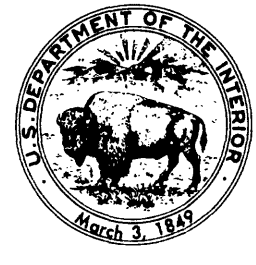
WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN KANSAS--FISCAL YEARS 1985 AND 1986

Compiled by L. J. Combs

U.S. GEOLOGICAL SURVEY

Open-File Report 87-211



Lawrence, Kansas

1987

DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

UNITED STATES GEOLOGICAL SURVEY

Dallas L. Peck, Director

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WATER-RESOURCES ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY IN KANSAS--FISCAL YEARS 1985 AND 1986

Compiled by

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ABSTRACT

The principal mission of the U.S. Geological Survey, Water Resources Division, in Kansas is to investigate the occurrence, quantity, quality, distribution, and movement of surface and ground water throughout the State. Primary activities include the systematic collection, analysis, and interpretation of hydrologic data, evaluation of water demands, and water-resources research. Hydrologic investigations are conducted through four types of projects: (1) data-collection programs, (2) statewide or regional investigations, (3) local or areal investigations, and (4) research. These projects are funded through cooperative agreements with State and local agencies, transfer of funds from other Federal agencies, and direct Federal funds.

Forty-three water-related projects were ongoing during fiscal years 1985 and 1986 in Kansas. This report describes for each project the problem that initiated the study, the objectives of the project, the approach designed to achieve the objectives, and significant milestones or publications that resulted during fiscal years 1985 and 1986. Information on more than 2,150 data-collection stations in Kansas is presented in maps and tables. A list of 47 project reports published or released by the U.S. Geological Survey, its cooperators, or technical and scientific organizations during 1985 and 1986 is provided.

INTRODUCTION

The Organic Act of March 3, 1879, established the U.S. Geological Survey as a separate Bureau of the Department of the Interior. The Survey's principal mission became (1) the classification and survey of public lands, (2) the examination of the geologic structure and the mineral resources of the national domain, and (3) the determination of the water resources of the United States. Seven years later, in 1886, the first water-resources investigation by the U.S. Geological Survey in Kansas was completed by A. C. Peale. A cooperative program with the Kansas State Board of Irrigation and Surveys instituted the first streamflow-gaging stations in western Kansas during 1895. The gaging program was extended to eastern Kansas in 1899.

From these early beginnings, the U.S. Geological Survey has expanded its work in Kansas to meet the growing demand for scientific data by Federal, State, and local agencies for use in the management of one of the State's most precious resources--water. The Kansas District, with headquarters in Lawrence and a subdistrict office in Garden City (fig. 1), investigates the occurrence, quantity, quality, distribution, and movement of surface and ground water. Its activities include the systematic collection, analysis, and interpretation of data; the investigation of water demand for public supply, industrial, domestic, and agricultural purposes; and the research and development of new techniques to improve the scientific basis of data collection and investigative principles.

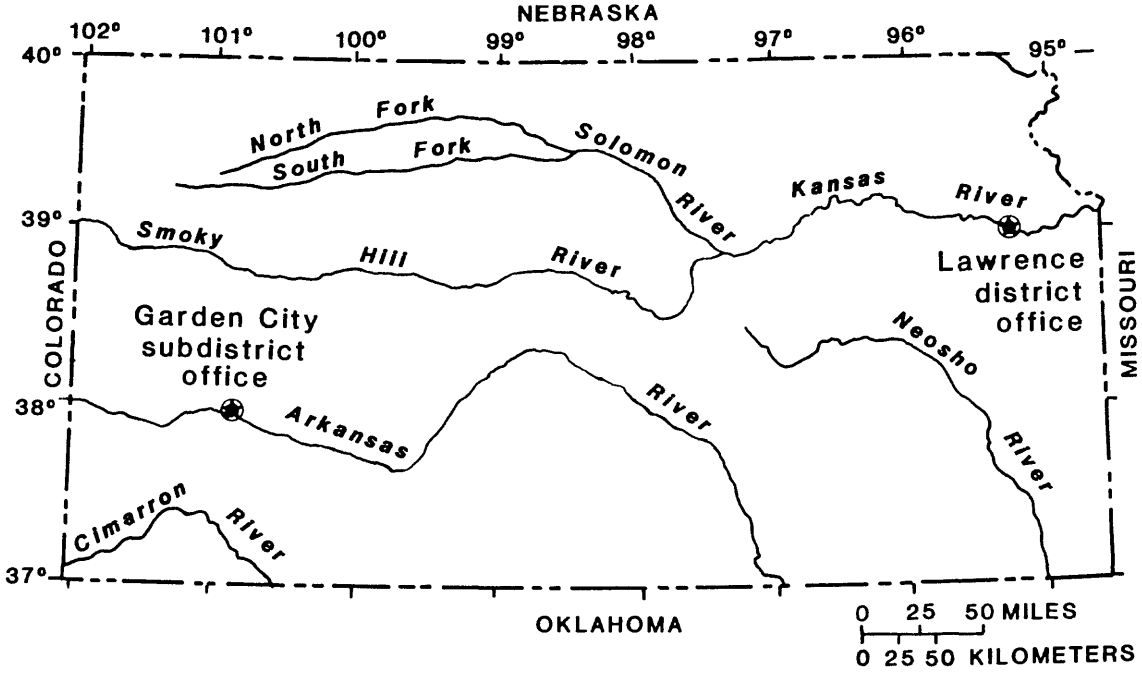


Figure 1.--Location of offices of the U.S. Geological Survey in Kansas.

Hydrologic-data collection and analyses and investigative studies are conducted at project offices in Lawrence and Garden City. Hydrologic data management, the District sediment laboratory, computer applications, and the scientific reports section are centered at the District office in Lawrence. The fiscal year (FY) for Federal government operations extends from October 1 of each year to September 30 of the following year. In publications of the U.S. Geological Survey, this time period is also known as a water year.

PROGRAM FUNDING AND COOPERATION

Moneys for program operation of the U.S. Geological Survey in Kansas come from joint-funding agreements with State and local agencies, transfer of funds from other Federal agencies, and direct Federal allotments to the U.S. Geological Survey. Distribution of funding for program operation in FY85-86 is illustrated in figure 2. Those agencies cooperating with the U.S. Geological Survey in Kansas during the 1985 and 1986 fiscal years were:

State and local agencies

Arkansas River Compact Administration
City of Hays
City of Wichita
Kansas Department of Health and Environment
Kansas Department of Transportation
Kansas Geological Survey
Kansas State Board of Agriculture, Division of Water Resources
Kansas Water Office
Pawnee Watershed District No. 81
Sedgwick County
Southwest Kansas Groundwater Management District No. 3
Western Kansas Groundwater Management District No. 1

Federal agencies

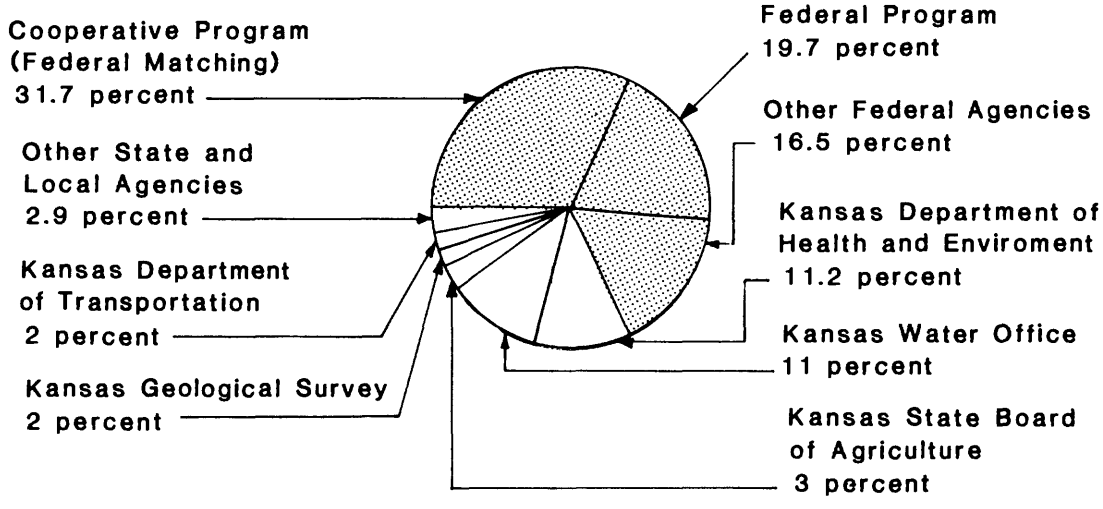
U.S. Bureau of Reclamation
U.S. Department of Agriculture, Soil Conservation Service
U.S. Department of Army, Corps of Engineers
U.S. Environmental Protection Agency

PUBLICATIONS

Water-resources data and the results of hydrologic investigations in Kansas are published or released either by the U.S. Geological Survey, by cooperating agencies, or by journals of technical and scientific organizations. Requests for such information and for publications resulting from past or present investigations of the U.S. Geological Survey in Kansas

U. S. GEOLOGICAL SURVEY
SUMMARY OF KANSAS DISTRICT PROGRAM

Federal Fiscal Year 1985



Federal Fiscal Year 1986

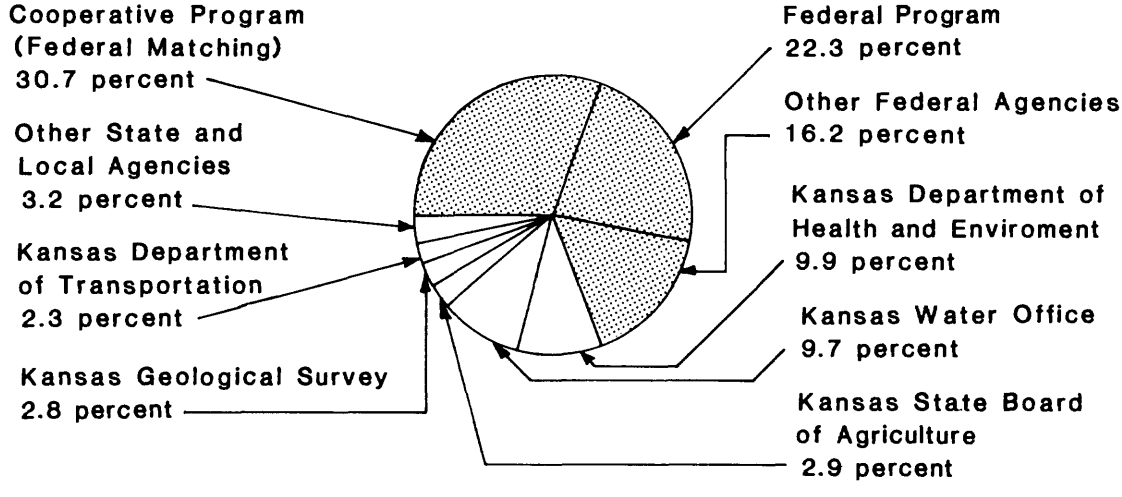


Figure 2.--Distribution of funding for the water-resources program of the U.S. Geological Survey in Kansas, fiscal years 1985 and 1986.

should be addressed to one of the following:

District Chief
U.S. Geological Survey
Water Resources Division
1950 Constant Avenue - Campus West
Lawrence, Kansas 66046
Telephone: 913-864-4321

Subdistrict Chief
U.S. Geological Survey
Water Resources Division
206 Fulton Terrace
Garden City, Kansas 67846
Telephone: 316-275-4123

U.S. Geological Survey
Books and Open-File Reports
Box 25425
Denver Federal Center
Denver, Colorado 80225
Telephone: 303-236-7476

During 1985-86, personnel of the U.S. Geological Survey in Kansas authored or coauthored 47 water-related reports. This total included 40 interpretive reports and 7 data reports. A complete listing of these reports begins on page 62.

The U.S. Geological Survey has also conducted an extensive mapping program in Kansas from its regional office in Rolla, Missouri. Standard topographic quadrangle maps published in the 7 1/2- and 15-minute series provide coverage for the entire State. County-wide metric topographic maps (1:50,000 and 1:100,000 scale) and 7 1/2-minute slope maps are available only for selected areas. To obtain an index or to purchase these maps, contact:

Kansas Geological Survey
Publications Sales, 4th Floor
1930 Constant Avenue - Campus West
Lawrence, Kansas 66046

For additional information on the U.S. Geological Survey's mapping program in Kansas, write to:

Mid-Continent National Cartographic Information Center
U.S. Geological Survey
1400 Independence Road
Rolla, Missouri 65401

Studies in Kansas to investigate the frequency and extent of flooding have resulted in delineation of the 100-year flood boundary on selected topographic quadrangle maps (fig. 3). These maps are available from the Kansas District office in Lawrence.

DATA-COLLECTION PROGRAMS

Throughout its long history of service, one mission of the U.S. Geological Survey, Water Resources Division, has been the comprehensive and systematic collection of hydrologic data and the timely release of

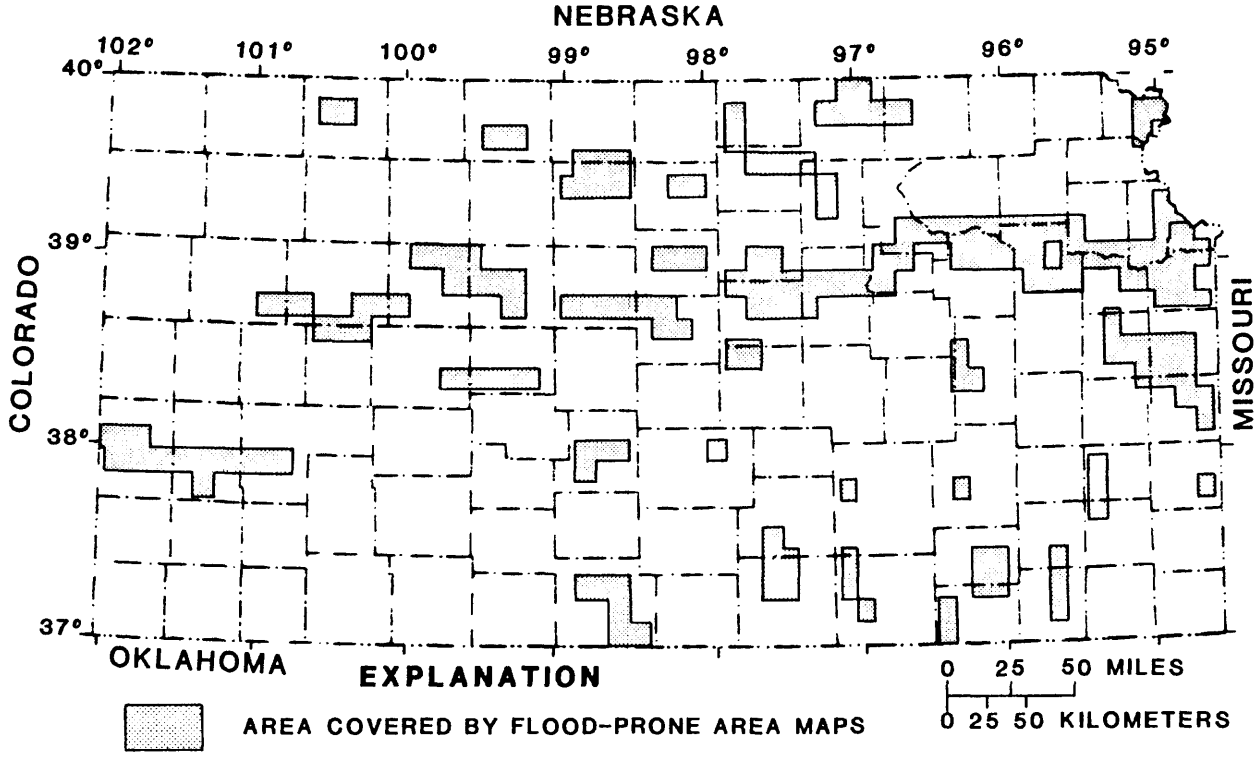


Figure 3.--Availability of flood-prone area maps.

such data for public use. To help provide this service, a network of hydrologic-data stations is maintained throughout Kansas to obtain records of (1) stage, discharge, chemical quality, and sediment yield of streams; (2) stage, content, and chemical quality of lakes and reservoirs; (3) precipitation; and (4) water levels and chemical quality of ground water.

