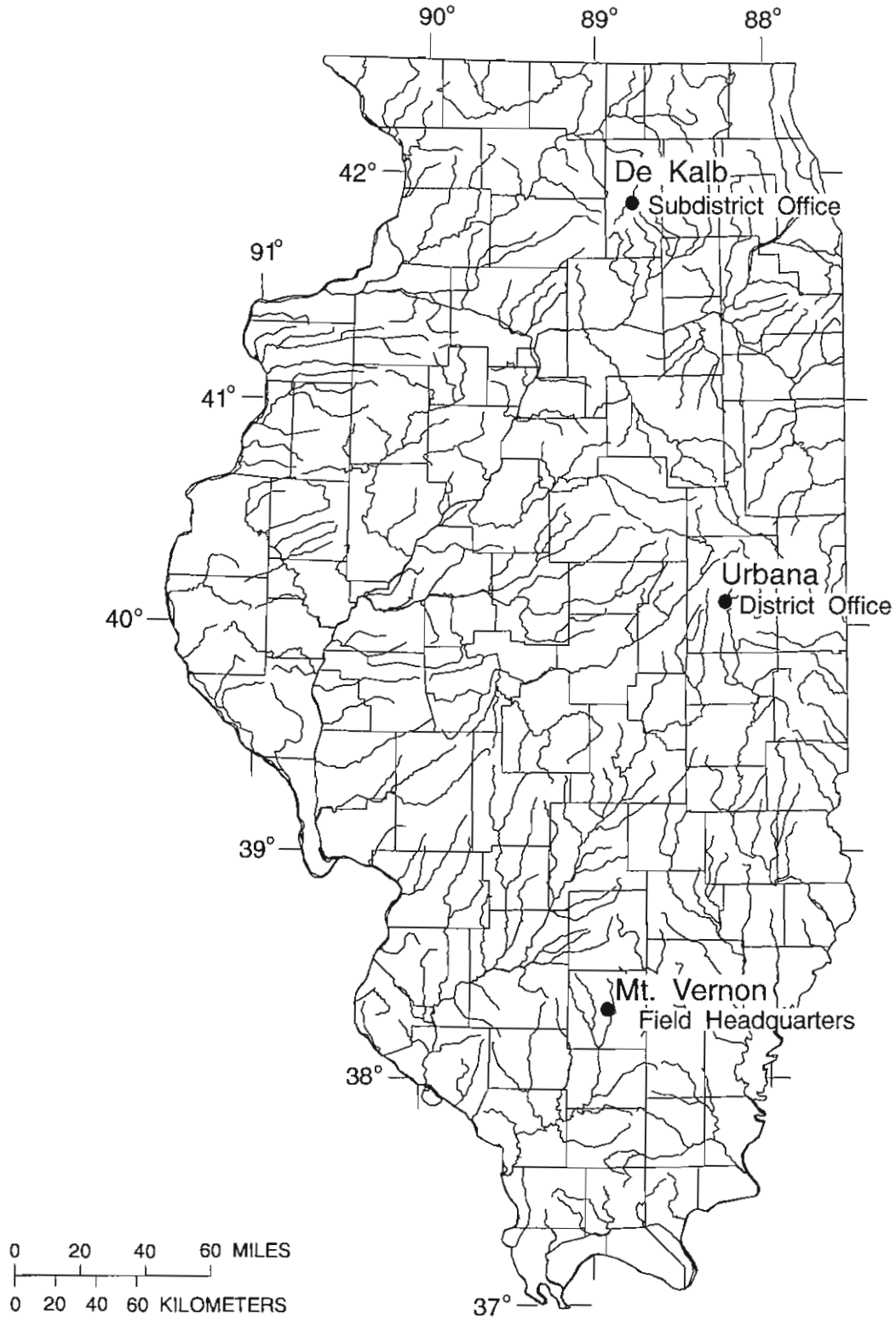


Figure 4. District, subdistrict, and field headquarters office locations.

quality, U.S. Environmental Protection Agency (USEPA) Superfund site work, waste disposal, and stream quality. Special investigative techniques for water-resource evaluation include the use of test drilling, packer tests, tracers, surface and borehole geophysics, and ground-water and surface-water modeling of flow and solute movement. Personnel prepare and review reports of investigations for both scientific and lay audiences.

Operations Section

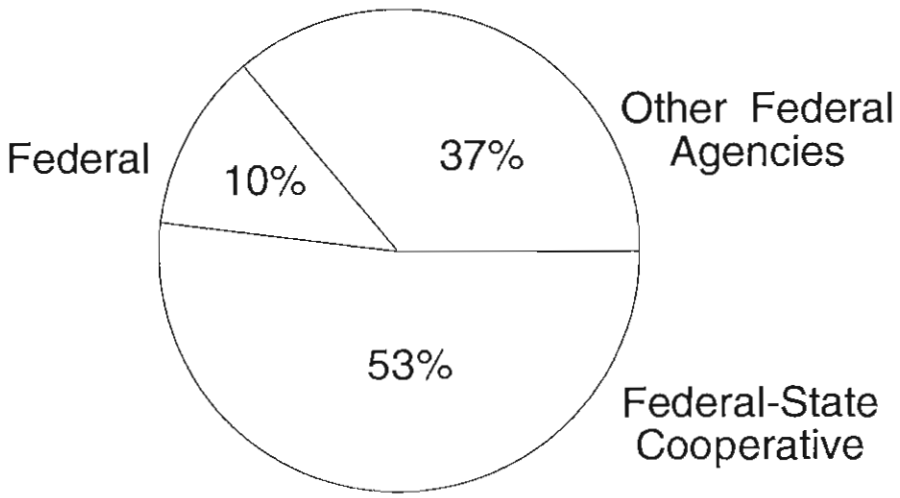
The Operations Section designs and implements a network of streamflow, water-quality-, and sediment-sampling sites based on data needs. The Section directs the installation and maintenance of equipment, data collection and analysis, and compilation of records for publication in the annual data report. The Section provides assistance in the collection of water-resources data in support of projects, conducts special data-collection efforts as needed or requested including major floods, low-flow measurements, and indirect measurements. The Section conducts special projects related to water use and coordinates the water-use program.

De Kalb Subdistrict Office

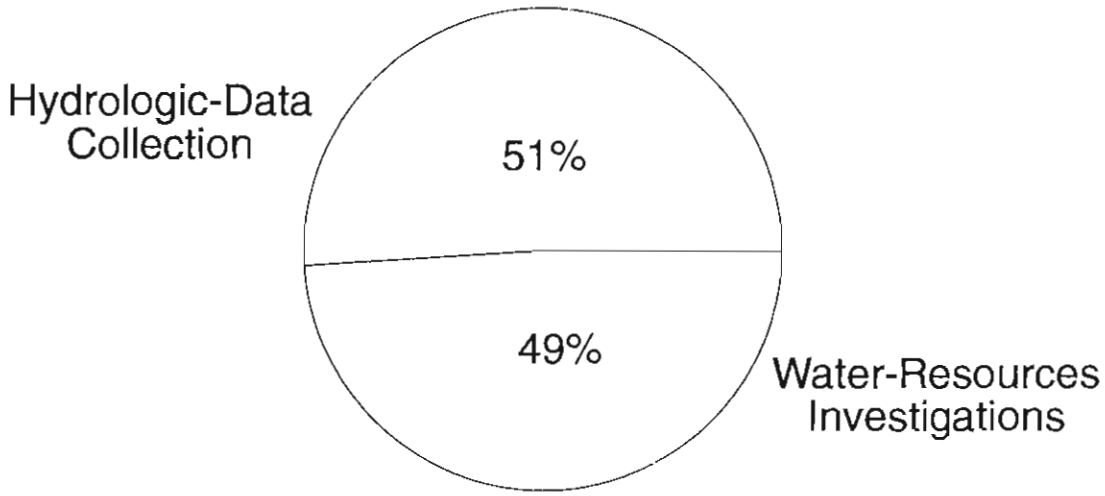
The De Kalb Subdistrict Office performs multi-discipline hydrologic investigations to determine the quantity and quality of surface and ground water and to define and evaluate the extent and availability of water resources of drainage basins and counties in the northern quarter of Illinois. The Subdistrict maintains a network of stream-gaging sites and directs the data collection, analysis, and compilation of records for publication in the annual data report.

ILLINOIS DISTRICT FUNDING SOURCES

Funds to support the work performed by the Illinois District, Water Resources Division, are derived from three principal sources—Federal Program, Federal-State Cooperative Program, and Other Federal Agencies Program. The activities funded are directed toward obtaining the information needed by managers and planners to achieve the best use and management of the water resources in Illinois and the Nation. Funding from all sources in fiscal year 1994 amounted to about $4,106,000, which was received as follows:



The diagram below shows the percentage of the activities for fiscal year 1994 in the two broad categories of hydrologic-data collection and water-resources investigations:



Federal Program

Funds for the Federal Program are appropriated by Congress and are specifically identified in the annual USGS budget. These funds are used to support research, data collection, high-priority topical programs, the coordination of all Federal programs related to collection of water data, and internal support services.

Federal-State Cooperative Program

Federal funds are appropriated by Congress for the Federal-State Cooperative Program and used to match those furnished by State and other local tax-supported agencies on a 50-50 basis (Gilbert and Mann, 1993). These funds are used for a variety of hydrologic-data-collection activities and water-resources investigations in which there are both national interests and State and local interests. Agencies supporting water-resources activities in Illinois during fiscal year 1994 are listed in table 1.

Other Federal Agencies Program

In this program, the funds are transferred to the USGS as reimbursement for work performed at the request of another Federal agency. These funds are used for a variety of hydrologic-data collection and water-resources investigations such as stream gaging, ground-water-quality assessments, and suspended-sediment monitoring in streams.

Table 1. Agencies supporting water-resources activities in Illinois during fiscal year 1994

State Agencies

Illinois Department of Transportation
- Division of Water Resources
- Division of Highways

Illinois Environmental Protection Agency
Illinois Department of Energy and Natural Resources
- State Water Survey

Illinois Department of Conservation

Local Agencies

Bloomington and Normal Sanitary District
Forest Preserve District of Cook County
Forest Preserve District of Du Page County
Du Page County, Department of Environmental Concerns,
- Stormwater Management Division

Kane County Development Department
Lake County Stormwater Management Commission
McHenry County, Department of Planning and Development
McHenry County Conservation District
Vermilion County Conservation District
Winnebago County, Department of Public Works
Danville Sanitary District
City of Champaign
City of De Kalb, Public Works Department
City of Decatur, Public Works Department
City of Springfield, Commission of Public Property
City of Monticello, City Services
City of Urbana
Kankakee Soil and Water Conservation District
Otter Creek Utility District
Village of Oak Brook

Universities

University of Illinois

Federal Agencies

U.S. Department of the Army
- Corps of Engineers
  - Rock Island District
  - St. Louis District
  - Chicago District

U.S. Environmental Protection Agency, Region V
Federal Emergency Management Agency
U.S. Fish and Wildlife Service
U.S. Air Force
- Air Mobility Command
  - Directorate of Environmental Programs

WATER CONDITIONS

Illinois generally has adequate supplies of water suitable for most uses. The average annual precipitation for the 1961–90 period is shown in figure 5. Water is available from several major rivers and lakes within or bordering Illinois and from ground-water sources. In the northern one-third of the State, most municipal water supplies (excluding the Chicago metropolitan area) are obtained from ground-water sources, whereas, in the remainder of the State, municipal water supplies generally are obtained from surface-water sources. In the southern two-thirds of the State, however, potable ground water can be obtained locally from shallow alluvium-filled valleys that were eroded into the bedrock by ancestral streams.

Annual average precipitation Statewide for the 1994 water year (October 1, 1993–September 30, 1994), over the nine crop-reporting districts, averaged 87 percent (33.3 in.) of the 30-year (1961–90) average and ranged from 75 percent (27.0 in.) in the northwestern part of the State to 97 percent (41.6 in.) in the southwestern part. Monthly average precipitation ranged from a low of 22 percent (0.69 in.) of normal in the western part of the State in March to a high of 253 percent (9.70 in.) of normal in the west-southwestern part of the State in April. Monthly precipitation was deficient during October, December, February, March, May, and July through September; and excessive during November, January, April, and June.

Streamflow records have been collected continuously at three index stations since the early 1900's (fig. 6). Annual average discharge, when compared to that of the 30-year period (1961–90), was in the normal range at Pecatonica River at Freeport (05435500) and was excessive at Sangamon River at Monticello (05572000) and at Skillet Fork at Wayne City (03380500). Monthly average discharges at the three index stations were in the normal-flow range during December, January, March through July, and September at Freeport; during January through March, May, and July through September at Monticello; and during December, February, and June at Wayne City. Monthly average discharge was excessive during the months of October, November, February, and August at Freeport; during October through December, and April at Monticello; and during October, November, January, April, and May at Wayne City.

Flooding occurred in many parts of the State in November, January, April, and June. April was the wettest month of the year with precipitation at 166 percent of normal. During April, peak discharges of record were set at several gaging stations in Illinois. Stream discharges nearly equaled or exceeded the 100-year flood at streams in the eastern, central, and west-southwestern parts of the State including Middle Fork Vermilion River above Oakwood (03336645), Vermilion River near Danville (03339000), Embarras River near Camargo (03343400), Sangamon River at Fisher (05570910), South Fork Sangamon River near Rochester (05576000), Sangamon River at Riverton (05576500), Sangamon River near Oakford (05583000), and West Okaw River near Lovington (05591700).

DATA COLLECTION

The USGS Water Resources Division is the principal Federal agency responsible for providing hydrologic information required for the best utilization and management of the Nation's water resources. The activities of the Illinois District are structured to provide data and information required to meet these needs.

Surface-Water-Data Stations

Surface-water data are collected for general hydrologic purposes such as assessments of water resources, areal analyses, determination of long-term trends, research and special studies, or for

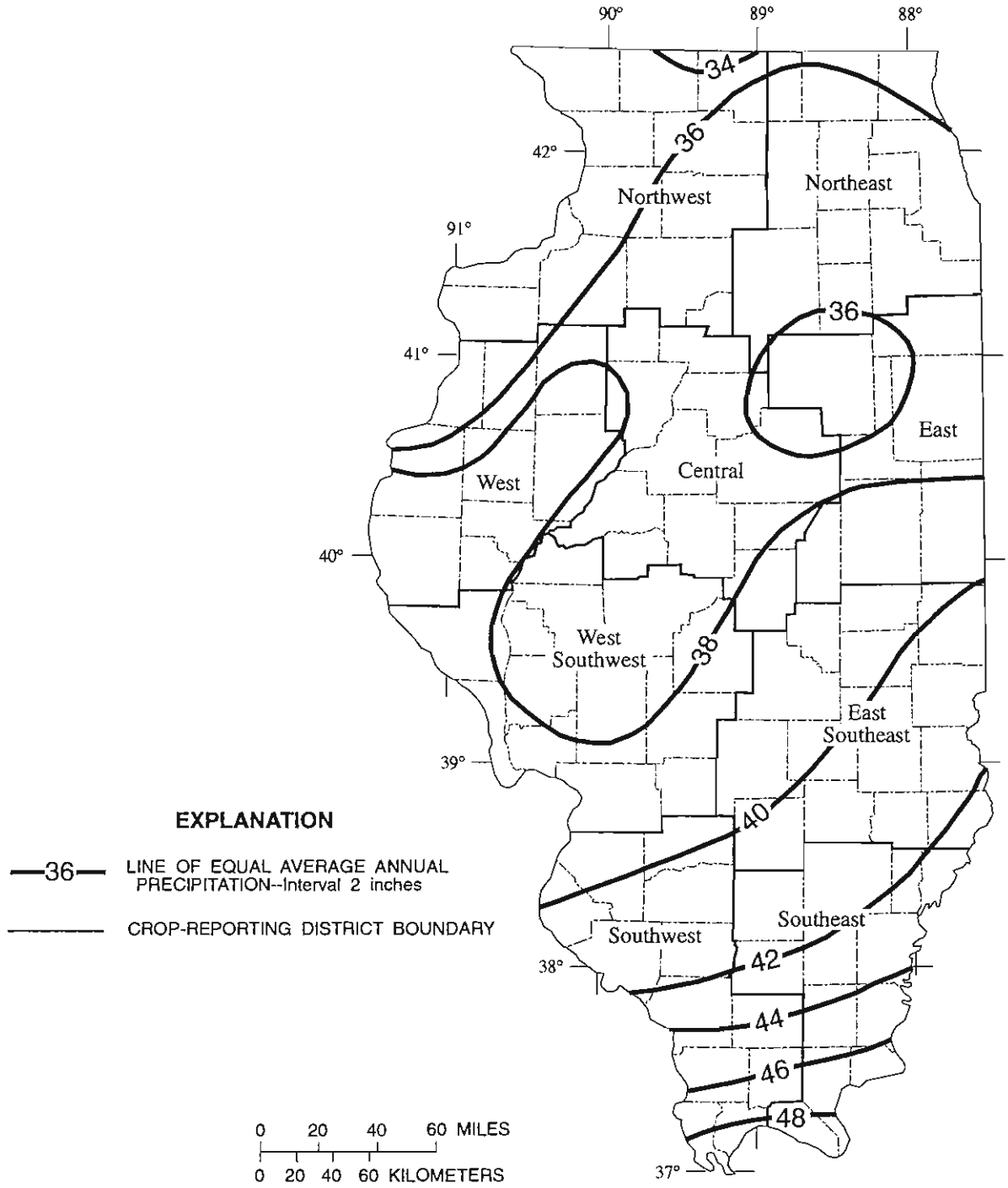


Figure 5. Average annual precipitation in Illinois, 1961–90. Data from Wendland and others, 1992.

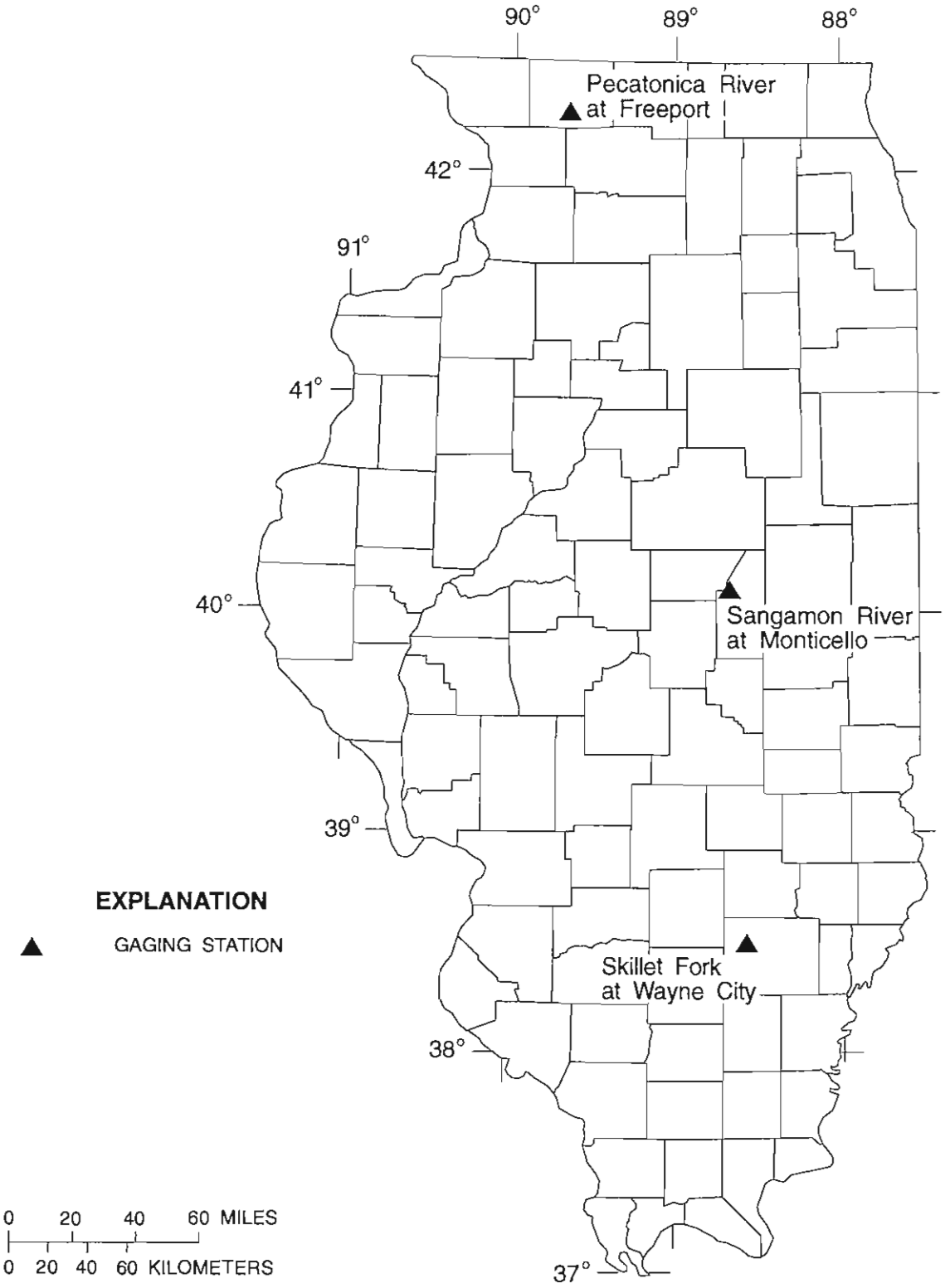


Figure 6. Index streamflow-gaging stations in Illinois.

management and operational purposes. The need for surface-water data in Illinois has varied over the years. In 1940, the USGS operated 46 continuous-record streamflow-gaging stations; by 1980, the streamflow-gaging-station network increased to 183. Currently (1994), the Illinois District of the USGS operates 148 continuous-record streamflow-gaging stations (fig. 7).

Stage and Discharge Stations

Stage data are generally recorded every 15 minutes at each continuous-record stage-only and streamflow-gaging station; some stations are equipped with telemetry and transmit stage data on a near real-time basis to the District office where it is converted to discharge. In 1994, data on stage and discharge in Illinois were recorded and published by the Illinois District for the following numbers of stations:

Station classification	Number of stations	
Stream stations		172
Continuous record:		
Discharge	148	
Stage only	8	
Partial record:		
Peak (maximum) flow only	12	
8:00 a.m. stage only	4	
Lake, reservoir, and subimpoundment stations		8
Stage and contents	3	
Stage only	5	
Total		180

Of the 148 continuous-record streamflow-gaging stations, 138 are part of the Illinois District surface-water network and the other 10 are used for special projects. The locations of these stations and stage-only stations are shown in figure 8, and the types of data collected at each station are shown in table 2 (at end of report).

