

**WATER-DATA PROGRAM OF THE U.S. GEOLOGICAL SURVEY
IN KANSAS, FISCAL YEAR 1983**

By

R. K. Livingston and K. D. Medina

U.S. GEOLOGICAL SURVEY Water-Resources Investigations Report 84-4306



UNITED STATES DEPARTMENT OF THE INTERIOR

WILLIAM P. CLARK, Secretary

GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

District Chief
U.S. Geological Survey, WRD
1950 Constant Avenue - Campus West
University of Kansas
Lawrence, Kansas 66046
[Telephone: (913) 864-4321]

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CONVERSION FACTORS

For those readers who may be interested in the International System of Units (SI), the conversion factors for the inch-pound units used in this report are listed below:

<u>Multiply inch-pound unit</u>	<u>By</u>	<u>To obtain SI unit</u>
mile	1.609	kilometer
gallon	3.785	liter
acre-foot	1,233	cubic meter
acre-foot per year	1,233	cubic meter per year

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ABSTRACT

The U.S. Geological Survey is the principal Federal agency cooperating with State agencies in the collection of hydrologic data needed for the planning, development, use, and management of the water resources in Kansas. Hydrologic-data collection by the U.S. Geological Survey in Kansas began in 1895. The fiscal-year 1983 water-data program, operated in cooperation with several Federal, State, and local agencies, included 278

stations for collection of river, lake, and reservoir data; 1,940 wells for collection of groundwater data; and 58 sampling stations and 215 wells for collection of water-quality data. This report provides a detailed description of the water-data program, including coordination and funding, data-collection activities, quality-assurance plans, availability of data, network design, and future needs for water data.

INTRODUCTION

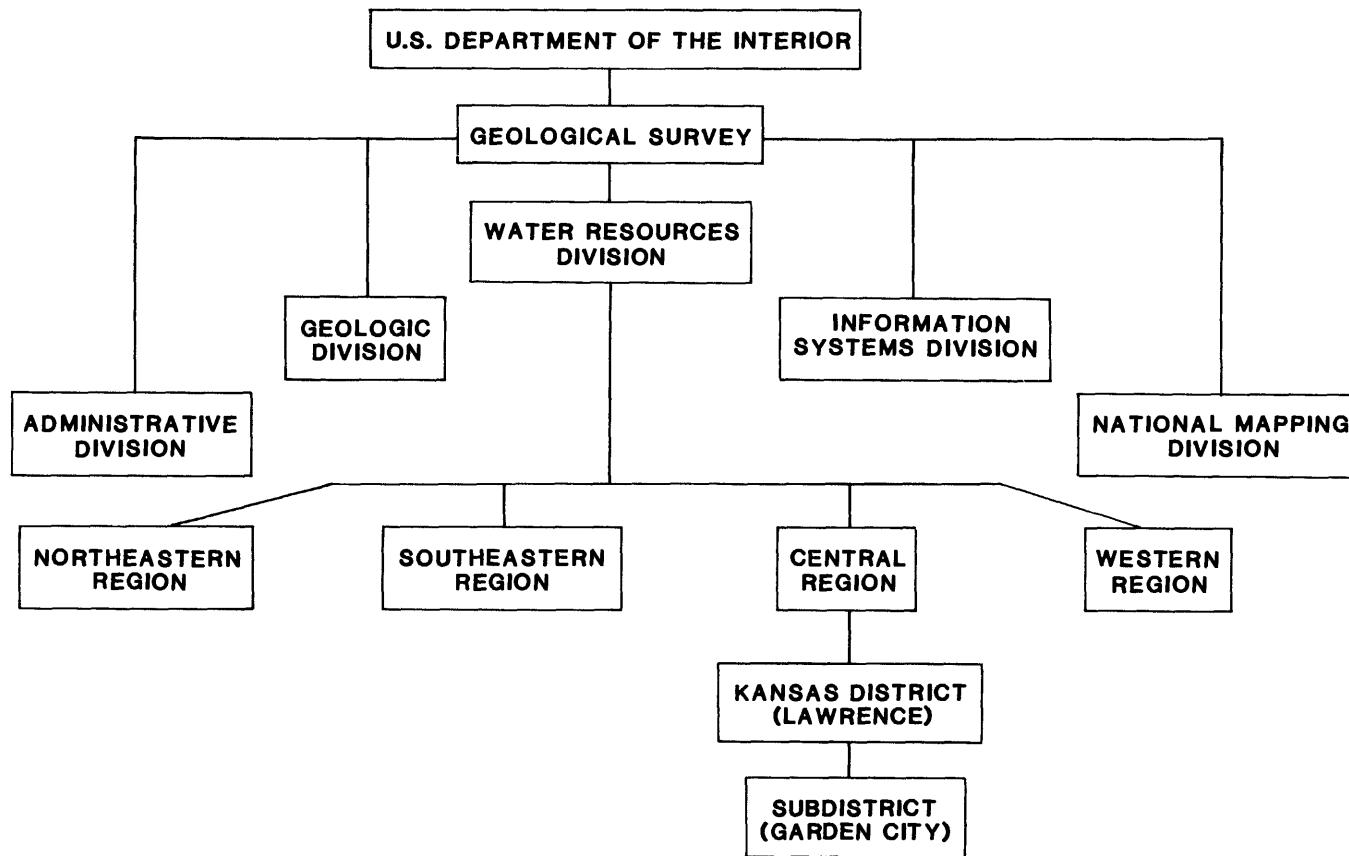
In virtually all parts of Kansas, the quantity, quality, and distribution of water are critical to the State's economy and to public health and safety. In a number of areas in the State demands for water supplies are increasing because of population increases, industrial expansion, and agricultural requirements. Generally, local concerns include flooding, chronic water shortages during dry periods, dwindling ground water for food-produc-

tion activities, and deteriorating water quality. As a result of these concerns, a need exists for reliable hydrologic data to facilitate planning, development, use, and management of the State's water resources. Because the water-data program of the U.S. Geological Survey in Kansas provides much of the needed hydrologic data, this report provides a detailed description of the major elements of the program for fiscal year 1983.

Purposes of the Water-Data Program

The U.S. Geological Survey, established in 1879, is the principal Federal agency cooperating with State agencies in the collection of hydrologic data needed for the planning, development, use, and management of the Nation's water resources. The first Federal-State cooperative program of the U.S. Geological Survey for the collection of water data began in Kansas in 1895. The Water Resources Division, one of the five divisions within the Survey, as shown on facing page, manages and conducts water-data collection through offices such as the Kansas District Office in Lawrence and the Subdis-

trict Office in Garden City. Purposes of the Division's water-data program are to collect, analyze, and disseminate the hydrologic data needed to: (1) Support the obligations and concerns of the Federal government, and (2) respond to the mutual needs and concerns of Federal, State, and local agencies regarding management, development, regulation, conservation, and environmental protection of water resources. As will be discussed later in this report, these data are subject to standardized quality-assurance practices and entered in computer files for ready access by users of the information.



