ILLINOIS
Stream Water Quality

Illinois has abundant surface-water resources, including about 14,100 miles of streams in or bordering the State (13,200 miles of interior streams and 880 miles of border streams) (Illinois Environmental Protection Agency, 1990, p. 2). The Illinois River and its major tributaries form the largest drainage basin in Illinois (U.S. Geological Survey, 1986, p. 216). Other major rivers include the Rock, Kaskaskia, Big Muddy, Embarras, and Little Wabash.

Offstream surface-water withdrawals in Illinois in 1985 averaged 13,500 Mgal/d (million gallons per day), or 93.6 percent of total offstream withdrawals (U.S. Geological Survey, 1990, p. 235). The largest offstream surface-water uses were thermoelectric power generation (11,700 Mgal/d), public supply (1,320 Mgal/d), and industry and mining (438 Mgal/d). Instream uses include hydroelectric power generation, maintenance of fish and other aquatic life, navigation, and recreation.

Land use can substantially affect the quality of water. Cropland or cropland mixed with pasture, woodland, and forest cover much of Illinois; the State also has several large urban areas (fig. 1*A*). Cropland predominates in the Central Lowland (fig. 1*B*); woodland and forest cover much of the Ozark Plateaus, Interior Low Plateaus, and Coastal Plain; and additional woodland areas border the major streams. The largest urban areas are the greater Chicago metropolitan area, Joliet, Aurora, Rockford, Rock Island–Moline, East St. Louis, Peoria, Springfield, and Champaign–Urbana (fig. 1*C* and 2). Illinois' population (11.4 million) remained essentially unchanged from 1980 to 1990 (U.S. Bureau of the Census 1990 decennial census files).

Contaminated stream water can directly affect the health of the population that obtains its drinking water from surface-water sources. Contaminated stream water also can affect the economy of an area by restricting recreational uses of water bodies. Stream water-quality problems in Illinois have numerous point and nonpoint sources. Point sources include municipal and industrial wastewater-treatment facilities and combined-sewer overflows; nonpoint sources include agricultural runoff, urban runoff, surface mining, and channelization (Illinois Environmental Protection Agency, 1990, p. 18). These sources contribute nutrients, chemicals, and suspended sediment that affect the quality of surface water.

WATER-QUALITY MONITORING

Water-quality data obtained from analyses of water samples collected at monitoring stations are stored in the U.S. Geological Survey's (USGS) National Water Information System and the U.S. Environmental Protection Agency's (EPA) national data base known as STORET. Water-quality and streamflow data are reported by water year—the 12 months from October 1 through September 30. A water year is identified by the calendar year in which it ends. For example, water year 1991 comprises October 1, 1990, through September 30, 1991.