Water-Quality and Sediment Stations

Water-quality samples were collected monthly, quarterly, bimonthly, or less frequently depending upon the particular station. The water-quality constituents of interest included physical parameters, nutrients, major ions, trace metals, suspended sediment, and organics. Data were collected from 20 water-quality-sampling stations operated by the Illinois District during fiscal year 1994. Station locations are shown in figure 9 and are listed in table 2 (at end of report). Of the 20 stations, 4 stations are operated as part of the USGS's NAtional Stream Quality Accounting Network (NASQAN) program, 7 are part of the Federal-State cooperative program, and 9 are part of the Federal Mid-Continent Herbicide Initiative.

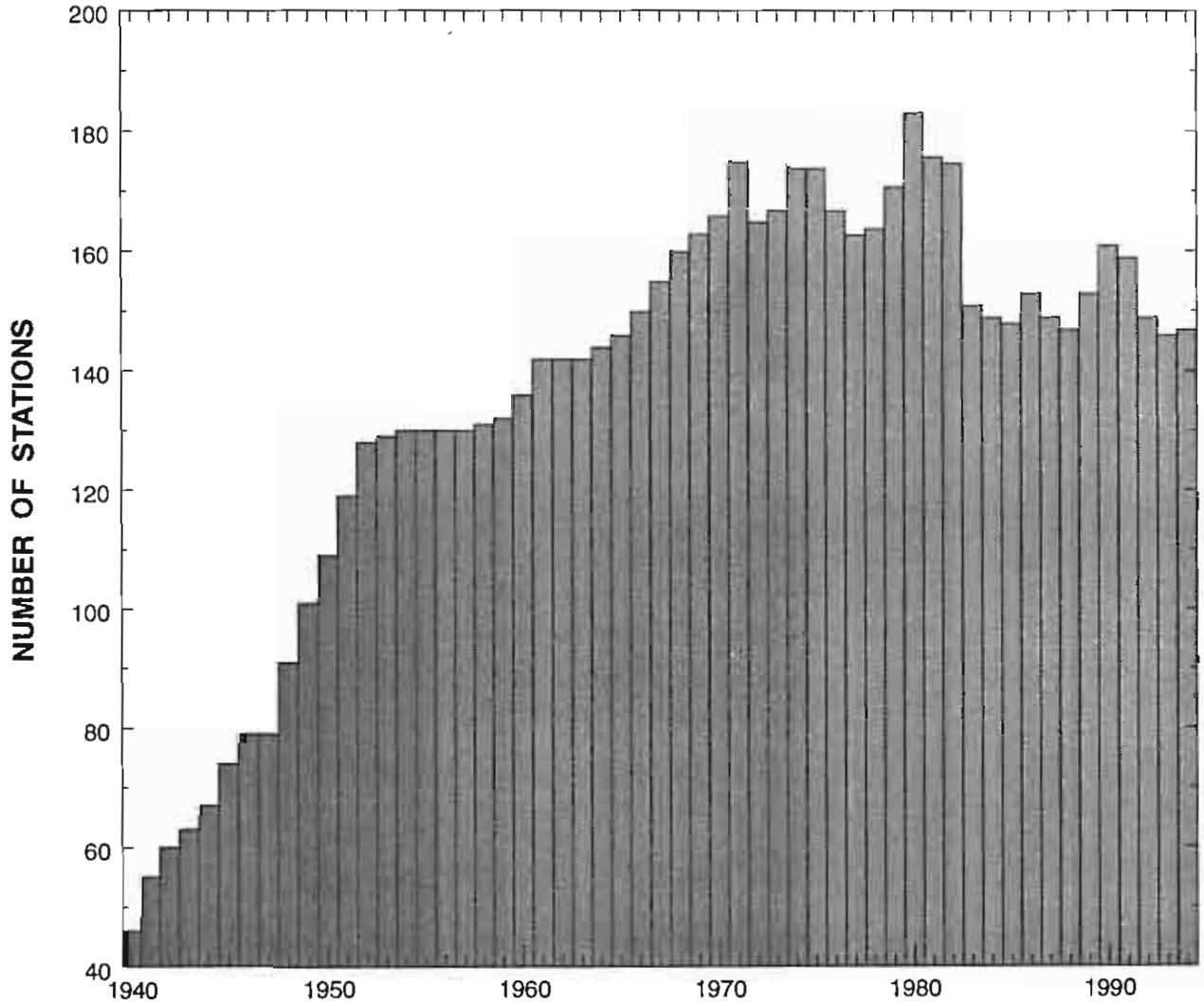


Figure 7. Number of continuous-record streamflow-gaging stations operated by the Illinois District, 1940–94.

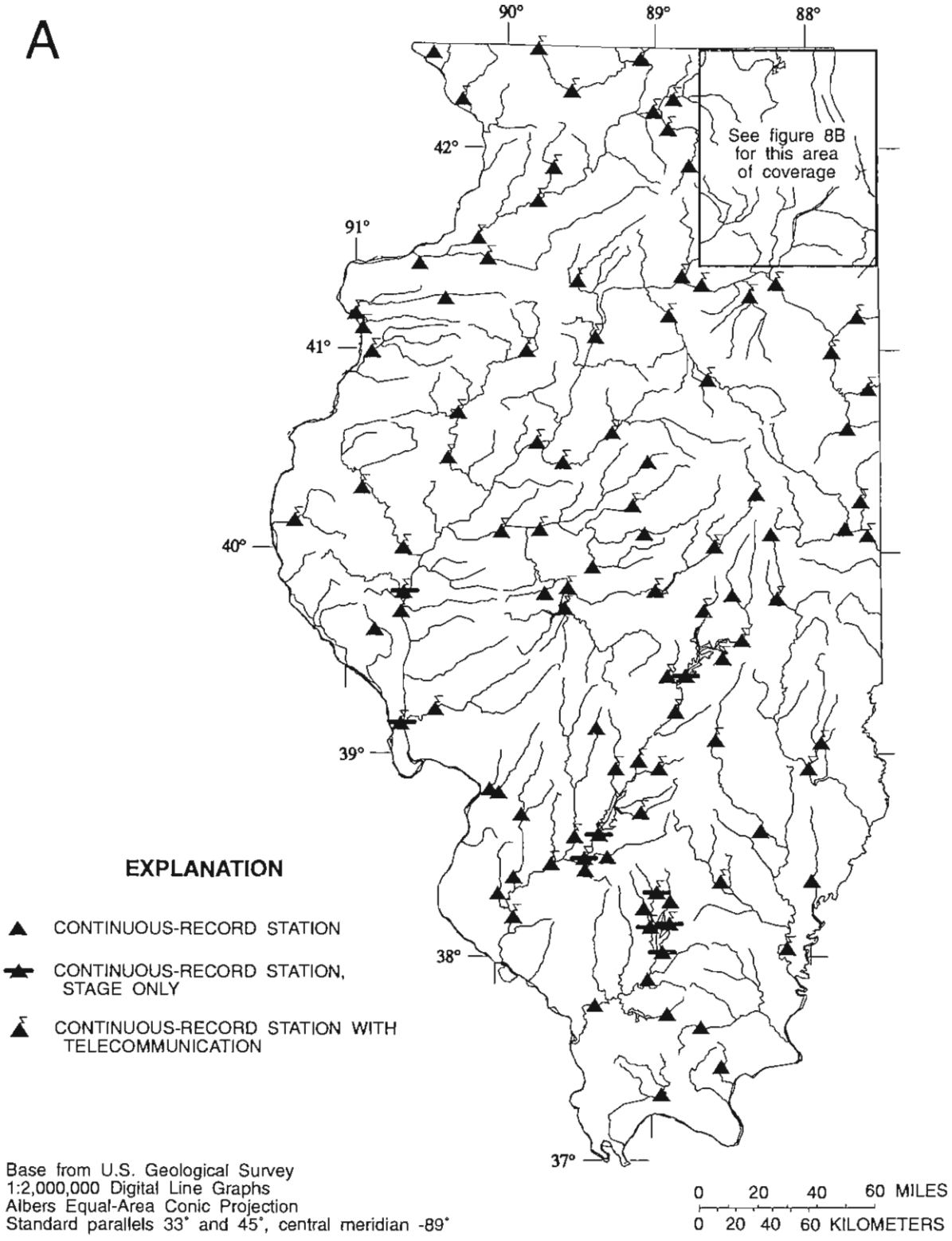


Figure 8. Discharge and stage stations operated by the Illinois District in (A) Illinois except northeastern Illinois and (B) northeastern Illinois, 1994.

B

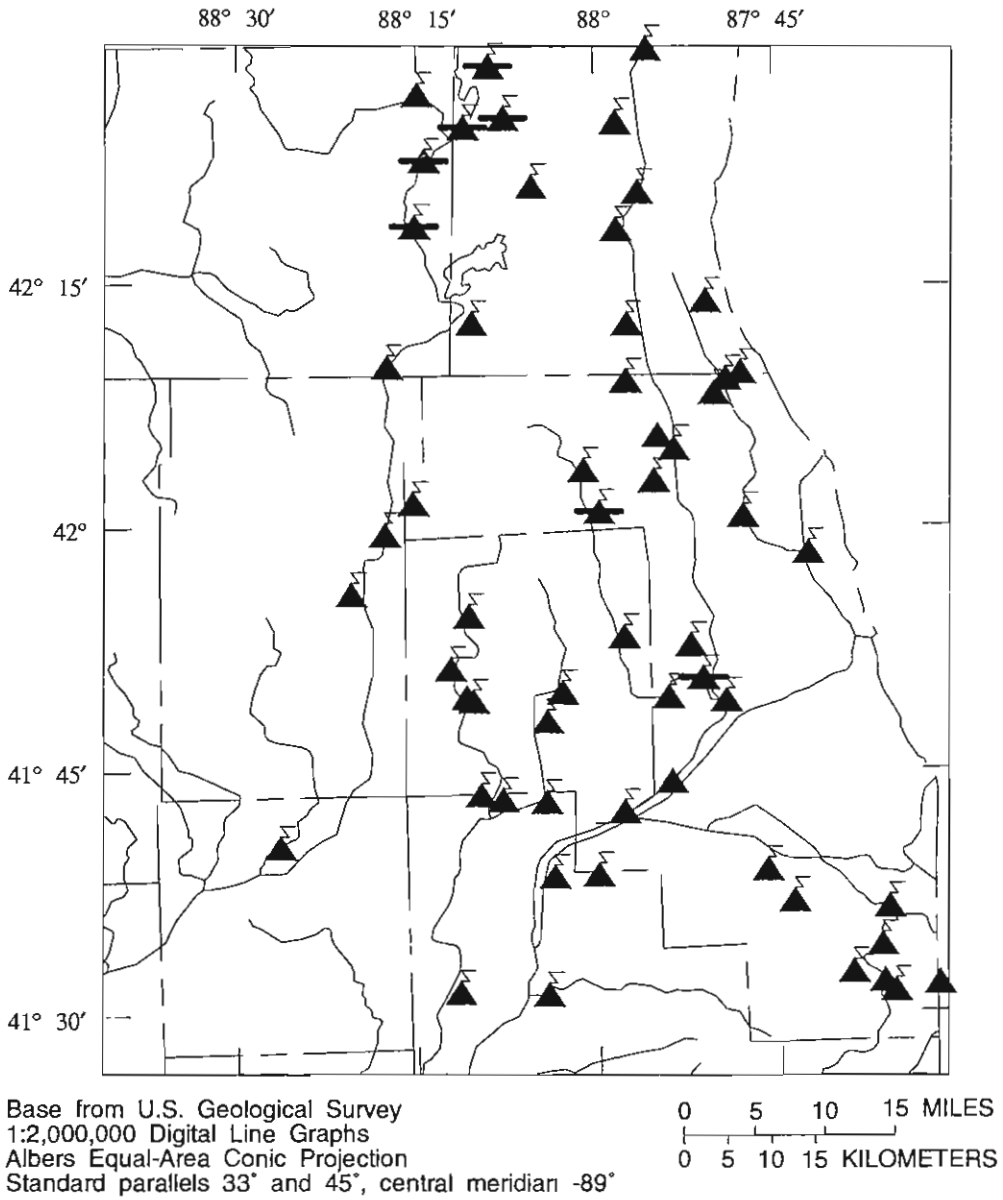


Figure 8. Continued.

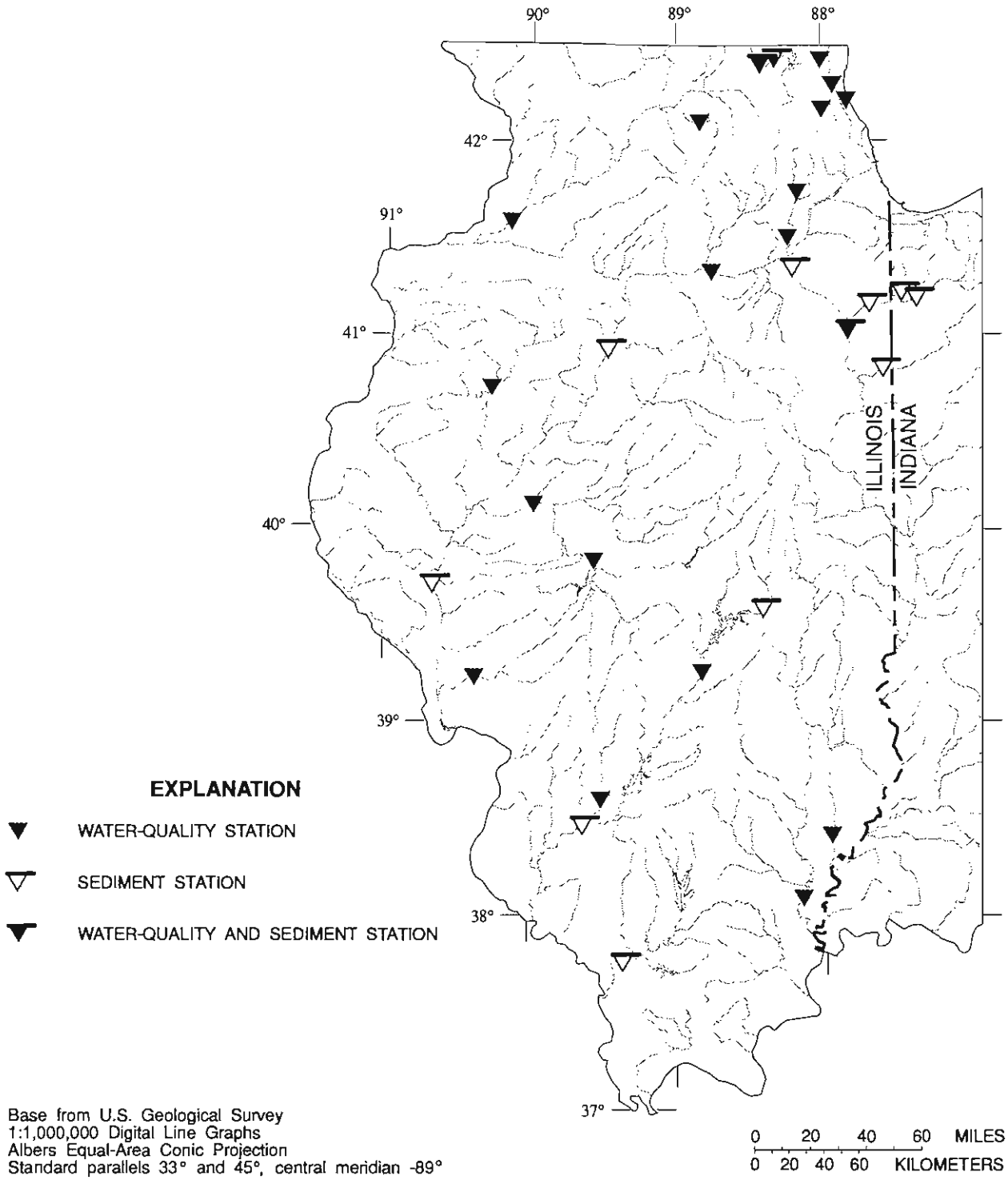


Figure 9. Water-quality and sediment stations operated by the Illinois District, 1994.

Daily or near-daily suspended-sediment samples were collected from, and daily suspended-sediment-discharge records were computed for 13 stations; the station locations are shown in figure 9 and listed in table 2 (at end of report). Of the 13 stations, 5 are operated as part of the sediment network and the remaining 8 are project stations, 2 of which are located in Indiana.

The various types of water-quality and suspended-sediment data were collected and published by the Illinois District for the following numbers of surface-water stations:

Data classification	Number of stations
Physical data:	
Water temperature	14
Specific conductance	14
pH	14
Dissolved oxygen	14
Sediment data (daily)	13
Chemical data:	
Inorganic constituents	20
Organic constituents	10
Microbiological data	5

Ground-Water Stations

Water-level measurements in wells, discharges of springs and wells, and ground-water-quality analyses are used in assessing ground-water conditions and trends; hydrologic data, however, must be integrated with other observations and studies of ground-water systems to understand ground-water conditions and trends. In Illinois, the USGS measures water levels in 13 observation wells. Four wells, three of which are piezometers, are at the same location but at different depths. Water samples are periodically collected for water-quality analysis from all of the observation wells. The types of data collected include water levels, water temperature, specific conductance, pH, and inorganic constituents.

The ground-water stations and types of data collected at each station are listed in table 3 (at end of report). The number of stations, by county, are shown in figure 10.

DATA MANAGEMENT

The USGS Water Resources Division manages data from its own activities and from the activities of other water-oriented agencies. The data are stored in the National Water Data Storage and Retrieval System. Data site information is available from the National Water-Data Exchange.

National Water Data Storage and Retrieval System

The National WATer Data STOrage and REtrieval System (WATSTORE) of the USGS was established in November 1971 to computerize the water data of the USGS and to provide for more effective

Figure 10. Ground-water stations operated by the Illinois District, by county, 1994.

and efficient management of its data-related activities. The system is operated and maintained on the central computer facilities of the USGS at its National Center in Reston, Va., and on computers in District offices throughout the Nation as part of the Distributed Information System. Data may be obtained from WATSTORE through the 48 District Offices of the USGS Water Resources Division. General inquiries about WATSTORE may be directed to:

Chief Hydrologist
U.S. Geological Survey
437 National Center
Reston, VA 22092
(703) 648-5215

or

U.S. Geological Survey
Water Resources Division
102 East Main Street, 4th Floor
Urbana, IL 61801
Phone: (217) 344-0037

National Water-Data Exchange

The NAtional Water-Data EXchange (NAWDEX) is an interagency program to facilitate the exchange of water data and to promote the improvement of water-data handling procedures. Participants in the NAWDEX program are Federal, State, and local governments and interstate, academic, and private organizations that collect, store, and use water data. NAWDEX is managed by a Program Office, which is administered by the Water Resources Division.

Services are available through the Program Office at the USGS National Center in Reston, Va., and a nationwide network of Assistance Centers in all 50 States, the District of Columbia, and Puerto Rico, which provide local and convenient access to NAWDEX facilities. A directory of assistance centers (Blackwell, 1993) that provides names of organizations and persons to contact, as well as addresses, telephone numbers, and office hours for each of these organizations, is available on request from the Program Office in Reston, Va.

The NAWDEX program can assist any organization or individual in identifying and locating water data. To accomplish this service, NAWDEX maintains a computerized Master Water-Data Index that identifies sites for which water data are available, the type of data available for each site, and the organization retaining the data. The NAWDEX program also maintains a Water-Data Sources Directory identifying organizations from which water data may be obtained. In addition, NAWDEX has direct access to some large water data bases of its members and has reciprocal agreements for the exchange of services with others. For additional information concerning the NAWDEX program or its services contact:

Program Office
National Water Data Exchange (NAWDEX)
U.S. Geological Survey
421 National Center
12201 Sunrise Valley Drive
Reston, VA 22092
Phone: (703) 648-6848
Hours: 7:00 to 4:30 eastern time

or

NAWDEX Assistance Center
Illinois
U.S. Geological Survey
Water Resources Division
102 East Main Street, 4th Floor
Urbana, IL 61801
Phone: (217) 344-0037
Hours: 8:00 to 4:30 central time

Flint Creek near Fox River Grove

DESCRIPTIONS OF PROJECTS IN 1994

Rock Creek, Kankakee River State Park

IL001 SURFACE-WATER STATIONS

LOCATION: Statewide

PROJECT CHIEF:
John K. LaTour
Urbana

PERIOD OF PROJECT:
Continuous since July 1930

COOPERATORS:
Illinois Department of Transportation, Division of Water Resources; Illinois Department of Energy and Natural Resources, State Water Survey; Illinois Department of Conservation; Winnebago County Department of Public Works; Bloomington and Normal Sanitary District; Vermilion County Conservation District; Du Page County Department of Environmental Concerns; Forest Preserve District of Cook County; Forest Preserve District of Du Page County; Kane County Development Department; Lake County Stormwater Management Commission; McHenry County, Department of Planning and Development; McHenry County Conservation District; Danville Sanitary District; City of Champaign; City of De Kalb; City of Decatur; City of Monticello; City of Springfield; City of Urbana; Village of Oak Brook; Otter Creek Utility District; U.S. Army Corps of Engineers: Rock Island District, St. Louis District, and Chicago District; University of Illinois

PROBLEM: Surface-water information is needed by State, local, and Federal agencies and the private sector for developing and managing our Nation's land and water resources. Without this information, the surveillance, planning, design, hazard warning, operation, and management in water-related fields such as water supply, hydroelectric power, flood control, irrigation, bridge and culvert design, wildlife management, pollution abatement, flood-plain management, and water-resources development could not be achieved.

OBJECTIVES: A. To collect surface-water data sufficient to satisfy information needs for current purposes, such as (1) assessment of water resources, (2) operation of reservoirs or industries, (3) forecasting, (4) disposal of wastes and pollution controls, (5) assessment of stream-water quality, (6) compact and legal requirements, and (7) research or special studies. B. To collect data necessary for analytical studies to define, for any location, the statistical properties of, and trends in, the occurrence of water in streams and lakes for use in planning and design.

APPROACH: Standard methods of data collection will be used as described in the USGS report series, "Techniques of Water-Resources Investigations of the United States Geological Survey." Partial-record gaging will be used instead of complete-record gaging where it serves the required purpose.