ORGANIZATION OF GEOLOGICAL SURVEY, U.S. DEPARTMENT OF THE INTERIOR

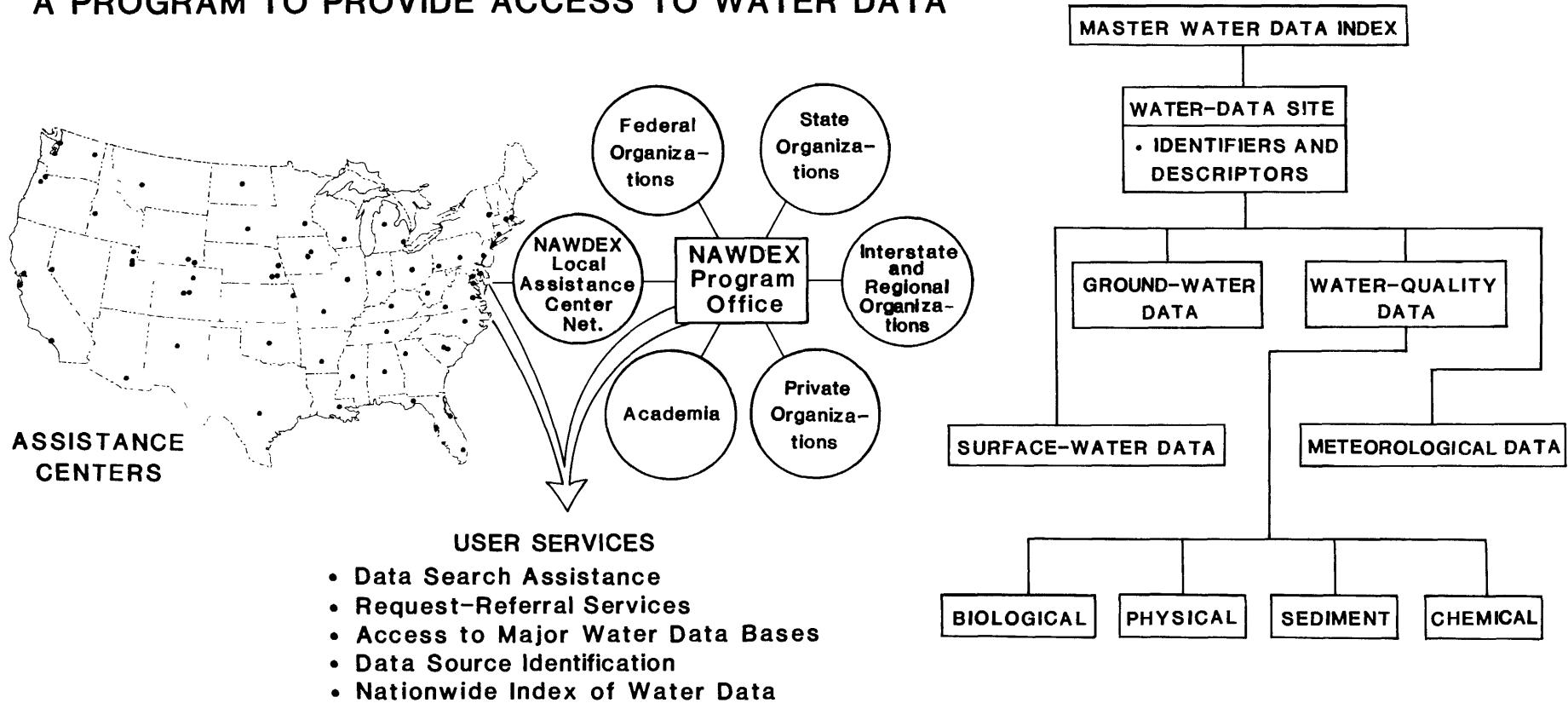
Coordination and Exchange of Water Data

To meet both local and National data needs, the U.S. Geological Survey cooperates with State and local governments and other Federal agencies. This cooperation has led to a coordinated water-data program that is attuned closely to respond to local data needs, yet is also sufficiently broad to provide the information required to plan and assess regional water-resources development and management. The U.S. Geological Survey's Office of Water Data Coordination has been designated as the coordinator of water-data acquisition activities by more than 30 Federal agencies. The exchange of water data is facilitated by the National Water Data Exchange (NAWDEX), a National confederation of water-oriented organizations working together to improve access to water data (Edwards, 1977). The Kansas District Office, one of 63 NAWDEX assistance centers, annual-

ly processes more than 300 requests for sources of water information. (See illustration on facing page.) The Division of Water Resources of the Kansas State Board of Agriculture and the Kansas Geological Survey are currently (1984) members of NAWDEX.

In addition to coordination among Federal agencies, the various State water agencies share their changes in water-data needs through correspondence and planning meetings. An attempt is made to circulate notification of major changes in the existing water-data program at least 2 years ahead of the implementation date. Similarly, planned new activities are reviewed to insure awareness by all interested parties.

A PROGRAM TO PROVIDE ACCESS TO WATER DATA



NATIONAL WATER DATA EXCHANGE (NAWDEX) AND TYPES OF AVAILABLE DATA

Funding

To conduct its water-data program in Kansas, the U.S. Geological Survey receives funding from three sources--Federal appropriations, reimbursements from other Federal agencies, and Federal-State cooperative programs. (See illustration on facing page.) Federal appropriations currently (1984) fund 10 continuous-record, surface-water stations and the collection of water-quality or sediment samples at 16 stations. These activities primarily are part of interstate compact agreements and special-purpose programs of the U.S. Geological Survey (discussed later in this report). Other Federal agencies, including the Kansas City and Tulsa Districts of the U.S. Army Corps of Engineers and the U.S. Bureau of Reclamation, provide funds to the U.S. Geological Survey to operate and maintain 98 surface-water stations (including partial-record, reservoir-content, and other stations) and 11 water-quality stations in Kansas. These stations provide data necessary for reservoir management and water-development planning and design.

The Federal-State cooperative program is a significant source of funding in Kansas. This program, which is deeply rooted in the concept that Federal, State, and local governments have mutual interests

in evaluating, planning, developing, conserving, and managing the Nation's water resources, provides for Congressional appropriations to be used to share, on a 50-50 matching basis, the cost of water-resources activities of the U.S. Geological Survey; State and local agencies provide their matching share in repay and direct-services charges. Cooperating agencies in the Kansas water-data program include:

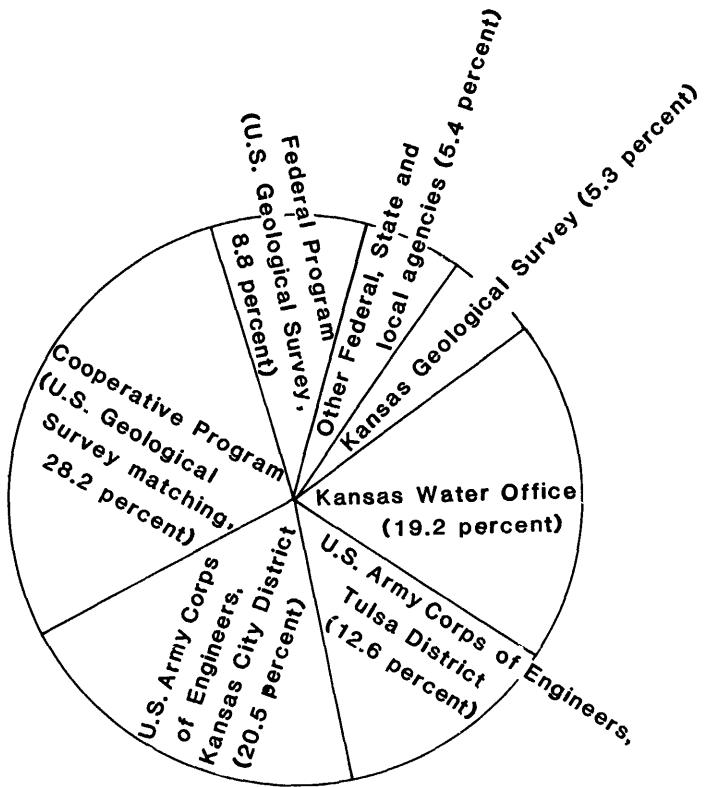
- * Kansas Water Office
- * Kansas Department of Health and Environment
- * Kansas Geological Survey
- * Kansas Department of Transportation
- * City of Wichita
- * Arkansas River Compact Administration
- * Kansas State Board of Agriculture, Division of Water Resources
- * City of Hays

The funding for the water-data program is distributed among various cost items as shown on facing page. The risk of losses due to vandalism, floods, and other unforeseen causes is borne by the U.S. Geological Survey, which replaces the damaged equipment without additional charge to the cooperating agency.

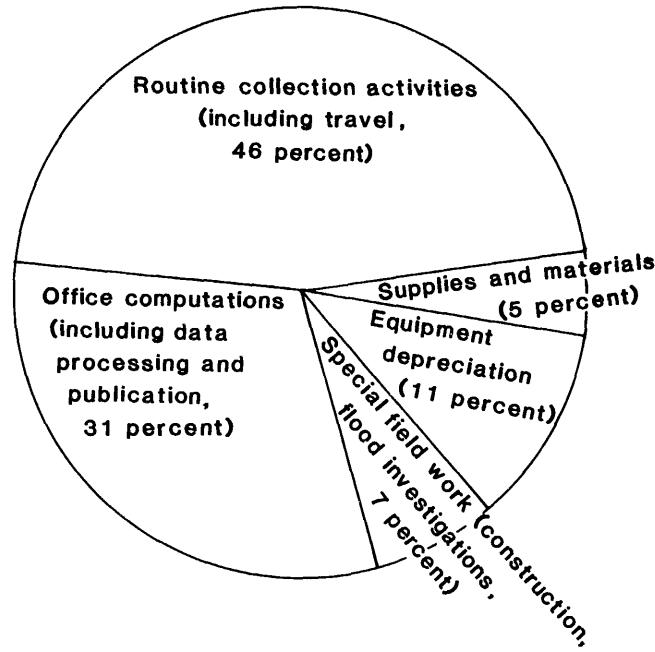
Acknowledgments

Much of this report is a compilation of material previously published by the U.S. Geological Survey. Therefore, the authors wish to acknowledge

the following two references that were used extensively--Chase and others (1983) and Gilbert and Buchanan (1982).



SOURCES OF FUNDS FOR WATER-DATA PROGRAM
OF THE KANSAS DISTRICT, FISCAL YEAR 1983



EXPENDITURE OF FUNDS IN THE WATER-DATA PROGRAM
OF THE KANSAS DISTRICT, FISCAL YEAR 1983

WATER-DATA PROGRAM FUNDING SOURCES AND EXPENDITURES

SYSTEMATIC DATA-COLLECTION ACTIVITIES

The U.S. Geological Survey maintains a nationwide system of streamflow-gaging stations, ground-water observation wells, and sampling sites for collecting water-quality information for both surface and ground water. The Hydrologic Data-Collection Program is the Survey's principal program for collecting and analyzing data on the Nation's surface and ground water. These data are used to support the needs of Federal, State, and local governments for water-resources appraisals, environmental-impact assessments, and energy-related studies, and form an invaluable foundation for responding to emerging issues.