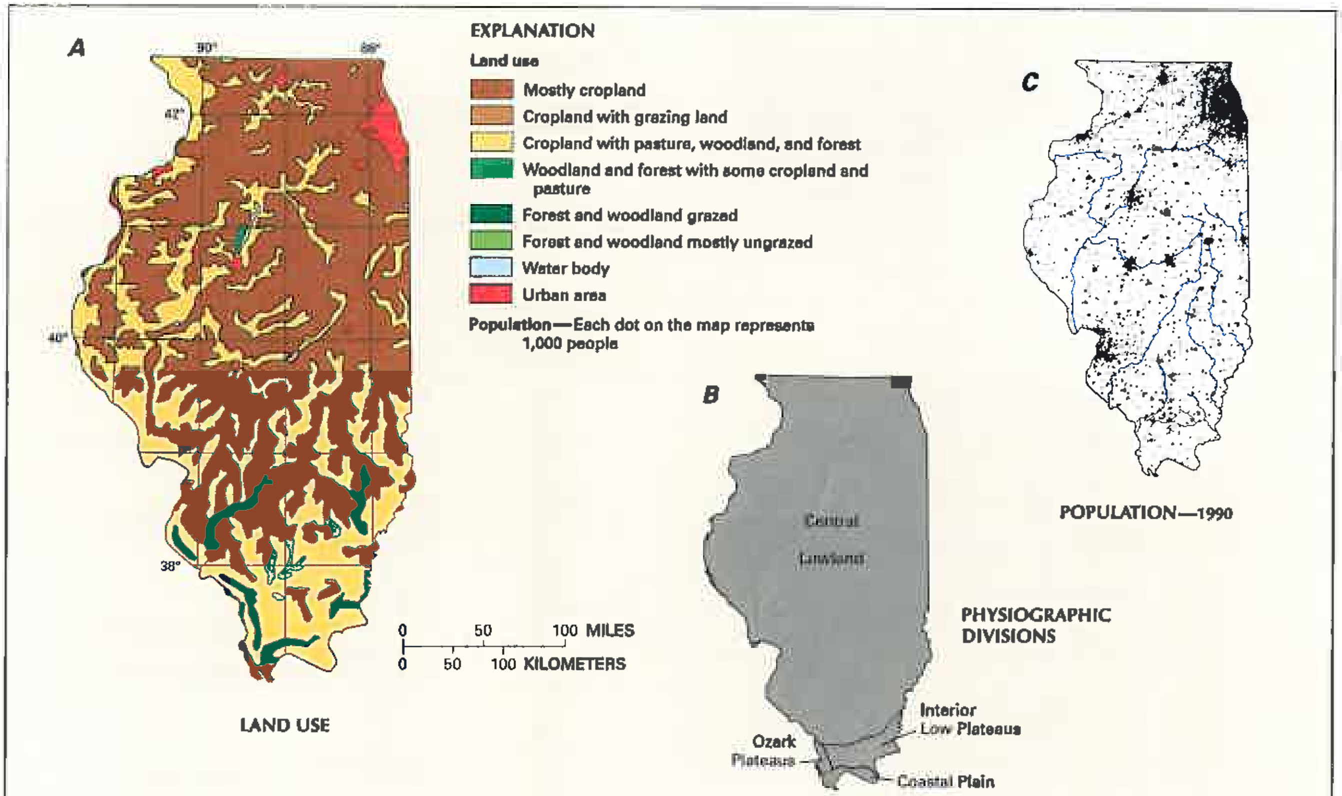
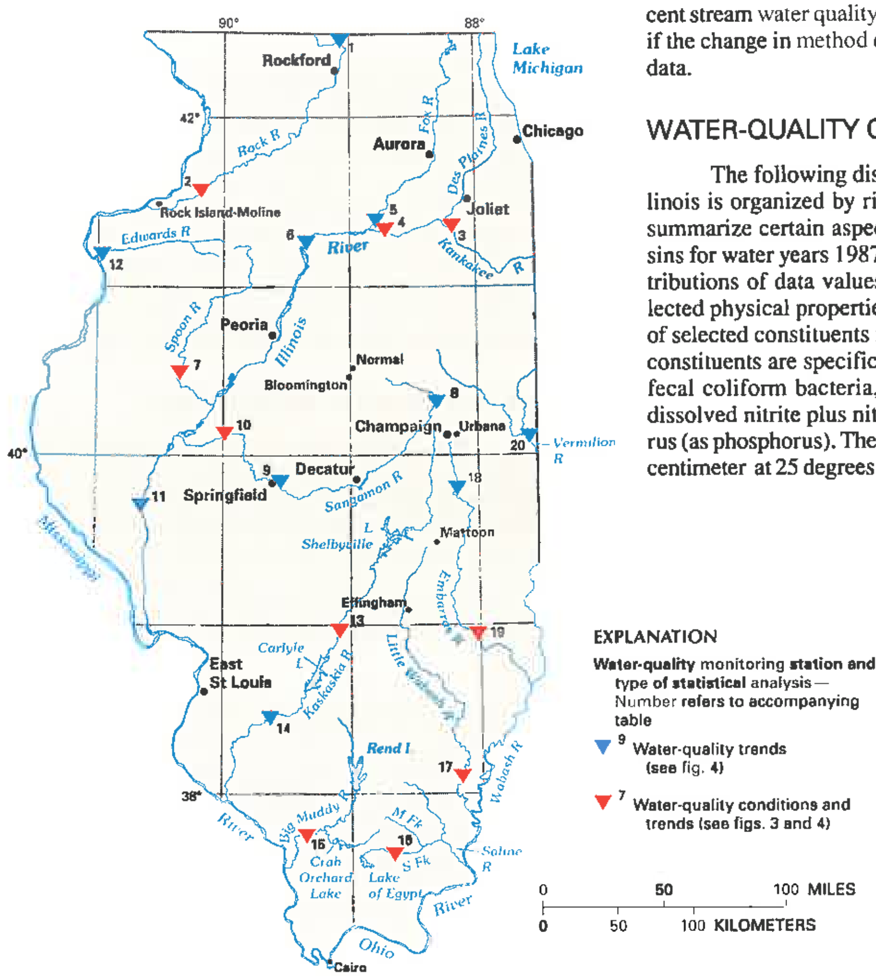


Figure 1. Land use, physiography, and population in Illinois. *A*, Major land uses. *B*, Physiographic divisions. *C*, Population distribution in 1990. (Sources: *A*, Major land uses modified from Anderson, 1967. *B*, Physiographic divisions from Fenneman, 1946; landforms from Thelin and Pike, 1990. *C*, Data from U.S. Bureau of the Census 1990 decennial census files.)

The data used in this summary of Illinois' stream water quality were obtained from water samples collected at intervals of 4–6 weeks at 20 monitoring stations at which data collection is systematic and continuing (fig. 2). Analyses of water samples collected at 10 stations are the basis for the discussion and graphic summary (fig. 3) of stream water-quality conditions during water years 1987–89, and data from all 20 stations are the basis for the discussion and graphic summary (fig. 4) of stream water-quality trends. Water samples were collected and analyzed by using standard methods approved by the USGS (Britton and Greeson, 1987; Fishman and Friedman, 1989; Ward and Harr, 1990) or by using equivalent methods. If a method of sample collection or analysis changed over time, data from an analysis were included in the evaluation of recent stream water quality or of stream water-quality trends only if the change in method did not affect the comparability of the data.



WATER-QUALITY CONDITIONS

The following discussion of stream water quality in Illinois is organized by river basin (fig. 3). Graphs in figure 3 summarize certain aspects of stream water quality in the basins for water years 1987–89. The graphs show frequency distributions of data values that represent measurements of selected physical properties of stream water and concentrations of selected constituents in stream water. These properties and constituents are specific conductance, pH, dissolved oxygen, fecal coliform bacteria, dissolved sulfate, dissolved solids, dissolved nitrite plus nitrate (as nitrogen), and total phosphorus (as phosphorus). The data are reported in microsiemens per centimeter at 25 degrees Celsius, standard pH units, milligrams