SUMMARY OF RESULTS: Surface-water data were collected for all active sites. Finished the collection and compilation of 1993–94 flood data. Repaired 25 gages damaged during the floods. Replaced four gage shelters and installed six new gages. Purchased 33 data loggers and 18 pressure sensors to upgrade gage equipment. Made many discharge measurements with an Acoustic Doppler Current Profiler (ADCP). Provided data for many flood reports. Published WRIR 94–4112, "Measurements of Leakage from Lake Michigan Through Three Control Structures near Chicago, Illinois, April–October 1993" and articles in the American Society of Civil Engineers Journal, "Recent Applications of Acoustic Doppler Current Profilers" and "The Miller City Levee Break and Incipient Meander Cutoff." Data for the 1993 water year were published in the annual data report.

PLANS: Continue surface-water data collection with modifications to the data network. Install new data loggers and pressure sensors to replace ADR recorders and manometers. Standardize programs in the data loggers to streamline data processing. Develop data bulletin board for cooperators. Acquire more knowledge about the operation of ADCP's by continuing to make discharge measurements with this equipment. Implement safety requirements in regard to confined space. Publish data in the annual data report.

PLANNED REPORTS:

Water resources data—Illinois, water year 1994, volume 1, Illinois except Illinois River Basin

Water resources data—Illinois, water year 1994, volume 2, Illinois River Basin

ADCP measurements during the Mississippi River flood, 1993

PUBLISHED REPORTS:

Maurer, J.C., Wicker, T.L., and LaTour, J.K., 1994, Water resources data—Illinois, water year 1993, volume 1, Illinois except Illinois River Basin: U.S. Geological Survey Water-Data Report IL–93–1, 247 p.

Oberg, K.A., and Schmidt, A.R., 1994, Measurements of leakage from Lake Michigan through three control structures near Chicago, Illinois, April–October 1993: U.S. Geological Survey Water-Resources Investigations Report 94-4112, 48 p.

Zuehls, E.E., LaTour, J.K., and Wicker, T.L., 1994, Water resources data—Illinois, water year 1993, volume 2, Illinois River Basin: U.S. Geological Survey Water-Data Report IL–93–2, 297 p.

PUBLISHED PAPERS:

Oberg, K.A., and Jacobson, R.B., 1994, The Miller City levee break and incipient meander cutoff, *in* Hydraulic Engineering '94, volume 1, Proceedings of the 1994 Conference, American Society of Civil Engineers, Hydraulics Division, August 1–5, 1994, Buffalo, New York, p. 623–627.

Oberg, K.A., and Miller, D.S., 1994, Recent applications of acoustic doppler current profilers, *in* Fundamentals and Advancements in Hydraulic Measurements and Experimentation, Proceedings of the Symposium, American Society of Civil Engineers, Hydraulics Division, August 1–5, 1994, Buffalo, New York, p. 341–350.

The Chicago Sanitary and Ship Canal at the Lockport lock and dam above the confluence with the Des Plaines River

Downstream view of the Du Page River at Shorewood

IL002 GROUND-WATER STATIONS

COOPERATOR:
Federal Program

LOCATION: Statewide

PROJECT CHIEF:
Charles F. Avery
Urbana

PERIOD OF PROJECT:
Continuous since April 1982

PROBLEM: Water-resource planning and ground-water quantity and quality assessment require a statewide base level of relatively standardized data. Ground-water levels respond to natural recharge and discharge and variations and to pumpage from wells. Natural water-level fluctuations can provide information on long-term trends in climate variability. In Illinois, concentrated urbanization in the northeastern corner and intense farming and mining in much of the State require monitoring of ground water to assess the impact of human activities on present and potential water uses. Water-level declines have exceeded 800 feet since predevelopment in northeastern Illinois. Water-quality changes can indicate natural or human impacts on ground-water sources.

OBJECTIVES: Long-term observation of ground-water levels and monitoring of ground-water quality in Illinois. To provide high-quality data from a network of monitoring stations across the State and to achieve timely dissemination of data from this network, to all potential users, in a readily usable form.

APPROACH: Coordinate ground-water data-gathering efforts with State, local, and other Federal agencies in Illinois. Efforts will be directed to having all participants use current and uniform data-collection and reporting procedures. Data collection is planned to meet site-specific needs and to provide a statewide baseline of information from which to evaluate the general status of the State's ground-water quantity and quality.

SUMMARY OF RESULTS: Water levels in three piezometers and one well in Lake County, one well each in Bureau, Du Page, Winnebago, Vermilion, De Kalb, Kendall, Ogle, Kane, and Grundy Counties. Water levels in the piezometers and well in Lake County have risen about 15 feet during the 1992 and 1993 water years. The piezometers and well are open to aquifers in the Cambrian-Ordovician aquifer system. Water levels in the lower Mt. Simon aquifer of the system have not risen as much as water levels in the other aquifers. Data for the 1993 water year were published in the annual data report.

PLANS: Continue water-level data collection. Collect water samples for analysis at five sites per year. Publish data in the annual data report.

PUBLISHED REPORTS:

Maurer, J.C., Wicker, T.L., and LaTour, J.K., 1994, Water resources data—Illinois, water year 1993, volume 1, Illinois except Illinois River Basin: U.S. Geological Survey Water-Data Report IL–93–1, 247 p.

Zuehls, E.E., LaTour, J.K., and Wicker, T.L., 1994, Water resources data—Illinois, water year 1993, volume 2, Illinois River Basin: U.S. Geological Survey Water-Data Report IL–93–2, 297 p.

IL003 QUALITY OF WATER STATIONS

COOPERATORS:
Forest Preserve District of Du Page County
Federal Program
McHenry County Conservation District

LOCATION: Statewide

PROJECT CHIEF:
Paul J. Terrio
Urbana

PERIOD OF PROJECT:
Continuous since June 1967

PROBLEM: Water-resource planning and water-quality assessment require a statewide base level of relatively standardized data. In Illinois, dense urbanization, especially in the northeastern corner, and intense farming and mining in other parts of the State require monitoring to assess the impact of human activities on present and potential water uses.

OBJECTIVES: To provide high-quality data to assist the cooperator with their water-resource planning and management needs and to support the NAtional Stream Quality Accounting Network (NASQAN) by collecting high-quality, nationally consistent water-quality data. To achieve timely dissemination of water-quality data, to all potential users, in a readily usable form.

APPROACH: Coordinate surface-water-quality data-gathering efforts among the USGS and State, local, and other Federal agencies in Illinois. Efforts will be directed toward having all participants use current and uniform sampling, analytical, and data-reporting procedures. Sampling and data collection are tailored to meet site-specific needs and to supply a baseline of information from which to evaluate the general nature of the State's surface-water quality.

SUMMARY OF RESULTS: Quarterly, bimonthly, and monthly water-quality data were collected at five sites. Storm-runoff samples analyzed for agricultural organic compounds were collected from 10 streams throughout Illinois both before and after spring planting. Data for the 1993 water year were published in the annual data report.

PLANS: Collect water-quality samples from two sites; one site (cooperative) will be sampled monthly and one site (NASQAN) will be sampled quarterly. Publish data in the annual data report.

PUBLISHED REPORTS:

Coupe, R.H., and Johnson, G.P., 1991, Triazine herbicides in selected streams in Illinois during storm events, spring 1990, *in* Mallard, G.E., and Aronson, D.A., eds., U.S. Geological Survey Toxic Substances Hydrology Program: U.S. Geological Survey Open-File Report 91–088, p. 65.

Maurer, J.C., Wicker, T.L., and LaTour, J.K., 1994, Water resources data—Illinois, water year 1993, volume 1, Illinois except Illinois River Basin: U.S. Geological Survey Water-Data Report IL–93–1, 247 p.

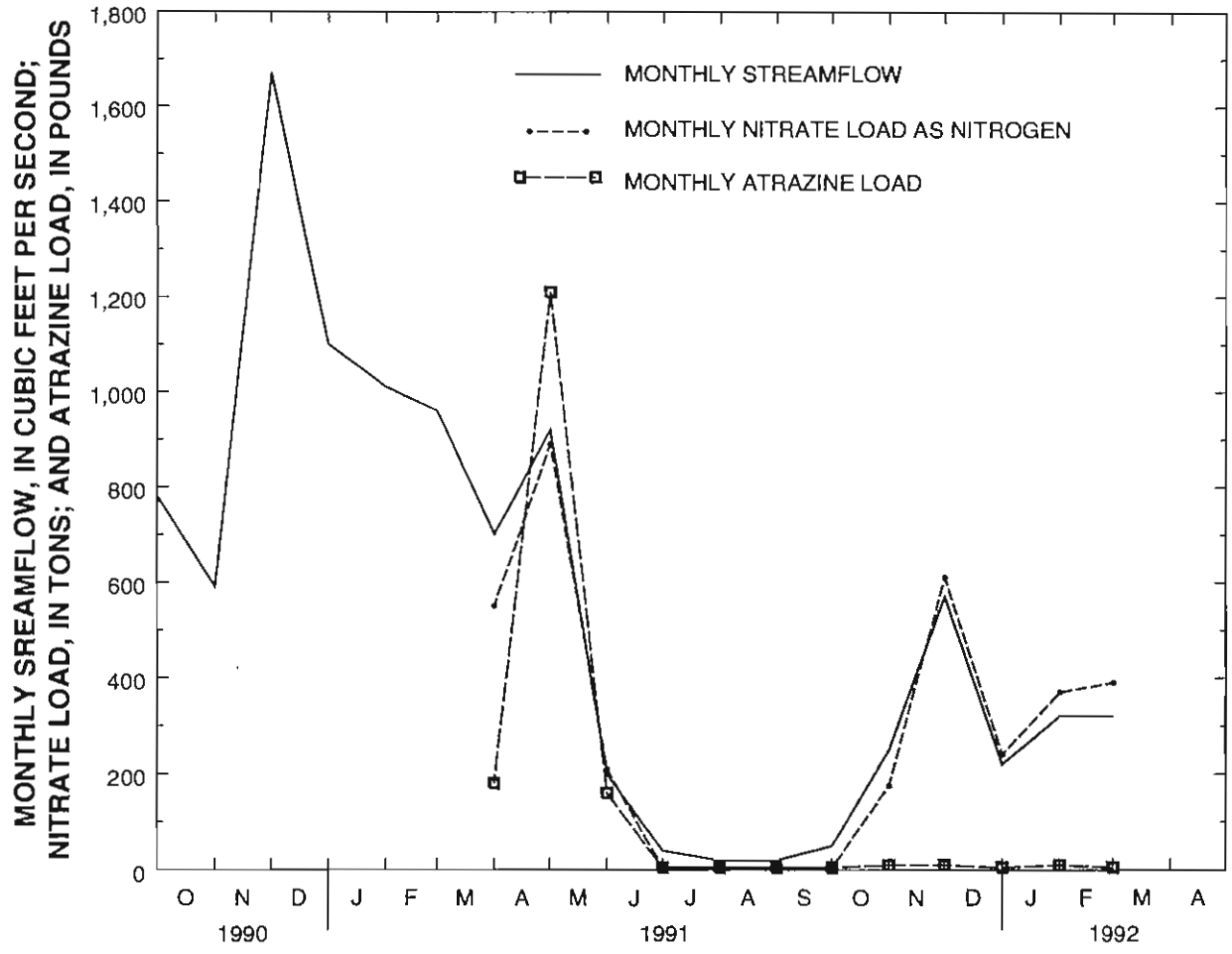
Tarte, S.R., Schmidt, A.R., and Sullivan, D.J., 1992, Floating sample-collection platform with stage-activated automatic water sampler for streams with large variation in stage: U.S. Geological Survey Open-File Report 92–149, 14 p.

Zuehls, E.E., LaTour, J.K., and Wicker, T.L., 1994, Water resources data—Illinois, water year 1993, volume 2, Illinois River Basin: U.S. Geological Survey Water-Data Report IL–93–2, 297 p.

PUBLISHED ABSTRACTS:

Terrio, P.J., 1994, Instrumentation and sample collection equipment: Storm and storm-runoff monitoring, *in* 2nd National Nonpoint Source Watershed Monitoring Conference: Urban Streambank Restoration and Storm Event Monitoring, Northbrook, Illinois, September 26–30, 1994, p. 13.

Terrio, P.J., and Goolsby, D.A., Agricultural pesticides in Illinois lakes, 1992–1993, *in* Dare to Take the Plunge, 9th Annual Conference, Illinois Lake Management Association, Decatur, Illinois, April 14–16, 1994, unpaginated.



Monthly mean streamflow and monthly loads of nitrate and atrazine, Sangamon River at Monticello, Illinois

IL004 SEDIMENT STATIONS

COOPERATORS:
U.S. Army Corps of Engineers,
St. Louis District
Rock Island District
Illinois Department of Conservation
McHenry County Conservation District

LOCATION: Statewide

PROJECT CHIEF:
Gary P. Johnson
Urbana

PERIOD OF PROJECT:
Continuous since January 1976

PROBLEM: Water-resource planning and water-quality assessment require a nationwide base level of information. Sediment concentrations and discharges in streams must be defined and monitored. A large percentage of the land in Illinois is devoted to agriculture whereby the land is exposed to erosion. Recent studies conducted under Section 208 of Public Law 92–500 have suggested that sediment may be a major cause of water-quality degradation in Illinois. In spring 1994, Carol Browner, Administrator of the U.S. Environmental Protection Agency (USEPA), issued a statement that described sediment as "the No. 1 problem threatening America's waterways." Because of sedimentation, "fish respiration is impaired, plant productivity and water depth are reduced, aquatic organisms and their habitats are smothered, and our aesthetic enjoyment of the water is reduced," according to the USEPA (1994) report "The Quality of Our Nation's Water: 1992." Other activities, such as highway construction and industrial and residential development, contribute sediment to streams. Planning and regulatory agencies need a data base to evaluate sediment transport in streams.

OBJECTIVES: To provide a data base for evaluating sediment problems in Illinois and a standard from which the effectiveness of erosion control programs can be evaluated for their effect on water quality. To contribute to the national base of sediment data for use in broad Federal and State planning and action programs and to provide data for Federal management of interstate waters.

APPROACH: Establish and operate a network of sediment stations on Illinois streams to develop records of daily discharge of suspended sediment. Suspended-sediment stations will be located at continuous-record streamflow-gaging stations and will be used to establish relations between suspended-sediment discharge and surface-water discharge. These relations will be used to estimate long-term suspended-sediment yields of selected basins and predominant land-use areas. Supplementary information at most stations will include particle-size determinations of suspended-sediment and bed-material samples.

SUMMARY OF RESULTS: Suspended-sediment samples were collected and analyzed, and daily suspended-sediment concentrations and loads were computed for five continuous-record streamflow-gaging stations. Data for the 1993 water year were published in the annual data report.

PLANS: Continue sediment monitoring at seven continuous-record streamflow-gaging stations. Eight additional stations will be established. Publish data in the annual data report.

PUBLISHED REPORTS:

Maurer, J.C., Wicker, T.L., and LaTour, J.K., 1994, Water resources data—Illinois, water year 1993, volume 1, Illinois except Illinois River Basin: U.S. Geological Survey Water-Data Report IL–93–1, 247 p.

Zuehls, E.E., LaTour, J.K., and Wicker, T.L., 1994, Water resources data—Illinois, water year 1993, volume 2, Illinois River Basin: U.S. Geological Survey Water-Data Report IL–93–2, 297 p.

Measuring streamflow and sediment discharge from a small watershed using a Parshall flume, digital stage recorder, and an automatic pumping sampler

IL006 FLOOD INVESTIGATIONS

COOPERATOR:
Federal Emergency Management Agency

LOCATION: Statewide

PROJECT CHIEF:
Charles S. Melching
Urbana

PERIOD OF PROJECT:
January 1984 through September 1987

July 1993 through September 1995

PROBLEM: The National Flood Insurance Act of 1968 and The Flood Disaster Protection Act of 1973 provide for the operation of a flood-insurance program. The Federal Emergency Management Agency (FEMA) needs flood studies in selected areas to determine applicable flood-insurance premium rates.

OBJECTIVES: To perform the necessary hydrologic and hydraulic evaluations and studies of areas in Illinois and adjacent States assigned by FEMA and to present the results in an appropriate format.

APPROACH: To perform the necessary evaluations or to perform surveys by ground or photogrammetric methods. Determine flood-discharge frequency relations utilizing local historical information, gaging-station records, or other applicable information. Determine water-surface profiles using the step-backwater models or by other acceptable methods and furnish the results in reports prepared to FEMA specifications.

SUMMARY OF RESULTS: The hydrology of the 10-, 50-, 100-, and 500-year design hydrographs for Ebner Coulee in La Crosse, Wis., was evaluated and a summary was sent to the Wisconsin Department of Natural Resources (WDNR) for review. After review by WDNR, it was decided to apply the design hydrographs determined in the original flood-insurance study. These design hydrographs, routed to Farnam Street (the entrance to the Ebner Coulee box culvert), have been retrieved from the microfiche of the original flood-insurance study. The review by WDNR took longer than expected and caused the project to be extended through fiscal year 1995.

PLANS: (1) Determine the hydraulic capacity of the box culvert. Preliminary estimates indicate that the hydraulic capacity of the box culvert under the surcharge conditions likely for the design floods is nearly equal to the peak discharge of the 100-year flood at Farnam Street. However, at Farnam Street at peak flow, the floodflow spreads 630 feet across the flood plain. Therefore, even though the drainage system has considerable capacity and could greatly reduce downstream flooding, there is no way to utilize much of this capacity. (2) Prepare a short letter to FEMA detailing the calculation of the hydraulic capacity of the box culvert and discussing the issue of utilization of the culvert capacity. It will be included in the letter that FEMA suggest to the city of La Crosse that additional structures are needed to direct water into the box culvert in order for them to obtain a reduced flood plain downstream from Farnam Street. (3) Complete project as per FEMA's response to the letter detailing the hydraulic capacity of the Ebner Coulee box culvert and related problems.

IL007 WATER USE

COOPERATORS:

Board of Trustees of the University of Illinois, State Water Survey
Illinois Environmental Protection Agency

LOCATION: Statewide

PROJECT CHIEF:

Charles F. Avery
Urbana

PERIOD OF PROJECT:

Continuous since March 1978

PROBLEM: A water supply may or may not be adequate depending upon present and future demands. Detailed information is being collected describing the quantity and quality of available water in Illinois. However, water-use inventories generally have been performed only intermittently or when a water supply has been adversely affected. Competing demands for water in Illinois dictate that adequate water-use information is essential for the proper management of available supplies.

OBJECTIVES: (1) Acquire water-use information throughout the State of Illinois as a basis for present analyses and future projections of water use. (2) Develop and maintain a water-use data base that will be responsive to the data needs of users at local, State, and national levels. (3) Establish methods of estimating water use.

APPROACH: Responsibilities will be divided between the Illinois State Water Survey (ISWS), the Illinois Environmental Protection Ageney (IEPA), and the USGS. The ISWS will obtain water-withdrawal and delivery data from questionnaires sent to water users throughout the State. The ISWS and USGS will enter the data into a site-specifie data base that is usable to both ageneies. The USGS will transfer the statewide data to the Site-Speeific Water Use Data System (SSWUDS). The IEPA will obtain return data by way of the National Pollutant Discharge Elimination System (NPDES). The IEPA and USGS will enter the data into a data base. The USGS will maintain the statewide return data in SSWUDS. The withdrawal, delivery, and return data will be aggregated by water-use category (water supply, commercial, industrial, fossil-fuel power, nuclear power, mining, hydroelectric, and sewage treatment) and location (county, hydrologic unit, and aquifer). Water uses by other categories (domestic, livestock, irrigation, and reservoir evaporation) will be estimated. The aggregations are done to meet State and national data needs.

SUMMARY OF RESULTS: In cooperation with the ISWS, 1991 water-use data were obtained. The data were aggregated and entered into the Aggregated Water-Use Data System (AWUDS). Obtained the 1990–91 site-specific withdrawal data and the 1993 return data. Verification of the water-use sites is progressing. A draft of the 1988 water-withdrawals report for Illinois was completed and has undergone in-house review.

PLANS: (1) Obtain 1992 site-specific withdrawal data. (2) Enter 1993 return data into NEWSWUDS. (3) Assign unique identification numbers to return sites and establish the sites in the SITEFILE. Merge site-specific withdrawal sites with sites already in the SITEFILE utilizing GWSI. (4) Publish the report "Water Withdrawals and Use for Illinois, 1988."

PLANNED REPORT:

Water withdrawals in Illinois, 1990

REPORT IN PROCESS:

Water withdrawals in Illinois, 1988

PUBLISHED REPORTS:

Kirk, J.R., Jarboe, Jacquelyn, Sanderson, E.W., Sasman, R.T., and Sinclair, R.A., 1979, Water withdrawals in Illinois, 1978: Illinois State Water Survey Circular 140, 34 p.

Kirk, J.R., Jarboe, Jacquelyn, Sanderson, E.W., Sasman, R.T., and Lonnquist, Carl, 1982, Water withdrawals in Illinois, 1980: Illinois State Water Survey Circular 152, 47 p.

Kirk, J.R., Sanderson, E.W., and Sasman, R.T., 1984, Water withdrawals in Illinois, 1982: Illinois State Water Survey Circular 161, 43 p.

Kirk, J.R., Hlinka, K.J., Sasman, R.T., and Sanderson, E.W., 1985, Water withdrawals in Illinois, 1984: Illinois State Water Survey Circular 163, 43 p.

Kirk, J.R., 1987, Water withdrawals in Illinois, 1986: Illinois State Water Survey Circular 167, 43 p.

LaTour, J.K., 1991, Determination of water use in Rockford and Kankakee areas, Illinois: U.S. Geological Survey Water-Resources Investigations Report 90–4166, 70 p.

———1993, Contribution of return flows to streamflow in selected stream reaches in Illinois, 1988–89: U.S. Geological Survey Water-Resources Investigations Report 93–4089, 35 p.