Throughout the 50 States, Guam, and Puerto Rico, there are almost 17,000 surface-water stations, about 27,000 wells where water-level or pumpage or both types of data are collected, and about 9,400

surface-water stations and 7,400 wells where water-quality information is collected. These data-collection sites provide standardized records for stream discharge (flow) and stage (height), reservoir and lake storage, ground-water levels, well and spring discharge, and the quality of surface and ground water.

The Kansas part of this National program during fiscal year 1983 (summarized in the table on facing page) included 140 continuous-record and 105 partial-record streamflow-gaging stations, and 24 reservoir-content stations. Data for determining chemical or biological quality of surface water were obtained at 14 stations and for sediment at 55 stations. Ground-water levels were measured in 1,940 wells, and samples for determining water quality of ground water were collected from 215 representative wells throughout the State.

SUMMARY OF DATA-COLLECTION ACTIVITIES IN KANSAS WATER-DATA PROGRAM

[Federal fiscal year 1983, October 1982-September 1983]

Funding source	Participating agency	Surface-water stations					Ground-water wells		
		Complete-record streamflow	Partial-record streamflow	Reservoir content	Water-quality or biological	Chemical	Sediment	Other stations	Water level
Federal (9 percent)	U.S. Geological Survey	10	--	--	11	5	--	--	--
Other Federal agencies (34 percent)	Kansas City District, U.S. Army Corps of Engineers	35	15	9	--	--	1/ 5	--	--
	Tulsa District, U.S. Army Corps of Engineers	22	--	8	1	8	1/ 1	--	--
	U.S. Bureau of Reclamation	2	--	1	2	--	--	--	--
Cooperative program (57 percent)	Kansas Water Office	67	30	5	--	42	2/27	--	--
	Kansas Department of Health and Environment	--	--	--	--	--	--	--	215
	Kansas Geological Survey	--	--	--	--	--	--	1,940	--
	Kansas Department of Transportation	--	60	--	--	--	--	--	--
	City of Wichita	2	--	1	--	--	3/ 6	--	--
	Arkansas River Compact Administration	4/--	--	--	--	--	--	--	--
	Kansas State Board of Agriculture, Division of Water Resources	1	--	--	--	--	--	--	--
	City of Hays	1	--	--	--	--	--	--	--
100 percent		140	105	24	14	55	39	1,940	215

1 Stage record only.

2 Continuous seasonal precipitation.

3 Includes three storm-rainfall and three flood-hydrograph stations.

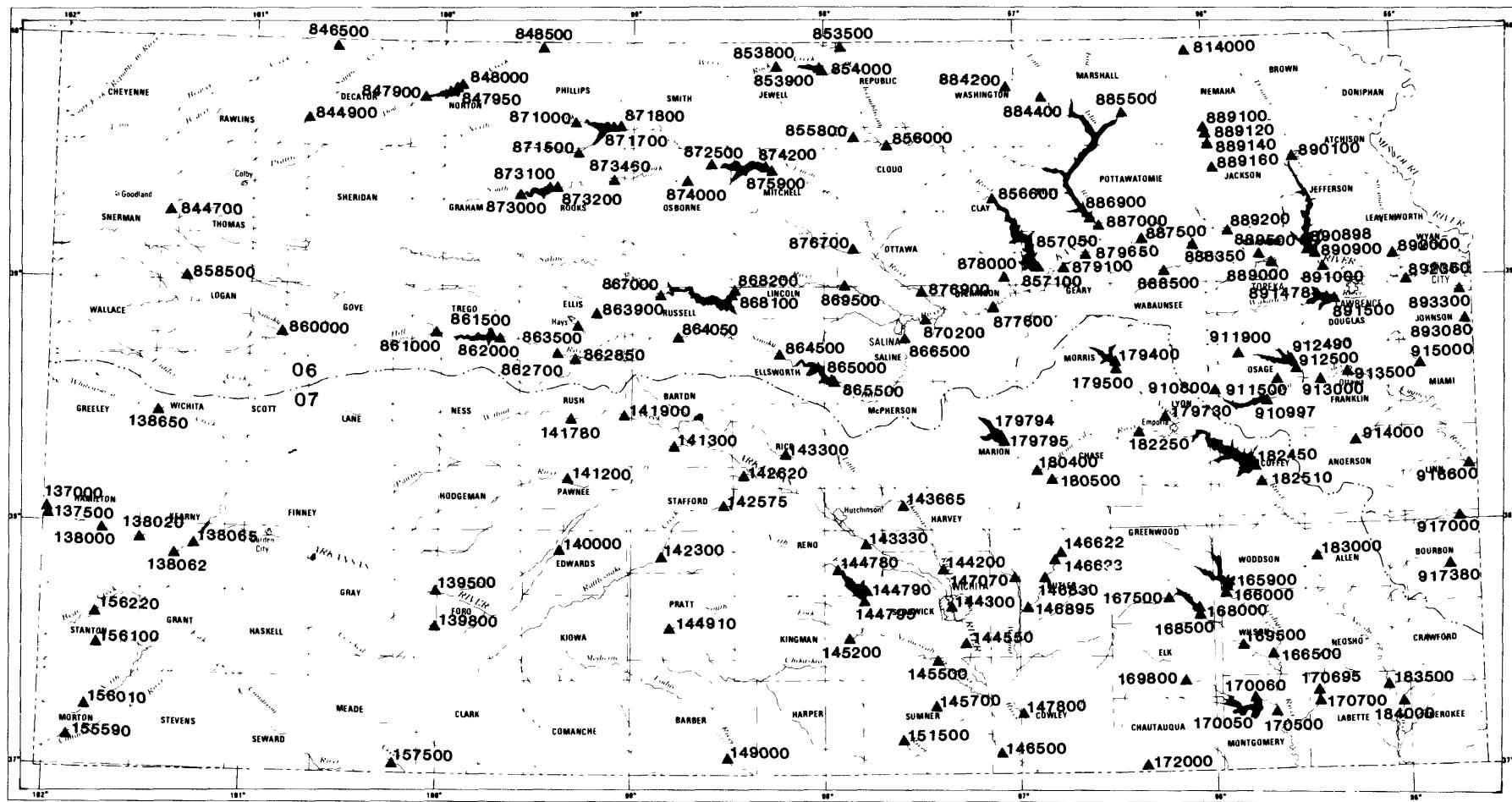
4 Funding for additional measurements.

Surface Water

In Kansas during fiscal year 1983, the U.S. Geological Survey collected continuous stage (water-level) records at 140 streamflow-gaging stations and 24 reservoir-content stations. (See illustration on facing page.) Onsite recorders stored water-stage data as punches on paper tapes at intervals of 15 or 60 minutes. These tapes then were processed by local computer for computation of stream discharge (flow). Computations included the average discharge for the day, summaries by the month and for the year, as well as extremes (peak and low flows) during the year, and the results were published in an annual report (Geiger and others, 1983).

Partial-record stations were used to collect only selected information, usually peak or low flows. There were 96 crest-stage stations, where the peak stage was recorded and published with corresponding instantaneous peak discharge and 9 low-flow stations, where instantaneous discharge measurements were made during base flow.

There were also 41 stations where only selected information was collected, such as flood ratings (relationship between stage and discharge), stage records only, and flood hydrographs (selected peaks only), or where seasonal data were required.