Site no. on map	USGS station name and no.	Drainage area (square miles)	Major land use (see fig. 1)
1	Rock River at Rockton (05437500)	6,363	Mostly cropland.
2	Rock River near Joslin (05446500)	9,549	Ditto.
3	Kankakee River near Wilmington (05527500)	5,150	Cropland with pasture, woodland, and forest.
4	Illinois River at Marseilles (05543500)	8,259	Mostly cropland; urban areas.
5	Fox River at Dayton (05552500)	2,642	Ditto.
6	Illinois River at Hennepin (05556200)	12,756	Mostly cropland.
7	Spoon River at Seville (05570000)	1,636	Cropland with pasture, woodland, and forest.
8	Sangamon River at Fisher (05570910)	240	Mostly cropland.
9	Sangamon River at Riverton (05576500)	2,618	Ditto
10	Sangamon River near Oakford (05583000)	5,093	Mostly cropland; urban areas.
11	Illinois River at Valley City (05586100)	26,742	Mostly cropland.
12	Edwards River near New Boston (05466500)	445	Cropland with pasture, woodland, and forest.
13	Kaskaskia River at Vandalia (05592500)	1,940	Mostly cropland.
14	Kaskaskia River near Venedy Station (05594100)	4,393	Cropland with pasture, woodland, and forest.
15	Big Muddy River at Murphysboro (05599500)	2,169	Ditto.
16	South Fork Saline River near Carrier Mills (03382100)	147	Ditto.
17	Little Wabash River at Main Street at Carmi (03381495)	3,088	Ditto.
18	Embarras River at Camargo (03343395)	180	Mostly cropland.
19	Embarras River at Ste. Marie (03345500)	1,516	Cropland with pasture, woodland, and forest.
20	Vermilion River near Danville (03339000)	1,290	Ditto.

Figure 2. **Selected water-quality monitoring stations, type of statistical analysis, and geographic features in Illinois.** (Sources: Major land uses modified from Anderson, 1967; other data from U.S. Geological Survey files.)

per liter (mg/L), and colonies per 100 milliliters (col/100 mL). Sources and environmental significance of each property and constituent are described in table 1.

Water quality at each monitoring station is the result of geological, chemical, biological, and hydrologic processes that occur over a large area. Water-quality problems that affect aquatic life or public health only locally are not fully represented in this summary.

Water-quality conditions are referenced to water uses and water-quality standards designated by the Illinois Environmental Protection Agency (IEPA) (1990, p. 4 and 7). The IEPA has applied ratings to streams based on a stream's ability to support aquatic life. The ratings include (1) full-aquatic-life use support, (2) partial support with minor use impairment, (3) partial support with moderate-use impairment, and (4) nonsupport. Specific IEPA standards for general-use purposes are as follows: pH (in standard units), 9.0 maximum, 6.5 minimum; dissolved oxygen, 5.0 mg/L minimum; fecal coliform bacteria, 200 col/100 mL maximum; dissolved sulfate, 500 mg/L maximum; dissolved solids, 1,000 mg/L maximum; and total phosphorus, 0.05 mg/L maximum.

ROCK RIVER

The Rock River originates in Wisconsin and flows to the Mississippi River. One-third of the drainage area is in Illinois. In the Illinois part of the basin, the surficial geology comprises mostly glacial drift and outwash deposits overlying dolomite, shale, limestone, and coal. Land use in the basin is mostly cropland. Reservoirs formed by seven of eight low-hydraulic-head dams, which originally were constructed for hydroelectric power generation, are now used for recreation (U.S. Geological Survey, 1986, p. 216). Agricultural runoff and wastewater-treatment-plant effluent are potential sources of contamination.

The IEPA (1990, p. 31, fig. 8) has classified the Rock River as having minor use impairment because of excessive phosphorus in discharge from wastewater-treatment plants and in agricultural runoff. At site 2, the median concentration of phosphorus (0.23 mg/L) (fig. 3) was almost five times the IEPA standard. Coal in the basin has had little effect on water quality; the median sulfate concentration (40 mg/L) at site 2 was the lowest for the 10 monitoring stations and was well below the IEPA standard.

KANKAKEE RIVER

The Kankakee River originates in Indiana and joins the Des Plaines River downstream from site 3 to form the Illinois River. The river has been extensively channelized in Indiana but is relatively unmodified in Illinois. In the Illinois part of the basin, the surficial geology comprises mostly lakebed and glacial moraine deposits overlying dolomite and coal. Land use in the basin is predominantly cropland with some pasture and woodland. Livestock raising is an important activity, and coal is strip mined near the western edge of the basin. Agricultural and coal-mine runoff are potential sources of contamination.

The main stem of the Kankakee River in Illinois upstream from site 3 has been rated by the IEPA as having full aquatic-life-use support; however, nutrients and silt result in minor use impairment owing to agricultural runoff to one of the smaller tributaries (Illinois Environmental Protection Agency, 1990, p. 34, fig. 9). Many samples from site 3 (fig. 3) exceeded the IEPA standards for fecal coliform bacteria and total phosphorus concentrations, probably because of agricultural runoff.

ILLINOIS RIVER

The Illinois River originates at the confluence of the Des Plaines and Kankakee Rivers and is augmented with diversions from Lake Michigan. Seventy-five percent of the Illinois River basin is in Illinois. The river system drains the heavily industrialized area in the northeastern part of the State. Commerce along the river is made possible by a series of locks and dams. The basin's surficial geology comprises mostly glacial-drift and moraine deposits overlying dolomite, limestone, shale, and coal. Land uses in the basin are mostly agricultural and urban. Wastewater-treatment-plant effluent and urban and agricultural runoff are potential sources of stream contamination.