Systematically and routinely, the U.S. Geological Survey gathers data from more than 2,150 hydrologic stations in Kansas. The backbone of the system is a network of 148 automated streamflow-gaging stations. Measurements taken at most automated data-collection stations are punched on paper tapes that are retrieved during visits to each site at intervals of 4 weeks or more. Although the measurements are recorded at the hydrologic station in a timely manner, the manual retrieval of data generally means a timelag of 4 weeks or more in the dissemination of data.

A major objective of the U.S. Geological Survey in Kansas is to decrease the timelag between the collection and distribution of hydrologic data. Of the 148 automated streamflow-gaging stations in Kansas, more than 20 are linked via telephone lines for immediate retrieval of current stream stages. Even more detailed, real-time data are available from 80 hydrologic stations via satellite transmission to computer-receiving stations. Those hydrologic stations equipped with satellite-transmission facilities are shown in figure 4.

Hydrologic data collected in Kansas as part of the water-resources-data network are published annually in a comprehensive report entitled "Water Resources Data for Kansas, Water Year 19--". Each water-data report carries an identification number consisting of the two-letter

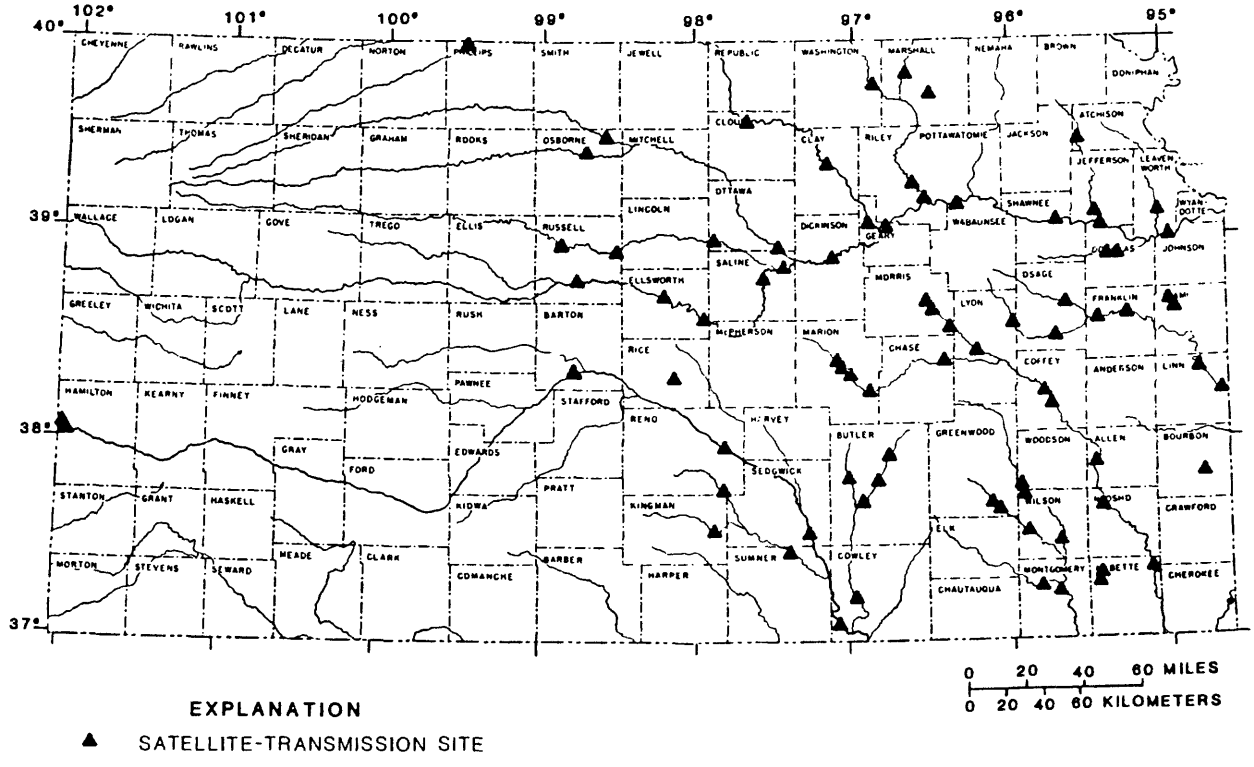
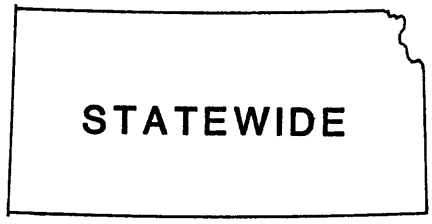


Figure 4.--Location of satellite-transmission sites for 1986 water year.

state abbreviation, the last two digits of the water year, and the volume number. For example, the report for the 1985 water year is identified as "U.S. Geological Survey Water-Data Report KS-85-1." Reports for each water year are released the following calendar year. Water-data reports are available from the U.S. Geological Survey office in Lawrence, Kansas, or from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161.

Hydrologic data also are stored in both current and historical computer files in the U.S. Geological Survey's National Water-Data Storage and Retrieval System (WATSTORE). The data are available for water planning and management in machine-readable form, computer-printed tables or graphs, statistical analyses, and digital plots. Local assistance in the acquisition of computer services is available from the Kansas District office in Lawrence.



PROJECT TITLE: Surface-water data program

PROJECT NUMBER: KS-001

COOPERATING AGENCY: Multi-agency

PROJECT CHIEF: C. O. Geiger

Problem -- Surface-water information is needed for purposes of surveillance, planning, design, hazard warning, operation, and management in such water-related fields as water supply, hydroelectric power, flood control, irrigation, flood-plain management, and water-resources development. To provide this information, an appropriate and comprehensive data base is necessary.

Objectives -- Collect surface-water data sufficient to satisfy needs for current uses, such as (1) assessment of water resources, (2) operation of reservoirs or for industrial supplies, (3) forecasting, (4) pollution control and disposal of wastes, (5) discharge data to accompany water-quality measurements, (6) compact and legal requirements, and (7) research or special studies.

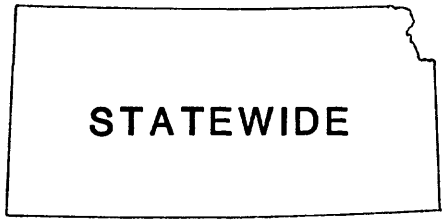
Collect data necessary for analytical studies to define, for any location, the statistical properties of, and trends in, the occurrence of water in streams, lakes, and reservoirs for use in planning and design.

Approach -- A network of gaging stations (figs. 5, 6, 7 and tables 1, 2, and 3 at the end of this report) is maintained to provide surface-water data for management and operation, for determination of long-term trends, and for research and special studies. Data are collected on stage and discharge of streams or canals, on stage, surface area, content of lakes and reservoirs, and on precipitation. The network of stations is reviewed periodically to ensure the collection of meaningful and worthwhile data.

Significant milestones -- During the 1986 water year, 140 complete-record streamflow-gaging stations, 109 partial-record stations, and 27 precipitation stations provided surface-water data throughout the State. Data on stage, surface-area, and contents of 24 lakes and reservoirs also were collected.

Reports -- Geiger, C.O., Lacock, D.L., Putnam, J.E., Riche, B.L., and Merry, C.E., 1986, Water resources data, Kansas, water year 1985: U.S. Geological Survey Water-Data Report, KS-85-1, 478 p.

Geiger, C.O., Lacock, D.L., Shelton, L.R., Penny, M.L., and Merry, C.E., 1985, Water resources data, Kansas, water year 1984: U.S. Geological Survey Water-Data Report, KS-84-1, 500 p.



PROJECT TITLE: Ground-water data program

PROJECT NUMBER: KS-002

COOPERATING AGENCY: Multi-agency

PROJECT CHIEF: C. O. Geiger

Problem -- Long-term water-level records are needed (1) to evaluate the effects of climatic variations on the recharge to and discharge from the ground-water systems in Kansas, (2) to provide a data base from which to measure the effects of development, (3) to assist in the prediction of future supplies, and (4) to provide data for management of the resource.

Objectives -- Collect water-level data sufficient to provide a minimum long-term data base so that the general response of the hydrologic system to natural climatic variations and induced stresses is known and so that potential problems can be defined early enough to allow proper planning and management.

Provide a data base against which the short-term records acquired in areal studies can be analyzed. This analysis must (1) provide an assessment of the ground-water resources, (2) allow predictions of future conditions, (3) detect and define pollution and supply problems, and (4) provide the data base necessary for management of the resource.

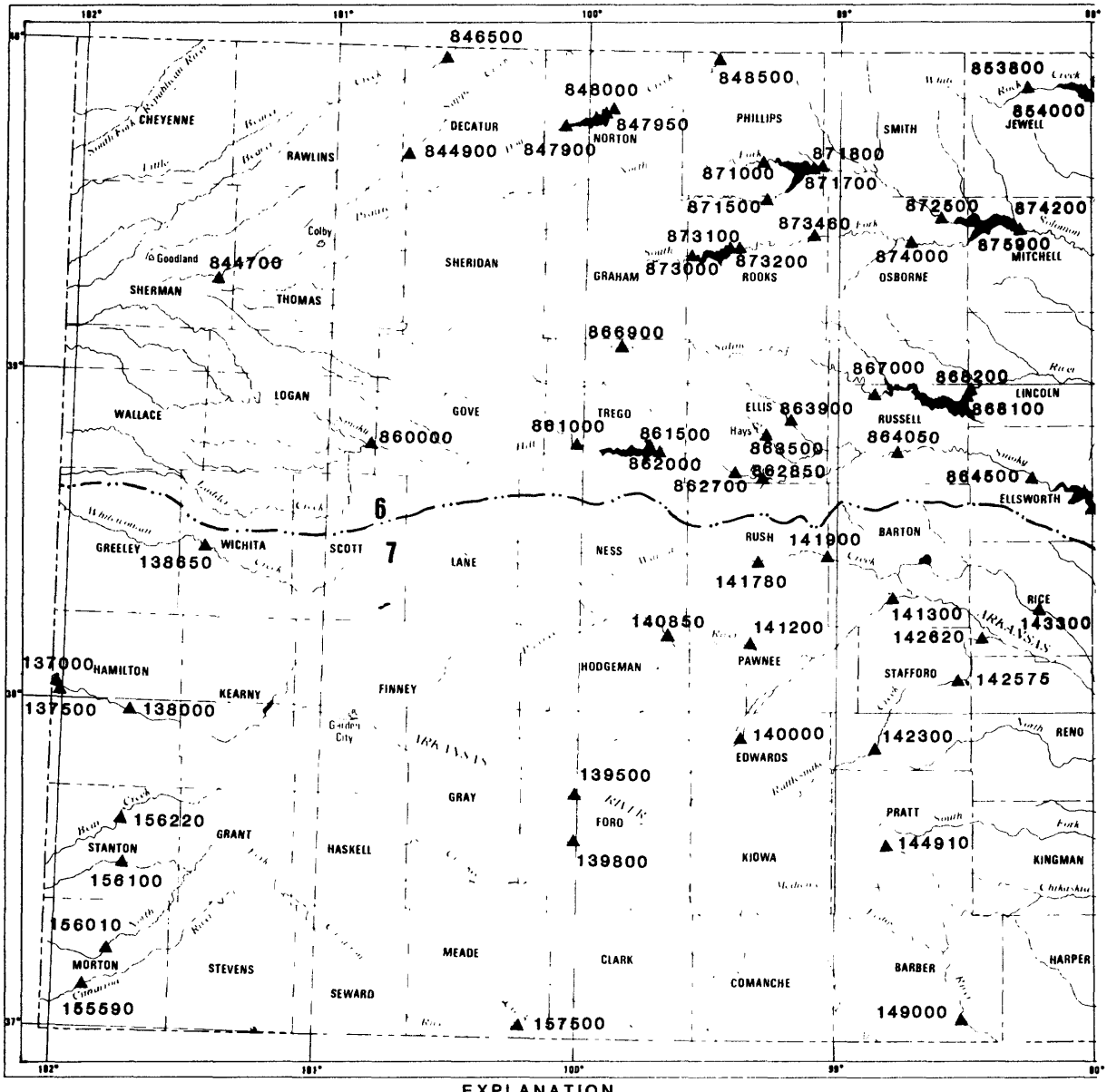
Approach -- A network of observation wells (fig. 8 and table 4 at the end of this report) is measured to provide a data base for monitoring the general response of ground-water systems to natural climatic variations and to stresses of pumpage. A long-term record of water-level measurements, in conjunction with a description of the hydrologic system, provides data for proper planning and management, and for scientific investigations.

Significant milestones -- Ground-water levels were measured in approximately 1,850 observation wells during the 1986 water year.

Reports -- Dague, B.J., 1985, January 1985 water levels, and data related to water-level changes in western and south-central Kansas: U.S. Geological Survey Open-File Report 85-423, 162 p.

____1986, January 1986 water levels, and data related to water-level changes in western and south-central Kansas: U.S. Geological Survey Open-File Report 86-317, 165 p.

Dague, B.J., and Stullken, L.E., 1986, Kansas ground-water observation-well network, 1985: U.S. Geological Survey Open-File Report 86-231, 52 p.



EXPLANATION

172000 ▲ Complete-record stations and number

Note: Numbers shown are abbreviated versions of the complete identification numbers given in table 1