EXPLANATION

▲172000

COMPLETE-RECORD STATION AND NUMBER

Note: numbers shown are six digits of U.S. Geological Survey station number; the first two digits are the drainage-basin number

06

DRAINAGE BASINS

Missouri River basin

07

Arkansas River basin

— — — — —
BASIN BOUNDARY

0 10 20 30 MILES
0 10 20 30 KILOMETERS

DISTRIBUTION OF COMPLETE-RECORD SURFACE-WATER GAGING STATIONS, FISCAL YEAR 1983

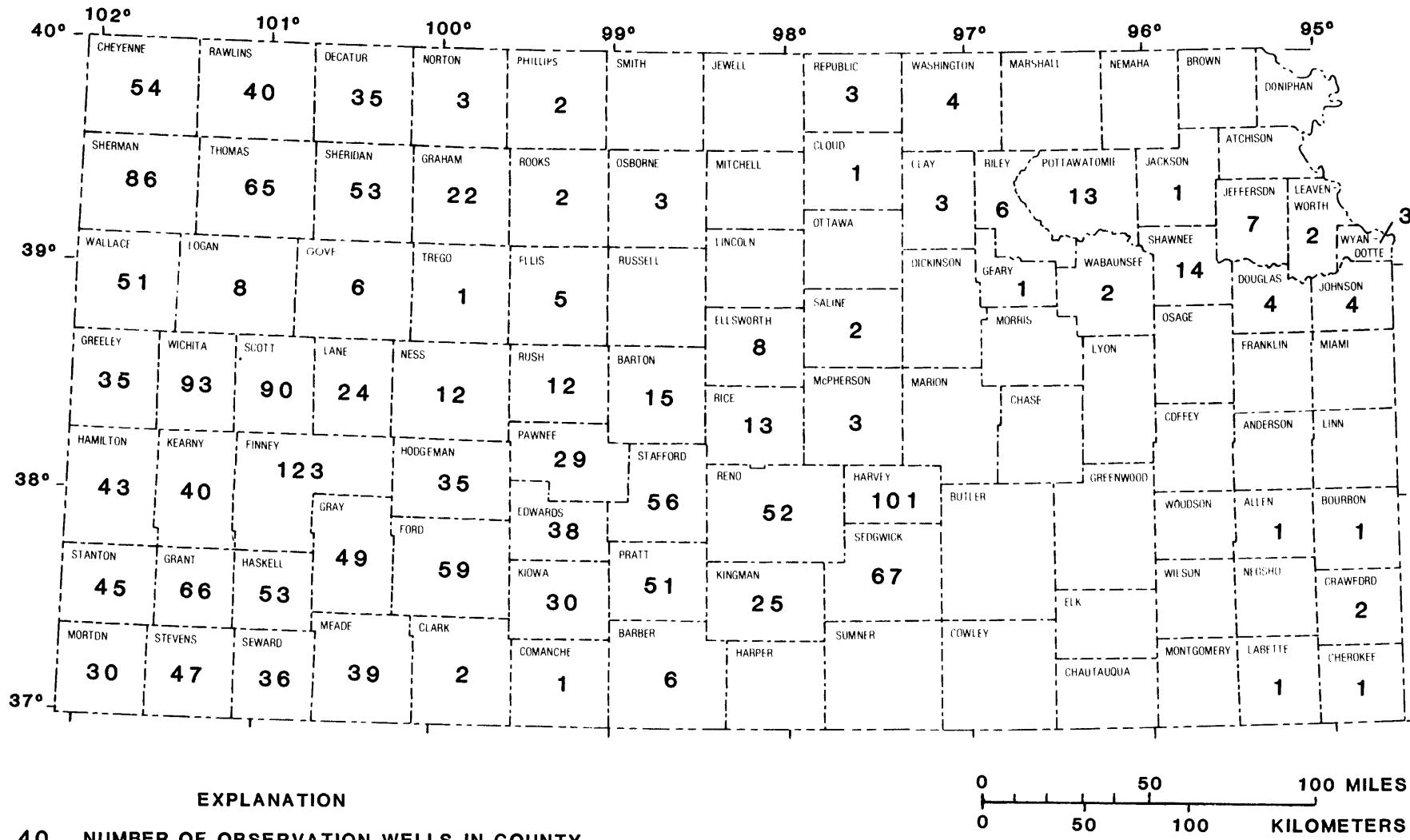
Ground Water

The ground-water data-collection network in Kansas during fiscal year 1983 consisted of 1,940 wells at which measurements of the depth of water below land surface are made on a periodic basis, generally at least once a year. Water-level data are used to assess changes in ground-water storage that are a result of natural causes or man's activities. Related investigations may involve analysis of aquifer characteristics, such as saturated thickness, porosity, horizontal and vertical hydraulic

conductivity, transmissivity, and storage coefficients. General geologic appraisals, detailed surface and subsurface mapping, test drilling, and geophysical work make use of water-level data, as well as computer-modeling studies that predict changes in water levels and available supplies in response to stresses on the hydrologic system. The distribution of observation wells in the ground-water data-collection network during fiscal year 1983 is shown on the facing page.

DISTRIBUTION OF OBSERVATION WELLS IN GROUND-WATER

DATA-COLLECTION NETWORK, FISCAL YEAR 1983



Quality of Water

In addition to making quantitative measurements of streams and wells, the U.S. Geological Survey monitored the quality of surface and ground water at the stations and wells shown in the illustration on the facing page. At the surface-water stations, the water temperature usually was measured at the time a discharge measurement was made, and commonly pH and specific conductance were determined at the same time. Water samples were collected at selected surface-water stations for laboratory determination of constituents that may vary, depending on requirements. Major inorganic constituents, major nutrients, organic compounds, and trace metals were determined in most samples. Some stations were sampled for pesticide and radiochemical constituents and for phytoplankton identification.

In Kansas during fiscal year 1983, chemical or biological data were collected by the U.S.

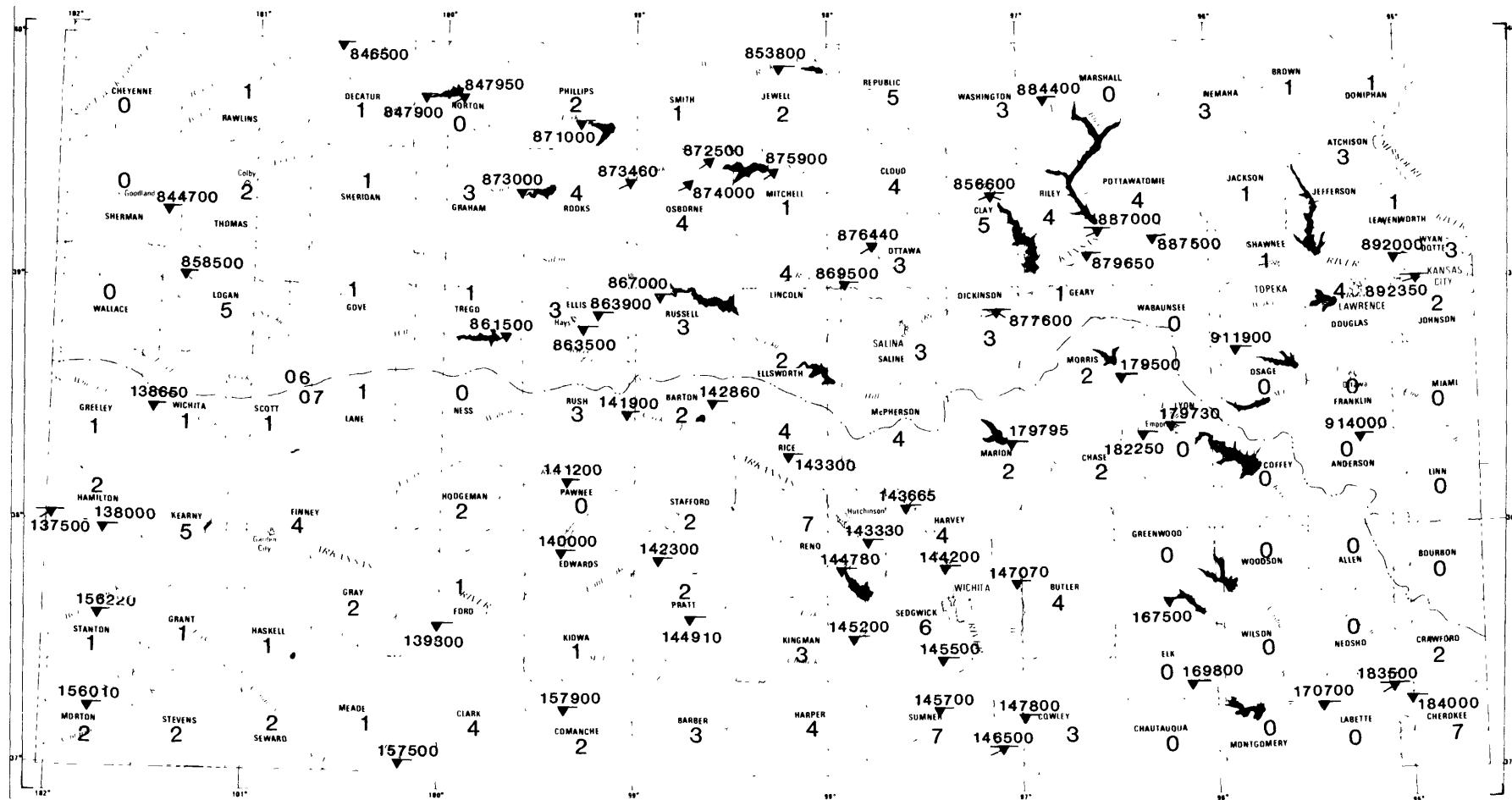
Geological Survey at 14 gaging stations on a routinely scheduled basis as part of the Federal program and in cooperation with other Federal agencies. In addition, there were miscellaneous sites where samples were collected and analyzed for a few selected constituents, usually as a part of a special study or investigation.

Ground-water quality was sampled using a statewide network of 215 wells. These wells were sampled at least annually and were analyzed for constituents pertaining to the quality suitable for drinking water. The wells were selected so that the results would be representative of most of the major aquifers from which the water was withdrawn.