The Illinois River upstream from site 4 has minor use impairment because of industrial- and municipal-wastewater discharges and soil erosion (Illinois Environmental Protection Agency, 1988, p. 29, fig. 8). Barge traffic on the river contributes to the problem by resuspending sediments and increasing wave action that causes bank erosion. The median concentrations of dissolved solids (474 mg/L) and phosphorus (0.43 mg/L) at site 4 (fig. 3) were the highest for the 10 monitoring stations; phosphorus concentrations exceeded the IEPA standard, and probably resulted from the large volume of wastewater-treatment-plant effluent.

SPOON RIVER

The Spoon River flows into the Illinois River in west-central Illinois. The surficial geology of the basin comprises mostly glacial drift overlying limestone, shale, and coal. Cropland, pasture, and woodland cover most of the basin, and there are several active and abandoned coal strip mines.

The quality of stream water in the basin slightly impairs aquatic-life maintenance because of turbidity and, to a lesser degree, because of nutrients from agricultural runoff, coal mining, and municipal-wastewater effluent (Illinois Environmental Protection Agency, 1990, p. 38, fig. 10). Few fecal coliform bacteria samples exceeded the IEPA standard, and the median nitrite plus nitrate concentration was low (fig. 3). These concentrations probably were low because of the sparse population in the river basin. The median phosphorus concentration (0.14 mg/L) at site 7 (fig. 3) exceeded the IEPA standard yet was one of the lowest for the 10 monitoring stations.

SANGAMON RIVER

The Sangamon River joins the Illinois River in central Illinois. The river is extensively channelized along its lower reach; less channelization has taken place along the upper reaches. The basin contains five major reservoirs. In most of the basin, glacial drift overlies limestone, shale, and coal. Land use is predominantly cropland, but there is some oil production, and coal has been deep-shaft mined. Agricultural runoff, urban runoff, and municipal-wastewater effluent are potential sources of contamination.

Wastewater-treatment-plant effluent and urban runoff from the large communities of Decatur, Bloomington–Normal, and Springfield impair aquatic-life maintenance in the Sangamon River (Illinois Environmental Protection Agency, 1990, p. 42, fig. 11). During water years 1987–89, the median concentration of phosphorus (0.34 mg/L) at site 10 (fig. 3) and some concentrations of fecal coliform bacteria exceeded the IEPA standards for general-use purposes. The high concentrations probably were the result of large volumes of wastewater-treatment-plant effluent.

KASKASKIA RIVER

The Kaskaskia River originates near Champaign and empties into the Mississippi River. Streamflow in the river is partially regulated by dams that form Lake Shelbyville and Carlyle Lake. The surficial geology comprises mostly glacial drift overlying limestone, shale, and coal. Land uses are mostly agricultural. Agricultural runoff and chemical-plant effluent are potential sources of contamination.

The Kaskaskia River upstream from site 13 is capable of full aquatic-life-use support except for a 17.6-mile reach downstream from a chemical plant; aquatic-life maintenance in the reach was partially impaired by organic contaminants (Illinois Environmental Protection Agency, 1990, p. 46, fig. 12). Organic pesticides (chlordane, dieldrin, and heptachlor epoxide) were present in the stream sediment upstream from Lake Shelbyville. During water years 1987–89, some fecal coliform bacteria samples and the median phosphorus concentration (0.15 mg/L) at site 13 (fig. 3) exceeded the IEPA standards. The high concentrations probably were the result of agricultural runoff.

BIG MUDDY RIVER

The Big Muddy River flows through southern Illinois to the Mississippi River. Six dams regulate streamflow in the Big Muddy River basin; Rend and Crab Orchard Lakes are the largest reservoirs. The drainage basin is underlain mostly by glacial drift that overlies limestone, shale, and coal. Cropland, pasture, woodland, and forest are the major land uses, but there is some coal and oil production. Agricultural runoff, coal mining, and wastewater-treatment-plant effluent are potential sources of contamination.

The main stem of the Big Muddy River has received a minor use-impairment rating as a result of agricultural runoff, coal-mine runoff, and municipal wastewater-treatment-plant effluent; the exception is a full-use rating for a 0.7-mile reach downstream from Rend Lake (Illinois Environmental Protection Agency, 1990, p. 56, fig. 14). Some fecal coliform bacteria concentrations and all phosphorus concentrations at site 15 (fig. 3) exceeded the IEPA standards. The source of contamination probably was agricultural runoff and wastewater effluent. The median sulfate concentration (280 mg/L) was the second highest for the 10 monitoring stations and reflects the extensive coal mining in the basin that exposes sulfur-bearing minerals to weathering.

SOUTH FORK SALINE RIVER

The South Fork Saline River originates in southern Illinois, joins the Middle Fork Saline River, and empties into the Ohio River. The South Fork Saline River is regulated by the dam that forms Lake