Turbine pump on a municipal ground-water well

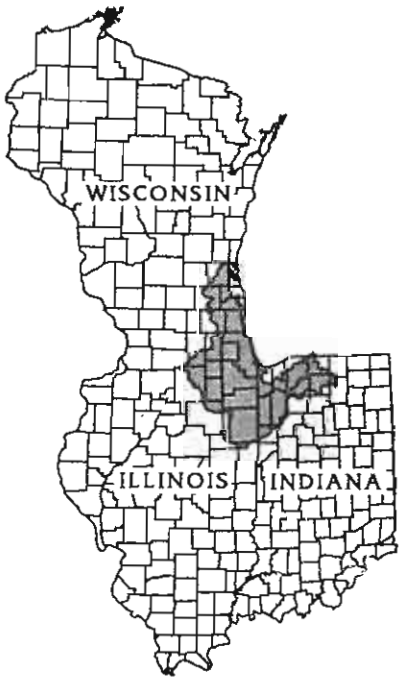
IL075 UPPER ILLINOIS RIVER BASIN WATER-QUALITY ASSESSMENT

COOPERATOR:
Federal Program

LOCATION: Upper Illinois River Basin

PROJECT CHIEF:
Stephen F. Blanchard
Urbana

PERIOD OF PROJECT:
Continuous since April 1986



PROBLEM: Protecting the quality of the Nation's ground-water and surface-water resources is a priority national concern. The quality of the Nation's water resources has a direct effect on public health and on the economic success of agriculture, industry, and recreation. The impact of degraded water quality may have short- or long-term effects on public health or economic success. In 1986, the USGS initiated a NAtional Water-Quality Assessment (NAWQA) program to help address problems related to degraded water quality. The upper Illinois River Basin project is one of seven pilot water-quality studies initiated in the pilot phase of the NAWQA program.

OBJECTIVES: (1) Provide a description of present surface-water-quality conditions. (2) Develop conceptual models that relate observed conditions to sources and causes. (3) Track long-term trends in water quality. (4) Improve the understanding of the relation between causative factors and water quality.

APPROACH: A liaison committee consisting of representatives of Federal, State, and local agencies will be formed to provide a forum for the USGS to inform interested parties of NAWQA plans and findings, to seek advice, to identify available data and reports, and to establish collaborative efforts to supplement the NAWQA program. Available data and reports will be compiled and summarized to provide a description of past and current trends in conditions. Descriptive information that may aid in the interpretation of trends will be compiled. Simple statistical methods, such as regression analysis, will be used to relate observed trends to the descriptive information. New data will be collected from the operation of a fixed-location river-sampling station network and from synoptic surveys. Reports describing project plans, data, and findings will be published.

SUMMARY OF RESULTS: Published four reports and one conference paper.

PLANS: Continue to summarize and interpret water-quality data for the basin. Complete and publish all planned reports for the project.

PLANNED REPORT:

Results of investigations, March 1987 through August 1991

REPORTS IN PROCESS:

Trace elements in water, sediment, and biota, upper Illinois River Basin

Organic compounds in water, sediment, and biota, upper Illinois River Basin

Nutrients, dissolved oxygen, and fecal-indicator bacteria, upper Illinois River Basin

Cross-sectional and depth variation, 1987–88

Surface-water-quality assessment of the upper Illinois River Basin in Illinois, Indiana, and Wisconsin: Analysis of available water-quality data through 1986.

PUBLISHED ABSTRACTS AND PAPERS:

Terrio, P.J., 1987, Methods for selecting bottom-material sampling sites in the upper Illinois River Basin, *in* Program and Abstracts, Illinois State Section of the American Water Resources Association, 1987 Annual Conference, April 28–29, 1987, Champaign, Ill., p. 32.

Blanchard, S.F., 1989, Surface-water quality of the upper Illinois River Basin in Illinois, Indiana, and Wisconsin—analysis of existing information, *in* Pederson, G.L., and Smith, M.M., comps., U.S. Geological Survey Second National Symposium on Water Quality: U.S. Geological Survey Open-File Report 89–409, p. 5.

Colman, J.A., and Sanzolone, R.F., 1992, Geochemical characterization of streambed sediment in the upper Illinois River Basin: Water Resources Bulletin, v. 28, no. 5, p. 933–950.

Ruhl, P.M., and Striegl, R.G., 1989, Relations between fish population and water quality in the upper Illinois River Basin in Illinois, Indiana, and Wisconsin—analysis of existing information, *in* Pederson, G.L., and Smith, M.M., comps., U.S. Geological Survey Second National Symposium on Water Quality: U.S. Geological Survey Open-File Report 89–409, p. 80–81.

Smith, S.M., Sanzolone, R.F., and Colman, J.A., 1989, Use of multivariate techniques for background and anthropogenic-source analysis of trace elements in streambed materials in the upper Illinois River Basin in Illinois, Indiana, and Wisconsin, *in* Pederson, G.L., and Smith, M.M., comps., U.S. Geological Survey Second National Symposium on Water Quality: U.S. Geological Survey Open-File Report 89–409, p. 93.

Stanke, F.A., 1989, Using a geographic information system to relate human and natural factors to stream-water quality in the upper Illinois River Basin in Illinois, Indiana, and Wisconsin, *in* Pederson, G.L., and Smith, M.M., comps., U.S. Geological Survey Second National Symposium on Water Quality: U.S. Geological Survey Open-File Report 89–409, p. 96.

Terrio, P.J., 1989, Occurrence and distribution of nutrients and dissolved oxygen in the upper Illinois River Basin in Illinois, Indiana, and Wisconsin—results of a 1988 low-flow synoptic survey, *in* Pederson, G.L., and Smith, M.M., comps., U.S. Geological Survey Second National Symposium on Water Quality: U.S. Geological Survey Open-File Report 89–409, p. 100–101.

Terrio, P.J., 1991, Occurrence and distribution of nutrients, dissolved oxygen, and Escherichia Coli bacteria in the upper Illinois River Basin in Illinois, Indiana, and Wisconsin: Results of a 1988 low-flow synoptic survey, *in* Program and Abstracts, 1991 Annual Conference, Illinois State Section of the American Water Resources Association, October 21, 1991, Peoria, Ill.

Schmidt, A.R., 1992, Sediment and water quality in the upper Illinois River Basin, *in* Proceedings, 1991 Governor's Conference on the Management of the Illinois River System, October 22–23, 1991, Peoria, Ill., p. 78–87.

PUBLISHED REPORTS:

Mades, D.M., 1987, Surface-water-quality assessment of the upper Illinois River Basin in Illinois, Indiana, and Wisconsin: Project description: U.S. Geological Survey Open-File Report 87–473, 39 p.

Steffeck, D.W., and Striegl, R.G., 1989, An inventory and evaluation of biological investigations that relate to stream-water quality in the upper Illinois River Basin of Illinois, Indiana, and Wisconsin: U.S. Geological Survey Water-Resources Investigations Report 89–4041, 54 p.

Zogorski, J.S., Blanchard, S.F., Romack, R.D., and Fitzpatrick, F.A., 1990, Availability and suitability of municipal wastewater information for use in a national water-quality assessment: A case study of the upper Illinois River Basin in Illinois, Indiana, and Wisconsin: U.S. Geological Survey Open-File Report 90–375, 68 p.

Colman, J.A., and Sanzolone, R.F., 1991, Surface-water-quality assessment of the upper Illinois River Basin in Illinois, Indiana, and Wisconsin: Geochemical data for fine-fraction streambed sediment from high- and low-order streams, 1987: U.S. Geological Survey Open-File Report 90–571, 108 p.

Fitzpatrick, F.A., and Colman, J.A., 1993, Surface-water quality assessment of the upper Illinois River Basin in Illinois, Indiana, and Wisconsin: Data on manmade nonagricultural volatile and semivolatile organic chemicals in water, May 1988 through March 1990: U.S. Geological Survey Open-File Report 92–467, 70 p.

Sullivan, D.J., and Blanchard, S.F., 1994, Surface-water-quality assessment of the upper Illinois River Basin in Illinois, Indiana, and Wisconsin: Fixed-station network and selected water-quality data for April 1987–August 1990: U.S. Geological Survey Open-File Report 91–175, 213 p.

Sullivan, D.J., and Terrio, P.J., 1994, Surface-water-quality assessment of the upper Illinois River Basin in Illinois, Indiana, and Wisconsin: Data on agricultural organic compounds, nutrients, and sediment in water, 1988–90: U.S. Geological Survey Open-File Report 93–421, 61 p.

Terrio, P.J., 1994, Relations of changes in wastewater-treatment practices to changes in stream-water quality during 1978–88 in the Chicago area, Illinois, and implications for regional and national water-quality assessments: U.S. Geological Survey Water-Resources Investigations Report 93–4188, 56 p.

Preparing to sample for macroinvertebrates in streams in the upper Illinois River Basin

IL080 USGS/USEPA INTERAGENCY AGREEMENT PROJECTS

COOPERATOR:
U.S. Environmental Protection Agency, Region V

LOCATION: Statewide

PROJECT CHIEF:
Robert T. Kay
De Kalb

PERIOD OF PROJECT:
March 1986 through September 1995

PROBLEM: The U.S. Environmental Protection Agency (USEPA), Region V, has requested that the USGS, Illinois District, provide technical assistance on several Superfund sites within the State. The technical assistance varies from reviewing technical reports submitted to USEPA by their consultants to designing and performing hydrogeologic investigations at Superfund sites and regional areas of environmental concern.

OBJECTIVES: To provide technical consultation, training, and quality assurance and to perform investigations for the USEPA under the conditions of the Joint Interagency Agreement.

APPROACH: Design, perform, and analyze hydrogeologic and water-quality activities at the Byron Salvage Yard, Parson's Casket, and DeWane Landfill Superfund sites and Tipton Farms and the city of Byron. Design and perform area-wide hydrogeologic studies in the Belvidere area and the extent of the Galena-Platteville bedrock unit in northern Illinois and southern Wisconsin. Provide technical review on results of work at all sites. Write reports describing results of USGS data analysis of hydrogeologic conditions at Byron, Parson's Casket, and other sites, and the Belvidere and Galena-Platteville areas.

SUMMARY OF RESULTS: (1) Published report, "Interaction of Ground Water with the Rock River near Byron, Illinois." (2) Finished writing report on hydrogeology and ground-water quality at the Byron Salvage Yard/Dirk's Farm property site. The report is in the review process prior to publication. (3) Began preparation of geohydrologic maps for the Galena-Platteville bedrock unit study. (4) Continued co-location of USGS hydrologist at USEPA Region V Technical Support Section, Chicago, Ill. (5) Began analysis of tracer-test data for fractured-rock study in the Byron area. (6) Collected ground-water-quality samples and measured ground-water levels in the Belvidere area. (7) Drilled, sampled, and performed aquifer tests on test holes in the Belvidere area. (8) Performed oversight activities and documented review for the MIG/DeWane Landfill in the Belvidere area. Performed aquifer tests and began analysis of aquifer-test results at Tipton Farms. Measured water levels in available wells.

PLANS: (1) Complete co-location of USGS hydrologist at USEPA. (2) Obtain approval for publication of report on geology, hydrology, results of aquifer testing and water-quality sampling at the Byron site. (3) Obtain approval to publish an Open-File Report titled "Well-Construction, Hydrogeologic, and Ground-Water Quality Data in the Vicinity of Belvidere, Boone County, Illinois." (4) Complete analysis of data collected during tracer testing at the Byron site. Write report and submit for review. (5) Publish selected geohydrologic maps on the Galena-Platteville bedrock unit in Illinois and Wisconsin. (6) Continue data analysis and report writing for the Belvidere area project. (7) Continue oversight activities and document review for the MIG/DeWane landfill study. (8) Continue aquifer-test analysis and

complete geophysical logging of three deep wells at Tipton Farms. Complete an annotated outline and a first draft of a report describing the hydrogeology at Tipton Farms.

PLANNED REPORTS:

Hydrogeology, aquifer tests, water-quality sampling, Byron Salvage Yard

Hydrogeology and results of aquifer tracer tests at a hazardous-waste disposal site near Byron, Illinois

Rock-stratigraphic nomenclature, lithology, and subcrop area of the Galena-Platteville bedrock unit in southern Wisconsin and northern Illinois

Hydrogeology and analysis of geophysical well logs, Tipton Farms, Illinois

REPORTS IN PROCESS:

Hydrogeology and ground-water quality at the Byron Salvage Yard/Dirk's Farm site, Illinois

Well-construction, hydrogeologic, and ground-water-quality data in the vicinity of Belvidere, Boone County, Illinois

PUBLISHED ABSTRACTS:

Kay, R.T., Ryan, B.J., Mears, E.J., and Yeskis, D.J., 1987, Hydrogeology of the Byron/Johnson Salvage Yard Superfund site near Byron, Illinois, *in* Proceedings of the ASCE Water Resources Symposium, October 21–22, 1987, Rosemont, Ill.

Ryan, B.J., Kay, R.T., and Wallace, K.A., 1987, Hydraulic testing in two aquifers at a Superfund site near Byron, Illinois, *in* Program with Abstracts, 32nd Annual Midwest Ground Water Conference, October 28–30, 1987, Madison, Wis.

Avery, C.F., Yeskis, D.J., and Bolen, W.F., 1991, Interaction of ground water with the Rock River near Byron, Illinois, *in* Programs and abstracts, American Geophysical Union 1991 Fall Meeting, December 9–13, 1991, San Francisco, Calif.

PUBLISHED REPORTS:

Kay, R.T., Olson, D.N., and Ryan, B.J., 1989, Hydrogeology and results of aquifer tests in the vicinity of a hazardous-waste disposal site near Byron, Illinois: U.S. Geological Survey Water-Resources Investigations Report 89–4081, 55 p.

Kay, R.T., and Earle, J.D., 1990, Determination of hydraulic properties in the vicinity of a landfill near Antioch, Illinois: U.S. Geological Survey Water-Resources Investigations Report 89–4124, 28 p.

Mills, P.C., 1993a, Vertical distribution of hydraulic characteristics and water quality in three boreholes in the Galena-Platteville Aquifer at the Parson's Casket Hardware Superfund site, Belvidere, Illinois, 1990: U.S. Geological Survey Open-File Report 93–402, 36 p.

——1993b, Hydrogeology and water quality of the Galena-Platteville Aquifer at the Parson's Casket Hardware Superfund site, Belvidere, Illinois, 1991: U.S. Geological Survey Open-File Report 93–403, 86 p.

——1993c, Hydrogeology and water quality of the Galena-Platteville Aquifer at the Parson's Casket Hardware Superfund site, Belvidere, Illinois, 1991–1992: U.S. Geological Survey Open-File Report 93–404, 29 p.

Avery, C.F., 1994, Interaction of ground water with the Rock River near Byron, Illinois: U.S. Geological Survey Water-Resources Investigations Report 94–4034, 22 p.

Hazardous-response training is a prerequisite to working at hazardous-waste sites

Aquifer-test field installation at a hazardous-waste site

IL083 RAINFALL-RUNOFF RELATIONS IN THREE SMALL WATERSHEDS IN DU PAGE COUNTY

COOPERATOR:
Du Page County, Department of Environmental Concerns

LOCATION:
Du Page County

PROJECT CHIEF:
James J. Duncker
Urbana

PERIOD OF PROJECT:
October 1987 through September 1994

PROBLEM: Little information about the variation in time and space of rainfall and corresponding storm runoff exists in Du Page County. The development of a comprehensive, county-wide storm-water-management program in Du Page County requires an understanding of rainfall-runoff relations. Actual runoff data are needed for developing rainfall-runoff relations.

OBJECTIVES: (1) Determine rainfall-runoff relations in three small watersheds using observed data and rainfall-runoff modeling. (2) Analyze differences in rainfall-runoff relations between watersheds and relate differences to causative factors such as land use.

APPROACH: Streamflow and meteorologic data will be collected in three small watersheds in northeastern Illinois. Continuous records of stage and discharge will be collected in each watershed. At least three rain gages for each watershed will be installed. Other pertinent data, such as land use and soil type, will be obtained from available sources. These data will be used to calibrate a continuous simulation rainfall-runoff model for each watershed. A subset of the data collected will be reserved for model verification.

SUMMARY OF RESULTS: Model simulation of the three small watersheds is nearing completion. A final simulation of Kress Creek will be completed after a land-cover/soils GIS coverage is obtained from Du Page County. Current simulation results of rainfall-runoff relations are satisfactory. A draft copy of the report describing model-simulation results of rainfall-runoff relations was reviewed by the Du Page County staff.

PLANS: Data collection at the streamflow- and rainfall-gaging stations will continue throughout the 1995 water year as part of the Illinois District data-collection program (project IL001). Model simulations should be completed by October 1994, and the report on rainfall-runoff relations should be submitted for colleague review by November 1994.

REPORT IN PROCESS:

Rainfall-runoff relations in three small watersheds in Du Page County, Illinois

PUBLISHED REPORT:

Duncker, J.J., Vail, T.J., and Earle, J.D., 1993, Rainfall in and near Du Page County, Illinois, February 1986–September 1991: U.S. Geological Survey Open-File Report 92–485, 142 p.

IL096 HYDROGEOLOGY AND CONTAMINANT ASSESSMENT IN THE SOUTHEASTERN CHICAGO AREA

COOPERATOR:
U.S. Environmental Protection Agency, Region V

LOCATION:
Southeastern Chicago Area

PROJECT CHIEF:
Robert T. Kay
De Kalb

PERIOD OF PROJECT:
September 1991 through September 1995

PROBLEM: The U.S. Environmental Protection Agency, Region V, has requested that the USGS, Illinois District, perform an investigation designed to define the hydrogeologic and water-quality conditions in the southeastern Chicago area. This area has significant surface-water and ground-water contamination, which presents a significant potential hazard.

OBJECTIVES: Characterize the hydrology of the surface water and shallow ground-water system in the area of southeast Chicago. Characterize aquifer properties and water quality in the area. Identify the nature and extent of a potential nonaqueous-phase-liquid layer, if present, underlying the study area. Characterize effects of fill deposits on ground-water quality.

APPROACH: Perform one or more synoptic water-level surveys in the area. Perform drilling, hydraulic testing, and water-quality sampling to determine the type of contamination present in the study area. Collect land-use, lithologic, and water-quality data to determine the location and extent of fill deposits and their affect on ground-water quality.

SUMMARY OF RESULTS: (1) Analyzed water-level data collected during the synoptic water-level survey. The report describing ground-water levels and directions of flow was written and reviewed and is awaiting Director's approval. (2) Installed monitoring wells. (3) Collected approximately 130 ground-water samples and analyzed for organic compounds, metals, cyanide, and major ions. (4) Analyzed water-quality data and wrote part of report on results of sampling. (5) Began characterization of fill deposits including preparing maps of the extent and thickness of the fill and utilizing remote-sensing methodologies and fill identification and comparison with field data. Began writing report on fill characterization.

PLANS: Publish the report on the results of sampling and submit the fill characterization report for Director's approval. Possibly perform another round of water-quality sampling.

PLANNED REPORTS:

Results of ground-water-quality sampling in northwestern Indiana and the Lake Calumet area of southeastern Chicago

Characterization and effect of ground-water quality of fill deposits in northwestern Indiana and the Lake Calumet area of southeastern Chicago

REPORT IN PROCESS:

Ground-water levels and directions of flow, and presence of light-non-aqueous-phase liquids in ground water in northwestern Indiana and the Lake Calumet area of northeastern Illinois

IL097 SEDIMENTATION OF THE KANKAKEE RIVER

COOPERATOR:
Kankakee Soil and Water Conservation District

LOCATION:
Kankakee River Basin (northeastern Illinois and northwestern Indiana)

PROJECT CHIEF:
Paul J. Terrio
Urbana

PERIOD OF PROJECT:
May 1992 through September 1996

PROBLEM: Sedimentation in the Kankakee River in Illinois has been a major concern to Illinois residents for many years. Previous studies (Bhowmik and Bogner, 1981; Gross and Berg, 1981) concluded that extensive drainage of the wetlands and channelization of the Kankakee River did cause increased sedimentation, but, by the early 1950's, the river had reached equilibrium and further sedimentation was not observed. However, during the years since the State studies were completed, Illinois residents utilizing the river continue to be concerned about whether sedimentation rates have continued to increase.

OBJECTIVES: (1) Determine the long-term sedimentation rate in the flood plain and compare rates in channelized and natural reaches of the river, (2) determine changes in channel geometry and volume over the past 30 years from the dam at Kankakee to the State line, and (3) determine a suspended-sediment budget for the central portion of the Kankakee River Basin.

APPROACH: The study will build on and extend the previous work of the State Water and Geological Surveys and the Illinois Department of Transportation, Division of Water Resources. Long-term flood-plain sedimentation rates will be estimated by applying dendrogeomorphic techniques. The rate of sedimentation in the channel will be determined by measuring changes in channel geometry for selected reaches of the river over the past 30 years. A long-term sediment-monitoring program will be initiated to calculate a sediment budget.

SUMMARY OF RESULTS: Report titled "Dendrogeomorphic estimate of changes in sedimentation rate along the Kankakee River near Momence, Illinois" has been approved for publication. Operation of six suspended-sediment monitoring stations continued. Channel geometry cross-section data for two reaches of the Kankakee River were collected in September 1994. Data for the 1993 water year were published in the annual data report.

PLANS: Publish report of the dendrogeomorphic study. Continue operation of six suspended-sediment and bedload-monitoring stations. Analyze results of channel geometry cross-section data by comparing recent data to historical data collected from 1950–80. Determine changes in channel shape and capacity. Write annotated outlines and drafts of reports concerning evaluation of channel geometry and suspended-sediment data and submit channel geometry report for colleague review.

PLANNED REPORTS:

Evaluation of channel geometry investigation on the Kankakee River near Momence, Illinois

Suspended-sediment data collected on the Kankakee River, Illinois, 1992–95

REPORT IN PROCESS:

Dendrogeomorphic estimate of changes in sedimentation rate along the Kankakee River near Momence, Illinois

PUBLISHED REPORT:

Zuehls, E.E., LaTour, J.K., and Wicker, T.L., 1994, Water resources data---Illinois, water year 1993, volume 2, Illinois River Basin: U.S. Geological Survey Water-Data Report IL–93–2, 297 p.

Downstream view of the confluence of the Kankakee River (right) and the Iroquois River (left) at Aroma Park

IL099 HYDRAULIC MODEL VERIFICATION AND DOCUMENTATION FOR UNSTEADY FLOW

COOPERATORS:
Illinois Department of Transportation, Division of Water Resources

LOCATION:
Northeastern Illinois

PROJECT CHIEF:
Audrey L. Ishii
Urbana

PERIOD OF PROJECT:
June 1992 through September 1996

PROBLEM: Steady-flow model computations may be inadequate for flood-plain delineation in many locations, particularly where river reaches have low or flat slopes and extensive flood-plain flow and storage. Most unsteady-flow models are restricted from application at internal boundaries, such as bridges, dams, weirs, and culverts. A verified and documented unsteady-flow model that includes internal boundaries in its overall solution scheme is needed for a wide variety of applications.

OBJECTIVE: To verify and document the one-dimensional, unsteady flow, Full EQuations (FEQ) hydraulic-routing model and its companion Full EQuations UTiLity (FEQUTL) program. The verification will be accomplished with a well-documented data set of measured flows and elevations under a variety of unsteady-flow conditions. The documentation will include a detailed description of the governing equations of the model, solution procedures, input and output requirements, and a guide to model applications.