Sediment

Data on concentration, load, or particle size of suspended sediment were collected on a routine basis by the U.S. Geological Survey at 55 surface-water gaging stations (see facing page) during fiscal year 1983. Quantities of sediment transported were determined by measuring sediment concentra-

tions in streams and relating these measurements to concurrent streamflow. Miscellaneous samples were collected at other gaging stations for background information when flow conditions warranted the collection of a sediment sample.



DISTRIBUTION OF SURFACE-WATER-QUALITY STATIONS AND GROUND-WATER-QUALITY SAMPLING SITES, FISCAL YEAR 1983

Water Use

The U.S. Geological Survey started a water-use information program in 1978 to provide for the comprehensive and systematic collection, storage, analysis, and dissemination of water-use data and information throughout the United States. Statistics on domestic, industrial, and agricultural water use are required for the planning, management, and development of water resources and to provide information necessary to identify and resolve critical water problems. The U.S. Geological Survey is designing and managing the National program in cooperation with State and Federal agencies. The manpower-intensive collection of data at the local level is done primarily by State or local agency personnel. A major thrust of the program in Kansas

has been the design and implementation of a State water-user and water-rights data base. This data base, maintained by the Kansas State Board of Agriculture, Division of Water Resources, contains point-source data on all water diversions within the State, together with additional management information about diversion points. The aggregated water-withdrawal and water-use data are provided to the U.S. Geological Survey (see table on facing page for example for 1982) from this data base for central storage. Inasmuch as the water-use data base is not fully implemented as yet, the availability of information is not at design levels, particularly in the area of return flows.

**EXAMPLES OF WATER-USE INFORMATION AGGREGATED BY COUNTY FOR 1982,
AS REPORTED BY WATER-RIGHTS HOLDERS**

Type of use	FORD COUNTY				SHAWNEE COUNTY			
	Surface water		Ground water		Surface water		Ground water	
	(gallons)	(acre-feet)	(gallons)	(acre-feet)	(gallons)	(acre-feet)	(gallons)	(acre-feet)
Domestic	0	0	299,782	1	0	0	58,653	0.2
Industrial	0	0	1,906,107,785	5,847	2,097,779,860	6,434	2,202,837,481	6,757
Irrigation	376,553,415	1,155	36,707,903,709	112,600	76,584,760	235	1,013,507,399	3,109
Municipal	0	0	1,713,262,646	5,255	8,279,329,738	25,397	176,601,466	542
Recreation	0	0	0	0	233,560,221	716	0	0
Stock water	0	0	271,482,760	833	0	0	0	0
Water power	0	0	0	0	0	0	0	0
Total	376,553,415	1,155	40,599,056,682	124,536	10,687,254,579	32,782	3,393,004,999	10,408
Total water use	40,975,610,097 gallons				14,080,259,578 gallons			
	125,691 acre-feet				43,190 acre-feet			

Special-Purpose Networks and Programs

National Stream-Quality Accounting Network

The U.S. Geological Survey operated seven stations in Kansas as part of the National Stream Quality Accounting Network (NASQAN) (Ficke and Hawkinson, 1977) during the 1983 fiscal year, as shown in the illustration on the facing page. The National program consisted of more than 500 stations at which samples for chemical analyses were collected at fixed frequencies to determine the water quality of the Nation's streams. Design of the network specifies measurements of a broad range of water-quality characteristics that were

selected to meet many of the information needs on a National or regional scale. The primary objectives are to account for the quality and quantity of water moving within and from the United States, to depict areal variability in stream quality, to detect changes in stream quality, and to provide data for future assessments of changes in stream quality. Data of this type are needed to determine long-term trends and the physical, chemical, and biological characteristics of the Nation's surface waters.

Hydrologic Bench-Mark Network

Beginning in 1978, the Hydrologic Bench-Mark Network was established as a nationwide network of stations to collect data in selected areas where water resources were known to be minimally affected by man and where it is anticipated that land use and land cover will remain unchanged (Cobb and Biesecker, 1971). Data obtained from this network are used to document changes, largely unaffected by man, in hydrologic characteristics with time. The goal is to provide a better understanding of the hydrologic structure of natural basins and to pro-

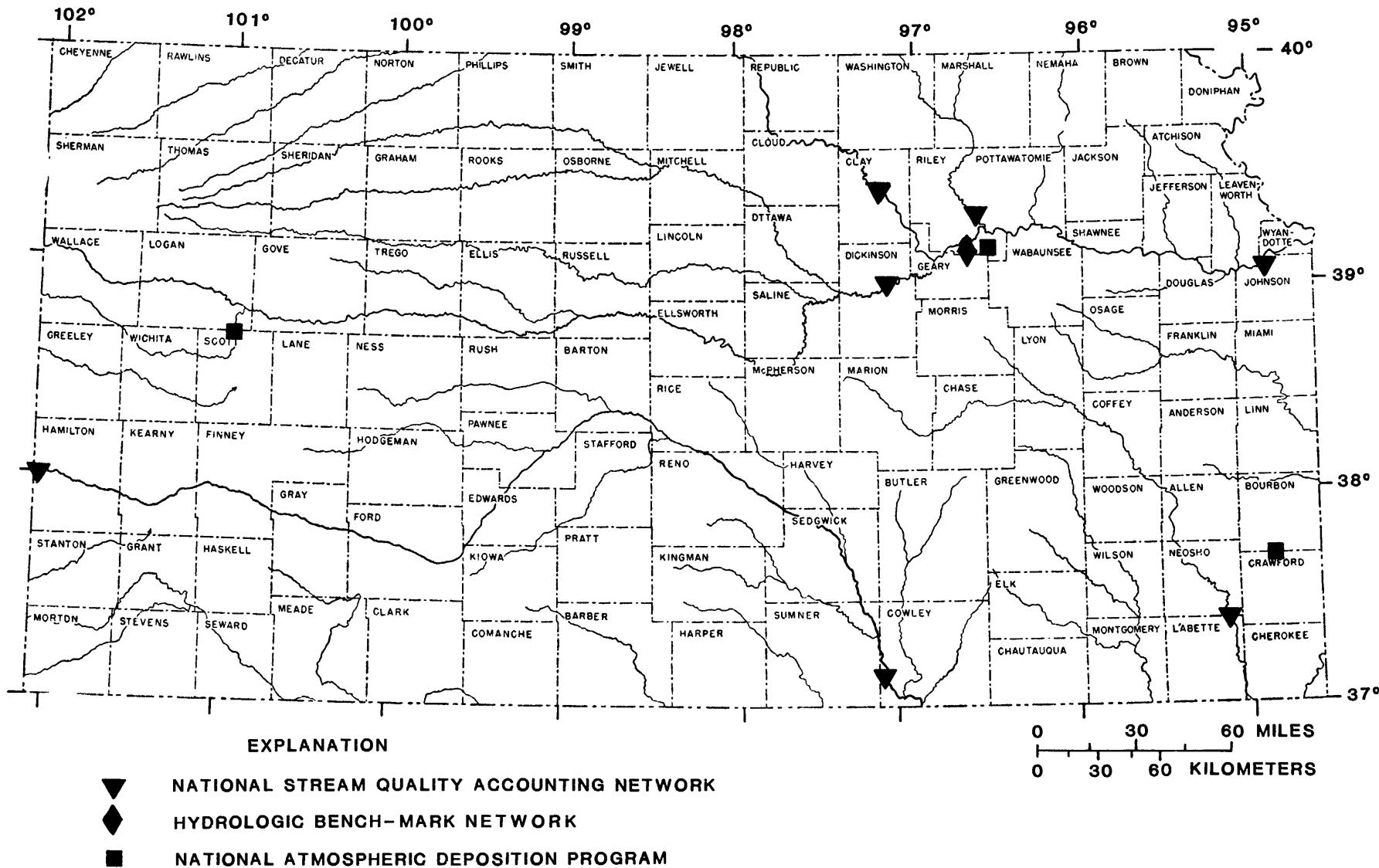
vide a comparative base for studying the effects of man on the hydrologic environment. The one hydrologic bench-mark station in Kansas, Kings Creek near Manhattan (06879650), is located in the Konza Prairie Research Natural Area in Riley County (facing page). Hydrologic variables measured at this station, in addition to continuous streamflow and rainfall, include water quality, pH, specific conductance, and stream temperatures. Data also are obtained for radioactivity levels, pesticide and sediment concentrations, nutrients, and biota.

National Atmospheric Deposition Program

This program includes a planned National network of 75 to 100 stations established by the National Atmospheric Deposition Program and the National Trends Network. The three stations in Kansas are Konza Prairie Research Natural Area in Riley County, Scott Lake in Scott County, and Farlington Fish Hatchery in Crawford County (see facing page). Continuous wetfall, dryfall, and recorded rainfall data are collected to determine spatial and temporal trends in the supply of bene-

ficial nutrient elements and injurious substances in both precipitation and dry particulate matter. Chemical analyses for wetfall and dryfall include concentrations of selected pesticides, radioactive materials, trace metals, and asbestos fibers. Data collection is a combined effort of the U.S. Geological Survey, Kansas State University at Manhattan, the Kansas Fish and Game Commission, and the Kansas Park and Resources Authority.