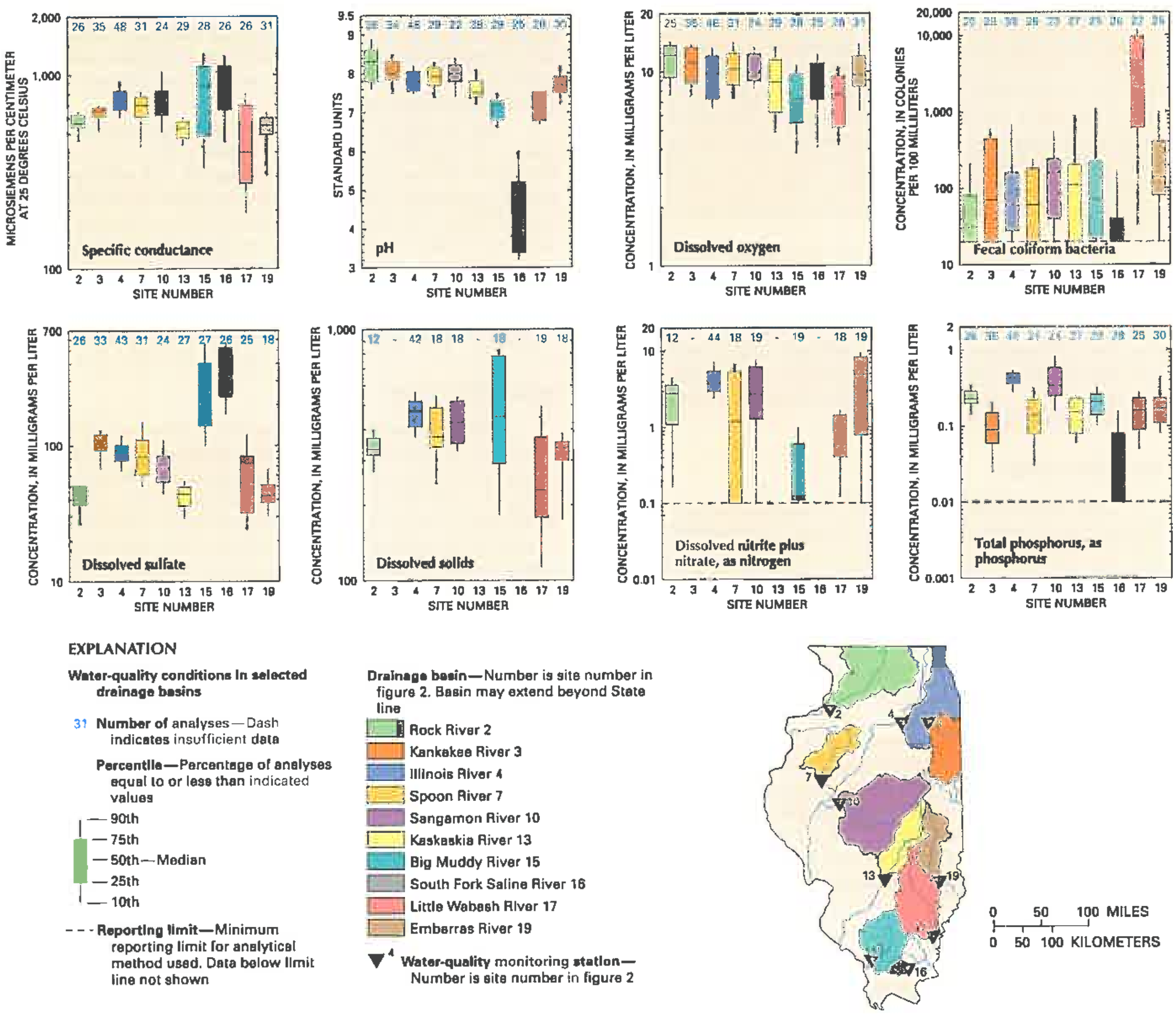


Figure 3. Water quality of selected streams in Illinois, water years 1987–89. (Sources: Data from U.S. Geological Survey files.)

of Egypt. The surficial geology of the basin comprises mostly glacial-drift and lakebed deposits overlying limestone, shale, and coal. Cropland, pasture, woodland, and forest cover most of the basin, and there has been extensive strip and deep-shaft coal mining.

Most of the South Fork Saline River upstream from site 16 has been given a full aquatic-life-use support rating; however, the 9-mile reach just upstream from the monitoring station has a non-support-use rating (Illinois Environmental Protection Agency, 1990, p. 60, fig. 15). Acid runoff from an inactive coal mine in the basin causes low pH values and has adversely affected the river. The median pH value (4.3) at site 16 (fig. 3) was much less than the minimum IEPA standard of 6.5. The pH value and the median sulfate concentration were the lowest and highest, respectively, for the 10 monitoring stations and were directly related to coal mining. In contrast, the median concentrations of fecal coliform bacteria and total phosphorus were the lowest, probably because the basin is sparsely populated, and possibly also because the acidity kills the bacteria.

LITTLE WABASH RIVER

The Little Wabash River originates near Mattoon and flows to the Wabash River. Eleven water-supply reservoirs have been built in the drainage basin; the largest of these is near Effingham. Glacial-drift and lakebed deposits overlie limestone, shale, and coal in most of the basin. Land uses are predominantly agricultural, but there also is oil and gas production (U.S. Geological Survey, 1986, p. 221). Wastewater-treatment-plant effluent is a source of stream contamination.

The Little Wabash River upstream from site 17 has been rated as having minor use impairment except for a 4-mile reach near Mattoon that has been adversely affected by wastewater-treatment-plant effluent (Illinois Environmental Protection Agency, 1990, p. 52, fig. 13). The median concentration of fecal coliform bacteria (2,200 col/100 mL) at site 17 (fig. 3) was the highest for the 10 monitoring stations and exceeded the IEPA standard; some samples exceeded 10,000 col/100 mL. Phosphorus concentrations in all samples collected at site 17 exceeded the IEPA standard. The high concentrations of fecal coliform bacteria and phosphorus probably were the result of wastewater-treatment-plant effluent.

EMBARRAS RIVER

The Embarras River originates near Urbana and flows to the Wabash River. In most of the basin, glacial drift overlies limestone, shale, and coal. Land uses in the basin are cropland, pasture, woodland, and forest, but oil is produced as well. Municipal wastewater-treatment-plant effluent and agricultural and oil-field runoff are potential sources of contamination in the basin.