Drainage basins

6 Missouri River basin

7 Arkansas River basin

Basin boundary

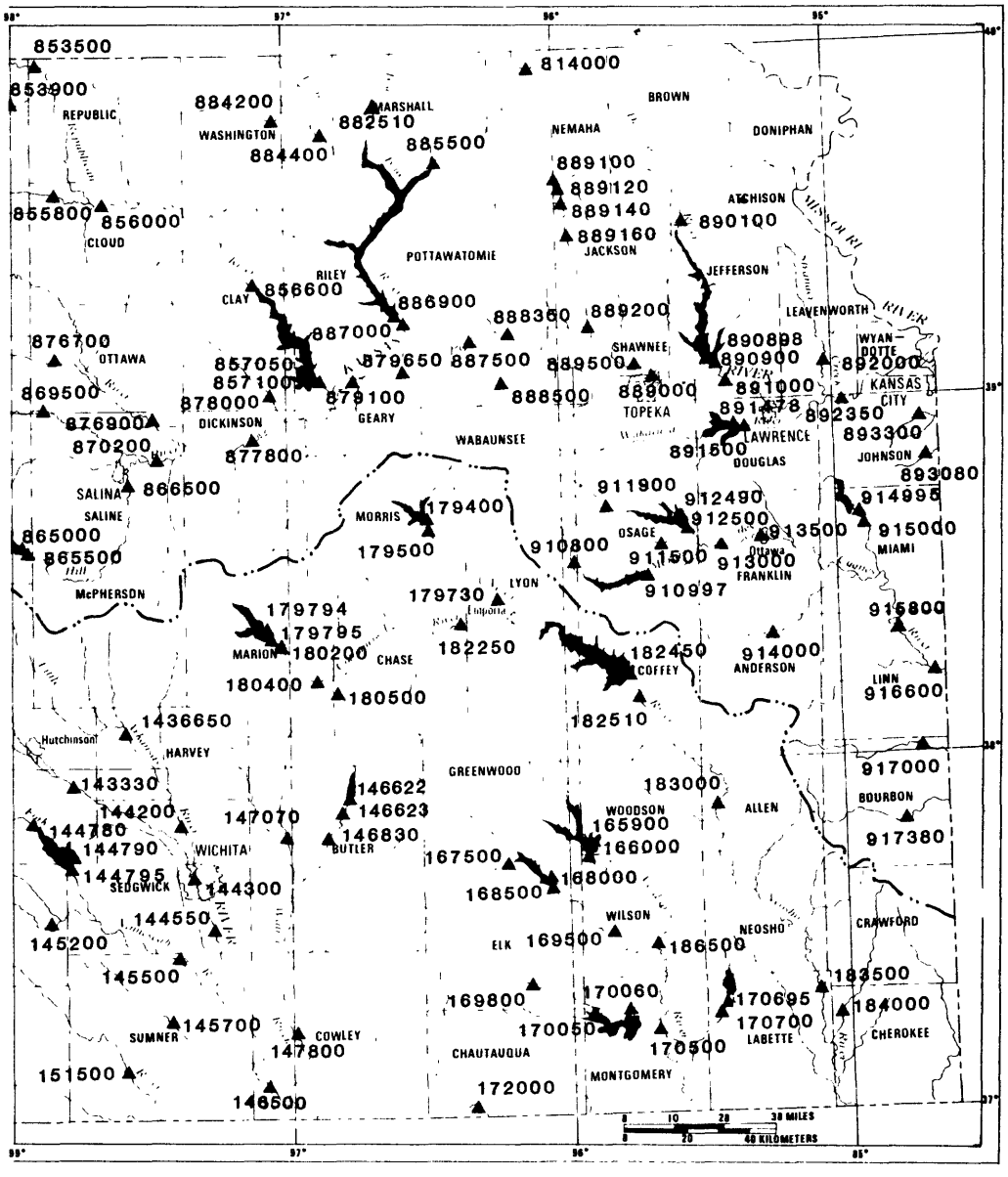
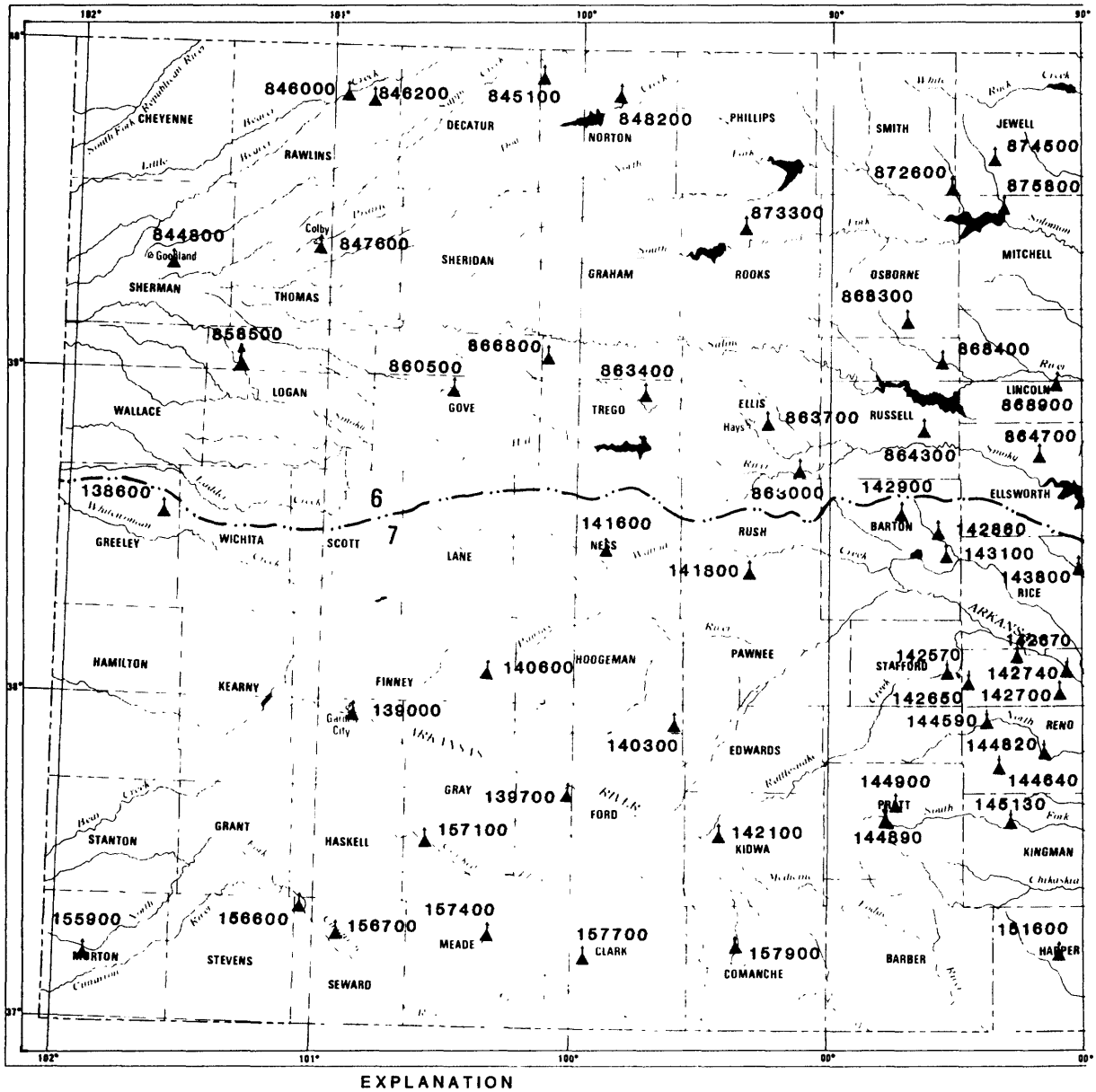


Figure 5.--Location of complete-record streamflow-gaging stations, 1986 water year.



EXPLANATION

813700 ▲ High-flow station and number

145130 ▲ Low-flow station and number

Note: Numbers shown are abbreviated versions of the complete identification numbers given in table 2

Drainage basins

6 Missouri River basin

7 Arkansas River basin

Basin boundary

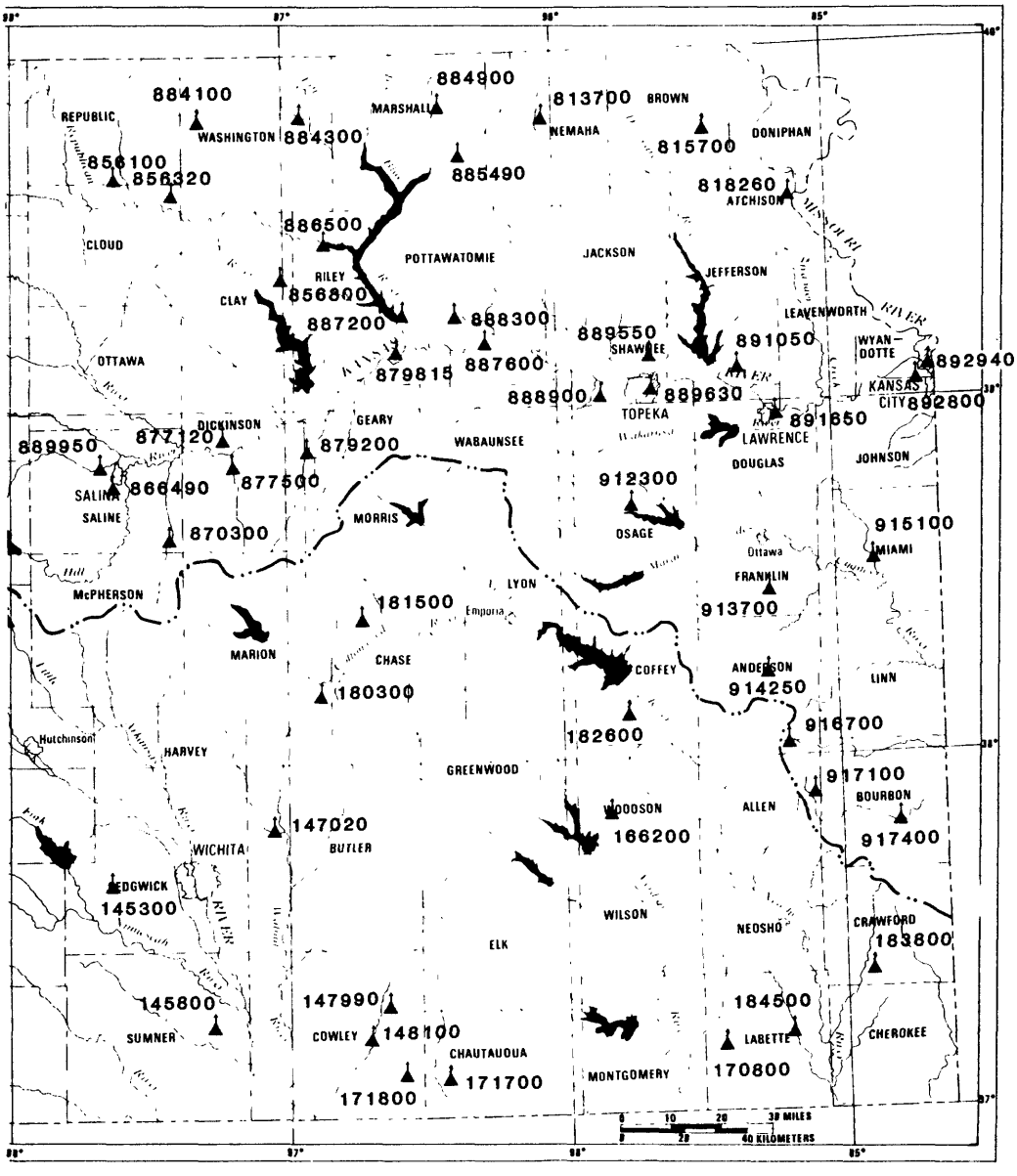


Figure 6.--Location of partial-record streamflow-gaging stations, 1986 water year.

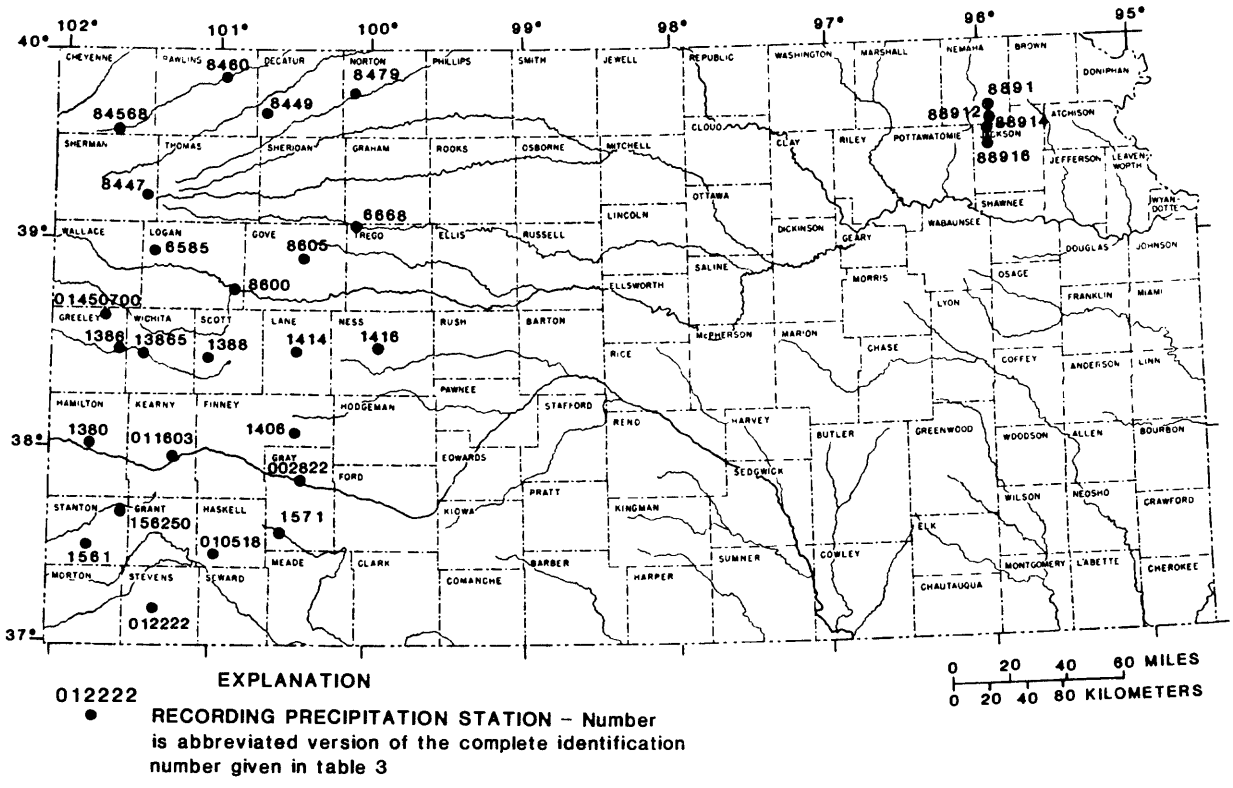


Figure 7.--Location of recording precipitation stations, 1986 water year.

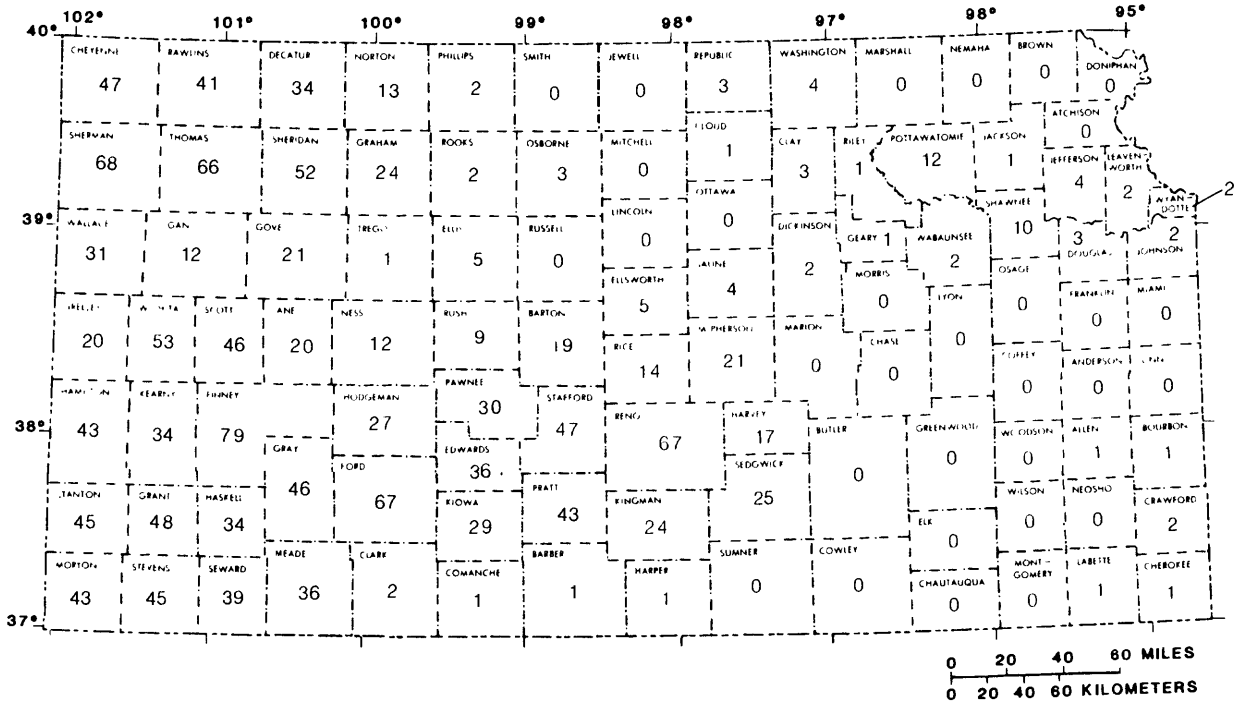
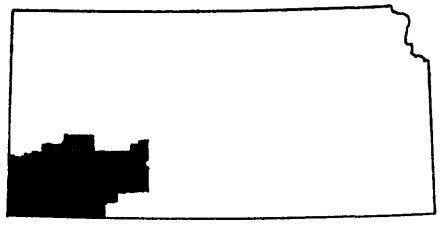


Figure 8.--Number of ground-water-level observation wells per county, 1986 water year.