**DISTRIBUTION OF STATIONS IN SPECIAL- PURPOSE NETWORKS AND PROGRAM,
FISCAL YEAR 1983**



"Real-Time" Data

Because of the many operations required to collect, analyze, and process hydrologic data, it generally takes 4 to 6 weeks for current information to be made available to the users. However, reliable hydrologic data often are required on a more timely basis for such purposes as flood warnings, irrigation-water allocations, water-supply forecasting, reservoir management, and water-quality monitoring. The need for "real-time" data in Kansas is provided by three types of systems--satellite telemetry, telephone, and radio telemetry, as shown on facing page.

Most of the "real-time" data for providing stream-gage heights in Kansas will be obtained

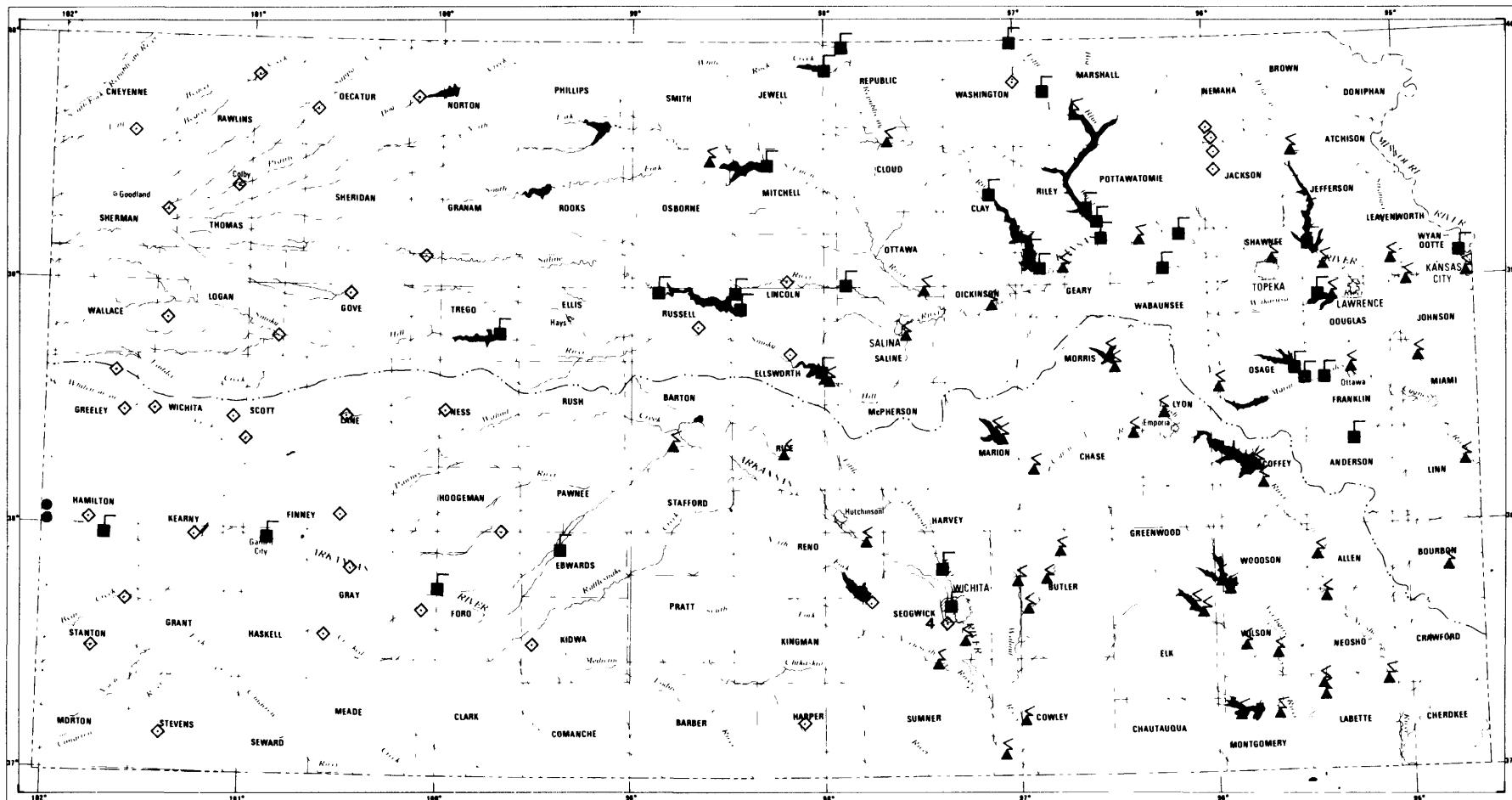
through a network of 54 (as of October 30, 1984) satellite-relay stations established by the U.S. Army Corps of Engineers. Satellite telemetry has proven to be a reliable and, for many applications, a cost-effective tool for the acquisition of remote or "real-time" hydrologic data. These data will be available through either the computer facilities of the U.S. Geological Survey or the U.S. Army Corps of Engineers.

There are currently (1984) 32 streamflow stations in Kansas that are equipped for data telemetry using landlines (telephone) and 2 stations using high-frequency radios.

Rainfall

The recording rainfall stations shown in the illustration on the facing page are operated for special studies such as rainfall-runoff modeling. The rainfall is measured by increments of 0.01 inch and recorded at 15-minute intervals. The data are collected by the U.S. Geological Survey and stored in computer files for future use. There

also are 27 recording rainfall stations in western Kansas (not shown), which were established to provide additional areal coverage for recording rainfall intensities and quantities; these stations are operated on a seasonal basis.



EXPLANATION

▲ SATELLITE TELEMETRY -- As of
October 30, 1984

■ TELEPHONE -- currently available

● RADIO TELEMETRY -- currently available

4 ◊ RECORDING RAINFALL STATION -- Number indicates
number of stations at that location

0 10 20 30 MILES
0 10 20 30 KILOMETERS

**DISTRIBUTION OF STATIONS WHERE "REAL-TIME" DATA
ARE AVAILABLE AND RECORDING RAINFALL STATIONS**

ADDITIONAL DATA-COLLECTION ACTIVITIES

In addition to information collected systematically as part of the U.S. Geological Survey's water-data program, there are many areas or sites

for which hydrologic data are available due to present and past special water-resources investigations or significant hydrologic events.

Water-Resources Investigations

In concert with its mission to collect and disseminate hydrologic information, the U.S. Geological Survey also conducts analytical and interpretative water-resource appraisals and supportive basic and problem-oriented water-related research. This element of the Survey's program in Kansas is described in detail by Kenny and Combs (1983). Most of the investigations described were funded as part of the cooperative program. Some of the most recent investigations (see illustration on

facing page) with data-collection activities include:

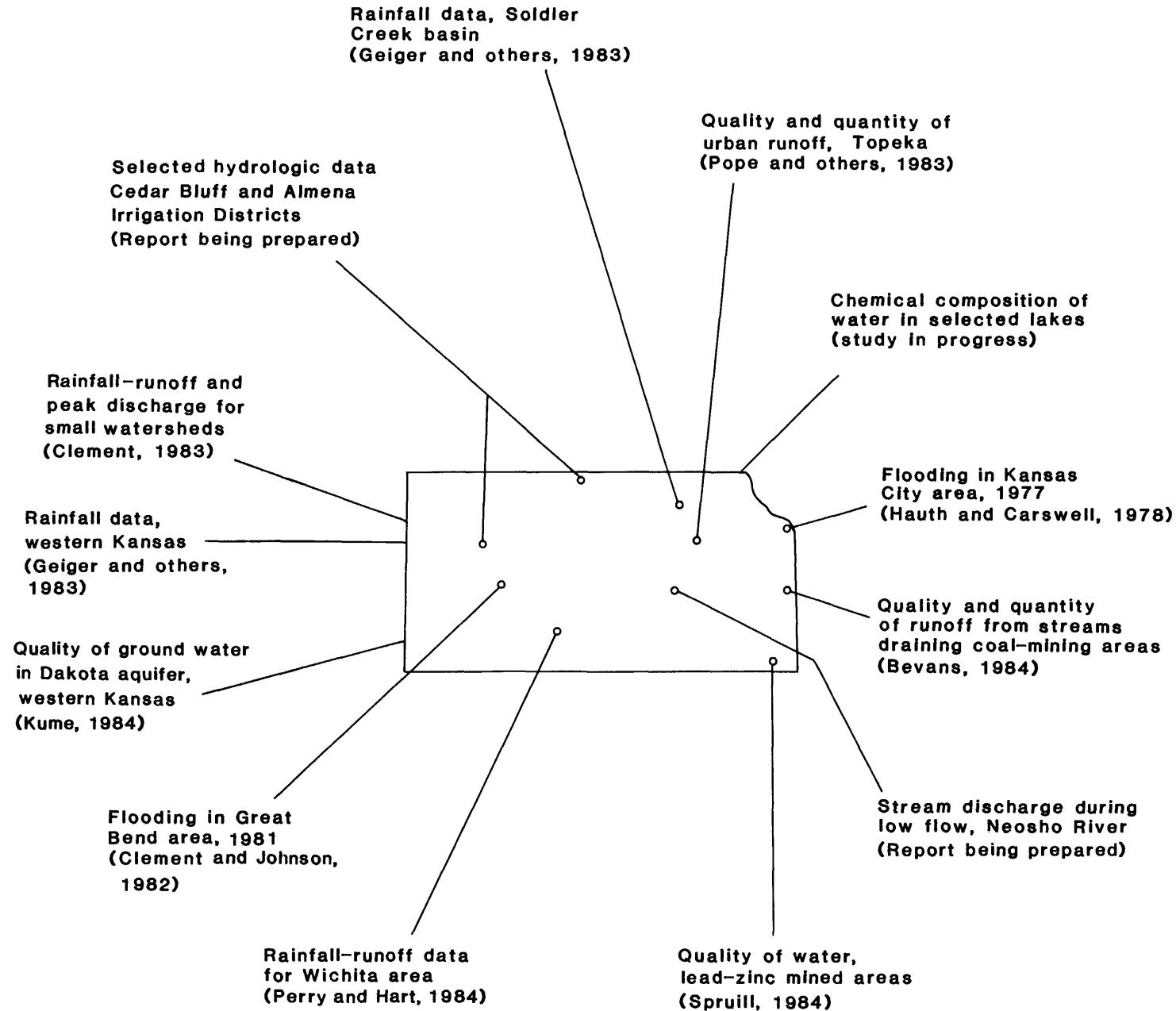
- * Rainfall data in western Kansas and the Soldier Creek basin near Topeka
- * Quality of ground water from wells completed in the Dakota aquifer of western Kansas
- * Chemical composition of water in selected lakes in eastern Kansas.

Significant Hydrologic Events

The extremes of drought and flooding provide an opportunity to acquire information particularly important to planners, designers, and managers involved with water-related projects and programs. Consequently, the U.S. Geological Survey has a keen interest in obtaining data during such conditions, and special Federal funding is provided when justified. Flooding in the Kansas City area during 1977 and in the Great Bend area during 1981 has stimulated immediate response to collect data, such as highwater-mark elevations, hydraulic characteristics of channels, rainfall totals, and flood damages, in order to assess the hydrologic signif-

icance of these floods. During droughts, instantaneous discharge measurements are made at numerous miscellaneous sites in the affected area in order to document the magnitude and extent of these low flows. In order to inform the public of current hydrologic conditions, a monthly U.S. Geological Survey report, "National Water Conditions," is based in part on streamflow at three index surface-water gaging stations and four wells in Kansas and is sent to thousands of water users and news media nationwide.

LOCATION OF WATER-RESOURCES INVESTIGATIONS OR SIGNIFICANT HYDROLOGIC EVENTS FOR WHICH HYDROLOGIC DATA ARE COLLECTED



QUALITY-ASSURANCE PLANS

The objectives of quality assurance for the water-data program are to: (1) Provide a formal standardization, documentation, and review of the policies, practices, and activities that are used for assuring technical quality and reliability, and (2) maintain or improve the quality. The Kansas District of the U.S. Geological Survey has prepared quality-assurance plans that detail all aspects of quality assurance in the water-data program and serve at all levels of operation as a guide to personnel involved in related activities (see illustration on facing page). These plans are founded on the following basic principles:

1. Data are collected, analyzed, and disseminated in an unbiased, scientifically objective manner.
2. District water-data programs and interpretative studies will be planned efficiently and effectively to provide information needed to address high-priority local, State, and National water problems.
3. Onsite, laboratory, and office activities will be performed in accordance with specified Survey procedures and policies.
4. Activities will be performed by adequately qualified, trained, experienced, and properly supervised personnel.

5. All activities and studies will receive appropriate and timely review for completeness, reliability, credibility, and conformance to standards.
6. Remedial actions will be taken to correct any observed or suspected program deficiency.

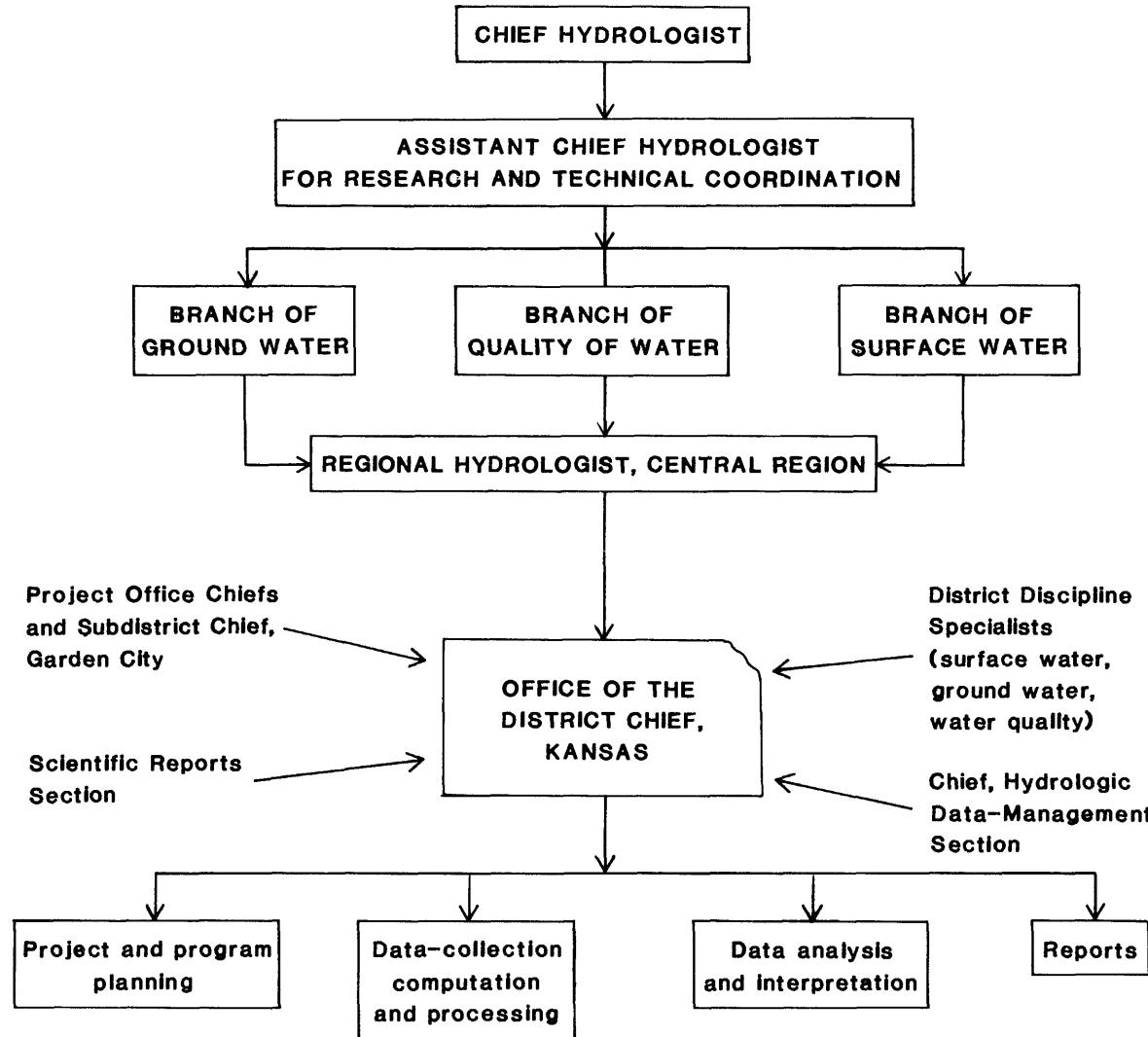
The high degree of credibility that the water-data program has achieved over the years is a result of the Survey's conscientious effort to adhere to these principles on a continuing basis.

From the National perspective, the Survey is working with other Federal agencies and with the non-Federal community to publish a "National Handbook of Recommended Methods for Water Data Acquisition." This handbook will result in better data compatibility and uniformity whenever possible, as well as document standards of data collection and quality control. The handbook will include recommended method for collecting a variety of water data, including surface and ground water, chemical and biological water quality, sediment, soil moisture, drainage-basin characteristics, evaporation, and transpiration, snow and ice, and hydrometeorology (Johnson and others, 1978).

AVAILABILITY OF DATA

The Survey disseminates water data through annual data reports, maps, computerized services,

and other forms of public releases.