APPROACH: The study has four main tasks: (1) data collection and documentation, (2) model calibration and verification, (3) model documentation, and (4) the preparation, testing, and revision of a user's guide. For the first task, discharge and stage data will be collected with continuous recorders on a small stream subject to overbank and backwater flow. Measurement of flows in the overbank and culvert sections will be made during floods, and elevations upstream and downstream from the culvert will be recorded. This data set and the dye, stage, and discharge data collected during a period of unsteady flow on the Fox River for a previous project (IL091) (Balding, 1994a, p. 40) will be documented in a report and used to verify the model. For the second task, models will be prepared or obtained for the Fox River, the small stream, and a sewer pipe utilized under laboratory conditions for which unsteady-flow data are available. The models will be calibrated with data independent of the verification data sets. The induced or natural floodwaves will be routed through the models and the differences between the simulated and measured flows and elevations compared. For the Fox River model, the simulated flow field will be input to a transport model and the simulated dye concentrations compared to the measured dye concentrations. The model documentation (task 3) will result in a report documenting (a) river network visualization and schematization, flow-governing equations, and solution procedures used in FEQ; (b) governing equations and tabular representations used in the well-established features of FEQUTL; and (c) input formats for FEQ and FEQUTL. The report will be written by a contractor according to detailed specifications provided by the USGS. A detailed annotated outline will be prepared by the Illinois District and USGS specialists at all stages of development. The final task (task 4) is to provide a user's guide that describes a specific, typical application of the model in sufficient detail to provide guidance to first-time users and a ready reference of key features for experienced users. This guide will be tested on first-time users within the Illinois District and revised prior to publication.

SUMMARY OF RESULTS: The verification study for overbank and culvert flooding was completed, and the results have been described in a draft of a report to be published in the Water-Supply Paper series. The report has been reviewed and is being readied for Director's approval. Three floods were measured at Spring Brook near Warrenville, Ill. Data collected during one flood were used for calibration, and data from two floods were used for verification of the model. The sensitivity of model parameters such as culvert area and overbank length was also investigated and reported. The Fox River verification report has been approved as a Water-Supply Paper. The documentation report has been reviewed and is being prepared for Director's approval. The user's guide is being written in collaboration with the author of the FEQ model, Dr. Delbert Franz. The guide will be organized around the development of a single hypothetical stream-system model. The steps in the model development will be annotated and illustrated from a conceptual model of the flow network and controls to a complex computer model with several detailed hydraulic structures. The report "Data-Collection Methods and Data Summary for Verification of a One-Dimensional, Unsteady-Flow Model of the Fox River in Northeastern Illinois, October–November 1990," has been printed and distributed.

PLANS: All reports are to be published except for the user's guide. The cooperators have requested that the scope of the user's guide be enlarged to include recent model enhancements, particularly the graphical analysis modules. They have asked that the project be continued for an additional year in order to include the enhancements.

PLANNED REPORT:

User's guide for the Full Equations (FEQ) model of one-dimensional unsteady, open-channel flow

REPORTS IN PROCESS:

Implementation and verification of a one-dimensional, unsteady-flow model for Spring Brook near Warrenville, Illinois

Full Equations (FEQ) Model for the solution of the full, dynamic equations of motion for one-dimensional, unsteady flow in open channels and through control structures

Full Equations Utilities (FEQUTL) model for the approximations of hydraulic characteristics of open channels and control structures during unsteady flow

Verification of a one-dimensional, unsteady-flow model for the Fox River in Illinois

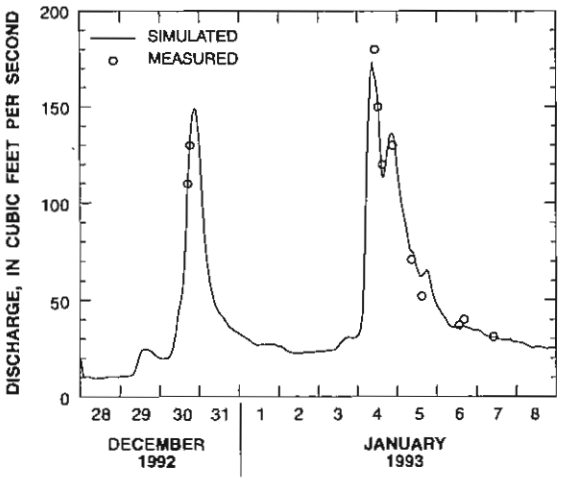
PUBLISHED PAPER AND ABSTRACT:

Ishii, A.L., and Wilder, J.E., 1993, Effect of boundary condition data selection on unsteady-flow model calibration, *in* Proceedings of XXV Congress of International Association for Hydraulic Research, special lectures, technical session A, flood and drought, v.1, August 30–September 3, 1993, Tokyo, Japan, p. 193–200.

Turner M.J., and Schmidt, A.R., 1993, Application of a transport model to verify a one-dimensional, unsteady-flow model, *in* Program and abstracts, American Geophysical Union 1993 Fall Meeting, December 6–10, 1993, San Francisco, Calif.

PUBLISHED REPORT:

Turner, M.J., 1994, Data-collection methods and data summary for verification of a one-dimensional, unsteady-flow model of the Fox River in northeastern Illinois, October–November 1990: U.S. Geological Survey Open-File Report 93–483, 40 p.



Simulated and measured flow of a small stream in northern Illinois

IL100 SOUTHEAST ROCKFORD SITE CHARACTERIZATION

COOPERATOR:
U.S. Environmental Protection Agency, Region V

LOCATION:
Southeast Rockford

PROJECT CHIEF:
Robert T. Kay
De Kalb

PERIOD OF PROJECT:
October 1992 through September 1995

PROBLEM: The southeast Rockford area has undergone appreciable ground-water-quality degradation because of concentrated industrial and waste-disposal activities. The maximum depth of contamination and the potential for contamination of the deep dolomite and sandstone aquifers pumped for water supply in the area must be evaluated.

OBJECTIVES: Determine the types and concentrations of volatile organic compounds (VOC's) in the dolomite aquifer, the vertical extent of ground-water contamination, and the factors affecting the migration of VOC's in the aquifer.

APPROACH: Identify stratigraphy, fracture orientation, and ground-water movement within three boreholes. Collect ground-water samples from monitoring wells and analyze for VOC's.

SUMMARY OF RESULTS: Reviewed consultant's reports for technical merit. A geohydrologic investigation was performed with the U.S. Environmental Protection Agency, to determine the distribution of VOC's in a fractured-rock aquifer near the Southeast Rockford Ground-Water Contamination Site in Rockford, Ill. The geologic units of concern are the St. Peter Sandstone and Glenwood Formations; the dolomites of the Platteville and Galena Groups; and the sands, gravels, silts, and clays of Quarternary age. The hydraulic units of concern are the unconsolidated aquifer, composed of sand and gravel; the dolomite aquifer, composed of the Platteville and Galena Groups and the dolomitic parts of the Glenwood Formation; and the sandstone aquifer, composed of the St. Peter Sandstone and the sandstone deposits in the Glenwood Formation. The dolomite aquifer is hydraulically connected to the unconsolidated aquifer and the sandstone aquifer. Caliper and acoustic-televiewer data show several subhorizontal fractures in the dolomite that can be correlated throughout the study area. Comparison of televiewer and flowmeter data indicates that most of the flow in the dolomite aquifer is through these fractures. Ground-water flow through two of the fractures can be correlated over large parts of the study area. VOC's, in concentrations exceeding 2,000 micrograms per liter, were detected within the entire thickness of the dolomite aquifer where flow is measurable. VOC's were detected in an area of the aquifer where they were thought to be absent in previous investigations.

PLANS: Continue to review consultant's reports for technical merit.

PUBLISHED REPORT:

Kay, R.T., Prinos, S.T., and Paillet, F.L., 1994, Geohydrology and ground-water quality in the vicinity of a ground-water-contamination site in Rockford, Illinois: U.S. Geological Survey Water-Resources Investigations Report 93–4187, 28 p.

IL101 CRAB ORCHARD OVERSIGHT ACTIVITIES

COOPERATOR:
U.S. Fish and Wildlife Service

LOCATION:
Crab Orchard National Wildlife Refuge

PROJECT CHIEF:
Charles F. Avery
Urbana

PERIOD OF PROJECT:
October 1992 through September 1996

PROBLEM: The Crab Orchard National Wildlife Refuge, constituting an area of 43,000 acres, is located about 5 miles west of Marion, Williamson County, Illinois. The Illinois Ordnance Plant operated within the present refuge, in the 1940's, as a manufacturing and loading site for high explosives and other components. An ammonium nitrate fertilizer plant also operated at the site. A remedial investigation and feasibility study, completed in 1989, defined areas of contamination in the soil and shallow ground water at various sites. The U.S. Environmental Protection Agency grouped sites with similar characteristics into four operable units (metals areas, PCB's areas, explosives/munitions areas, and miscellaneous areas). The areal and vertical extent of contamination need further definition in order to evaluate the potential impacts to the subsurface environment.

OBJECTIVES: Perform oversight activities of work performed by the Department of the Army at the Explosives/Munitions Manufacturing Areas Operable Unit. Insure that this remedial investigation/feasibility study, performed by the Army, adequately characterizes the nature and extent of contamination as related to the hydrology of the study area. Assist the Fish and Wildlife Service in data-base-management activities.

APPROACH: Apply USGS methodology to evaluate site conditions. This may include the installation of monitoring wells, sampling for water quality, measuring of water levels, and performing aquifer-test analyses.

SUMMARY OF RESULTS: Reviewed remedial investigation/feasibility study documents for the Explosives/Munitions and PCB's Operable Units.

PLANS: Review documents for other operable units. Assist the Fish and Wildlife Service in developing and maintaining a data-base-management system and applying geographic information system technology for data analysis and review. Assist with global positioning system technology in well-location activities.

IL102 LAKE COUNTY PEAK FLOW

COOPERATOR:
Lake County Stormwater Management Commission

LOCATION:
Lake County

PROJECT CHIEF:
Charles S. Melching
Urbana

PERIOD OF PROJECT:
October 1993 through September 1996

PROBLEM: Engineers and planners rely on estimates of flood volumes, hydrographs, and peak discharges to mitigate damages associated with flooding and to design stormwater-management systems. For small watersheds (less than 25 square miles), methods utilized to estimate flood characteristics typically relate flood characteristics to watershed and storm characteristics such as drainage area, channel slope, and precipitation depth. Stormwater management in Lake County, Illinois, can be greatly improved by developing methods for estimating design-hydrograph characteristics (peak flows and time to peak, among others) specific to Lake County on the basis of large storms (greater than 0.5 inch of runoff depth) from small watersheds of varying size and amounts of development.

OBJECTIVE: To refine methods for estimation of time and magnitude of peak discharge for developed and undeveloped basins in Lake County, Illinois.

APPROACH: (1) Establish a data base of large storms for which reliable rainfall and runoff data are available for small watersheds in Lake County utilizing data collected between 1990 and 1993. (2) Determine key hydrograph characteristics (time to peak, time of concentration, time lag, ratio of peak magnitude to time to peak) for the large storms. (3) Relate the key hydrograph characteristics to watershed and storm characteristics (area, slope, main-channel length, and others). (4) Continue the operation of a portion of the 1990–93 streamflow and rainfall data-collection network. (5) Use the data collected in 1994–95 to verify and refine the relations between hydrograph characteristics and watershed characteristics.

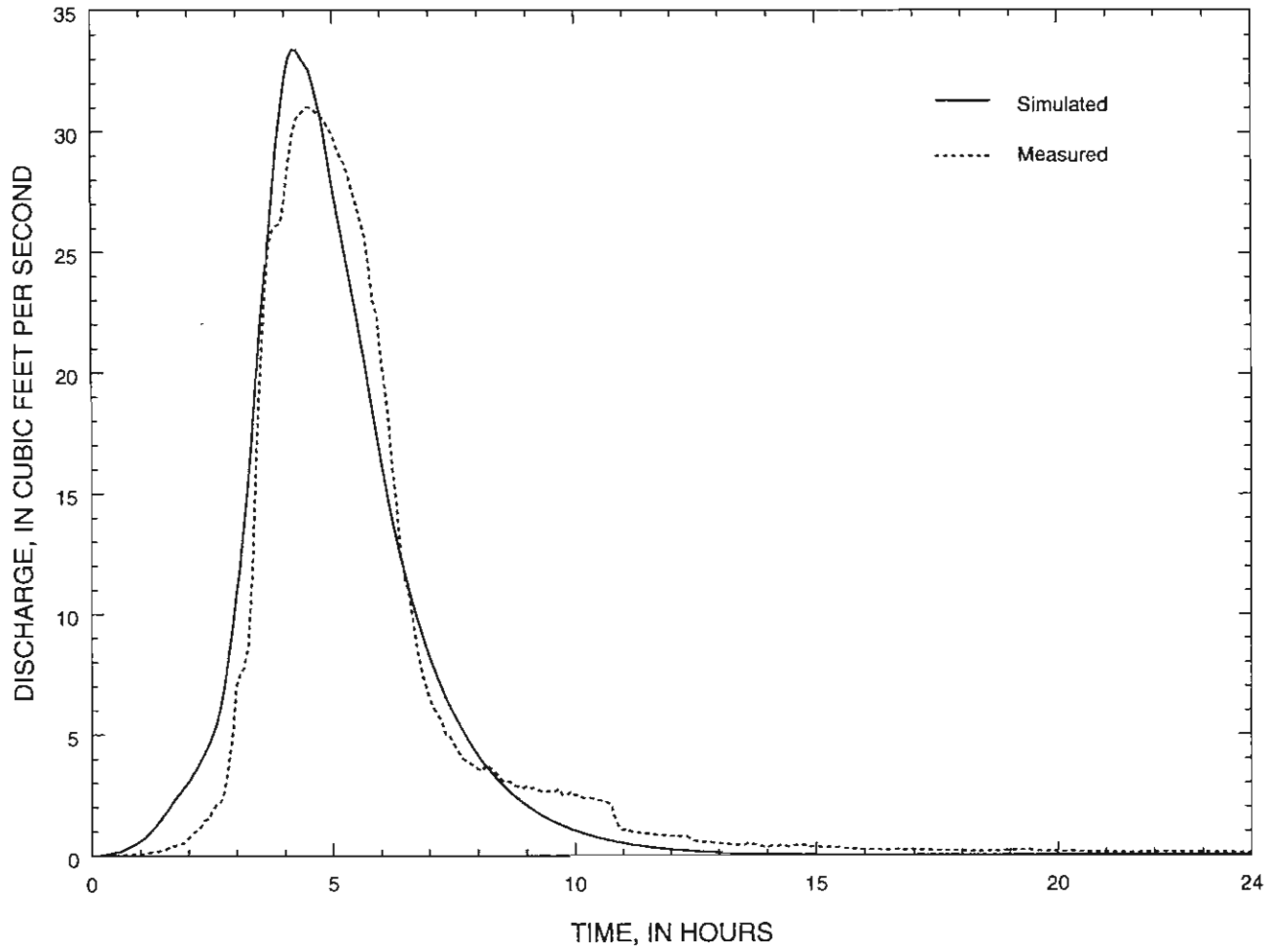
SUMMARY OF RESULTS: (1) Storms (through the 1993 water year) to be utilized for hydrograph analysis have been identified for all catchments in Lake County for which rainfall and runoff data are available. (2) Preliminary hydrograph analyses have been completed for all watersheds. Results to date indicate fairly good consistency among hydrograph characteristics determined for a given watershed. Typically, half of the storms analyzed for a given watershed have hydrograph characteristics within 10 percent. The variations in the hydrograph characteristics for the other storms are larger, but these larger variations might be explained by storm characteristics. (3) Installed rain gage and stream gage at Southwest Fork of South Branch of Ravine 10 at Highland Park, Ill. This gage replaces the gage at the Lakeview Plaza hydrologic response unit that was part of project IL089 (Balding, 1994b, p. 39). The new site is in a 160-acre watershed draining residential and commercial areas. The rainfall and runoff data collected from this watershed will be very valuable to the Ravine Erosion Control Demonstration Grant Project of the City of Highland Park.

PLANS: (1) Complete manual analysis of hydrographs to determine hydrograph characteristics. (2) Utilize the HEC-1 model to determine optimal values of hydrograph characteristics. (3) Perform multiple regression analysis of hydrograph characteristics (determined manually

and by optimization) and watershed and storm characteristics. (4) Analyze additional storm data collected in water years 1994 and 1995 for validation. (5) Write draft of the report to be published in the Water-Resources Investigations Report series and submit for colleague review.

PLANNED REPORT:

Peak flow analysis for small watersheds in Lake County, Illinois



Simulated and measured peak flow of a stream in Lake County

IL103 HYDROGEOLOGY AND WATER QUALITY OF AQUIFERS IN THE VICINITY OF BELVIDERE, BOONE COUNTY, ILLINOIS

COOPERATOR:
U.S. Environmental Protection Agency, Region V

LOCATION:
Belvidere, Illinois

PROJECT CHIEF:
Patrick C. Mills
Urbana

PERIOD OF INTEREST:
October 1993 through September 1994 (suspended)

PROBLEM: Volatile organic compounds (VOC's) and other potentially hazardous constituents have been detected in the glacial drift and bedrock aquifers tapped by municipal and private wells in the vicinity of Belvidere. Numerous known and potential sources for the hazardous constituents, including three Superfund sites identified by the U.S. Environmental Protection Agency, and both closed and operating industrial and landfill sites, are located near Belvidere. Presently, only site-specific ground-water investigations have been done in the Belvidere area. Additional hydrogeologic and water-quality data are needed to permit a more regional perspective to the evaluation of the water quality of the aquifers underlying the area.

OBJECTIVES: To provide the additional geohydrologic, water-level, and water-quality data necessary to better delineate the distribution and directions of movement of contaminant plumes in the aquifers underlying Belvidere, and to allow site-scale ground-water data to be evaluated in a more regional context.

APPROACH: Water wells in the vicinity of Belvidere will be inventoried. Geophysical, water-level, single-well-aquifer-test, and water-quality data will be analyzed and displayed utilizing a geographic information system (GIS). Directions of ground-water flow in the glacial and bedrock aquifers will be determined and the distribution of contaminant plumes will be delineated.

SUMMARY OF RESULTS: Completed a GIS data base for the Belvidere area. Information in the data base is included in the report "Well-construction, hydrogeologic, and ground-water-quality data in the vicinity of Belvidere, Boone County, Illinois," by T.A. Brown and P.C. Mills, which has undergone colleague review and has been submitted for approval. Delineated distributions of VOC's in the aquifers underlying Belvidere on the basis of available data. Drilled a test hole open to the Galena-Platteville aquifer. Collected rock cores, geophysically logged, determined hydraulic characteristics, and collected water-quality samples from the test hole. Installed two vertically nested monitoring wells in the test hole.

PLANS: None. Project suspended.

REPORT IN PROCESS:

Well-construction, hydrogeologic, and ground-water-quality data in the vicinity of Belvidere, Boone County, Illinois

IL104 U.S. AIR FORCE AIR MOBILITY COMMAND TECHNICAL ASSISTANCE

COOPERATOR:
U.S. Air Force Air Mobility Command, Directorate of Environmental Programs

LOCATION:
Multistate

PROJECT CHIEF:
Charles F. Avery
Urbana

PERIOD OF INTEREST:
April 1993 through September 1994 (terminated)

PROBLEM: The U.S. Air Force (USAF), Headquarters, Air Mobility Command, Directorate of Environmental Programs (HQ AMC/CEV) requires technical assistance from the USGS in the gathering, analyzing, and reviewing of environmental data and the assessment of environmental conditions at selected USAF installations. A number of environmental issues are addressed including implementation of the Installation Restoration Program (IRP). Four phases of work in the IRP are as follows: (1) Identify locations of potentially hazardous waste sites, (2) assess the severity of the contamination, (3) conduct studies based on the findings of preliminary assessments, and (4) implement cleanup activity where warranted.

OBJECTIVE: To provide technical assistance to the USAF HQ AMC/CEV at designated USAF installations. The assistance will consist of site characterization, hydrogeologic studies, analytical chemistry, quality assurance/quality control, research, instruction, and training.

APPROACH: (1) Conduct hydrogeologic investigations at designated AMC installations. (2) Review technical reports generated in the IRP. (3) Review chemical sample data from IRP sites to assure the integrity of the data. (4) Comment on hydrogeologic aspects of emergency remedial actions. (5) Conduct research studies on environmental issues on AMC installations. (6) Develop, maintain, and analyze environmental data bases. (7) Provide chemical analyses of water, soil, and hazardous-waste samples. (8) Provide instruction and training when requested by HQ AMC/CEV.

SUMMARY OF RESULTS: Reviewed technical documents at selected AMC installations throughout the country. Referred possible technical assistance by the USGS to appropriate USGS offices.

PLANS: None. Project terminated.

States where U.S. Air Force installations have implemented Installation Restoration Programs

IL105 DIGITAL TERRAIN MODELING

COOPERATOR:
Lake County Stormwater Management Commission

LOCATION:
Lake County

PROJECT CHIEF:
Robin B. King
Urbana

PERIOD OF PROJECT:
October 1993 through September 1995

PROBLEM: Water-resources management and engineering activities can be appreciably improved by utilizing products available from the interrelated technologies of digital raster-based processing, remote sensing/image processing, and geographic information systems (GIS). The application of these technologies to rainfall-runoff modeling studies ean enhance the speed and reliability of both management decision-making functions and hydrologic simulation programs. Digital data can be readily stored, manipulated, and retrieved with eomputer-processing techniques. Data which are particularly important to water-resources managers and engineers include digital representations of watershed surface features such as elevations, basin topographic divides, and land cover. An accurate assessment of microtopographic relief with a high-resolution digital elevation model (DEM) is essential to the reliable definition of surface features in watersheds. Microtopography has a dominant affect on the hydrologic characterization of small-area watersheds and the delineation of 2-foot elevation contours. Further, digital land-cover data in a classification scheme compatible with the input requirements of the relevant hydrologic simulation programs are also needed. The manual production of a high-resolution DEM, digital small-area watersheds, digital hypsography, and land cover would be too costly to consider as it is a highly labor-intensive process involving extensive interpretation, delineation, digitization, and cartographic correction. In addition, the production of this data with manual methods can introduce significant uncertainties into the final product because of the inherent errors associated with the digitization process, base-map accuracy, and the subjectivity of analyst interpretation. However, the recent developments in digital photogrammetry and raster-processing technology can substantially improve methods to create a high-resolution DEM and enhance the utility of this DEM to hydrologic modeling data requirements.