About 43 percent of the Embarras River system has been rated as having minor use impairment (because of channelization and agricultural and oil-field runoff), about 5 percent as having moderate-use impairment, and less than 1 percent as being nonsupportive of aquatic life (Illinois Environmental Protection Agency, 1990, p. 51, fig. 13). Phosphorus concentrations at site 19 (fig. 3) exceeded the IEPA standard. The high concentrations probably were the result of wastewater effluent and agricultural runoff.

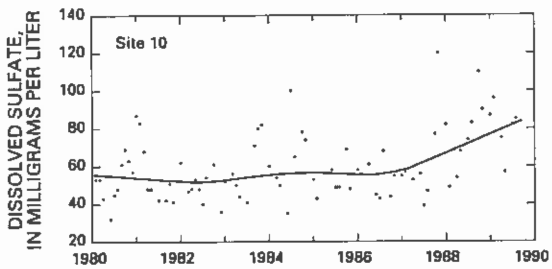
WATER-QUALITY TRENDS

Trend analysis is a statistical procedure used to detect changes in stream water quality at a monitoring station over time. For this report, water-quality data from 20 monitoring stations (fig. 2) were analyzed for trends by using the seasonal Kendall test (Hirsch and others, 1982), a method used extensively by the USGS. The graph (next page) of the dissolved-sulfate concentration in the Sangamon River at site 10 illustrates the trend inferred from the concentration data and demonstrates the variation in water quality that is common in streams.

Table 1. Sources and environmental significance of selected water-quality properties and constituents

[Source: Compiled by the U.S. Geological Survey, Office of Water Quality]

Property or constituent	Common sources	Environmental significance
Specific conductance (property)	A measure of the electrical conductivity of water; varies with the quantity of dissolved solids and is used to approximate the dissolved-solids content.	Dissolved solids can cause water to be unsuitable for public supply, agriculture, and industry; can harm aquatic organisms.
pH (property)	A measure of hydrogen-ion activity (acidity or alkalinity); can be affected by geologic setting, biological activity, municipal and industrial wastewater discharge, and atmospheric deposition.	Acidic water can corrode pipes and equipment; can cause the release of lead and other metals from distribution systems to drinking water; can affect wastewater-treatment processes and taste of water.
Dissolved oxygen	Introduced from the atmosphere; also a byproduct of aquatic plants.	Necessary for aquatic life; deficiency can result from assimilation of organic wastes or rapid growth and decay of algae.
Fecal coliform bacteria	Sources include effluent from sewage-treatment plants and runoff from pastures, feedlots, and urban areas.	Presence indicates contamination of water by wastes from humans and other warm-blooded animals.
Sulfate	Occurs in some rocks; also in mine runoff, industrial wastewater discharge, and atmospheric deposition.	Concentrations exceeding a natural, background level indicate contamination from human activity; in sufficient quantity, can cause water to be unsuitable for public supply; can harm aquatic organisms.
Dissolved solids	A result of rock weathering; also in agricultural runoff and industrial discharge.	In sufficient quantity, can cause water to be unsuitable for public supply, agriculture, and industry; can harm aquatic organisms.
Nitrite plus nitrate	Nonpoint sources are agricultural and urban runoff; a major point source is wastewater discharge.	Plant nutrient that, in sufficient quantity, can cause algal blooms and excessive growth of higher aquatic plants in bodies of water; can cause water to be unsuitable for public supply.
Phosphorus	Occurs in some rocks and sediments; also in runoff and seepage from phosphate-rock mines, agricultural and urban runoff, and industrial and municipal wastewater discharge.	Plant nutrient that, in sufficient quantity, can cause algal blooms and excessive growth of higher aquatic plants in bodies of water.



When possible, constituent-concentration data were adjusted for changes in streamflow to preclude identifying a trend in concentration that was caused only by a trend in streamflow. The data were not adjusted when (1) more than 10 percent of the samples had concentrations lower than the minimum reporting limit for the analytical method used or (2) streamflow was controlled substantially by human activities. When the concentration data could not be adjusted for streamflow, trends were determined directly from the concentration data.

Statewide trends in measurements of selected physical properties of stream water and in concentrations of selected constituents in stream water are shown on maps in figure 4. On each map, a trend is indicated at a monitoring station only if the data from that station were suitable for use in the trend analysis. For more information on the suitability criteria and on the trend-analysis procedure used for this report, see Lanfear and Alexander (1990).

SPECIFIC CONDUCTANCE

Specific conductance is a measure of the ability of a sample of water to conduct electricity. Because specific conductance and the dissolved-solids concentration are roughly proportional in most natural waters, the specific-conductance value often can be used to estimate the dissolved-solids concentration (Hem, 1985, p. 66–68).

Increasing wastewater discharges and urban runoff in conjunction with less than average precipitation and resulting decreased dilution during 1987–89 probably caused the increasing specific conductance in the Fox River at site 5 and the Edwards River at site 12. Cropland and pasture are the major land uses in the drainage basins of the Kaskaskia and Embarras Rivers; a decrease in runoff containing agricultural chemicals, owing to the less than average precipitation of 1987–89, probably caused the decreasing specific conductance at sites 14 and 19.

pH

The pH of a sample of water is a measure of its hydrogen-ion activity (effective concentration). An increase in hydrogen-ion content causes water to become more acidic but results in a lower measured pH value because the units of pH are inversely related to hydrogen-ion activity. Both natural processes and human activities (table 1) can affect pH. The pH of river water in most areas not affected by pollution is between about 6.5 and 8.5 (Hem, 1985, p. 64).