**LEVELS OF RESPONSIBILITY FOR QUALITY ASSURANCE
IN THE WATER-DATA PROGRAM IN KANSAS**

Publications

The U.S. Geological Survey, in cooperation with other agencies, publishes the hydrologic data systematically collected in Kansas in an annual water-data report, the most recent of which is "Water Resources Data, Kansas, Water Year 1982" (Geiger and others, 1983). This report includes streamflow records collected at 145 complete-record gaging stations, water-surface elevations collected at 24 lakes and reservoirs, streamflow discharges collected at 98 partial-record stations, analyses of water-quality samples collected at 58 gaging stations, miscellaneous

water temperatures collected at 205 gaging stations and at other sites, ground-water levels measured in 475 wells, and ground-water-quality records collected at 96 wells.

As previously mentioned, a significant quantity of water data is collected as part of special water-resources investigations or significant hydrologic events. It is the policy of the Survey that these data be published in the annual water-data report or in an interpretative report of the investigation, or as a separate data report.

Computerized Storage and Retrieval

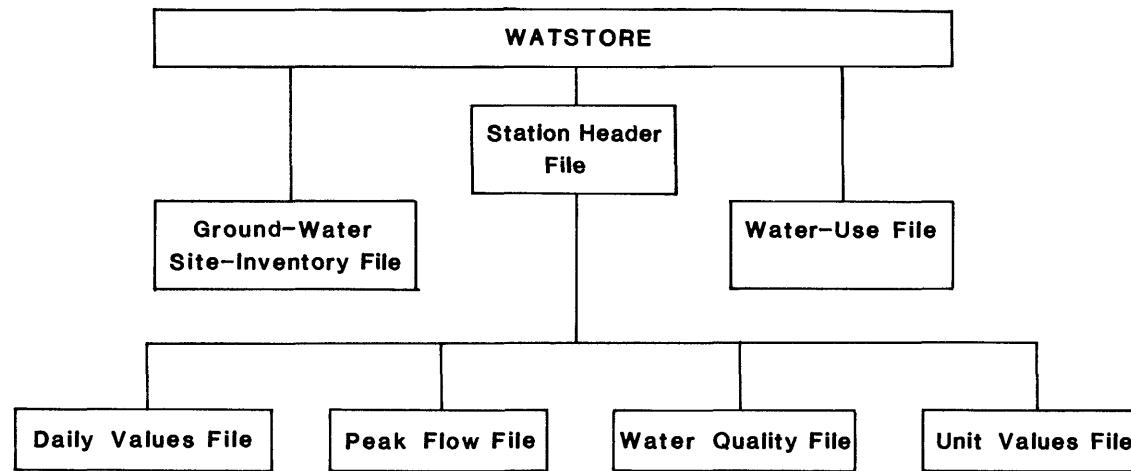
In addition to publication, information collected from hydrologic-data stations is stored in the Survey's National Water Data Storage and Retrieval System (WATSTORE) (Hutchison, 1975), as shown in the accompanying figure, and is available on request. For Kansas, the computerized data files include a Ground-Water Site-Inventory File that contains inventory information for more than 50,000 wells; a Daily Values File that contains about 10,600 daily observations of stream-

flow, water-quality, sediment-discharge, and ground-water levels; a Peak Flow File that contains about 360 observations of instantaneous peak-discharge and river-stage data; and a Water Quality File that contains more than 58,000 analyses of chemical constituents and physical properties of both surface and ground water. These data can be retrieved in machine-readable form or as computer-printed tables and graphs, or as results from statistical analyses.

Distributed Information System

To increase the timeliness of providing information to users of water data, the U.S. Geological Survey is completing installation of a National network of sophisticated minicomputers. The resulting Distributed Information System (DIS) will include minicomputers located in all the District and Research-Project offices. As the system is completed, hydrologic data will be processed, analyzed, and stored at these computers rather than at the centralized computer located in Reston, Virginia.

A minicomputer in Lawrence, with a connection to Garden City, comprises the DIS in Kansas as part of the National network. With the development of satellite data-collection systems, microprocessor-operated instrumentation for gaging stations, and remote sensing, this system will be invaluable to those requiring specific hydrologic data to make sound water-management and water-planning decisions.



NATIONAL WATER-DATA STORAGE AND RETRIEVAL SYSTEM

NETWORK ANALYSIS AND DESIGN

Hydrologic network analysis is a process for determining the locations at which data are to be collected, the types of data that are to be collected at each location, the frequency of collection of each type of data at each location, and the duration of each data-collection activity. The analysis also is an assessment of the present networks and an examination of the accuracy and cost effectiveness (relation between cost and accuracy) of the data base.

An evaluation of the cost effectiveness of the fiscal-year 1983 stream-gaging program in Kansas has been completed (Medina and Geiger, 1984). Data uses were identified for the 140 complete-record, streamflow-gaging stations operated in Kansas during fiscal-year 1983 with a budget of \$793,780 (see table on facing page). Evaluation of the needs and uses of data from the stream-gaging program confirmed that the 140 gaging stations were needed to meet data requirements during fiscal year 1983.

Data Uses

As a result of a survey of the major data users in Kansas (Medina and Geiger, 1984), the uses of the data from the 140 gaging stations during fiscal year 1983 were identified in the categories as shown in the table on the previous page. The dominant uses of data are for water-

quality monitoring and hydrologic forecasting. Multiple uses for the data obtained from the gaging stations also are presented in the table; more than 71 percent of the gaging stations had four or more uses for the data during fiscal year 1983.

Operational Concerns

The operation or visitation of the gaging stations is based on the premise that the station visit is timely enough to insure the continued operation of the equipment that records the data, the visit is frequent enough to insure an adequate sampling of current hydrologic conditions, and as specified by or required by needs for measure-

ments. Because the cost of data-collection activities is the largest item of expense in the water-data-program budget, the cost effectiveness of main- or improving the degree of accuracy of data obtained from the gaging stations is part of the planning and scheduling of visitations within the constraints of the current budget.

**SUMMARY OF DATA USES FOR COMPLETE-RECORD,
STREAMFLOW-GAGING STATIONS, 1983**

[Modified from Medina and Geiger, 1984]

Regional hydrology	Hydrologic systems	Legal obligations	Planning, design	Project operation	Hydrologic forecasting	Water quality monitoring
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Number of stations that are used in each category

71	88	5	2	92	114	115
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Percentage of stations that are used in each category

50.7	62.9	3.6	1.4	65.7	81.4	82.1
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Number of stations that have multiple uses

Number of uses	1	2	3	4	5	6	7	8	9
Number of stations	3	15	22	33	20	20	17	6	4
Percentage of stations in each category	2.1	10.7	15.7	23.6	14.3	14.3	12.1	4.3	2.9

FUTURE NEEDS FOR WATER DATA

Hydrologic data and information will continue to be required in the future. The increasing demands for our limited water resources (see table on facing page), placed in the context of man's continuing effects on the environment, impart a uniqueness to current data when compared to historical data. "As water is increasingly affected by land use, water management, and water use and control, current statistics will have limited use as predictors of the future" (Langbein, 1979).

Wise management of water resources for the benefit of present and future generations depends on knowledge of the entire hydrologic system. It is a misconception to view a data-collection network as providing hydrologic information only at those sites in the network. Rather the network should fulfill the need for regional as

well as site-specific data, yet also be responsive to legal and management considerations that dictate more accurate information. Periodic evaluation of the data-collection network assures that these and other needs are being achieved, and it has long been the policy of the U.S. Geological Survey to promote and support such evaluations in Kansas. One only has to think back 10 years to get a feeling for the value of continued collection of hydrologic data. Current water-resource concerns, such as determining minimum desirable streamflows, diminishing base flow of streams in western Kansas, changing quality of ground and surface waters due to urban runoff, industrial and agricultural practices, and waste disposal, focus attention on the value of the water-data program both in the past and in the future of Kansas.

WATER USE IN 1965 AND PROJECTED WATER REQUIREMENTS, 1980-2020

[From Kansas Water Resources Board, 1972]

Type of water use	Water requirements (acre-feet per year)			
	1965	1980	2000	2020
Agriculture				
Irrigation	2,263,004	6,461,800	10,707,700	13,557,800
Livestock	91,924	138,826	221,078	335,643
Mining	67,599	87,692	162,324	322,800
Manufacturing (total)	(151,538)	(225,239)	(433,963)	(843,939)
Food and kindred products	28,775	39,761	63,785	98,486
Printing, publishing, and paper products	4,886	9,599	19,281	36,702
Chemical and allied products	58,072	73,554	168,481	368,077
Petroleum, rubber, and related products	30,911	50,905	69,136	105,325
Machinery and fabricated metals	5,720	8,176	18,839	41,634
Transportation equipment	7,083	12,121	27,552	56,657
Other	16,091	31,123	66,889	137,058
Utilities	461,661	323,333	484,808	266,080
Population				
Urban	216,686	323,445	406,023	596,482
Rural	53,968	26,195	25,835	23,901
Total	3,306,380	7,586,530	12,441,731	15,946,645

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