OBJECTIVES: (1) Generate a high-resolution DEM at a cell size (X–Y axis) of 5 feet per data point. (2) Use the high-resolution DEM to delineate small-area watersheds and their associated stream network. (3) Use the high-resolution DEM to delineate digital hypsography at a contour interval of 2 feet. (4) Create a digital land-cover map utilizing a classification scheme based upon hydrological mapping units.

APPROACH: The study will be conducted in four distinct steps, with each step corresponding to one of the stated objectives. (1) The high-resolution DEM is created from scanned black-and-white aerial photography and digital photogrammetric software. The scanned imagery is first corrected for anomalies attributable to radiometry, radial displacement, and differences in the photographic emulsion layer. Sensor exterior and interior orientation parameters are computed until the only differences remaining are due to terrain parallax. A network of ground-control points are established, and a solution to the transformation is computed. A series of correlation

apertures are utilized with the width and spacing varying with processing stages. The terrain parallax is then converted to a grid of elevation measurements.

(2) Delineate small-area watersheds (5--20 acres in size) and generate stream networks. The watershed delineation software requires the creation of four data sets: (a) a depressionless DEM, (b) a flow-direction file, (c) a flow-accumulation file, and (d) a delta flow-area file.

(3) Delineate elevation contours utilizing a bi-linear interpolation method.

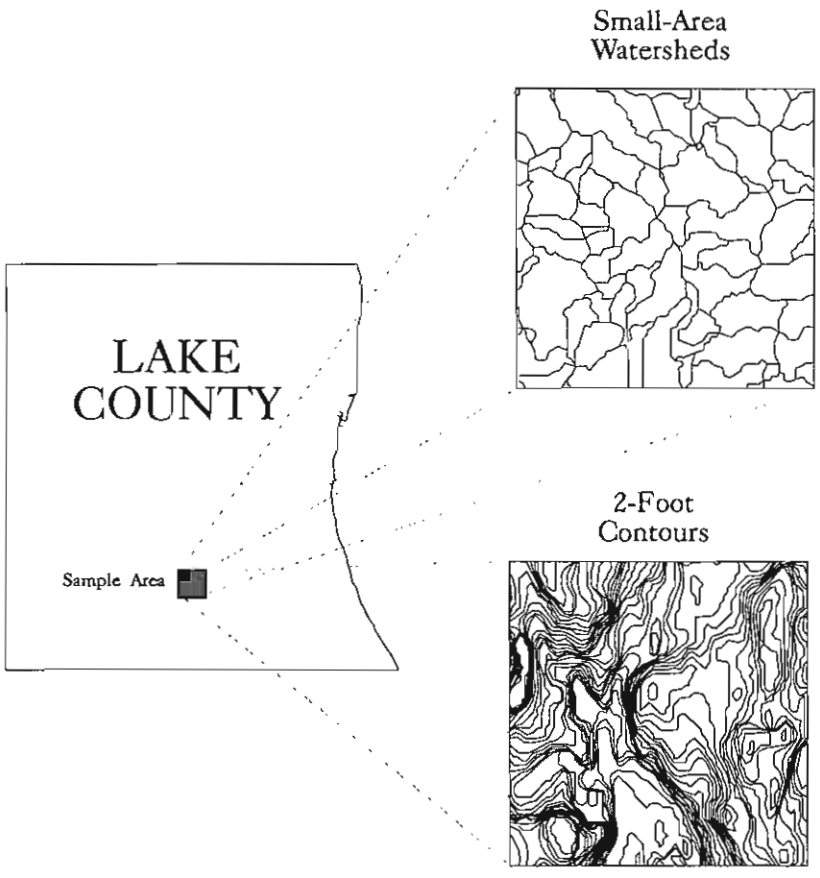
(4) Create a land-cover map with mapping units selected for hydrologic applicability. Use remote-sensing and image-processing techniques to classify land cover into a five-category mapping scheme, with the categories correlated to varying degrees of relative permeability. The land cover will be classified from Landsat Thematic mapper imagery with secondary data to include synthetic aperture radar and USGS digital-line graphs.

SUMMARY OF RESULTS: Nearly 25,000 watersheds were delineated in an approximately 500 square mile area. Elevation contours at the 2-foot contour interval were delineated. A digital land-cover map consisting of five mapping categories was created.

PLANS: Complete final delineation of watershed boundaries. Deliver digital products to the cooperator.

PLANNED REPORT:

Application of remote sensing and photogrammetry for data base development in Lake County, Illinois



A sample area of Lake County showing the delineation of small-area watersheds and associated 2-foot contours

IL106 LOWER ILLINOIS RIVER BASIN WATER-QUALITY ASSESSMENT

COOPERATOR:
Federal Program

LOCATION:
Lower Illinois River Basin

PROJECT CHIEF:
George E. Groschen
Urbana

PERIOD OF PROJECT:
October 1993 through
September 2000

PROBLEM: Protecting the quality of the Nation's ground-water and surface-water resources is a priority national concern. The quality of the Nation's water resources has a direct impact on public health and on the economic success of agriculture, industry, and recreation. The impacts of degraded water quality on public health or economic success may be related to short-term or long-term effects. In 1991, the USGS began the full-scale NAtional Water-Quality Assessment (NAWQA) program. The long-term goals of the NAWQA program are to describe the status and trends in the quality of a large, representative part of the Nation's ground- and surface-water resources and to provide a sound, scientific understanding of the primary natural and human factors affecting the quality of these resources. The lower Illinois River Basin project is I of 20 NAWQA studies that began in fiscal year 1994.

OBJECTIVES: (1) Describe the current water-quality conditions in the lower Illinois River Basin. (2) Define long-term trends (or lack of trends) in water quality. (3) Identify, describe, and explain, to the extent possible, the major natural and human factors that affect observed water-quality conditions and trends.

APPROACH: A liaison committee consisting of representatives of Federal, State, and local agencies will be formed to provide for exchange of information on the prioritization of water-quality issues of regional and local interest; identify sources of water-quality data and other information; assist in design and scope of project elements; and review of project-planning activities, findings, and interpretations, including reports. Descriptive information that may aid in the interpretation of trends will be compiled. Statistical methods, such as regression analysis, will be used to relate observed trends to the descriptive information. New data will be collected from the operation of a fixed-location river-sampling network, an observation network of new and existing wells, and synoptic surveys.

SUMMARY OF RESULTS: First liaison committee meeting held on March 4, 1994, in Peoria, Ill. Confirmed study-area boundaries of the lower Illinois River and its tributaries. Completed and printed Fact Sheet and distributed it to depositories and committee members. The major water-quality issues are sedimentation, toxic chemicals in sediment, high concentrations of nutrients and pesticides, and low dissolved oxygen concentrations in surface water. Began compilation of all available data. An Environmental Careers Organization employee was hired in June to assist in data compilation. An outline of the environmental setting report was drafted and approved by Region. The annotated outline was completed and sections of the first draft were finished. Two posters were prepared and presented (upper and lower Illinois River Basin study units) at a national meeting. Workplan and budget estimates for 1995 were completed in September.

PLANS: (1) Recruit and hire an Ecologist GS-11/12. (2) Hire a surface-water-quality specialist GS-12/13. (3) Complete draft of environmental setting report by January 1995. (4) Compile a list of topical reports based on selected retrospective data in December for regional review. (5) Complete first draft of topical retrospective report by September 1, 1995. (6) Hold second liaison committee meeting in June. (7) Complete compiling of available data including inventory tables defined in guidance documents. (8) Prepare graphical displays of available data and analyze selected retrospective data as outlined in guidance documents. (9) Select potential sites for data collection and perform reconnaissance of all sites. (10) Select data-collection sites based on objectives described in design and guidance documents. (11) Prepare Fiscal Year 1996 work plan.

PLANNED REPORTS:

Environmental setting of the lower Illinois River Basin

Topical report on selected retrospective data for the lower Illinois River Basin study unit

PUBLISHED REPORT:

Warner, K.L., and Schmidt, A.R., 1994, National Water-Quality Assessment program—the lower Illinois River Basin: U.S. Geological Survey Fact Sheet 94–018.

Applying chemicals to crops (above);
field-tile drain pipe (right)

IL107 DU PAGE COUNTY FLOOD WARNING

COOPERATOR:
Du Page County Department of Environmental Concerns

LOCATION:
Du Page County

PROJECT CHIEF:
Charles S. Melching
Urbana

PERIOD OF PROJECT:
July 1994 through September 1996

PROBLEM: Despite the millions of dollars spent each year to control floods or mitigate flood damages, annual flood damages nationwide continue to increase. This results partly because (1) some flood-control structures are not operated effectively and (2) response times among Federal, State, and local agencies to prevent flood damages may be inadequate. Du Page County, Illinois, is primarily drained by three major rivers (Salt Creek, East Branch Du Page River, and West Branch Du Page River) that flow through the county from north to south. Flood damages along the Salt Creek have been particularly high over the past 30 years, whereas damages along the other two rivers may increase because of urbanization. Proper operation of the Elmhurst Quarry Flood Control Project can greatly reduce flood damages along Salt Creek, whereas overuse of this project can lead to high pumping costs to drain the quarry. Detailed rainfall data throughout the county may improve flood warning for the other rivers. Reliable flood-warning systems provide cost-effective, flood-damage mitigation throughout the Nation. This project will develop improved flood-warning methods for Du Page County.

OBJECTIVES: Develop (1) an extensive, telemetered rain-gage network in and near Du Page County and (2) rule curves for flood-mitigation structure operation on the basis of a large number of simulations of sophisticated hydrologic (continuous simulation) and hydraulic (dynamic-wave flood routing) modeling.

APPROACH: (1) Expand and upgrade the rain-gage network in and near Du Page County to include 25 to 27 telemetered rain gages. The major watersheds will be gaged in the following sequence: Salt Creek, 1994; West Branch Du Page River, 1995; and East Branch Du Page River, 1996. (2) Perform a detailed analysis of historical rainfall and streamflow data in and near Du Page County to identify (a) the conditions most likely to cause flooding along Salt Creek and (b) storm travel paths and travel times to improve forecast lead time for lower Salt Creek. The results of this analysis will also assist the design of the expanded rain-gage network. (3) Develop rule curves relating upstream stages and watershed average rainfall to flow stage at Elmhurst Quarry and other key locations along lower Salt Creek by applying the coupled continuous-simulation hydrology model and dynamic-wave hydraulic model developed by Du Page County for simulation of flow on Salt Creek.

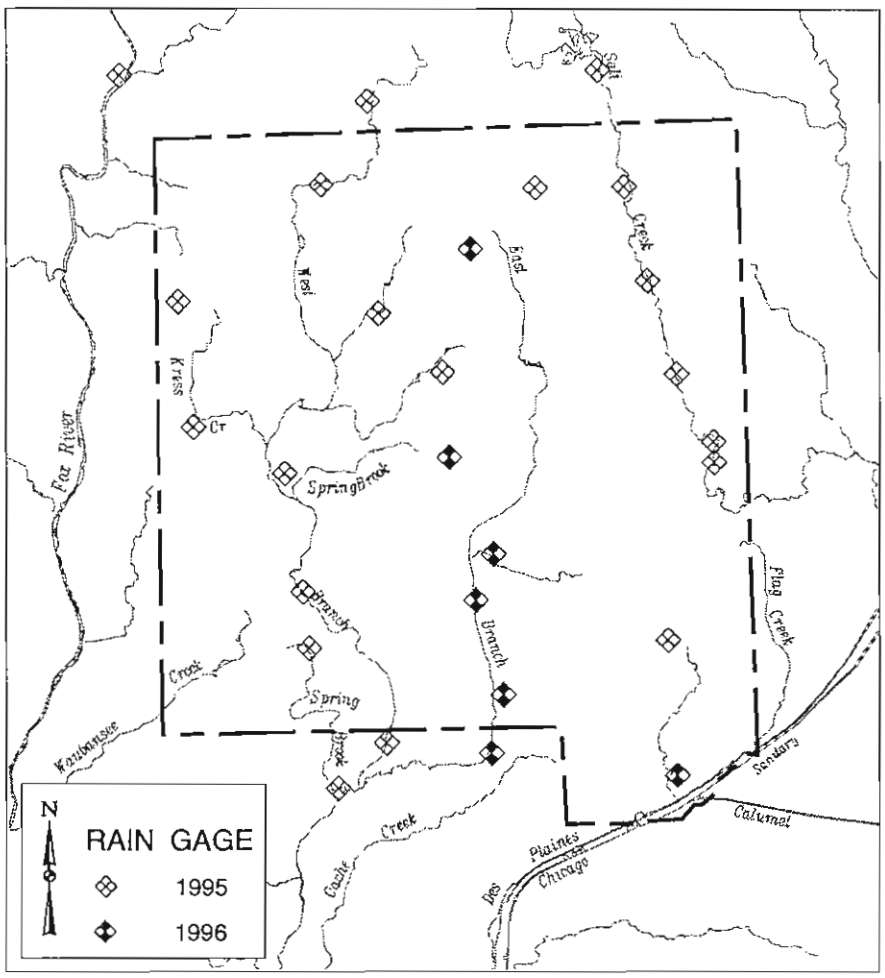
SUMMARY OF RESULTS: (1) Equipment required to install and add telemetry to rain gages in the Salt Creek watershed has been acquired. The installation of this equipment has been delayed because the USGS, Du Page County, and consultants to Du Page County on the design and operation of the Elmhurst Quarry Flood Mitigation Project are still selecting the best data-storage and transfer equipment and designing the software required to operate this equipment for the radio-telemetry system. These issues should be resolved by May 1995. (2) Correlation analysis has been completed

for daily rainfall data at gages in and near Du Page County. The results indicate that the correlation of rainfall between rain gages in and near Du Page County is surprisingly low (50 percent or less) for storms where at least one rain gage recorded 0.5 inch of rain. The data are being reanalyzed to focus on storm data, but preliminary results indicate only a small improvement in correlation. (3) Runoff data on Salt Creek have been analyzed to examine the correlation between high flows upstream and downstream and the travel times between upstream and downstream locations. Seventy-five to eighty percent of the high flows downstream are accompanied by high flows upstream. However, the time lag between the time of peak discharge upstream and downstream varied widely indicating the importance of channel storage and tributary inflows between upstream and downstream locations.

PLANS: (1) Install and add telemetry to rain gages in Salt Creek and West Branch Du Page River watersheds. (2) Complete analysis of rainfall data in and near Du Page County and send results of this analysis and the analysis of streamflow data on Salt Creek to Du Page County. (3) Complete approximately two-thirds of the rainfall-runoff simulations required to develop the flood-warning system for operation of Elmhurst Quarry on Salt Creek.

PLANNED REPORT:

Flood-mitigation operation with rule curves from hydrologic simulation



Rain-gage network in Du Page County (above); servicing a tipping-bucket rain gage (left)

IL108 BRIDGE SCOUR IN ILLINOIS

COOPERATOR:
Illinois Department of Transportation, Division of Highways

LOCATION:
Statewide

PROJECT CHIEF:
Robert R. Holmes, Jr.
Urbana

PERIOD OF PROJECT:
July 1994 through September 1996

PROBLEM: Before January 1, 1997, State Transportation Departments are required to perform a complete hydraulic and scour analysis for every bridge over water in the United States in order to identify scour-critical bridges as rated in Item 113 of the National Bridge Inspection Standards. The cost of these analyses is typically between $5,000 and $10,000 per bridge, and the number of bridges over water in most States ranges between 5,000 and 20,000. Thus, many States are developing methods that can reliably estimate Item 113 ratings without performing a complete hydraulic and scour analysis. In Illinois, there are more than 18,000 bridges over water—4,600 on State and Federal highways and 14,000 on roads maintained by local agencies. The State plans to perform complete analyses for the State and Federal highways. Local agencies, however, do not have the personnel or the resources to perform complete analyses for all 14,000 bridges they maintain. Thus, a reliable method to assist in the determination of bridges that are scour-critical and stable for scour without performing complete hydraulic and scour analyses is needed so that local agencies can direct their limited resources to the bridges requiring complete analyses.

OBJECTIVE: Develop relations between the 500-year total scour and geomorphic, hydrologic, and structural characteristics of bridges, which are easily obtained from site visits and office review of plans and maps.

APPROACH: (1) Develop a list of geomorphic, hydrologic, and structural characteristics of bridge sites that are easily obtained from site visits and office review of plans and maps and that may be strongly correlated to scour at bridge piers. (2) Develop a method of combining quantitative and qualitative characteristic descriptions into overall rating of various aspects of the waterway, bridge opening, foundation, and other features affecting scour at bridge piers. (3) Compare the range of characteristics identified in Step 1 and combined features identified in Step 2 for the bridges on State highways to typical characteristics and combined features of bridges maintained by local agencies. (4) If the bridges on State highways adequately represent conditions for bridges maintained by local agencies, then Step 5 is performed; otherwise, perform complete hydraulic and scour analyses for typical bridges not represented in the State highway data base. (5) Determine relations between the 500-year flood scour for the bridges on State highways that have undergone complete hydraulic and scour analyses and the characteristics (Step 1) and combined features (Step 2). (6) Test relations determined in Step 5 for additional State highway bridges analyzed by the Illinois Department of Transportation during the period in which Steps 3–5 were done. Adjust the relations determined in Step 5 as necessary.

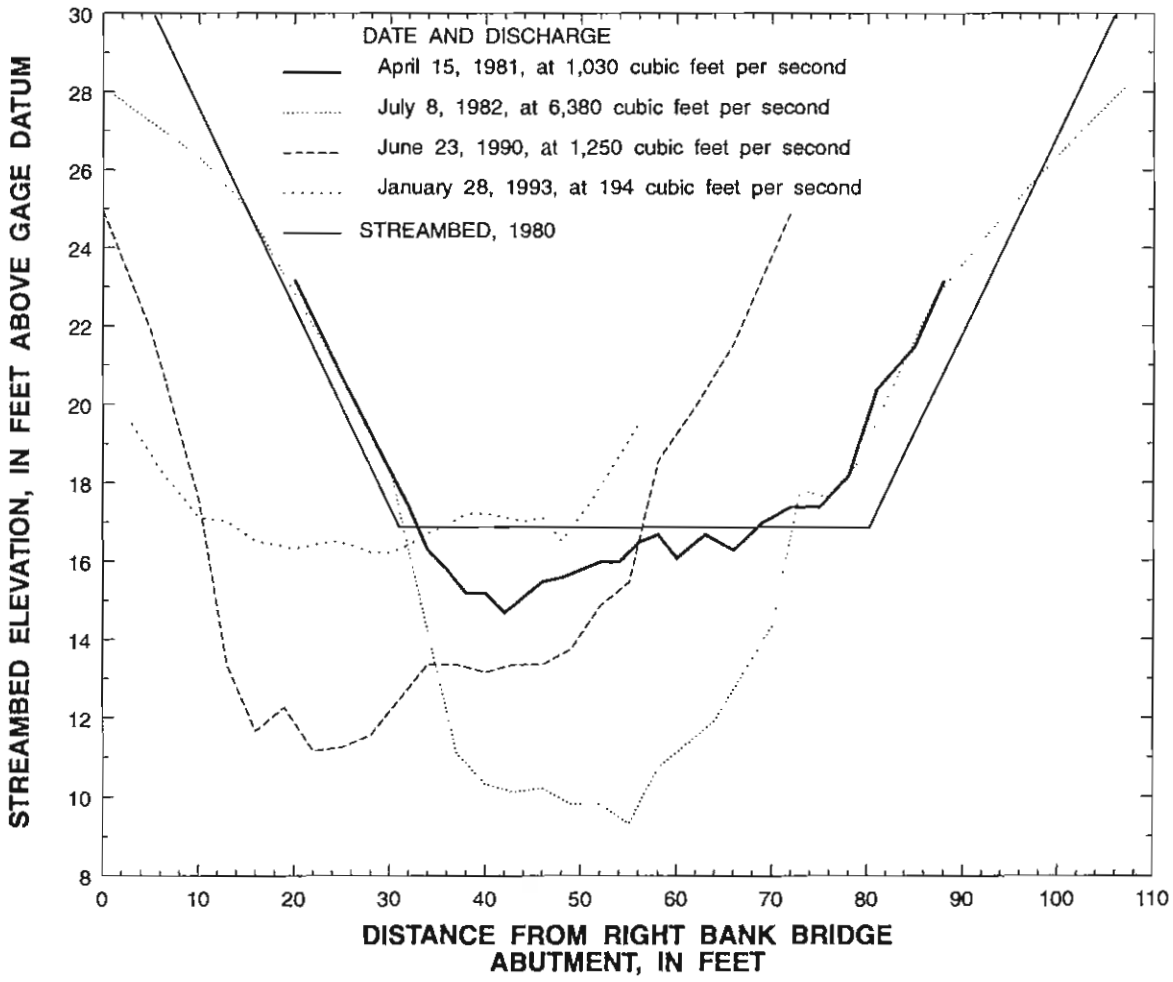
SUMMARY OF RESULTS: Met with Illinois Department of Transportation (IDOT) officials and developed a list of potential bridge-site characteristics that could be related to estimated scour

depths and Item 113 ratings. A data base was designed to store the data collected from IDOT files of bridges where conventional scour analysis was completed. Visits to four of the nine IDOT district offices were completed with approximately 300 bridge-site files inspected for the necessary data.

PLANS: Collect all necessary bridge information and data from IDOT files of bridge structures that have had conventional scour analysis performed. These data will be used to develop relations between computed 500-year-flood-scour depths and easily measurable bridge-site characteristics. These relations will be refined into a method to estimate the 500-year-flood-scour depths without using conventional hydraulic and scour-estimation methods. These estimated depths will be used by IDOT to assign an Item 113 rating to Illinois local agency bridges. The method and development will be presented in a Water-Resources Investigations Report.

PLANNED REPORT:

Development, testing, and application of a simplified method to estimate total streambed scour in Illinois



Streambed scour at Pope Creek at Keithsburg between April 1981 and January 1993

PUBLICATIONS

PUBLICATIONS

The USGS announces all its publications in a monthly catalog "New Publications of the U.S. Geological Survey." Free subscriptions to this list are available from U.S. Geological Survey, 582 National Center, Reston, VA 22092. All publications are for sale unless specifically stated otherwise. Prepayment is required and information on price and availability should be obtained before placing an order. The "U.S. Geological Survey Yearbook" provides a comprehensive description of the Federal Government's largest earth-science agency. Copies of the yearbook may be purchased at the address where Professional Papers are sold (see below).