Changes in pH were small at the monitoring stations where trends were detected, and the values at most of the monitoring stations were within the IEPA standards. Less than average precipitation during 1987–89 and the resulting decrease in dilution of wastewater-treatment-plant discharge probably caused the upward trends in the Illinois River at site 4 and in the Sangamon River at site 10. Coal-mine reclamation activities in the South Fork Saline River basin probably decreased acidic drainage to the river and allowed the increasing pH at site 16, but values remained too low to meet the IEPA standards.

Decreasing pH in the Spoon, Edwards, and Embarras Rivers at sites 7, 12, and 19 probably resulted in part from the less than average precipitation and runoff during 1987–89. Acidic ground water, which can result from contact with coal deposits and from contamination with oil-field brines, became a larger component of streamflow owing to the diminished precipitation. Also, decreasing use of agricultural lime (University of Illinois College of Agriculture, 1990, p. 51, fig. 10.3) in conjunction with the decrease in precipitation and runoff probably reduced the quantity of acid-neutralizing lime that entered the streams.

DISSOLVED OXYGEN

The dissolved-oxygen concentration in a stream is controlled by several factors, including water temperature, air temperature and pressure, hydraulic characteristics of the stream, photosynthetic or respiratory activity of stream biota, and the quantity of organic material present. A trend in dissolved-oxygen concentrations commonly is directly or indirectly the result of human activities. Generally, an upward trend in dissolved-oxygen concentrations indicates improving stream water-quality conditions and a downward trend indicates deteriorating conditions. Reductions in quantities of oxygen-depleting matter discharged by sewage-treatment plants in the Chicago metropolitan area and at Decatur probably caused the upward dissolved-oxygen trends in the Illinois River at site 4 and the Sangamon River at site 9.

FECAL COLIFORM BACTERIA

Fecal coliform bacteria are used as indicators of fecal contamination from humans and other warm-blooded animals. Such contamination can introduce disease-causing viruses and bacteria into a stream.

Fecal coliform bacteria concentrations had no trend at any of the monitoring stations from which data met the criteria for trend analysis. These bacteria are short lived in well-oxygenated streams. If a monitoring station is too distant from a pollution source to obtain live bacteria for culturing, trends in bacteria numbers might not be detected.

DISSOLVED SULFATE

The major natural sources of sulfate in streams are rock weathering, volcanoes, and biochemical processes (Hem, 1985, p. 113). Human activities such as mining, waste discharge, and fossil-fuel combustion also can be important sources.

Coal is, or has been, mined in the four basins that had upward trends in sulfate concentrations; however, the increasing concentrations do not necessarily indicate increases in coal mining. Rather, the upward trends in the Rock, Kankakee, and Sangamon Rivers at sites 2, 3, 9, and 10 might have been caused by a proportionately greater contribution of ground water—which traveled through the sulfur-rich coal deposits and coal-mine spoils—to streamflow during the 1987–89 drought. Coal-mine reclamation in the South Fork Saline River basin probably resulted in the decreasing sulfate concentration at site 16.

DISSOLVED SOLIDS

Dissolved solids in stream water result primarily from rock weathering but also can be introduced as a byproduct of human activities (table 1). Concentrations generally are greatest in streams draining basins underlain by rocks and soils that contain easily dissolved minerals.

Dissolved-solids concentrations had no significant trend at any of the five sites from which data were suitable for trend analysis. Relatively unchanging wastewater treatment and land-use practices in the five river basins probably were the reasons for the absence of trends.

DISSOLVED NITRITE PLUS NITRATE

Nitrite and nitrate are oxidized forms of nitrogen that together constitute most of the dissolved nitrogen in well-aerated streams. Nitrite readily oxidizes to nitrate in natural waters; therefore, nitrate generally is by far the more abundant of the two (Hem, 1985, p. 124).

Increased wastewater discharges and urban runoff in the Chicago metropolitan area probably caused the increasing nitrite plus nitrate concentration in the Illinois River at site 4. Cropland is a major land use in the basin; fertilizers applied to fields also are a potential source of nutrients, which can be transported to streams in runoff.

TOTAL PHOSPHORUS

The total phosphorus concentration of a water sample is a measure of the concentration of all forms of phosphorus present in the sample, dissolved and particulate. Human activities (table 1) can be important sources of phosphorus in streams. Improvements in