PROJECT TITLE: Hydrologic-data base for management decisions in Southwest Kansas Groundwater Management District No. 3

PROJECT NUMBER: KS-00202

COOPERATING AGENCY: Southwest Kansas Groundwater Management District No. 3

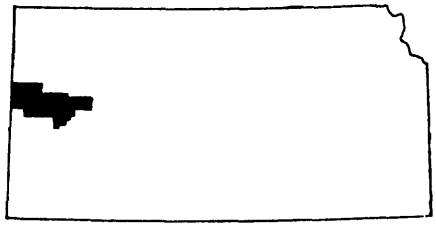
PROJECT CHIEF: L. E. Stullken

Problem -- Management, planning, and administration of water rights depend on the availability of and ready access to hydrologic data. State and local water agencies that must make these decisions have requested establishment of a system to provide current information on (1) large-yield wells in southwestern Kansas, (2) the amount and time distribution of ground-water withdrawals, (3) the amount and location of irrigated acreage, (4) the hydraulic characteristics of the High Plains (Ogallala) aquifer, (5) the configuration of the water table, (6) the annual changes in saturated thickness, and (7) the movement of ground water through the aquifer system. Most of these data are readily amenable to storage, retrieval, and analysis using digital computers.

Objectives -- To develop and maintain a comprehensive hydrologic-data base for the area within the Southwest Kansas Groundwater Management District and to provide timely storage, retrieval, and analyses of the data for use principally by the Management District and by the Division of Water Resources, Kansas State Board of Agriculture, in the management, planning, and administration of water rights.

Approach -- Establish and monitor a comprehensive observation-well network, produce saturated-thickness maps, perform several aquifer tests on selected wells, and assist the Management District in measuring and monitoring ground-water withdrawals for irrigation. Compile all data pertinent to the hydrology of the area in readily accessible computer files for various analyses essential to management and administrative decisions.

Significant milestones -- Work is nearing completion on a January 1986 saturated-thickness map for the unconsolidated aquifer in southwestern Kansas.



PROJECT TITLE: Hydrologic-data base, Western Kansas Groundwater Management District No. 1

PROJECT NUMBER: KS-00203

COOPERATING AGENCY: Western Kansas Groundwater Management District No. 1

PROJECT CHIEF: L. E. Stullken

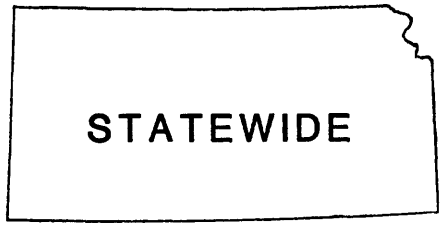
Problem -- Predevelopment saturated thickness in Groundwater Management District No. 1 has been reduced 50 percent or more in five areas of the district covering about 225 square miles. Water is being pumped from the High Plains (Ogallala) aquifer 5 to 35 times faster than it is being recharged. Some irrigation wells have been abandoned, and the groundwater supply is no longer adequate for some domestic wells in areas where the aquifer has been dewatered. The Management District needs a continuing data-collection and analysis program to provide information on ground-water conditions for making management decisions.

Objectives -- (1) Maintain and operate water-level recorders at a recharge reservoir, (2) collect continuous water-level data in problem locations, (3) prepare ground-water depletion maps, and (4) inventory existing wells using file records and onsite verification to prepare up-to-date location maps.

Approach -- Continuous recorders monitor surface storage and groundwater levels at the Janzen recharge reservoir. Hydrologic maps produced using kriging techniques are prepared annually. Previous maps have shown the water table, the resulting errors-of-estimate from the kriging, saturated thickness, and percentage change in saturated thickness of the High Plains aquifer in west-central Kansas.

Significant milestones -- Onsite inventories of existing wells were completed in October 1986. Mapping and data-base revisions are in progress.

Reports -- Dague, B.J., 1985, Percentage change in saturated thickness of the High Plains aquifer, west-central Kansas, 1950 to average 1983-85: U.S. Geological Survey Water-Resources Investigations Report 85-4255, scale 1:125,000, 1 sheet.



PROJECT TITLE: Water-quality data program

PROJECT NUMBER: KS-003

COOPERATING AGENCY: Multi-agency

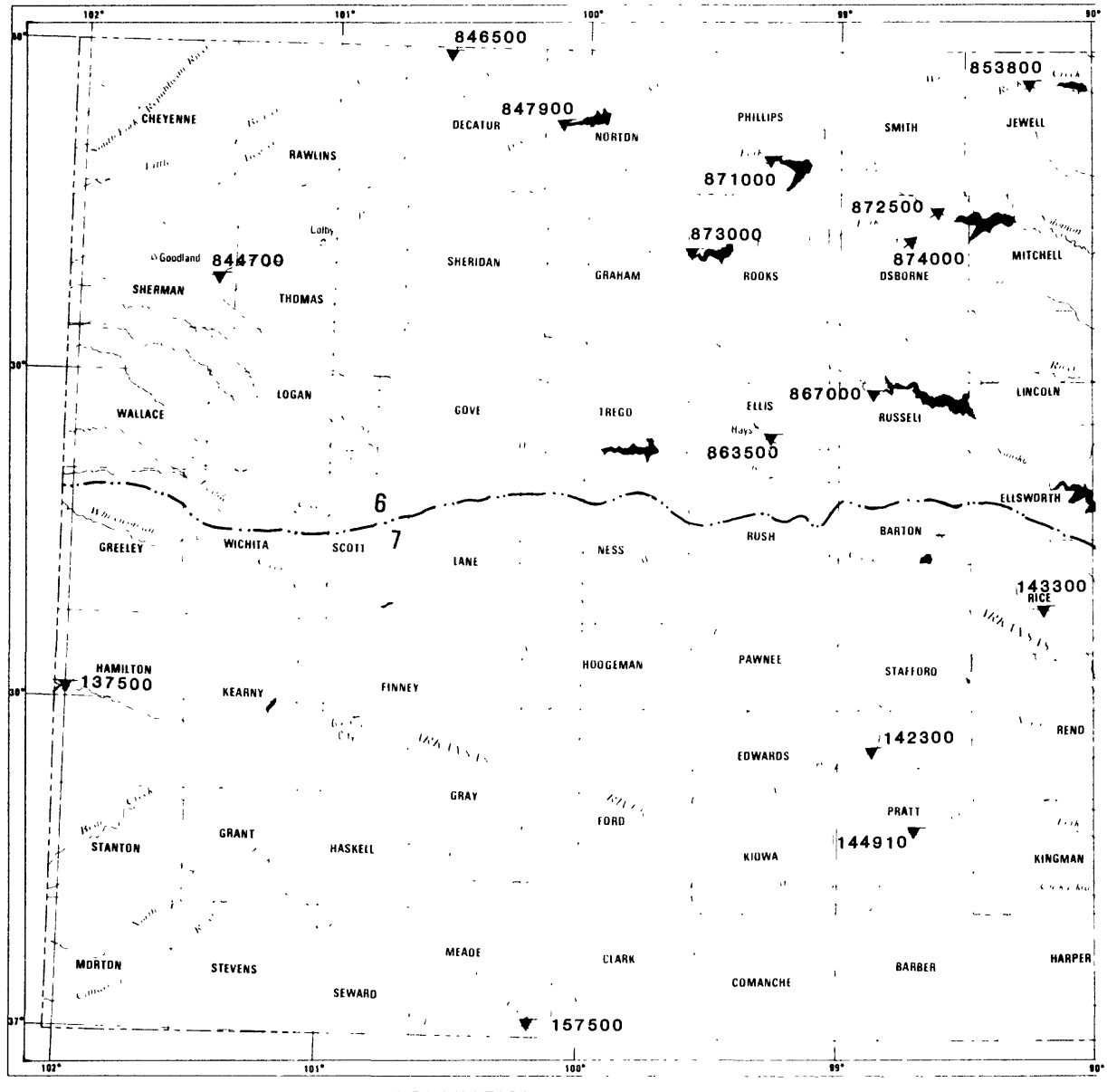
PROJECT CHIEF: C. O. Geiger

Problem -- Water-resources planning and water-quality assessment require a national data base of relatively standardized information. For intelligent planning and realistic assessment of the water resource, the chemical and physical quality of the rivers, streams, lakes, and reservoirs, as well as major ground-water systems, must be defined and monitored.

Objectives -- To provide a national bank of water-quality data for State, local, or Federal planning and action programs. Primary objectives of the network are to depict areal variability of streamflow- and water-quality conditions nationwide on a year-by-year basis and to detect and assess long-term changes in streamflow and water quality.

Approach -- Surface-water-quality stations (fig. 9 and table 5 at the end of this report) are maintained to monitor long-term and short-term trends related to changes in streamflow, reservoir operation, and local or regional pollution. In addition, a network for collection of surface-water-quality data, identified as the National Stream-Quality Accounting Network (NASQAN), is designed by the U.S. Geological Survey to meet many of the information demands of agencies or groups involved in national or regional water-quality planning and management. Water samples are collected at a few regular surface-water stations, as a Federal interagency activity, for monitoring the concentration and distribution of pesticides in streams where potential contamination could result from continued or future application of the commonly used insecticides and herbicides.

Water-quality samples also are collected from a network of wells (fig. 10 and table 6 at the end of this report) to determine the chemical characteristics of water in the principal aquifers and to assess the suitability of the water for use in domestic and municipal supplies. The data also are used to establish an adequate data base for monitoring changes in water quality according to the provisions of the Safe Drinking Water Act, 1974. Other samples of water from various geologic formations at selected locations are analyzed for interpretive hydrologic investigations.



EXPLANATION

▼ Chemical ▼ Biological ▼ Sediment

Drainage basin

6 Missouri River basin

7 Arkansas River basin

Basin boundary

Note: Numbers shown are abbreviated versions of the complete identification numbers given in table 5

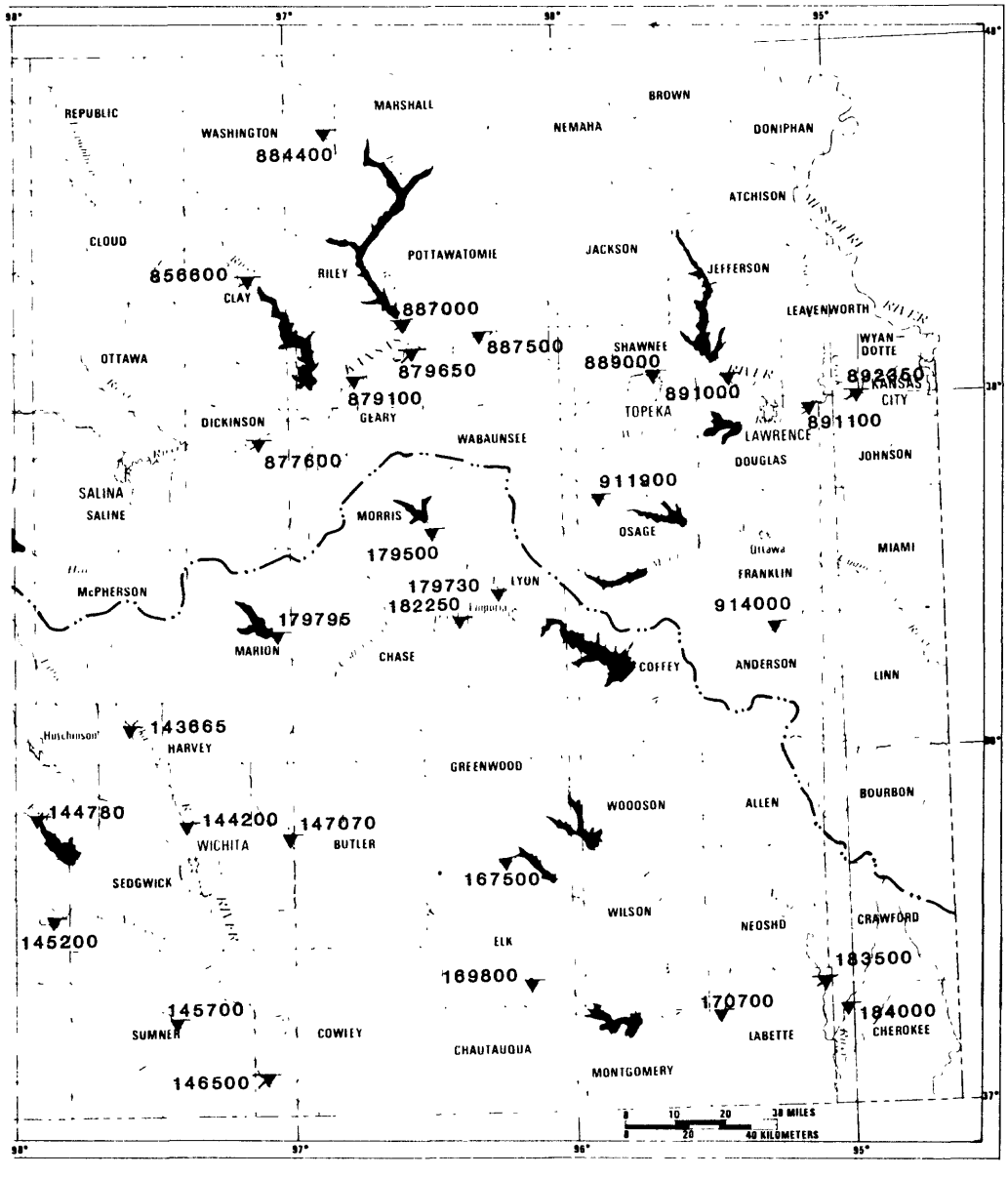
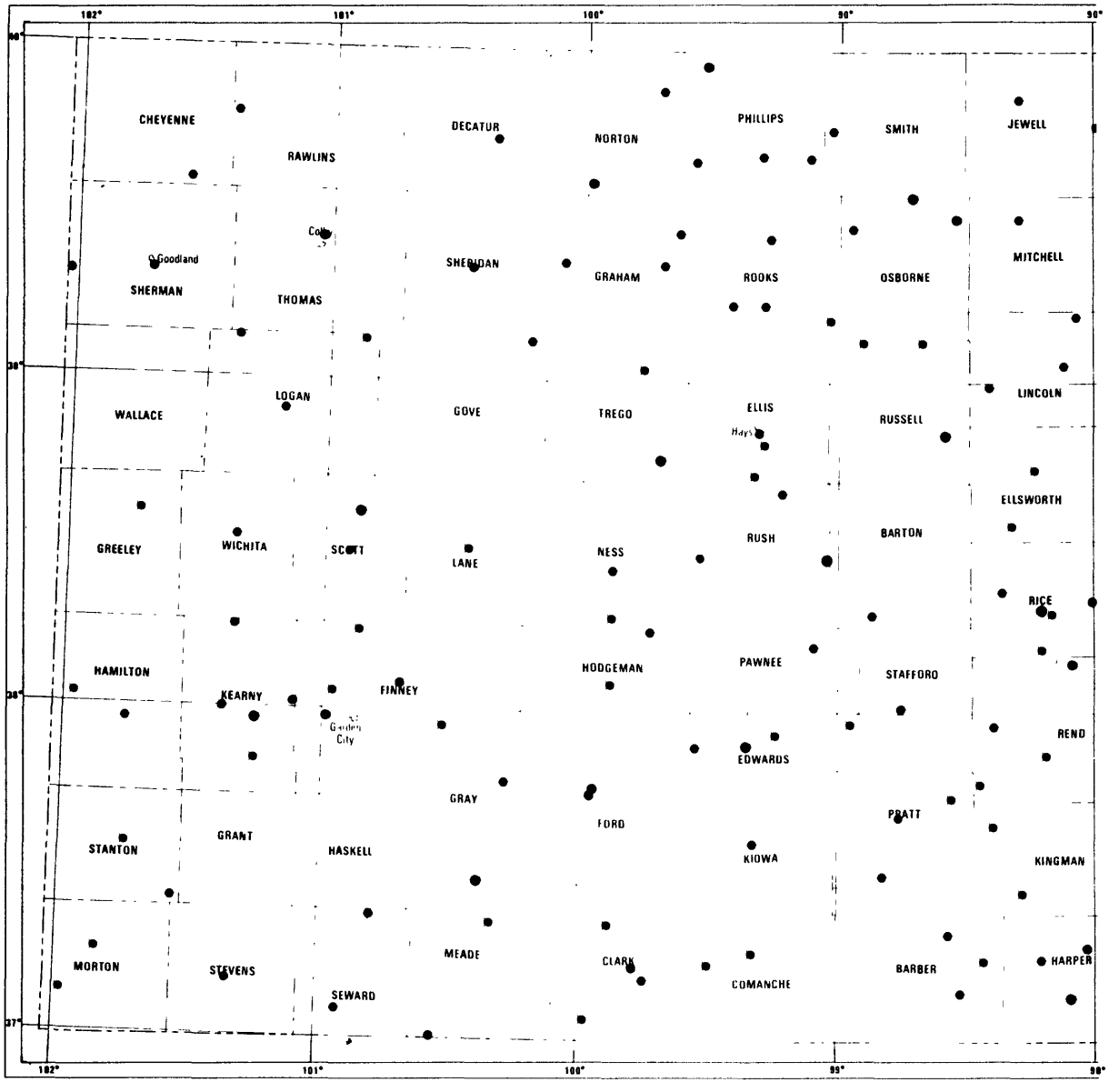