Water-Resources Information

A monthly summary of the national water situation is presented in "National Water Conditions." It is available free, on request, from the Hydrologic Information Unit, U.S. Geological Survey, 419 National Center, Reston, VA 22092.

Beginning with the 1971 water year, a new publication series entitled "U.S. Geological Survey Water-Data Reports," combined for each State under one cover streamflow data, water-quality data for surface and ground water, and ground-water-level data. For Illinois, the title is "Water Resources Data for Illinois—Water Year 19XX: U.S. Geological Survey Water-Data Report IL–XX–1 and IL–XX–2" (XX represents water year published). Prior to the 1971 water year, records of streamflow, quality of water, and ground-water levels were published in U.S. Geological Survey Water-Supply Papers as explained below.

Streamflow Records

Records of daily flows of streams prior to 1971 were published in the Water-Supply Paper series "Surface-Water Supply of the United States," which were released in numbered parts as determined by natural drainage basins; until 1961 this was an annual series. Monthly and yearly summaries of these data were then compiled in two reports: "Compilation of Records of Surface Waters of the United States through September 1950" and "Compilation of Records of Surface Waters of the United States, October 1950 to September 1960." For the period 1961–70, 5-year compilations were published; data for Illinois are published in Parts 3, 4, and 5 of these reports.

Water-Quality Records

Data on quality of surface water, prior to 1971, were published annually in the Water-Supply Paper series "Quality of Surface Waters of the United States," which also was released in numbered parts as determined by natural drainage basins. Data for Illinois are in Parts 3, 4, and 5 of that series.

Ground-Water Records

Ground-water levels and artesian pressures in observation wells prior to 1975 were reported by geographic areas in a 5-year Water-Supply Paper series. Data for Illinois are in "Ground-Water Levels in the United States, North-Central States."

PUBLICATIONS PERTINENT TO ILLINOIS

The reports listed below represent selected references prepared by the USGS in cooperation with other agencies. The list contains reports that contribute to the understanding of the hydrology of the water resources in Illinois.

Professional Papers

Professional Papers are comprehensive formal reports of significant and lasting scientific interest and include results of resource studies and of geologic, hydrologic, or topographic investigations. Professional Papers are sold by the USGS Information Services, Box 25286, Federal Center, Denver, CO 80225 (phone 303-202-4700).

P 448-H Low-flow characteristics of streams in the Mississippi embayment in Tennessee, Kentucky, and Illinois, by P.R. Speer, W.J. Perry, J.A. McCabe, O.G. Lara, and others, with a section on Quality of the water by H.G. Jeffery. 1965.

P 813-A Summary appraisals of the Nation's ground-water resources—Ohio Region, by R.M. Bloyd, Jr. 1974.

P 813-B Summary appraisals of the Nation's ground-water resources—Upper Mississippi Region, by R.M. Bloyd, Jr. 1975.

P 813-J Summary appraisals of the Nation's ground-water resources—Great Lakes Region, by W.G. Weist, Jr. 1977.

P 1467 Floods of March 1982 in Indiana, Ohio, Michigan, and Illinois, by D.R. Glatfelter, U.S. Geological Survey; and E.H. Chin, National Weather Service, NOAA. 1988.

Water-Supply Papers

Water-Supply Papers are formal reports dealing with all aspects of hydrology, including quality, recoverability, and use of water resources; statistical reports on streamflow, floods, ground-water levels, and water quality; and collections of short papers on related topics. Water-Supply Papers are sold by the USGS Information Services, Box 25286, Federal Center, Denver, CO 80225 (phone 303-202-4700).

W 1370-B Floods of October 1954 in the Chicago area, Illinois and Indiana, by W.S. Daniels and M.D. Hale. 1958.

W 1669-O Ground-water conditions at Argonne National Laboratory, Illinois, 1948–60, by D.B. Knowles, W.J. Drescher, and E.F. LeRoux. 1963.

W 2002 Water in urban planning, Salt Creek Basin, Illinois, by A.M. Spieker. 1970.

W 2005 Model hydrographs, by W.D. Mitchell. 1972.

W 2078 Some chemical characteristics of mine drainage in Illinois, by L.G. Toler. 1982.

W 2226 Low-level radioactive-waste burial at the Palos Forest Preserve, Illinois: Geology and hydrology of the glacial drift, as related to the migration of tritium, by J.C. Olimpio. 1984.

W 2250 National Water Summary 1983—Hydrologic events and issues, by U.S. Geological Survey. 1984.

W 2262 A system for measuring surface runoff and collecting sediment samples from small areas, by J.R. Gray and M.P. deVries, *in* Meyer E.L., ed., Selected papers in the hydrologic sciences. 1984.

W 2269 Traveltime and longitudinal dispersion in Illinois streams, by J.B. Graf. 1986.

W 2275 National Water Summary 1984—Hydrologic events, selected water-quality trends, and ground-water resources, by U.S. Geological Survey. 1985.

Illinois ground-water resources, by M.G. Sherrill, T.R. Lazaro, and L.L. Harbison.

W 2300 National Water Summary 1985—Hydrologic events and surface-water resources, by U.S. Geological Survey. 1986.

Illinois surface-water resources, by G.O. Balding.

W 2301 Relations between quality of urban runoff and quality of Lake Ellyn at Glen Ellyn, Illinois, by R.G. Striegl and E.A. Cowan. 1987.

W 2325 National Water Summary 1986—Hydrologic events and ground-water quality, by U.S. Geological Survey. 1988.

Illinois ground-water quality, by D.C. Voelker.

W 2327 Evapotranspiration and microclimate at a low-level radioactive-waste disposal site in northwestern Illinois, by R.W. Healy, M.P. deVries, and A.M. Sturrock, Jr. 1989.

W 2333 Tritium migration from a low-level radioactive-waste disposal site near Chicago, Illinois, by J.R. Nicholas and R.W. Healy. 1988.

W 2350 National Water Summary 1987—Hydrologic events and water supply and use, by U.S. Geological Survey. 1990.

Storm and flood of August 13 to 15, 1987, in Cook and Du Page Counties, Illinois, by G.W. Curtis.

Illinois water supply and use, by J.K. LaTour.

W 2362 Floods of December 1982 to May 1983 in the central and southern Mississippi River and the Gulf of Mexico Basins, by R.B. Stone and R.H. Bingham. 1991.

W 2367 Results of hydrologic research at a low-level radioactive-waste disposal site near Sheffield, Illinois, by B.J. Ryan. 1991.

W 2375 National Water Summary 1988–89—Hydrologic events and floods and droughts, by U.S. Geological Survey. 1991.

Illinois floods and droughts, by E.E. Zuehls.

W 2386 Water and tritium movement through the unsaturated zone at a low-level radioactive-waste disposal site near Sheffield, Illinois, 1981–85, by P.C. Mills and R.W. Healy. 1993.

W 2390 Effects of low-level radioactive-waste disposal on water chemistry in the unsaturated zone at a site near Sheffield, Illinois, 1982–1984, by C.A. Peters, R.G. Striegl, P.C. Mills, and R.W. Healy. 1992.

W 2398 Water movement and water chemistry in the unsaturated zone at a low-level radioactive-waste disposal site near Sheffield, Illinois, 1986–87, by P.C. Mills. 1993.

W 2400 National Water Summary 1990–91—Hydrologic events and stream water quality, by U.S. Geological Survey. 1993.

Illinois stream water quality, by G.O. Balding and R.H. Coupe.

Circulars

Circulars contain technical or nontechnical information of popular interest including timely administrative or scientific information. Circulars may be ordered, free of charge, from the USGS Information Services, Box 25286, Federal Center, Denver, CO 80225 (phone 303-202-4700).

C 216 Water resources of the St. Louis area, Missouri and Illinois, by J.R. Searcy, R.C. Baker, and W.H. Durum. 1952.

C 601-C Flood hazard mapping in metropolitan Chicago, by J.R. Sheaffer, D.W. Ellis, and A.M. Spieker. 1970.

C 900 Guide to obtaining USGS information, by Kurt Dodd, H.K. Fuller, and P.F. Clarke. 1989.

C 953 Proceedings of the advanced seminar on sedimentation, August 15–19, 1983, Denver, Colorado, edited by G.D. Glysson. 1987.

Erosion and landform modification at a low-level radioactive-waste disposal facility near Sheffield, Illinois, by J.R. Gray.

Measurement of bedload discharge in nine Illinois streams with the Helley-Smith sampler, by J.B. Graf.

C 1004 Estimated use of water in the United States in 1985, by W.B. Solley, C.F. Merk, and R.R. Pierce. 1988.

C 1036 Safe disposal of radionuclides in low-level radioactive-waste repository sites; Low-level radioactive-waste disposal workshop, U.S. Geological Survey, July 11–16, 1987, Big Bear Lake, California, proceedings edited by M.S. Bedinger and P.R. Stevens. 1990.

Surface hydrology at the low-level radioactive-waste repository site near Sheffield, Illinois, by J.R. Gray.

Results of some geohydrologic studies at the low-level radioactive-waste repository site near Sheffield, Illinois, by R.W. Healy.

C 1120-A Flood discharges in the upper Mississippi River Basin, 1993, by Charles Parrett, N.B. Melcher, and R.W. James, Jr. 1993.

C 1120-B Precipitation in the upper Mississippi River Basin, January 1 through July 31, 1993, by K.L. Wahl, K.C. Vining, and G.J. Wiche. 1993.

C1120-C Occurrence and transport of agricultural chemicals in the Mississippi River Basin, July through August 1993, by D.A. Goolsby, W.A. Battaglin, and E.M. Thurman. 1993.

Yearbook

The U.S. Geological Survey Yearbook summarizes the activities of the USGS in response to its scientific and regulatory missions. The yearbook has been published annually since 1976 and is sold by the USGS Information Services, Box 25286, Federal Center, Denver, CO 80225 (303-202-4700).

U.S. Geological Survey yearbook, fiscal year 1992. 1993. 123 p.

The 1992 Chicago underground flood, by S.F. Blanchard and A.R. Schmidt. p. 37–39.

Hydrologic Investigations Atlases

Hydrologic Investigations Atlases may contain a wide range of hydrologic and hydrogeologic data of regional and national interest, such as streamflow, ground water, water quality, and extent of flooding. Hydrologic Investigations Atlases and other maps are sold by the USGS Information Services, Box 25286, Federal Center, Denver, CO 80225 (phone 303-202-4700). The Hydrologic Investigations Atlases that pertain to stream basins in Illinois are as follows:

HA-39. Floods in the Little Calumet River Basin near Chicago Heights, [northeastern] Illinois. 1960.

HA-449. Floods on Loop Creek and Richland Creek near Belleville, [southwestern] Illinois, by J.D. Camp. 1972.

The Hydrologic Investigations Atlases (HA) listed below are all flood maps for quadrangles in Illinois. The information in the table can be used, as shown in the following example, to construct the full bibliographic reference. The example reference is as follows:

HA-67 Floods in Arlington Heights quadrangle, [northeastern] Illinois, by D.W. Ellis, H.E. Allen, and A.W. Noehre. 1963.

HA number	Quadrangle	Authors	Date
67	Arlington Heights	Ellis, D.W., Allen, H.E., and Noehre, A.W.	1963
68	Elmhurst	Ellis, D.W., Allen, H.E., and Noehre, A.W.	1963
69	Highland Park	Ellis, D.W., Allen, H.E., and Noehre, A.W.	1963
70	Aurora North	Ellis, D.W., Allen, H.E., and Noehre, A.W.	1963
71	Wheeling	Ellis, D.W., Allen, H.E., and Noehre, A.W.	1963
85	Park Ridge	Ellis, D.W., Allen, H.E., and Noehre, A.W.	1963
86	Hinsdale	Ellis, D.W., Allen, H.E., and Noehre, A.W.	1964
87	Palatine	Allen, H.E., Ellis, D.W., and Long, D.E.	1964
88	Libertyville	Noehre, A.W., Ellis, D.W., and Long, D.E.,	1964
89	Joliet	Allen, H.E., and Wyerman, T.A.	1964
90	Harvey	Allen, H.E., and May, V.J.	1964
142	Geneva	Noehre, A.W., and Walter, G.L.	1965
143	Lombard	Allen, H.E., and May, V.J.	1964
144	Wadsworth	Noehre, A.W.	1964
145	Palos Park	Noehre, A.W., and Mycyk, R.T.	1966
146	Romeoville	Noehre, A.W., and Walter, G.L.	1965
147	Elgin	May, V.J., and Allen, H.E.	1965
148	Wheaton	May, V.J., and Allen, H.E.	1965
149	Sag Bridge	Noehre, A.W., and Walter, G.L.	1966
150	Barrington	Noehre, A.W., Walter, G.L., and Allen, H.E.	1965
151	Fox Lake	Noehre, A.W., May, V.J., and Walter, G.L.	1965
152	Tinley Park	Allen, H.E.	1965
153	Blue Island	Allen, H.E.	1966
154	Naperville	Allen, H.E., and May, V.J.	1965
202	West Chicago	Allen, H.E., and May, V.J.	1965
203	Streamwood	May, V.J., and Allen, H.E.	1965
204	Mokena	Noehre, A.W.	1965
205	Lake Calumet	Allen, H.E.	1966
206	River Forest	May, V.J.	1966
207	Wauconda	Allen, H.E.	1966
208	Lake Zurich	Noehre, A.W., and Mycyk, R.T.	1966
209	Steger	Allen, H.E.	1966
210	Normantown	May, V.J.	1966
211	Manhattan	Allen, H.E., and Mycyk, R.T.	1966
226	Antioch	Noehre, A.W., and Walter, G.L.	1966
227	Sugar Grove	Allen, H.E.	1966
228	Plainfield	May, V.J., and Schafish, R.J.	1966
229	Elburn	Allen, H.E.	1966
230	Grayslake	May, V.J., Noehre, A.W., and Walter, G.L.	1967
231	Frankfort	Mycyk, R.T.	1967
232	Pingree Grove	Allen, H.E.	1967
233	Zion	May, V.J., and Mycyk, R.T.	1967
234	Waukegan	Mycyk, R.T., and May, V.J.	1967
251	Peotone	Allen, H.E.	1967
252	Berwyn	Nochre, A.W., and Walter, G.L.	1967

HA number	Quadrangle	Authors	Date
253	Crystal Lake	May, V.J., and Mycyk, R.T.	1967
254	Elwood	Allen, H.E., and Myeyk, R.T.	1967
255	McHenry	Mycyk, R.T., and Walter, G.L.	1968
256	Woodstock	Allen, H.E.	1968
257	Beecher West	Allen, H.E.	1968
301	Dyer	Allen, H.E.	1968
302	Beecher East	Allen, H.E., and Noehre, A.W.	1969
303	Richmond	Mycyk, R.T., and Walter, G.L.	1969
304	Wilton Center	Allen, H.E., and Noehre, A.W.	1969
305	Symerton	Allen, H.E., Noehre, A.W., and Hauth, L.D.	1970
306	Wilmington	Allen, H.E., and Noehre, A.W.	1971
361	Huntley	Walter, G.L., and Mycyk, R.T.	1971
362	Channahon	Allen, H.E., and Noehre, A.W.	1971
363	Hebron	Allen, H.E., and Grant, R.S.	1971
458	Maple Park	Mycyk, R.T., and Walter, G.L.	1972
459	Hampshire	Mycyk, R.T., and Duerk, M.D.	1972
463	Marengo South	Allen, H.E.	1972
464	Riley	Mycyk, R.T., and Grant, R.S.	1972
472	Big Roek	Mycyk, R.T., Walter, G.L., and McDonald, B.L.	1973
495	Marengo North	Allen, H.E., and Noehre, A.W.	1973
496	Harvard	Allen, H.E., and Noehre, A.W.	1973
497	Garden Prairie	Mycyk, R.T., and Grant, R.S.	1973
498	Capron	Grant, R.S., and Duerk, M.D.	1973

Hydrologic-Unit Maps

Hydrologic-Unit Maps have been developed for each State and depict the major hydrologic regions, subregions, accounting units, and cataloging units used for the collection and organization of hydrologic data. Hydrologic-Unit Maps and other maps are sold by the USGS Information Services, Box 25286, Federal Center, Denver, CO 80225 (phone 303-202-4700).

U.S. Geological Survey, 1975, Hydrologic unit map of Illinois—1974.

A companion publication describing hydrologic units nationwide titled, "Hydrologic Unit Maps" by P.R. Seaber, F.P. Kapinos, and G.L. Knapp, 1987, U.S. Geological Survey Water-Supply Paper 2294, is available from the same above mentioned source.

Water-Resources Investigations Reports (WRI or WRIR)

Water-Resources Investigations Reports contain hydrologic information, mainly of local interest. The reports are intended for quick release to the public in book or map format.

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WRI 13-75. Drainage areas for Illinois streams, by K.M. Ogata, 1975. (PB 246298/AS)

WRI 77-104. Frequency analysis of Illinois floods using observed and synthetic streamflow records, by G.W. Curtis, 1977. (PB 277350/AS)

WRI 77-117. Technique for estimating magnitude and frequency of floods in Illinois, by G.W. Curtis, 1977. (PB 277255/AS)

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WRI 78-78. Water quality in the Sugar Creek Basin, Bloomington and Normal, Illinois, by B.J. Prugh, Jr., 1978. (PB 288359/AS)

WRI 79-23, 24, 25. Chemical analyses of surface water in Illinois, 1975–77, Volume I, Des Plaines River Basin and Lake Michigan; Volume II, Illinois River Basin and Mississippi River tributaries north of Illinois River Basin; Volume III, Ohio River tributaries and Mississippi River tributaries south of Illinois River Basin, by David Grason and R.W. Healy, 1979. Three-volume set (PB 299911/AS)

WRI 79-36. Effects of urbanization on the magnitude and frequency of floods in northeastern Illinois, by H.E. Allen, Jr. and R.M. Bejcek, 1979. (PB 299065/AS)

WRI 79-110. River mileages and drainage areas for Illinois streams—Volume I, Illinois except Illinois River Basin, by R.W. Healy, 1979. (AD A082472)

WRI 79-111. River mileages and drainage areas for Illinois streams—Volume 2, Illinois River Basin, by R.W. Healy, 1979. (AD A082473)

WRI 82-13. Time of concentration and storage coefficient values for Illinois streams, by J.B. Graf, George Garklavs, and K.A. Oberg, 1982. (PB 82-219320)

WRI 82-16. Hydrologic characteristics of surface-mined land reclaimed by sludge irrigation, Fulton County, Illinois, by G.L. Patterson, R.F. Fuentes, and L.G. Toler, 1982. (PB 83-124982)

WRI 82-22. A technique for estimating time of concentration and storage coefficient values for Illinois streams, by J.B. Graf, George Garklavs, and K.A. Oberg, 1982. (PB 82-218793)

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82-4073. Runoff, sediment transport, and water quality in a northern Illinois agricultural watershed before urban development, 1979–81, by H.E. Allen, Jr. and J.R. Gray. 1984.

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84-4180. Quality of water in the alluvial aquifer, American Bottoms, East St. Louis, Illinois, by D.C. Voelker. 1984.

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Sheffield, Illinois, by J.B. Foster, R.W. Healy, and J.R. Gray, p. 90–93.

Argonne National Laboratory site, Illinois, by J.R. Nicholas, p. 93–95.

84-4256. Hydrology of a surface coal mined area in Randolph County, Illinois, by J.V. Borghese and A.R. Klinger. 1984.

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90-4166. Determination of water use in Rockford and Kankakee areas, Illinois, by J.K. LaTour. 1991.

91-4034 U.S. Geological Survey Toxic Substances Hydrology Program: Proceedings of the technical meeting, Monterey, California, March 11–15, 1991, edited by G.E. Mallard and D.E. Aronson. 1991.

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Sheffield, Illinois, by P.C. Mills, p. 40–47.

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84-707. Hydrology of Area 27, Eastern Region, Interior Coal Province, Illinois, by E.E. Zuehls. 1987.

85-342. Hydrology of Area 31, Eastern Region, Interior Coal Province, Illinois and Indiana, by E.E. Zuehls. 1987.

Fact Sheets

Fact Sheets are informal, one page manuscripts describing items of National or local interest and are available (free of charge while supplies last) from the District Chief, U.S. Geological Survey, 102 E. Main Street, 4th floor, Urbana, IL 61801 (phone 217-344-0037). The sheets are also available from the USGS

Information Services, Box 25286, Federal Center, Denver, CO 80225 (phone 303-202-4700).

OFR 88-143. U.S. Geological Survey ground-water studies in Illinois, by D.C. Voelker, J.R. Nicholas, and K.L. Norton. 1988.

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FS 94-018. National water-quality assessment program—the lower Illinois River Basin, by K.L. Warner and A.R. Schmidt. 1994.

Miscellaneous Reports

The following miscellaneous reports were developed in cooperation with other State of Illinois agencies and published by those agencies. The reports are available, for inspection only, at the Illinois District Office of the U.S. Geological Survey. Information about these reports may be obtained from the District Chief, U.S. Geological Survey, 102 East Main Street, 4th Floor, Urbana, IL 61801 (phone 217-344-0037).

Carns, J.M., 1973, Magnitude and frequency of floods in Illinois.

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Mitchell, W.D., 1948, Unit hydrographs in Illinois.

———1950, Water-supply characteristics of Illinois streams.

———1954, Floods in Illinois—Magnitude and frequency.

———1957, Flow duration of Illinois streams.

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Sieber, C.R., 1970, A proposed streamflow-data program for Illinois.

Visoeky, A.P., Sherrill, M.G., and Cartwright, Keros, 1985, Geology, hydrology, and water quality of the Cambrian and Ordovician Systems in northern Illinois.

Water-Data Reports

The annual State Water-Data Report contains surface- and ground-water data for Illinois that has been collected by the USGS in cooperation with other Federal, State, and local agencies. These official USGS reports have an identification number consisting of the two-letter State abbreviation, the last two digits of the water year, and the volume number. The Illinois water-data reports are available free of charge, while supplies last, for every year beginning in 1971, from the District Chief, U.S. Geological Survey, 102 East Main Street, 4th Floor, Urbana, IL 61801 (phone 217-344-0037).

The reports may also be purchased as hard copy or microfiche from the National Technical Information Service (NTIS), U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161 (phone 703-487-4650).

The following are the most recently published water-data reports for Illinois. The NTIS ordering number is given in parentheses at the end of the citation:

Maurer, J.C., Wicker, T.L., and LaTour, J.K., 1994, Water resources data—Illinois, water year 1993, volume 1, Illinois except Illinois River Basin: U.S. Geological Survey Water-Data Report IL–93–1, 247 p. (PB94–204138).