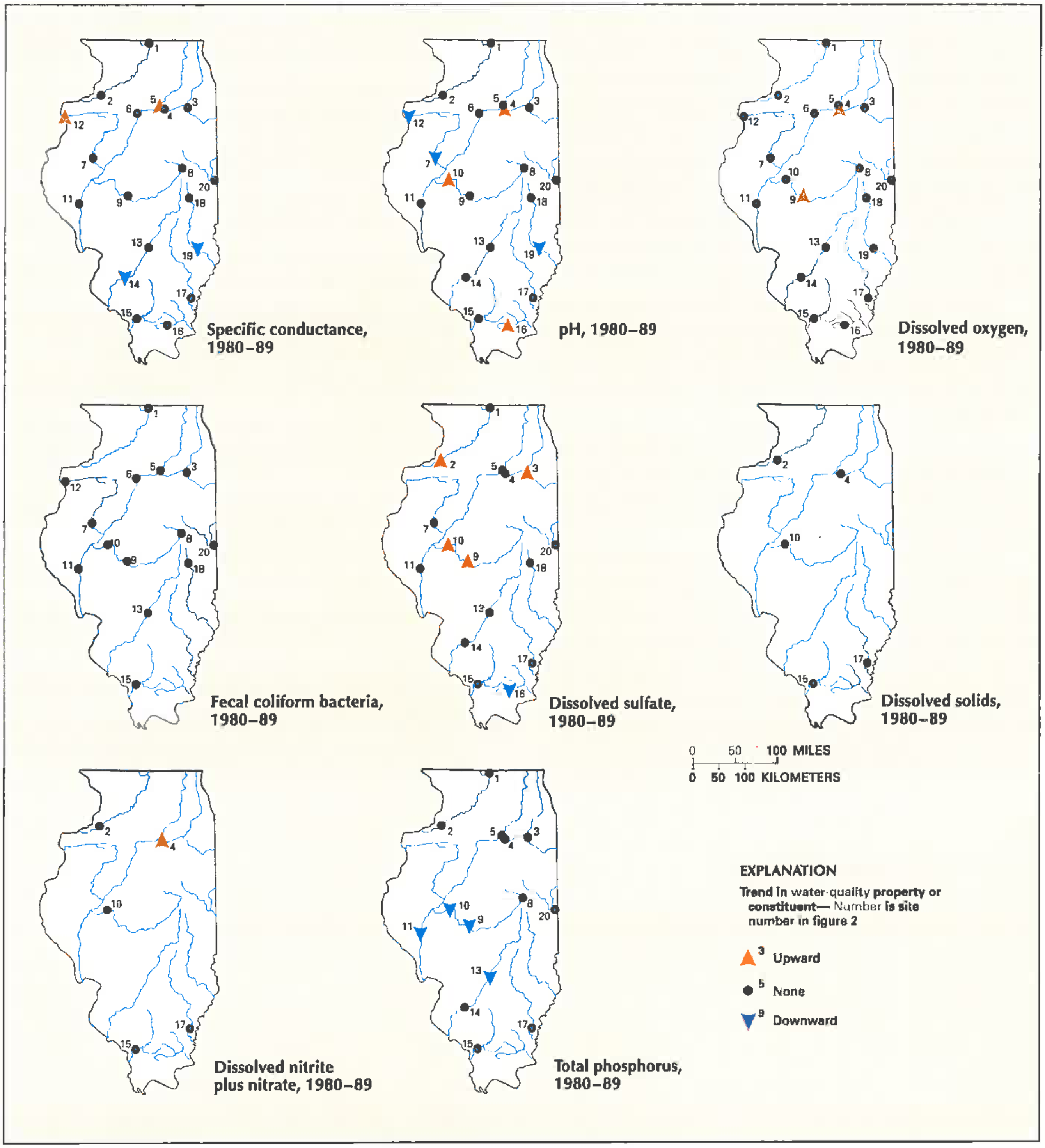


Figure 4. Trends in water quality of selected streams in Illinois, by water years. (Sources: Data from U.S. Geological Survey files.)

municipal wastewater-treatment-plant discharges and decreases in urban and agricultural runoff probably caused the decreasing phosphorus concentrations in the Sangamon River at sites 9 and 10, in the Illinois River at site 11, and in the Kaskaskia River at site 13.

WATER-QUALITY MANAGEMENT

The Illinois Environmental Protection Act of 1970 assigned a seven-member Pollution Control Board the responsibility of establishing the basic regulations and standards necessary for the preservation of the environment. The act also created and established the IEPA as the principal State agency for the implementation of environmental programs. This includes activities such as monitoring, planning, permitting, financial assistance administration, compliance assurance, and program management that are conducted to prevent, control, and abate water pollution in Illinois. The IEPA is responsible for the maintenance and updating of the State Water Quality Management Plan that identifies the State's goals and objectives pertaining to activities that may degrade water quality. The State's General Assembly designated the IEPA as the State Water Pollution Control Agency for all purposes of the Federal Clean Water Act. The Illinois Environmental Protection Act further established the Department of Energy and Natural Resources as the research and education arm of the State's environmental protection apparatus.

Illinois established the State Water Plan Task Force in 1980 to provide a means of coordinating the activities of State agencies responsible for water-resource management and water-pollution control. An overall State Water Plan was submitted to the Governor and legislature in January 1984, and the task force monitors the plan's implementation.

The IEPA participates in water-resource-management activities of the Association of State and Interstate Water Pollution Control Administrators, International Joint Commission of the Great Lakes Water Quality Board, Ohio River Valley Sanitation Commission, Upper Mississippi River Conservation Committee, and other interstate committees and commissions.

The IEPA has maintained an effective and efficient surface-water-monitoring and assessment program since its inception in 1970. Adjustments and additions to the monitoring effort have been undertaken to keep pace with technological advances and broadening environmental concerns. Monitoring activities focus on water and sediment chemistry as well as on physiological and biological data (aquatic invertebrates, fisheries, and habitat). A comprehensive Surface Water Monitoring Strategy outlines monitoring programs, quality-assurance activities, laboratory-support needs, and data-management procedures. Results from each of the monitoring elements are used in a comprehensive report (Illinois Environmental Protection Agency, 1988; 1990) prepared pursuant to section 305(b) of the Federal Clean Water Act, which requires that States submit biennial water-quality assessments to the EPA and the U.S. Congress (Joel Cross, Illinois Environmental Protection Agency, written commun., 1990).

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Prepared by G.O. Balding and R.H. Coupe

FOR ADDITIONAL INFORMATION: District Chief, U.S. Geological Survey, 102 E. Main Street, 4th floor, Urbana, IL 61801