Figure 9.--Location of surface-water-quality gaging stations, 1986 water year.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OSBORNE
MITCHELL
LOGAN
WALLACE
GOVE
TREGO
ELLIS
RUSSELL
LINCOLN
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GREELEY
WICHITA
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BARTON
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KEARNY
FINNEY
HODGEMAN
PAWNEE
STAFFORD
Garden City
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REND
GRAY
FORD
PRATT
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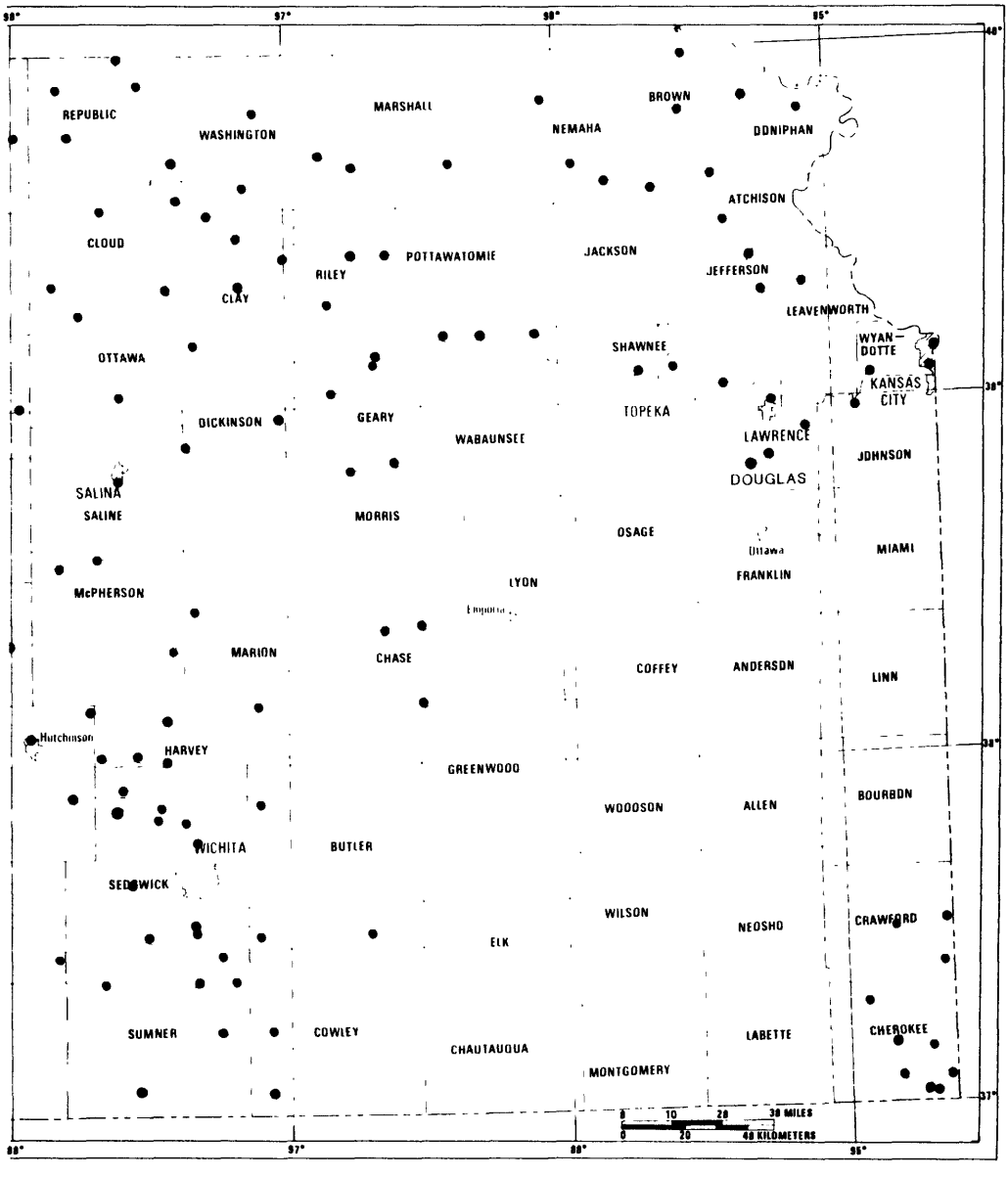
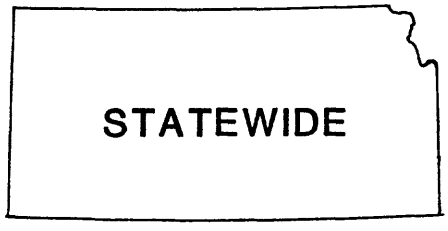


Figure 10.--Location of ground-water-quality sampling sites, 1986 water year.

Significant milestones -- During the 1986 fiscal year, water-quality data were collected at 10 complete-record streamflow-gaging stations and 9 partial-record stations on a regularly scheduled basis. Seven of these stations were in the National Stream Quality Accounting Network, and one station was in the Hydrologic Benchmark Network. Chemical analyses were determined on samples from approximately 250 wells.



PROJECT TITLE: Sediment data program

PROJECT NUMBER: KS-004

COOPERATING AGENCY: Multi-agency

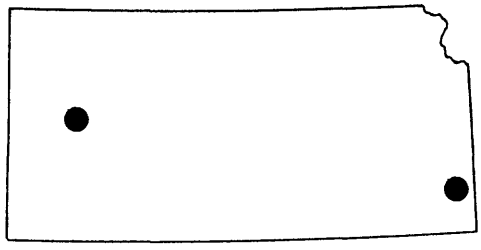
PROJECT CHIEF: C. O. Geiger

Problem -- Sediment concentrations and discharges in rivers and streams must be defined and monitored in order to make a comprehensive water-quality assessment of the Nation's water resources.

Objectives -- To provide a national data base of standardized sediment information for use in State, local, and Federal planning and action programs.

Approach -- A network of sediment stations (as shown in figure 9 and listed in table 5 at the end of this report) has been established to provide spatial and temporal averages and trends in concentration, discharge, and particle size of sediment being transported by rivers and streams. In addition, periodic measurements are made of the particle-size distribution of suspended sediment and bed material.

Significant milestones -- During the 1986 fiscal year, water samples were collected at 43 sites for analysis and determination of suspended-sediment discharge.



PROJECT TITLE: National Atmospheric Deposition Program

PROJECT NUMBER: KS-005

COOPERATING AGENCY: Federal

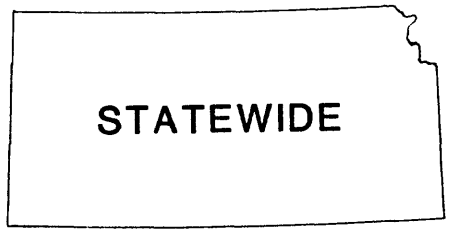
PROJECT CHIEF: C. O. Geiger

Problem -- In recent decades human activities have greatly increased both the abundance of substances dispersed in the atmosphere and their impact on the biosphere of the earth. These changes have resulted mainly from increases in: (1) Combustion of fossil fuels in power production, space heating, and transportation; (2) emissions of dust, aerosols, and gases from industrial and land-management activities; (3) use of fertilizers and other chemicals in intensive agriculture and forestry; and (4) decomposition and combustion of industrial, urban, and agricultural wastes.

Objectives -- Establish a National Atmospheric Deposition Network to determine spatial and temporal trends in the supply of beneficial nutrient elements and injurious substances in precipitation and dry particulate matter. Determine the relative importance and contribution of precipitation, dry particulate matter, aerosols, and gases to the total atmospheric deposition.

Approach -- Sites in Kansas, located on the index map above, are equipped with identical collectors of wet/dry deposition, a recording rain gage, and pH and specific-conductance meters. Samples of precipitation are collected at each site on a weekly basis. During the first phase of network operations, analyses will be made for sulfate, nitrate, phosphate, chloride, ammonia, potassium, calcium, magnesium, pH, acidity or alkalinity and conductivity. Later certain additional analyses will be added including fluorine, bromine, manganese, zinc, copper, iron, molybdenum, boron, lead, mercury, iodine, nickel, cadmium, and vanadium. Pesticides and radioactive materials will also be added. To insure that the data are of sufficient quality to provide maximum credibility for a wide variety of fundamental research and mission-oriented purposes, a Quality Assurance Committee oversees the operations.

Significant milestones -- During the 1986 water year, data were collected at two sites as part of the National Trends Network and National Atmospheric Deposition Programs (NTN and NADP).



PROJECT TITLE: Water use

PROJECT NUMBER: KS-007

COOPERATING AGENCY: Division of Water Resources, Kansas State Board of Agriculture

PROJECT CHIEF: C. H. Baker, Jr.

Problem -- Use of Kansas waters and competition among types of uses are increasing each year. State water-rights agencies need detailed information about water use in order to effectively manage the resource. As part of the National Water-Use Program in Kansas, plans have been made to create a State-operated and maintained water-use/water-rights data base. This long-term plan has been brought to the immediate foreground by a growing concern within the State for automated handling of water-use/water-rights data. In order to facilitate the progress of the water-use program in Kansas and to ensure that the resulting State data base will fully meet the needs of the National Water-Use Program, it is important for the U.S. Geological Survey to participate in the State data-base development.

Objective -- To design, implement, load, and evaluate an automated State water-use/water-rights data base. The data base will serve the dual functions of a management tool for administering water rights within the State and of acting as a repository for water-use data to meet National and State needs.

Approach -- Actual development of the data base will be done by the Kansas Department of Administration, Division of Information Systems and Computing. Data capture, preparation, and input are handled jointly by the Division of Water Resources, Kansas State Board of Agriculture, and the Division of Information Systems and Computing. U.S. Geological Survey personnel work closely with both State agencies to insure that all data elements needed for the National Water-Use Program are provided in the data base and to provide for data exchange between the completed State data base and the National Water-Use Data System.

Significant milestones -- Updated water-use information from reports filed with the Division of Water Resources for the years 1983, 1984, and 1985 has been transferred to the Kansas District computer files. Recent data on water-rights appropriations also are stored at the District level.

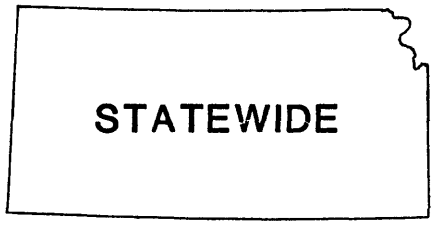
Kansas water-use information for 12 categories was collected from several State and Federal sources and aggregated by county and hydrologic unit for the 5-year National report, "Estimated Use of Water in the United States, 1985." The data-entry program for this effort allows rapid generation of tables of calculated values and reports and also serves as the vehicle for entry of data for the National Water-Use Data System.

Reports -- Kenny, J.F., 1986, Water demands in Kansas, 1944-84: U.S. Geological Survey Water-Resources Investigations Report 86-4038, 17 p.

HYDROLOGIC INVESTIGATIONS

Hydrologic investigations provide water-resources information that is valuable for a variety of uses by Federal, State, and local agencies, by the general public, and by universities and the consulting community. These investigations may include regional, state, county, and site-specific studies, as well as applied research. Some of the anticipated uses of the results of these investigations include general resources information and definition of hydrologic systems; water supply (planning and development); protection and conservation of resources; pollution detection, control, abatement, and enforcement; bridge, culvert, and highway design; public safety (flood warnings and flood-plain delineation); salinity control and abatement; hazardous-waste disposal; land management; and fish and wildlife resources management. These investigations help to assess the State's water resources in terms of quality, quantity, and use of water, and to develop the knowledge and hydrologic understanding necessary to predict the consequences of alternative plans and policies for water development and use.

Statewide or Regional Investigations



PROJECT TITLE: Evaluation of the Ground-Water-Quality Monitoring Network

PROJECT NUMBER: KS-00201

COOPERATING AGENCY: Kansas Department of Health and Environment

PROJECT CHIEF: T. B. Spruill

Problem -- Data on the chemical quality of ground water is needed from a statewide network of wells in response to State and Federal regulations imposed by the Safe Drinking Water Act of 1974 (Public Law 93-523).

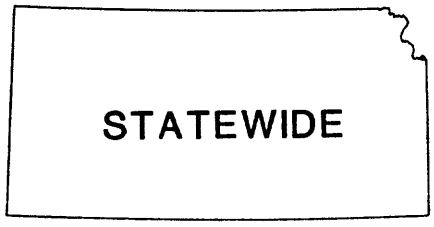
A continuing evaluation of the adequacy of the network is needed for monitoring water quality in the principal aquifers of the State. These data are necessary for effective management decisions regarding the State's water resources.

Objective -- Evaluate the chemical-quality data to determine the adequacy of the network for describing baseline ground-water quality, to detect pollution of the principal aquifers in the State, and to determine the significance of the data with respect to State and Federal water-quality standards imposed by the Safe Drinking Water Act.

Approach -- Collect water samples for chemical analysis from a statewide network of about 250 wells. The wells will be sampled to provide baseline data for determining the general chemical quality of water in the principal aquifers and to provide a basis for detecting possible long-term changes in regional ground-water quality. Interprete sampled data and evaluate adequacy of the data for detecting changes in chemical quality and regional occurrence of pollution.

Reports -- Spruill, T.B., 1982, Nitrate-nitrogen concentrations in ground water from three selected areas in Kansas: U.S. Geological Survey Water-Resources Investigations Report 82-11, 32 p.

_____1983, Statistical summaries of selected chemical constituents in Kansas ground-water supplies, 1976-81: U.S. Geological Survey Open-File Report 83-263, 29 p.



PROJECT TITLE: Estimation of total ground-water storage and natural recharge

PROJECT NUMBER: KS-00204 & 144

COOPERATIVE AGENCY: Kansas Water Office

PROJECT CHIEF: C.V. Hansen

Problem -- An analysis of the ground-water supply in Kansas, particularly related to its ability to provide consistent supplies into the future, requires defining the amount of ground water in storage and the amount of natural recharge to the principal aquifers in the State. A recent compilation or summary of quantitative estimates of these amounts is not available.

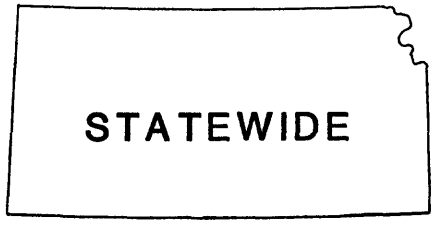
Objective -- The study will provide estimates of total ground-water storage in and natural recharge to the major aquifers in Kansas. Estimates will be based on existing information available from past studies.