Zuehls, E.E., LaTour, J.K., and Wicker, T.L., 1994, Water resources data—Illinois, water year 1993, volume 2, Illinois River Basin: U.S. Geological Survey Water-Data Report IL–93–2, 297 p. (PB94–204120).

Conference Papers and Abstracts and Journal Articles

Conference papers and abstracts and journal articles by USGS personnel, in the Illinois District, are printed in non-USGS publications and are not available from the USGS. The abstracts listed are those that were published in 1994. Typically, the abstracts summarize the principal conclusions of an author's current work but contain little supporting data.

Lessons learned in a hydrogeological case at Sheffield, Illinois, by J.B. Foster, *in* Proceedings of the Symposium on Low-Level Waste Disposal, Site Characterization and Monitoring, June 16–17, 1982, Arlington, Virginia, NUREG/CP–0028, CONF–820674, Vol. 2, p. 237–244.

Preliminary results of a study of the unsaturated zone at the low-level radioactive-waste disposal site near Sheffield, Illinois, by R.W. Healy, *in* Proceedings of the Fifth Annual Participants' Information Meeting, DOE Low-Level Waste Management Program, August 30–September 1, 1983, Denver, Colorado, CONF–8308106, p. 669–673.

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Effects of an urban lake on stormwater runoff and quality, by R.G. Striegl, *in* Proceedings of Urban Effects on Water Quality and Quantity, October 20–21, 1983, Urbana, Illinois, Illinois Department of Energy and Natural Resources Document No. 84/06, p. 74–83.

Study of the unsaturated zone at a low-level radioactive-waste disposal site, by R.W. Healy, C.A. Peters, M.P. deVries, P.C. Mills, and D.L. Moffett, *in* Proceedings of the Characterization and Monitoring of the Vadose (Unsaturated) Zone, National Water Well Association, December 8–10, 1983, Las Vegas, Nevada, p. 820–830.

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Runoff, sediment transport, and landform modifications near Sheffield, Illinois, by J.R. Gray, *in* Proceedings of the Sixth Annual Participants' Information Meeting, DOE Low-Level Waste Management Program, September 11–13, 1984, Denver, Colorado, CONF–8409115, p. 534–544.

Methods for determining the transport of radioactive gases in the unsaturated zone, by R.G. Striegl, *in* Proceedings of the Sixth Annual Participants' Information Meeting, DOE Low-Level Waste Management Program, September 11–13, 1984, Denver, Colorado, CONF–8409115, p. 579–587.

Ground-water drainage to surface mines refined, by L.S. Weiss, *in* Hydraulics and Hydrology in the Small Computer Age, Volume 1, Proceedings of the Specialty Conference sponsored by the Hydraulics Division of the American Society of Civil Engineers, Aug. 12–17, 1985, Lake Buena Vista, Florida, p. 621–626.

Collapse and erosion at the low-level radioactive-waste burial site near Sheffield, Illinois, by J.R. Gray and L.L. McGovern, *in* Proceedings of the Seventh Annual Participants' Information Meeting, DOE Low-Level Waste Management Program, September 11–13, 1985, Las Vegas, Nevada, CONF–8509121, p. 737–753.

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Use of a geographic information system in the upper Illinois River Basin pilot project of the National Water-Quality Assessment Program, by F.A. Fitzpatrick, *in* Workshop proceedings; Remote sensing and GIS applications to nonpoint source planning, U.S. Environmental Protection Agency, April 1991, p. 55–66.

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Sediment and water quality in the upper Illinois River Basin, by A.R. Schmidt *in* Proceedings, 1991 Governor's Conference on the Management of the Illinois River System, October 22–23, 1991, Peoria, Illinois, p. 78–87.

Geochemical characterization of streambed sediment in the upper Illinois River Basin, by J.A. Colman and R.F. Sanzolone, *in* Water Resources Bulletin, v. 28, no. 5, October 1992, p. 933–950.

The role of the U.S. Geological Survey in the Great Lakes Basin, by K.L. Warner, *in* U.S. Water News, December 1992, v. 9, no. 6, p. 21.

Assessing the effect of pesticides in agricultural runoff on aquatic life in the Sangamon River near Monticello, Illinois, by R.H. Coupe, M.S. Henebry, and M.R. Branham, *in* Water Science and Technology, v. 28, no. 3–5, 1993, printed in Great Britain, p. 569–572.

Integrating well logs into a multiple-scale investigation of a fractured sedimentary aquifer, by F.L. Paillet, R.T. Kay, Douglas Yeskis, and W.H. Pedler, *in* The Log Analyst, v. 34, no. 1, January–February 1993, p. 24–40.

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An alternative field methodology for investigating a fractured bedrock, Superfund site [abs.], by Bill Bolen, Doug Yeskis, Craig Thomas, and Bob Kay, *in* 38th Annual Midwest Ground Water Conference Program and Abstracts, October 6–8, 1993, Champaign, Illinois, p. 60.

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Data collection for water-hammer analysis of the deep tunnel, Chicago, Illinois [abs.], by J.J. Duncker and K.A. Oberg, *in* Program and Abstracts, Illinois Section of the American Water Resources Association, 1993 Biennial Conference, October 26, 1993, Northern Illinois University, De Kalb, Illinois, unpaginated.

Evaluation of four methods for computing continuous discharge record for the Illinois River at Valley City [abs.], by L.C. Schideman and K.A. Oberg, *in* Program and Abstracts, Illinois Section of the American Water Resources Association, 1993 Biennial Conference, October 26, 1993, Northern Illinois University, De Kalb, Illinois, unpaginated.

Acoustic doppler current profiler streamflow measurements in Illinois [abs.], by K.A. Oberg, *in* Program and Abstracts, Illinois Section of the American Water Resources Association, 1993 Biennial Conference, October 26, 1993, Northern Illinois University, De Kalb, Illinois, unpaginated.

Regional rainfall-runoff relations for small watersheds in Lake County, Illinois [abs.], by J.J. Duncker, T.J. Vail, and C.S. Melching, *in* Program and Abstracts, Illinois Section of the American Water Resources Association, 1993 Biennial Conference, October 26, 1993, Northern Illinois University, De Kalb, Illinois, unpaginated.

Agricultural pesticides in Illinois lakes, 1992–1993 [abs.], by P.J. Terrio and D.A. Goolsby, *in* Dare to take the plunge, 9th Annual Conference, Illinois Lake Management Association, Decatur, Illinois, April 14–16, 1994, unpaginated.

Use of geophysical logs in hydrogeologic investigations at selected superfund sites in north-central Illinois, by P.C. Mills, James Ursic, R.T. Kay, and D.J. Yeskis, *in* Proceedings of Borehole Geophysics to Ground-Water Investigations, Albany, New York, June 2–4, 1992, p. 49–53.

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WHERE TO OBTAIN ADDITIONAL INFORMATION ON U.S. GEOLOGICAL SURVEY PROGRAMS IN ILLINOIS

In addition to the reports and abstracts listed above, further information may be obtained regarding water, maps, and geology by contacting the following offices of the U.S. Geological Survey:

WATER

District Chief
U.S. Geological Survey
102 East Main Street, 4th floor
Urbana, Illinois 61801

Phone: (217) 344-0037

MAPS

Chief, Mid-Continent Mapping Center
Earth Science Information Center
U.S. Geological Survey
1400 Independence Road
Rolla, Missouri 65401

Phone: (314) 341-0851

GEOLOGY

Assistant Chief Geologist, Eastern Region
U.S. Geological Survey
953 National Center
Reston, Virginia 22092

Phone: (703) 648-6660

GENERAL INFORMATION

U.S. Geological Survey
Earth Science Information Center
507 National Center
Reston, Virginia 22092

Phone: (800) USA-MAPS

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Bhowmik, N.G., and Bogner, W.C., 1981, Sediment transport and hydraulics of flow in the Kankakee River, Illinois–Phase II: Illinois State Water Survey Contract Report 282, 67 p.

Blackwell, C.D., 1993, Directory of assistance centers of the National Water-Data Exchange (NAWDEX): U.S. Geological Survey Open-File Report 93–76, 40 p.

Gilbert, B.K., and Mann, W.B., 1993, The U.S. Geological Survey Federal-State cooperative water-resources program—fiscal year 1992: U.S. Geological Survey Open-File Report 93–120, 33 p.

Gross, D.L., and Berg, R.C., 1981, Geology of the Kankakee River System in Kankakee County, Illinois: Illinois State Geological Survey Environmental Geology Note 92, 80 p.

U.S. Environmental Protection Agency, 1994, The quality of our Nation's water, 1992: U.S. Environmental Protection Agency Report EPA841–S–94–002, 43 p.

U.S. Geological Survey, 1992, Water Resources Division information guide: Reston, Va., 21 p.

Wendland, W.M., Kunkel, K.E., Conner, Glen, and others, 1992, Mean 1961–1990 temperatures and precipitation over the upper Midwest: Illinois State Water Survey Miscellaneous Publication 136, 27 p.

TABLES 2–3

Table 2. Surface-water stations operated by the Illinois District for which data are published

[C, Crest stage - peak-stage and peak-discharge record only; CQ, Chemical quality; D, Discharge - continuous record of stage and discharge; DS, Discharge with auxiliary slope gage - continuous record of stage and discharge; R, Lake contents - furnished by U.S. Army Corps of Engineers, St. Louis District; S, Stage - continuous record of stage; S/8-Stage at 0800 hours; SD, Suspended sediment]

Station Number	Station name	Type of data
03336645	Middle Fork Vermilion River above Oakwood, Ill.	D
03337000	Boneyard Creek at Urbana, Ill.	D
03338780	North Fork Vermilion River near Bismarck, Ill.	D
03339000	Vermilion River near Danville, Ill.	D
03343400	Embarras River near Camargo, Ill.	D
03345500	Embarras River at Ste. Marie, Ill.	D
03346000	North Fork Embarras River near Oblong, Ill.	D
03378000	Bonpas Creek at Browns, Ill.	D,CQ
03378635	Little Wabash River near Effingham, Ill.	D
03379500	Little Wabash River below Clay City, Ill.	D
03380500	Skillet Fork at Wayne City, Ill.	D
03381495	Little Wabash River at Main Street at Carmi, Ill.	CQ
03381500	Little Wabash River at Carmi, Ill.	DS
03382100	South Fork Saline River near Carrier Mills, Ill.	D
03384450	Lusk Creek near Eddyville, Ill.	D
03385000	Hayes Creek at Glendale, Ill.	C
03612000	Cache River at Forman, Ill.	D
040874126	Southwest Fork of South Branch of Ravine 10 at Highland Park, Ill.	CQ
05414820	Sinsinawa River near Menominee, Ill.	D
05419000	Apple River near Hanover, Ill.	D
05435500	Pecatonica River at Freeport, Ill.	D
05437500	Rock River at Rockton, Ill.	D
05438500	Kishwaukee River at Belvidere, Ill.	D
05439000	South Branch Kishwaukee River at De Kalb, Ill.	D
05439500	South Branch Kishwaukee River near Fairdale, Ill.	D,CQ
05440000	Kishwaukee River near Perryville, Ill.	D
05443500	Rock River at Como, Ill.	D
05444000	Elkhorn Creek near Penrose, Ill.	D
05446000	Rock Creek at Morrison, Ill.	C
05446500	Rock River near Joslin, Ill.	D,CQ
05447500	Green River near Geneseo, Ill.	D
05448000	Mill Creek at Milan, Ill.	D
05466000	Edwards River near Orion, Ill.	D
05466500	Edwards River near New Boston, Ill.	D
05467000	Pope Creek near Keithsburg, Ill.	D
05468500	Cedar Creek at Little York, Ill.	C
05469000	Henderson Creek near Oquawka, Ill.	D
05495500	Bear Creek near Marcelline, Ill.	D
05502020	Hadley Creek near Barry, Ill.	C
05512500	Bay Creek at Pittsfield, Ill.	D

Table 2. Surface-water stations operated by the Illinois District for which data are published---Continued

Station Number	Station name	Type of data
05518000	Kankakee River at Shelby, Ind.	SD
05519000	Singleton Ditch at Schneider, Ind.	SD
05520500	Kankakee River at Momence, Ill.	D,SD
05525000	Iroquois River at Iroquois, Ill.	D,SD
05525500	Sugar Creek at Milford, Ill.	D
05526000	Iroquois River near Chebanse, Ill.	D,SD,CQ
05527500	Kankakee River near Wilmington, Ill.	D,SD
05527800	Des Plaines River at Russell, Ill.	D
05527940	Tempel Farms Ditch near Old Mill Creek, Ill.	CQ
05527950	Mill Creek at Old Mill Creek, Ill.	D
05528000	Des Plaines River near Gurnee, Ill.	D
05528030	Bull Creek near Libertyville, Ill.	D
05528040	Terre Faire Ditch at Libertyville, Ill.	CQ
05528230	Indian Creek at Prairie View, Ill.	D
05528475	Green Lake Ditch at Buffalo Grove, Ill.	CQ
05528500	Buffalo Creek near Wheeling, Ill.	D
05529000	Des Plaines River near Des Plaines, Ill.	D
05529500	McDonald Creek near Mount Prospect, Ill.	D
05530000	Weller Creek at Des Plaines, Ill.	D
05530990	Salt Creek at Rolling Meadows, Ill.	D
05531044	Salt Creek near Elk Grove Village, Ill.	S
05531300	Salt Creek at Elmhurst, Ill.	D
05531410	Salt Creek at 22nd Street at Oak Brook, Ill.	S
05531500	Salt Creek at Western Springs, Ill.	D
05532000	Addison Creek at Bellwood, Ill.	D
05532300	Salt Creek at Brookfield, Ill.	S
05532500	Des Plaines River at Riverside, Ill.	D
05533000	Flag Creek near Willow Springs, Ill.	D
05533400	Sawmill Creek near Lemont, Ill.	D
05534500	North Branch Chicago River at Deerfield, Ill.	D
05535000	Skokie River at Lake Forest, Ill.	D
05535070	Skokie River near Highland Park, Ill.	D
05535500	West Fork of North Branch Chicago River at Northbrook, Ill.	D
05536000	North Branch Chicago River at Niles, Ill.	D
05536105	North Branch Chicago River at Albany Avenue at Chicago, Ill.	D
05536215	Thorn Creek at Glenwood, Ill.	D
05536235	Deer Creek near Chicago Heights, Ill.	D
05536255	Butterfield Creek at Flossmoor, Ill.	D
05536265	Lansing ditch near Lansing, Ill.	D
05536275	Thorn Creek at Thornton, Ill.	D
05536290	Little Calumet River at South Holland, Ill.	D
05536340	Midlothian Creek at Oak Forest, Ill.	D
05536500	Tinley Creek near Palos Park, Ill.	D
05536995	Chicago Sanitary and Ship Canal at Romeoville, Ill.	D
05537500	Long Run near Lemont, Ill.	D

Table 2. Surface-water stations operated by the Illinois District for which data are published—Continued

Station Number	Station name	Type of data
05539000	Hickory Creek at Joliet, Ill.	D
05539900	West Branch Du Page River near West Chicago, Ill.	D
05540060	Kress Creek at West Chicago, Ill.	D
05540091	Spring Brook at Forest Preserve near Warrenville, Ill.	D
05540095	West Branch Du Page River near Warrenville, Ill.	D
05540130	West Branch Du Page River near Naperville, Ill.	D
05540160	East Branch Du Page River near Downers Grove, Ill.	D
05540195	St. Joseph Creek at Route 34 at Lisle, Ill.	D
05540250	East Branch Du Page River at Bolingbrook, Ill.	D
05540275	Spring Brook at 87th Street near Naperville, Ill.	D,CQ
05540500	Du Page River at Shorewood, Ill.	D
05542000	Mazon River near Coal City, Ill.	D
05543500	Illinois River at Marseilles, Ill.	D,CQ
05547000	Channel Lake near Antioch, Ill.	S
05547500	Fox Lake near Lake Villa, Ill.	S
05547755	Squaw Creek at Round Lake, Ill.	D
05548000	Nippersink Lake at Fox Lake, Ill.	S
05548105	Nippersink Creek above Wonder Lake, Ill.	D
05548110	Nippersink Creek below Wonder Lake, Ill.	D
05548280	Nippersink Creek near Spring Grove, Ill.	D
05548500	Fox River at Johnsburg, Ill.	S
05549500	Fox River near McHenry, Ill.	S
05549850	Flint Creek near Fox River Grove, Ill.	D
05550000	Fox River at Algonquin, Ill.	D
05550500	Poplar Creek at Elgin, Ill.	D
05551000	Fox River at South Elgin, Ill.	D
05551200	Ferson Creek near St. Charles, Ill.	D
05551700	Blackberry Creek near Yorkville, Ill.	D
05552500	Fox River at Dayton, Ill.	D
05554000	North Fork Vermilion River near Charlotte, Ill.	C
05554500	Vermilion River at Pontiac, Ill.	D
05555300	Vermilion River near Leonore, Ill.	D
05556500	Big Bureau Creek at Princeton, Ill.	D
05557500	East Bureau Creek near Bureau, Ill.	C
05558300	Illinois River at Henry, Ill.	D
05559600	Illinois River at Chillicothe, Ill.	SD
05563000	Kickapoo Creek near Kickapoo, Ill.	C
05563500	Kickapoo Creek at Peoria, Ill.	C
05567000	Panther Creek near El Paso, Ill.	C
05567500	Mackinaw River near Congerville, Ill.	D
05568000	Mackinaw River near Green Valley, Ill.	D
05568500	Illinois River at Kingston Mines, Ill.	DS
05568800	Indian Creek near Wyoming, Ill.	D
05569500	Spoon River at London Mills, Ill.	D,CQ
05570000	Spoon River at Seville, Ill.	D

Table 2. Surface-water stations operated by the Illinois District for which data are published—Continued

Station Number	Station name	Type of data
05570910	Sangamon River at Fisher, Ill.	D
05572000	Sangamon River at Monticello, Ill.	D
05573540	Sangamon River at Route 48 at Decatur, Ill.	D
05576000	South Fork Sangamon River near Rochester, Ill.	DS
05576500	Sangamon River at Riverton, Ill.	D,CQ
05577500	Spring Creek at Springfield, Ill.	D
05578500	Salt Creek near Rowell, Ill.	D
05579500	Lake Fork near Cornland, Ill.	D
05580000	Kickapoo Creek at Waynesville, Ill.	D
05580950	Sugar Creek near Bloomington, Ill.	D
05582000	Salt Creek near Greenview, Ill.	D
05583000	Sangamon River near Oakford, Ill.	D,CQ
05584500	La Moine River at Colmar, Ill.	D
05585000	La Moine River at Ripley, Ill.	D
05585500	Illinois River at Meredosia, Ill.	S
05586000	North Fork Mauvaise Terre Creek near Jacksonville, Ill.	C
05586100	Illinois River at Valley City, Ill.	D,SD
05586500	Hurricane Creek near Roodhouse, Ill.	C
05587000	Macoupin Creek near Kane, Ill.	D, CQ
05587060	Illinois River at Hardin, Ill.	S
05587900	Cahokia Creek at Edwardsville, Ill.	D
05588000	Indian Creek at Wanda, Ill.	D
05590800	Lake Fork at Atwood, Ill.	D
05591200	Kaskaskia River at Cooks Mills, Ill.	D,SD
05591550	Whitley Creek near Allenville, Ill.	D
05591700	West Okaw River near Lovington, Ill.	D
05591950	Lake Shelbyville near Shelbyville, Ill.	R
05592000	Kaskaskia River at Shelbyville, Ill.	D
05592050	Robinson Creek near Shelbyville, Ill.	D
05592100	Kaskaskia River near Cowden, Ill.	D, CQ
05592500	Kaskaskia River at Vandalia, Ill.	D
05592575	Hickory Creek near Brownstown, Ill.	D
05592800	Hurricane Creek near Mulberry Grove, Ill.	D
05592900	East Fork Kaskaskia River near Sandoval, Ill.	D
05592990	Carlyle Lake near Carlyle, Ill.	R
05593000	Kaskaskia River at Carlyle, Ill.	D
05593520	Crooked Creek near Hoffman, Ill.	D
05593575	Little Crooked Creek near New Minden, Ill.	D
05593900	East Fork Shoal Creek near Coffeen, Ill.	D
05594000	Shoal Creek near Breese, Ill.	D, CQ
05594100	Kaskaskia River near Venedy Station, Ill.	D,SD
05594450	Silver Creek near Troy, Ill.	D
05594800	Silver Creek near Freeburg, Ill.	D,S/8
05595200	Richland Creek near Hecker, Ill.	D,S/8
05595700	Big Muddy River near Mt. Vernon, Ill.	S

Table 2. Surface-water stations operated by the Illinois District for which data are published—Continued

Station Number	Station name	Type of data
05595730	Rayse Creek near Waltonville, Ill.	D,S/8
05595765	Big Muddy Subimpoundment near Waltonville, Ill.	S
05595820	Casey Fork at Mt. Vernon, Ill.	D,S/8
05595860	Casey Fork Subimpoundment near Bonnie, Ill.	S
05595950	Rend Lake near Benton, Ill.	R
05597000	Big Muddy River at Plumfield, Ill.	DS
05597500	Crab Orchard Creek near Marion, Ill.	D
05599500	Big Muddy River at Murphysboro, Ill.	DS,SD
05600000	Big Creek near Wetaug, Ill.	C

Table 3. Ground-water stations in Illinois, by county, for which data are published by the Illinois District

[L, Ground-water-level measurement; Q, Ground-water-quality determination]

Station number	Local well name	Ownership	Type of data
	BUREAU COUNTY		
412338089280401	16N9E-4.1h1	Private	L
	DE KALB COUNTY		
414608088375201	38N5E-14.4d1	Municipal	L
	DU PAGE COUNTY		
414217087592801	37N11E-9.8c1	Federal	L
	GRUNDY COUNTY		
412720088153201	34N8E-1.3e1	Municipal	L, Q
	KANE COUNTY		
420507088325501	41N6E-9.1g2	Municipal	L, Q
	KENDALL COUNTY		
413152088342801	35N6E-5.6a1	Municipal	L
	LAKE COUNTY		
422803087475301	46N12E-14.6g1	Federal	L
422803087475302	46N12E-14.6g2	Federal	L
422803087475303	46N12E-14.6g3	Federal	L
422803087475304	46N12E-14.6g4	Federal	L
	OGLE COUNTY		
420453089172601	24N10E-13.6e2	Federal	L
	VERMILION COUNTY		
402558087351501	23N11E-22.8a1	Private	L
	WINNEBAGO COUNTY		
422930089023201	46N2E-6.2d1	Private	L

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