Approach -- Ground water in storage and natural recharge to ground water will be estimated from information obtained from model studies, studies of precipitation and evapotranspiration, and some studies specifically addressing natural recharge. A compilation of storage and natural-recharge determinations that have been made in the past will be used as a guide in making current estimates of natural recharge.

Significant milestones -- The principal aquifers in Kansas were defined as: (1) alluvial deposits in the major river valleys, (2) glacial deposits in northeastern Kansas, (3) the High Plains aquifer (mostly Ogallala Formation), (4) the Great Plains aquifer system (mostly Dakota Sandstone), and (5) the Ozark Plateaus aquifer (mostly Arbuckle Group). Freshwater was defined as water with 1,000 milligrams per liter or less dissolved-solids concentration. Areas of natural recharge were defined as areas of outcrop of the aquifer where the aquifer has some saturated thickness.

Maps of saturated thickness in the freshwater areas of the aquifers were constructed, based on previously published maps and data. A map of specific yield of the aquifers in unconsolidated deposits (aquifers 1, 2, and 3 above) was made, also based on previously published maps and data. The maps of saturated thickness, specific yield, and mean annual recharge were used to make estimates of the amount of freshwater in storage in the principal aquifers and of the amount of natural recharge to the principal aquifers. These estimates were tabulated by county, by river basin, and by aquifer.

A report on the results of this project is in review.



PROJECT TITLE: Flood hydrology and hydraulics for transportation applications

PROJECT NUMBER: KS-010

COOPERATING AGENCY: Kansas Department of Transportation

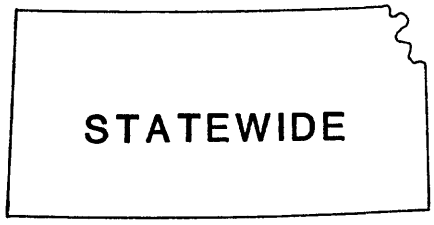
PROJECT CHIEF: R. W. Clement

Problem --A continuing need exists for adequately defined flood-frequency characteristics for Kansas streams to assist in the efficient design of highway-drainage structures, for flood-plain analysis, and to evaluate flood-risk factors. Long-term records of annual peak discharges are necessary to adequately define flood-frequency characteristics. Although streamflow records have been collected on Kansas streams since 1895, these records are available primarily for those streams that drain areas larger than 100 square miles. Little long-term data are available for streams draining areas of less than 100 square miles.

Objectives -- Define the flood-frequency characteristics on gaged streams in Kansas using long-term data, both observed and synthesized, and develop techniques to extend those characteristics to ungaged locations.

Approach -- Records of annual peak discharges for small drainage areas are obtained from a crest-stage gage network. Selected crest-stage gage sites are equipped to collect simultaneous records of rainfall and discharge. Long-term records of annual peak discharges are synthesized through the use of a rainfall-runoff model and a record of long-term rainfall. Data for large drainage areas are available from the regular streamflow-gaging network. Flood-frequency relations, determined by statistical methods, are extended to ungaged sites by using physical and climatic factors.

Significant milestones -- A study of the magnitude and frequency of floods on unregulated streams in Kansas has been completed. A weighted least squares regression model was used in two separate analyses to relate weighted estimates of selected hydrologic variables to physical and climatic characteristics. The weights are based on the reliability of the estimates, in this case, the inverse of the length of the streamflow record used to determine the estimate. The initial analysis used data from 245 streamflow-gaging stations to generalize the coefficient of skewness throughout the State. Subsequently, the model was used with data from 218 stations to generalize the magnitude of floods having selected recurrence intervals. The results of the analyses indicate that the estimates of station skewness and flood magnitudes had errors that were significantly smaller than those resulting from previously used methods. Results of the study have been reviewed and are presently awaiting approval for publication.



PROJECT TITLE: Streamflow characteristics

PROJECT NUMBER: KS-011

COOPERATING AGENCY: Kansas Water Office

PROJECT CHIEF: P. R. Jordan

Problem -- A need exists to express basic streamflow records in more useful forms and to develop improved methods of estimating the frequency of various types of flow in gaged and ungaged streams in Kansas.

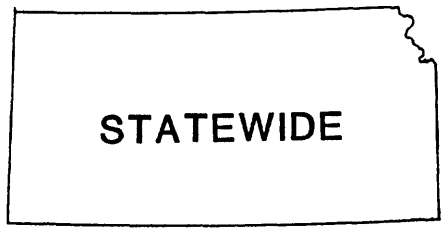
Objectives -- Define the significant characteristics of streamflow in Kansas; determine the interrelation between streamflow and ground-water storage; analyze and summarize existing data in useful terms for developing optimum benefit from the available water supplies and optimum protection from floods.

Approach -- Analyze significant streamflow characteristics and update results of previous studies using improved methods applied to initial data and to additional data from 16 to 20 years of record, particularly the data from small drainage basins. Where available, improved analytical techniques will be used to determine flow probabilities.

Significant milestones -- The project was completed during 1985.

Reports -- Jordan, P.R., 1985, Design of a sediment data-collection program in Kansas as affected by time trends: U.S. Geological Survey Water-Resources Investigations Report 85-4204, 114 p.

Medina, K.D., 1985, Analysis of surface-water data network in Kansas for effectiveness in providing regional streamflow information, with a section on theory and application of generalized least squares by G.D. Tasker: U.S. Geological Survey Open-File Report 85-680 (pending publication as a Water-Supply Paper), 39 p.



PROJECT TITLE: Potential for liquid-waste injection into the Arbuckle Group

PROJECT NUMBER: KS-078

COOPERATING AGENCY: Kansas Geological Survey

PROJECT CHIEF: J.E. Carr

Problem -- Rocks of the Arbuckle Group, which underlie nearly all of Kansas, are important oil reservoirs in much of the State and are an important freshwater aquifer in the southeastern part. The rocks also are a primary horizon for waste disposal, particularly oilfield brine. Little is known about the regional geohydrology and the potential effects of contamination to freshwater aquifers.

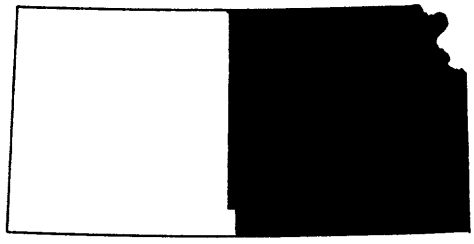
Objectives -- Determine the regional geohydrology of the Arbuckle Group from available data and further define the Arbuckle Group by making a preliminary assessment of the potential for waste injection to the aquifer. Determine the hydraulic characteristics and potential for liquid-waste injection in selected areas.

Approach -- Data will be compiled to determine the areal extent and thickness of aquifers, the areal changes in hydraulic characteristics and chemical characteristics of the water, and the configuraton of the potentiometric surface of salinewater in the Arbuckle and other aquifers. Test wells will be installed at selected sites to determine aquifer properties and chemical quality. Modeling techniques will be used to evaluate the potential for future injection and storage of liquid wastes and to assess the effects of waste injection on freshwater aquifers.

Significant milestones -- This project was completed in 1986.

Reports -- Carr, J.E., McGovern, H.E., and Gogel, Tony, 1986, Geohydrology of and potential for fluid disposal in the Arbuckle aquifer in Kansas: U.S. Geological Survey Open-File Report 86-491 (pending publication by the Kansas Geological Survey), 101 p.

Gogel, Tony, 1981, Preliminary data from Arbuckle test wells, Miami, Douglas, Saline, and Labette Counties, Kansas: U.S. Geological Survey Open-File Report 81-1112, 155 p.



PROJECT TITLE: Aquifer-test evaluation

PROJECT NUMBER: KS-093

COOPERATING AGENCY: Kansas Geological Survey

PROJECT CHIEF: T.B. Reed

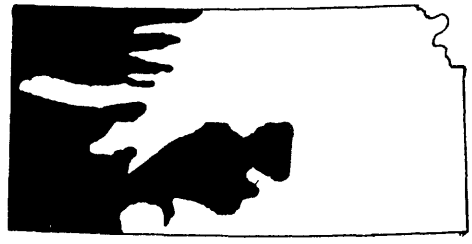
Problem -- Aquifer appraisal in eastern Kansas requires accurate determination of aquifer characteristics. Aquifer characteristics are the basic building blocks for all quantitative aquifer evaluations. The files of the U.S. Geological Survey, Kansas Geological Survey, and Division of Water Resources of the Kansas State Board of Agriculture contain numerous aquifer tests that have been conducted since 1937. These tests need to be reanalyzed to provide a cohesive set of reliable aquifer characteristics.

Objective -- To create an accurate, reproducible, documented file of aquifer characteristics by aquifer and by area for use in ongoing and future areal investigations.

Approach -- All available aquifer tests in eastern Kansas are to be compiled, and the tests evaluated for adequacy of documentation. Supplemental data will be collected as needed. Appropriate analytical or numerical techniques will be determined and applied to each aquifer test.

Significant milestones -- Aquifer-test data from 36 counties in eastern Kansas were evaluated, and aquifer characteristics from 142 wells were published. The project was completed in 1985.

Reports -- Reed, T.B., and Burnett, R.D., 1985, Compilation and analyses of aquifer-performance tests in eastern Kansas: U.S. Geological Survey Open-File Report 85-200, 125 p.



PROJECT TITLE: High Plains regional aquifer-system analysis, western Kansas

PROJECT NUMBER: KS-094

COOPERATING AGENCY: Federal

PROJECT CHIEF: L.E. Stullken

Problem -- The Ogallala Formation of late Tertiary age and unconsolidated deposits of Quaternary age comprise the principal aquifer underlying the High Plains. The aquifer contains about 2 billion acre-feet of water in storage, but water is being withdrawn for irrigation in excess of the rate of natural replenishment. The economic future of the High Plains in eight states, including Kansas, is dependent upon the capacity of the aquifer to sustain withdrawals. A detailed knowledge of the aquifer system is needed so that the system can be simulated, water-management alternatives evaluated, and the economic life of the aquifer projected.

Objective -- Previous studies of the hydrology of the High Plains have been limited by political boundaries. This study will provide a regional description of the water resources and the operation of the hydrologic system consistent with the natural hydrologic boundaries of the High Plains.

Approach -- Existing hydrologic data will be compiled and reviewed. The data will be regionalized to provide a detailed description of the aquifer system and stored in a digital computer for processing and retrieval. Computer simulations of flow in the aquifer system will be made to define additional data needs and add to knowledge of the system's flow characteristics.

Significant milestones --Seven map reports showing the generalized configuration of the base and water-table altitudes in the High Plains aquifer in Kansas have been published along with the first comprehensive report on the geohydrology of the aquifer in Kansas. This project is now complete.

Reports -- Pabst, M.E., and Stullken, L.E., 1984, Altitude and configuration of the water table in the High Plains aquifer in Kansas, 1980: U.S. Geological Survey Water-Resources Investigations Report 81-1004, scale 1:500,000, 1 sheet.

____1985a, Altitude and configuration of the water table in the High Plains aquifer in Kansas, 1960: U.S. Geological Survey Open-File Report 82-429, scale 1:500,000, 1 sheet.

_____1985b, Altitude and configuration of water table in the High Plains aquifer in Kansas, 1970: U.S. Geological Survey Open-File Report 82-448, scale 1:500,000, 1 sheet.

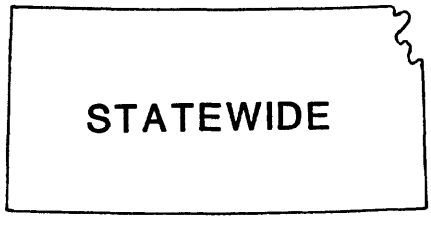
_____1986, Altitude and configuration of the water table in the High Plains aquifer in Kansas, 1965: U.S. Geological Survey Open-File Report 82-449, scale 1:500,000, 1 sheet.

Stullken, L.E., and Pabst, M.E., 1985a, Altitude and configuration of the water table in the High Plains aquifer in Kansas, pre-1950: U.S. Geological Survey Open-File Report 82-117, scale 1:500,000, 1 sheet.

_____1985b, Altitude and configuration of the water table in the High Plains regional aquifer system of Kansas, 1975: U.S. Geological Survey Open-File Report 81-144, scale 1:500,000, 1 sheet.

Stullken, L.E., Watts, K.R., and Lindgren, 1985, Geohydrology of the High Plains aquifer, western Kansas: U.S. Geological Survey Water-Resources Investigations Report 85-4198, 86 p.

Watts, K.R., and Stullken, L.E., 1985, Generalized configuration of the base of the High Plains aquifer in Kansas: U.S. Geological Survey Open-File Report 81-344, scale 1:500,000, 1 sheet.



PROJECT TITLE: Central Midwest regional aquifer-system analysis, Kansas

PROJECT NUMBER: KS-111

COOPERATING AGENCY: Federal

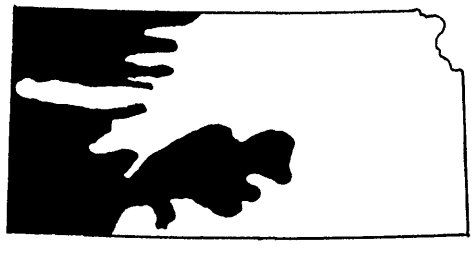
PROJECT CHIEF: R.J. Wolf

Problem -- The hydrology of the freshwater, brackish-water, and salinewater aquifer systems in rocks of Cambrian through Early Cretaceous age is not well defined. Because of the increased demand for water from the overlying High Plains aquifer in western Kansas, aquifers in this deeper rock system are being looked upon as a potential source of additional water supply. In addition, increased pumpage in eastern Kansas has caused salinewater encroachment into aquifers of this rock system. Added to these problems are those resulting from injection of industrial wastes and oilfield brine into these rocks.

Objectives -- Describe the hydrology of the freshwater, brackish-water, and salinewater aquifer systems in rocks of Cambrian through Early Cretaceous age. Create a regional data base for the rock systems and describe present and potential problems associated with current and future water use. Evaluate the aquifer-system's response to future stresses.

Approach -- A search of the available literature will be made to determine the extent of geologic interpretations and available data. Data are to be compiled to establish a data base of regional significance that includes detailed lithologic descriptions for selected wells, water-quality information, hydraulic characteristics of the rock systems, and information on water use, waste disposal, and brine injection. Appropriate maps will be prepared for steady-state digital-model construction to test the conceptual flow system and to define additional data needs to calibrate a digital model capable of simulating the flow system.

Significant milestones -- Six of the nine planned hydrologic atlases describing the physical framework and geohydrology of principal units in rocks of Cambrian through Early Cretaceous age have been written and are in review. A report describing the data base has been written and is in the final stages of review.



PROJECT TITLE: Water quality in the High Plains aquifer, western Kansas, related to irrigated and nonirrigated agricultural land use and petroleum production

PROJECT NUMBER: KS-135

COOPERATING AGENCY: Federal

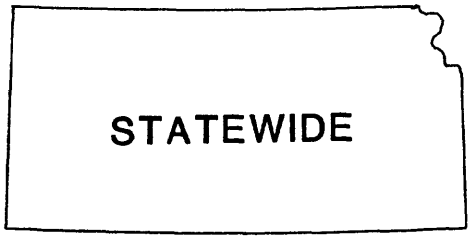
PROJECT CHIEF: J.O. Helgesen

Problem -- Little is known about the contamination of the High Plains aquifer by organic compounds. Agricultural chemicals applied at land surface to control weeds and insects are potentially hazardous to human health as they infiltrate to the water table. Contamination by oilfield brines presents yet another hazard. Sample collection and data interpretation with special emphasis on the relation of organic substances in ground water to agricultural use and oilfield brines are needed.

Objectives -- To provide the water samples and analyses needed to describe the current quality of water associated with major types of land use in the High Plains of Kansas (irrigated and dryland farming and petroleum production). Special attention to analysis of organic substances is needed because of the present lack of this information. Project results are expected to provide water-quality and land-use relationships that will have transfer value to other areas of similar climate and geohydrology.

Approach -- An initial reconnaissance phase will involve selection of study areas and some collection and analysis of samples. More intensive areal sampling and (or) site-specific experimental sampling will follow, depending on results of the reconnaissance phase. Statistical techniques will be employed for network design and for analysis and interpretation of results. Site-specific experiments may examine hydrologic controls on water quality to better guide sampling and definition of regional conditions. Observation wells will be installed to the extent necessary to provide optimum sampling locations. Results will be described in interim and final reports.

Significant milestones -- Initial reconnaissance of the western Great Bend Prairie and the Burrton oilfield areas was completed, and a report is in review. Results indicate localized presence of pesticides in ground water in the Great Bend Prairie area and the common occurrence of hydrocarbons in ground water in the Burrton oilfield area.



PROJECT TITLE: Geohydrologic evaluation of hazardous-waste sites in selected areas of Kansas

PROJECT NUMBER: KS-138

COOPERATING AGENCY: Kansas Department of Health and Environment

PROJECT CHIEF: R.J. Hart

Problem -- Hazardous-waste sites can pose significant risks to public health and the quality of the environment. At least 201 potential hazardous-waste sites have been identified in Kansas (Kansas Department of Health and Environment, written commun., 1983). The State has performed an initial assessment of 81 sites. A need exists to document which of the remaining sites in Kansas have contaminated ground and surface water and to identify those sites that warrant intensive geohydrologic investigation.

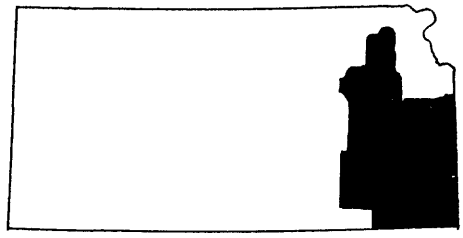
Objectives -- Principal objectives of the study are to: (1) Compile site-history, hydrogeologic, and chemical-quality information to document possible ground- and surface-water contamination at selected hazardous-waste sites in Kansas; (2) identify principal chemical contaminants that may be associated with specific types of hazardous-waste sites (private, county, municipal, industrial, and so forth) in specific areas of the State; (3) determine principal geochemical and hydrogeologic factors that affect the mobility of major chemical contaminants from hazardous-waste sites in selected areas of the State.

Approach -- Information will be collected for each site, including types of waste stored, mode of storage, time of storage, and geology. Surface geophysical methods will be used to detect possible contaminant plumes. Water samples, water levels, and geophysical logs will be obtained from piezometers. Water samples will be analyzed for major cations and anions, nitrate and ammonia nitrogen, trace elements, total organic carbon, and specific organic compounds. Principal contaminants associated with each waste-site category will be identified.

Significant milestones -- Geologic and water-quality data were collected and analyzed for nine potential hazardous-waste sites, and a report on these nine sites is in review. Evaluation of additional sites is anticipated.

Reports -- Perry, C.A., and Hart, R.J., 1985a, Installation of observation wells on hazardous-waste sites in Kansas using a hollow-stem auger: Ground Water Monitoring Review, Fall 1985, v. 5, no. 4, p. 70-73.

_____1985b, Installation of observation wells on hazardous-waste sites in Kansas using a hollow-stem auger: Proceedings of the Southern Regional Ground Water Conference, San Antonio, Texas, p. 173-179.



PROJECT TITLE: Relation of trihalomethane-formation potential to physical, chemical, and biological characteristics of water-supply lakes in eastern Kansas

PROJECT NUMBER: KS-139

COOPERATING AGENCY: Kansas Department of Health and Environment

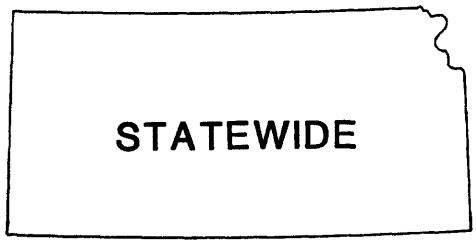
PROJECT CHIEF: L.M. Pope

Problem -- The formation of trihalomethanes as by-products of the chlorination process in the treatment of drinking water is a potentially serious environmental problem. Evidence from epidemiologic and toxicologic investigations has shown that trihalomethanes pose potential health risks to humans. The potential for trihalomethane formation in drinking water that originates from lakes may be influenced by characteristics of the lakes, such as concentrations of organic substances and nutrients, composition of the phytoplankton population, turbidity, transparency, surface area, depth, volume, and watershed area and land use.

Objectives -- To define the relationship among trihalomethane-formation potential and physical and water-quality characteristics of water-supply lakes. Specific objectives of the investigation are to: (1) Rank the tropic state of the lakes based on concentrations of organic nitrogen, ortho- and total phosphorous, nitrate as nitrogen, total and dissolved organic carbon, chlorophyll-a, and dissolved oxygen, light penetration, composition of phytoplankton populations, and primary productivity; and (2) determine the potential for trihalomethane formation of each lake and relate it to the tropic state of the lake.

Approach -- Six water-supply lakes will be selected to represent a range of lake and water-quality characteristics. Lake water quality will be determined semimonthly from April to October by in-situ measurements of temperature and dissolved oxygen and by lake-water samples collected for determinations of total and dissolved organic carbon, total and dissolved phosphorous, dissolved nitrite plus nitrate nitrogen and ammonia nitrogen, total suspended solids, major cations and anions, alkalinity, total iron and manganese, chlorophyll-a, phytoplankton, and trihalomethane-formation potential. Trihalomethane formation will be related to lake and watershed characteristics and results of sample analyses using multiple linear regression.

Significant milestones -- Samples have been collected. Preliminary analysis shows significant relationships among chloroform-formation potential and concentrations of dissolved and total organic carbon.



PROJECT TITLE: Assessment of agricultural pesticides in the saturated and unsaturated zones in Kansas

PROJECT NUMBER: KS-145

COOPERATING AGENCY: Kansas Department of Health and Environment

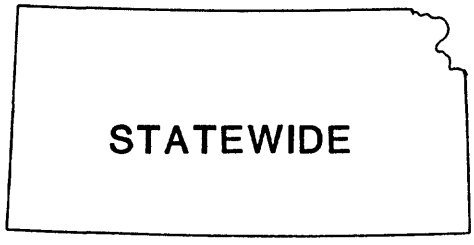
PROJECT CHIEF: C.A. Perry

Problem -- Intrusion of agricultural pesticides into the subsurface environment occurs, and residues of these toxic organics are now being found in shallow aquifers within the State. In order to better understand the dynamics and fate of pesticides in hydrologic settings, a preliminary assessment of pesticides currently in use in Kansas and hydrologic factors involved is needed. Also, preliminary chemical analysis of soil profiles and ground water is needed to determine the extent of the contamination.

Objectives -- Perform an assessment of pesticides usage in Kansas, determine areas that may be susceptible to contamination by pesticides, gather soil and water samples for chemical analysis, and from this information, develop a work plan for an intensive study of the movement and persistence of organic pesticides in the saturated and unsaturated zones.

Approach -- (1) Determine the most commonly used pesticides in Kansas and the crops to which they are applied. (2) Tabulate the chemical properties of these pesticides including the leach parameters. (3) Compile a generalized depth-to-ground-water map and a soil map for Kansas, giving soil properties as they apply to pesticide degradation and movement. (4) Analyze soil samples at selected depths and ground-water samples for organic pesticide concentrations. (5) Develop work plan and select sites for intensive study.

Significant milestones -- First draft of the report, "Assessment of factors affecting the movement of agricultural chemicals in Kansas soils and ground water," by C.A. Perry, Victor Robbins, and P.L. Barnes, has been completed.



PROJECT TITLE: Technology and information transfer

PROJECT NUMBER: KS-146

COOPERATING AGENCY: Kansas Water Office

PROJECT CHIEF: T.L. Huntzinger

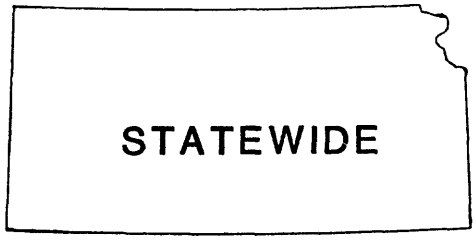
Problem -- The Kansas Water Office has the responsibility for the overall aspects of water-management activities within the State. Many State agencies have direct responsibility for specific aspects of water-resource interests in Kansas, but there has been no forum for information transfer among these agencies as a group. Also, common knowledge is lacking among agencies concerning the extent of involvement each has with the U.S. Geological Survey on the type of information provided by the Survey.

Objective -- To provide an initial forum for information transfer among the various water-resource interests in the State. Some effort will be directed toward procedures that assure continued information transfer and planned coordination among agencies. Also an opportunity will be made available to learn more about water resources of Kansas with information provided by the U.S. Geological Survey.

Approach -- Information transfer and coordination will be provided through popularized maps, pamphlets, and oral presentations on technical topics in hydrology.

Significant milestones -- A two-day water-resources seminar was held in July 1985 to summarize the Federal-State Cooperative Program in Kansas. Fifty-one attendees represented 14 State, local, and Federal agencies concerned with water in Kansas. Project funding ended in FY 86.

Reports -- Huntzinger, T.L., 1985, Federal-State cooperative program in Kansas, seminar proceedings, July 1985: U.S. Geological Survey Open-File Report 85-641, 39 p.



PROJECT TITLE: Movement and persistence of agricultural pesticides in the saturated and unsaturated zones in Kansas

PROJECT NUMBER: KS-151

COOPERATING AGENCY: Kansas Department of Health and Environment

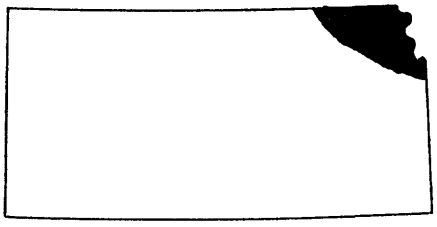
PROJECT CHIEF: C.A. Perry

Problem -- Intrusion of agricultural pesticides into the subsurface environment is occurring, and residues of these toxic organics have been detected in some aquifers in Kansas. The extent of this problem is unknown, and the physical processes involved in the movement and persistence of the pesticides are not defined. To better understand the dynamics and fate of pesticides in the field, a research study is needed.

Objectives -- Define the behavior of pesticides from the land surface down into the ground-water system for major agricultural areas within the State, determine current pesticide distribution, determine infiltration and recharge rates of pesticide leaching, determine actual field-decay rates, and compare these findings with estimates from the U.S. Environmental Protection Agency's pesticide-rootzone model and "Leaching Evaluation of Agricultural Chemicals Handbook."

Approach -- As a direct result of project KS-145, several sites were selected for intensive study of the movement and fate of pesticides in Kansas. Pertinent data will be collected from several Kansas State University Agronomy Farms and Experimental Stations. Soil and ground-water samples will be analyzed for pesticides and degradation products, and these analyses will be related to the physical characteristics of the sampling sites, including climate, infiltration of water, soil temperature, particle size, pH, clay type and moisture, and application rates. Actual measurements of pesticide movement and persistence will be compared with theoretical estimates.

Significant milestones -- Data-collection activities are continuing.



PROJECT TITLE: Glacial deposits (Pleistocene) in northeast Kansas

PROJECT NUMBER: KS-091

COOPERATING AGENCY: Kansas Geological Survey

PROJECT CHIEF: J. E. Denne

Problem -- As population and demand for water increase in northeast Kansas, ground-water supplies are gaining in significance. They are especially important during periods of little precipitation when surface-water supplies decline. Although the bedrock formations in the area generally contain little, if any, good-quality water, the glacial buried-valley aquifers may yield up to several hundred gallons per minute of freshwater to wells.

Because the buried-valley aquifers are variable in location, extent, and hydrologic characteristics, detailed study of them is necessary. Current aquifer usage and development potential for domestic, municipal, agricultural, and industrial needs also must be evaluated.

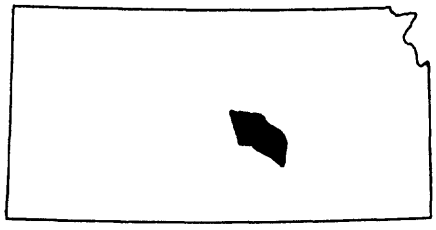
Objectives -- The objectives of this study are to: (1) locate and delineate the major Pleistocene aquifers of northeast Kansas, (2) determine water levels in and saturated thicknesses of these aquifers, (3) analyze the Pleistocene stratigraphy and the character of the glacial deposits, (4) analyze the quality of waters contained in the Pleistocene aquifers, (5) determine current municipal, agricultural, and industrial usage of the aquifers, and (6) evaluate potential of the aquifers for new water supplies.

Approach -- Buried-valley aquifers will be located by evaluation of existing hydrogeologic information, interpretation of maps and remote-sensing data, and onsite work (drilling and geophysical investigations). Water levels will be measured in wells and test holes, and saturated thicknesses will be calculated. Grain size and clay mineralogy of sediments will be analyzed for stratigraphic correlation and aquifer evaluation. Chemical constituents of water from Pleistocene aquifers will be determined by sample analyses (performed by the Kansas Department of Health and Environment). These analyses will allow realistic water-resource planning for the area. Knowledge of aquifer locations also should allow protection of ground water from contamination. The geophysical techniques (for example, seismic, resistivity, and thermal) developed and utilized in this program should prove useful for studies of other unconsolidated aquifers in Kansas.

Significant milestones -- Nearing completion of first draft of final report to be published by the Kansas Geological Survey.

Reports -- Denne, J.E., Miller, R.E., and Hathaway, L.R., 1985a, Basic data for the hydrogeology and geochemistry of glacial deposits in northeastern Kansas: Kansas Geological Survey Open-File Report 85-10, part 1, 177 p.

_____1985b, County maps of hydrogeologic data for study of glacial deposits in northeastern Kansas: Kansas Geological Survey Open-File Report 85-10, part 2, scale 1:125,000, 84 maps.



PROJECT TITLE: Hydrogeology of the Equus beds aquifer, central Kansas

PROJECT NUMBER: KS-092

COOPERATING AGENCY: Kansas Geological Survey

PROJECT CHIEF: J. M. Spinazola

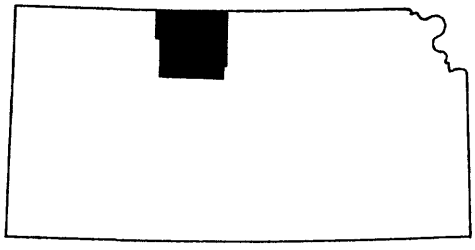
Problem -- Unconsolidated deposits of Pleistocene age, commonly known by the informal term "Equus beds," are the major source of water for municipal, industrial, and irrigation use in central Kansas. Continued increasing withdrawals of water from this important aquifer can result in mining of water, reduced well yields, deterioration of water quality, and impairment of existing water rights.

Objectives -- Determine the effects that increased ground-water withdrawals will have on (1) ground-water availability and (2) chemical quality of the ground water as they relate to the possible contamination of parts of the "Equus beds" as a result of induced movement of salinewater now present in the aquifer and salinewater inflow from the underlying Wellington aquifer.

Approach -- Additional data were collected with special emphasis on defining the distribution of chloride concentrations in the aquifer and on modeling of the ground-water flow system. An appropriate model was selected that would simulate the movement of salinewater. Evaluation of the simulation will be made, and new model development may result.

Significant milestones -- The project was completed in 1985.

Report -- Spinazola, J.M., Gillespie, J.B., and Hart, R.J., 1985, Ground-water flow and solute transport in the Equus beds area, south-central Kansas, 1940-79: U.S. Geological Survey Water-Resources Investigations Report 85-4336, 68 p.



PROJECT TITLE: Conjunctive-use models for North and South Fork Solomon River valleys, north-central Kansas

PROJECT NUMBER: KS-100

COOPERATING AGENCY: U.S. Bureau of Reclamation and Kansas Geological Survey

PROJECT CHIEF: J. E. Carr

Problem -- The management of surface and ground water, which is used for irrigation in the North and South Fork Solomon River valleys, is becoming more critical. Deficiencies in recent years of surface water for irrigation have resulted in the increasing use of ground water to supplement the available surface water. The conjunctive use of surface and ground water will be required for optimal use of the water resources of the valleys. The streams and associated alluvial aquifers are in close hydraulic connection and should be studied as stream-aquifer systems.

Objective -- The objective of the study is to evaluate various management alternatives for the stream-aquifer systems utilizing a digital model.

Approach -- A digital model of each stream-aquifer system was utilized. The model was capable of "inputting" streamflow, surface-water irrigation, pumping, and recharge on a monthly basis. Various water allocations, both of surface and ground water, were tested as management alternatives, and prediction as to the response of the stream-aquifer system was made. The model of the valley of the North Fork Solomon River was studied as phase 1. The modeling of the South Fork Solomon River was considered as phase 2 and was initiated at about the completion of phase 1.

Significant milestones -- Five interpretative reports have been published as a result of this project. The project was completed during 1986.

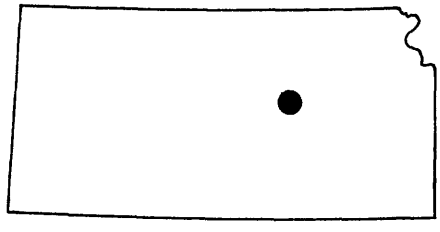
Reports -- Burnett, R.D., 1984, Predictive simulations of alternatives for managing the water resources of North Fork Solomon River valley between Kirwin Dam and Waconda Lake, north-central Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4249, 34 p.

Burnett, R.D., and Reed, T.B., 1985, Simulations of the effects of management alternatives on the stream-aquifer system, South Fork Solomon River valley between Webster Reservoir and Waconda Lake, north-central Kansas: U.S. Geological Survey Water-Resources Investigations Report 85-4200, 19 p.

_____1986, Availability of water for irrigation in the South Fork Solomon River valley, Webster Reservoir to Waconda Lake, north-central Kansas: U.S. Geological Survey Water-Resources Investigations Report 85-4003, 40 p.

Jorgensen, D.G., and Stullken, L.E., 1981, Hydrology and model of North Fork Solomon River valley, Kirwin Dam to Waconda Lake, north-central Kansas: Kansas Geological Survey Irrigation Series 6, 34 p.

Kume, Jack, Lindgren, R.J., and Stullken, L.E., 1985, Projected ground-water development, ground-water levels, and stream-aquifer leakage in the South Fork Solomon River valley between Webster Reservoir and Waconda Lake, north-central Kansas, 1979-2020: U.S. Geological Survey Water-Resources Investigations Report 85-4216, 42 p.



PROJECT TITLE: Geohydrology of Wellington Formation and Smoky Hill Valley alluvium in Salina area, central Kansas

PROJECT NUMBER: KS-110

COOPERATING AGENCY: Kansas Water Office

PROJECT CHIEF: J. B. Gillespie

Problem -- Salinewater is discharged from the alluvial aquifer into the Smoky Hill and Solomon Rivers east of Salina. The source of the salinewater is brine from the underlying aquifer in the Permian Wellington Formation. The eastward movement of brine in the Wellington aquifer is believed to be confined to a limited cross section in the alluvial aquifer underlying the Smoky Hill River valley. The Smoky Hill River is

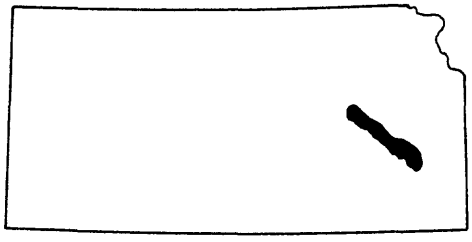
one of the major tributaries of the Kansas River, which supplies water for several of the largest urban and industrial centers in Kansas. Large concentrations of chloride that periodically occur have a significant adverse effect on the usability of the Smoky Hill and Kansas Rivers as a source of water.

Objectives -- Define more accurately the area under which the brine is flowing eastward in the Wellington aquifer. Determine the volume of brine moving eastward and delineate any areas of salinewater contamination in the alluvial aquifer in the Salina area. Evaluate possible locations of relief wells to intercept the eastward-flowing brine before it discharges into the Smoky Hill River.

Approach -- Test holes were drilled on the north and south sides of the valley boundaries to determine if there is any brine flowing underneath the adjacent uplands. Also, additional wells were installed in the Wellington aquifer underlying the valley alluvium. Aquifer tests were conducted on these wells, and the brine was injected into the deep Arbuckle aquifer. Short- and long-term aquifer tests were conducted on both aquifers simultaneously. Observation wells were augered in the alluvium. Water samples from both the Wellington and alluvial aquifers were collected for chemical analysis.

Significant milestones --Project work was completed during 1986.

Reports -- Gillespie, J.B., and Hargadine, G.D., 1986, Geohydrology of the Wellington-alluvial aquifer system and evaluation of possible locations of relief wells to decrease saline ground-water discharge to the Smoky Hill and Solomon Rivers, central Kansas: U.S. Geological Survey Water-Resources Investigations Report 86-4110, 31 p.



PROJECT TITLE: Transit losses and traveltimes for reservoir release during drought conditions along the Neosho River from Council Grove Lake to Iola, east-central Kansas

PROJECT NUMBER: KS-115

COOPERATING AGENCY: Kansas Water Office

PROJECT CHIEF: R. J. Hart

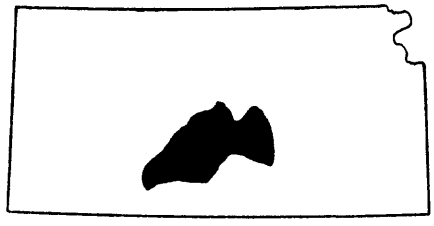
Problem -- The management of surface and ground water, which is used for water supply and irrigation in the Neosho River valley, is becoming more critical. The use of water directly from the river for irrigation has increased in recent years. All the water supply available from John Redmond Reservoir, about 100 miles downstream from Council Grove, has been purchased; therefore, additional water supplies are available only from Council Grove Reservoir. Natural streamflow gains and losses in the river must be calculated to determine the required amount of water released at the reservoir to supply the target discharge at the point of use.

Objective -- The purpose of this study is to determine the magnitude of natural streamflow gains and losses during drought conditions in two reaches of the Neosho River. One reach is from the outlet of Council Grove Reservoir to Neosho Rapids. The other reach is from the outlet of John Redmond Reservoir to the U.S. Geological Survey streamflow gage near Iola.

Approach -- This study entailed a data-acquisition phase and a modeling phase. First, a data base was developed from existing data and additional data that were collected to adequately describe the stream-aquifer system. The modeling phase entailed selection, calibration, and verification of a stream-aquifer model. The modeling phase also was devoted to using the calibrated model to determine streamflow losses under varying reservoir-release conditions during drought conditions.

Significant milestones -- The project was completed during 1985.

Reports -- Carswell, W.J., Jr., and Hart, R.J., 1985, Transit losses and traveltimes during drought conditions along the Neosho River from Council Grove Lake to Iola, east-central Kansas: U.S. Geological Survey Water-Resources Investigations Report 85-4003, 40 p.



PROJECT TITLE: Natural ground-water recharge dynamics in the Kansas Plains

PROJECT NUMBER: KS-122

COOPERATING AGENCY: Kansas Geological Survey

PROJECT CHIEFS: Marios Sophocleous and C. A. Perry

Problem -- Recent large-scale irrigation development in Kansas and the consequent declines in ground-water supplies focused attention on ground-water-recharge rates. These rates are not sufficient to meet the current demands over a long period of time. The lack of detailed information about natural recharge aggravates the problems of planning for and managing the ground-water resources of Kansas.

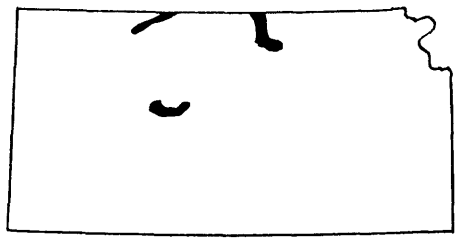
Objectives -- (1) Investigate the mechanisms of natural ground-water recharge; (2) quantify the amount of recharge water and specify its time distribution for two areas in Kansas, one in the "Equus beds" (informal usage) region and the other in the Big Bend region; (3) study and evaluate the latest technology with regard to instrumentation and techniques for studying ground-water recharge; and (4) coordinate onsite and laboratory measurements with mathematical modeling techniques to develop improved methods of estimating ground-water recharge.

Approach -- Two experimental sites were instrumented to provide integrated and automated measurements of the subsurface flow regime on a year-round basis. Onsite data were supplemented with laboratory determinations and were used to modify numerical models and thus to better understand and predict the recharge process.

Significant milestones -- Two journal articles have been published from this study, and two U.S. Geological Survey reports are in review. The project was completed in 1986.

Reports -- Sophocleous, Marios, and Perry, C.A., 1984, Experimental studies in natural groundwater-recharge dynamics--Assessment of recent advances in instrumentation: Journal of Hydrology, v. 70, p. 369-382.

_____1985, Experimental studies in natural groundwater-recharge dynamics--The analysis of observed recharge events: Journal of Hydrology, v. 81, p. 297-332.



PROJECT TITLE: Effects of irrigation return flow on the chemical quality of water in the Smoky Hill River, Prairie Dog Creek, and Republican River, Kansas

PROJECT NUMBER: KS-125

COOPERATING AGENCY: Kansas Department of Health and Environment

PROJECT CHIEF: T. B. Spruill

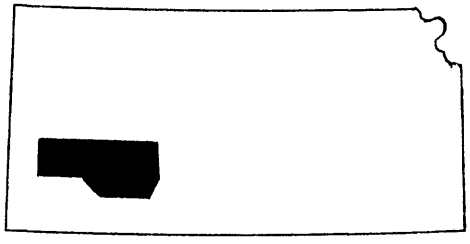
Problem -- Although ground water now provides the principal source of irrigation water in central and western Kansas, surface-water sources may become more important in the future because the ground-water reservoirs are being gradually depleted. Application of irrigation water in a semiarid region, such as western Kansas, may cause changes in the local hydrologic regime, as well as causing potentially deleterious changes in the soil and in ground- and surface-water quality. Water draining from an irrigated basin may be rendered unfit for other beneficial uses. Current conditions and possible long-term deleterious effects of irrigation need to be documented to provide information useful for management decisions directed at minimizing these problems.

Objectives -- (1) Areally define post-irrigation-season surface- and ground-water-quality characteristics within the irrigation districts and adjacent areas in the Prairie Dog Creek and Republican River valleys. (2) Statistically compare possible differences in surface- and ground-water quality of areas within each irrigaton district that are minimally irrigated, irrigated with ground water, and irrigated with surface water. (3) Define possible seasonal changes in hydrologic conditions and ground- and surface-water quality of areas that are minimally irrigated, irrigated with ground water, and irrigated with surface water. (4) Determine possible long-term effects of ground- and surface-water quality in the Cedar Bluff and Almena Irrigation Districts.

Approach -- Irrigation, domestic, and public-supply wells were selected in each of the three areas for water-quality sampling. Each of these areas contained 6 to 15 wells. Samples of well water in the Almena and Cedar Bluffs Districts were collected during the fall of 1981, and spring, summer, and fall of 1982. Samples of well water in the Bostwick District were collected from April to November 1982. Several seepage investigations also were conducted in each area. Data obtained from the study were analyzed statistically to determine significant areal, seasonal, and temporal changes in water quality.

Significant milestones -- The project was completed in 1985.

Reports -- Spruill, T.B., 1985, Statistical evaluation of the effects of irrigation on chemical quality of ground water and base flow in three river valleys in north-central Kansas: U.S. Geological Survey Water-Resources Investigations Report 85-4156, 64 p.



PROJECT TITLE: Hydrology of sandstone aquifers of Early Cretaceous age, southwest Kansas

PROJECT NUMBER: KS-127

COOPERATING AGENCY: Southwest Kansas Groundwater Management District No. 3

PROJECT CHIEF: K. R. Watts

Problem -- Sandstone of Early Cretaceous age forms a major aquifer system in southwest Kansas. As the intensely developed High Plains aquifer becomes depleted, more water users will tap the resources of these deeper aquifers. Detailed knowledge of the hydrology of the sandstone aquifers and possible hydraulic connections with the High Plains aquifer and underlying aquifers is needed so that the Southwest Kansas Groundwater Management District may refine their criteria for well spacing and appropriation of ground water.

Objective -- To define the hydrologic boundaries, aquifer characteristics and fluxes, potentiometric surfaces, water quality, and the water-supply potential of the sandstone aquifers and their connection with the High Plains aquifer.

Approach -- (1) Lithologic and geophysical data were used to refine the knowledge of the geologic and hydrologic boundaries of these aquifers;

(2) aquifer characteristics, transmissivity, and storage coefficients were determined from pump-test data;

(3) water-level information was collected from observation wells;

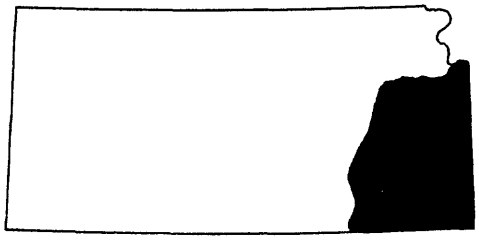
(4) water use from the aquifers was estimated for major water-use categories;

(5) an inventory of large-capacity wells completed in the Dakota aquifer was used to update the Ground-Water Site Inventory (GWSI) files of the U.S. Geological Survey; and

(6) a three-dimensional finite-element ground-water flow model consisting of up to five layers was calibrated and used to evaluate management strategies.

Significant milestones -- The project was completed in 1985.

Reports -- Watts, K.R., 1985, Potential effects of ground-water withdrawals from the Dakota aquifer, southwestern Kansas: U.S. Geological Survey Open-File Report 85-567 (pending publication as a Water-Supply Paper), 72 p.



PROJECT TITLE: Estimating stream-aquifer interactions in coal areas of eastern Kansas

PROJECT NUMBER: KS-131

COOPERATING AGENCY: Federal

PROJECT CHIEF: H. E. Bevans

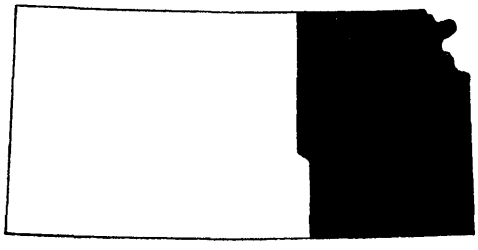
Problem -- Information about stream-aquifer interactions in coal areas of eastern Kansas, necessary to predict and manage the effects of strip mining, generally is unavailable because of the lack of aquifer-test data; however, previously developed quantitative analytical procedures are available that can provide alternative approaches to estimating stream-aquifer interactions. A need exists to demonstrate the application and evaluate the accuracy of these procedures.

Objectives -- The objectives of this investigation are to: (1) Demonstrate the application of quantitative analytical procedures for estimating stream-aquifer interactions, (2) evaluate the accuracy and transferability of the procedures, and (3) develop a method for estimating stream-aquifer interactions for ungaged streams in coal areas of eastern Kansas.

Approach -- Available streamflow data were utilized in quantitative analytical procedures to estimate stream-aquifer interactions in coal areas of eastern Kansas. The estimated interactions were compared between subareas to determine their transferability within the study area.

Significant milestones -- The project was completed during 1985.

Reports -- Bevans, H.E., 1986, Estimating stream-aquifer interactions in coal areas of eastern Kansas by using streamflow records, in Selected papers in the hydrologic sciences, 1986, Seymour Subitzky, ed.: U.S. Geological Survey Water-Supply Paper 2290, p. 51-64.



PROJECT TITLE: Effects of multipurpose use on the water quality of public water-supply lakes, eastern Kansas

PROJECT NUMBER: KS-132

COOPERATING AGENCY: Kansas Department of Health and Environment

PROJECT CHIEF: L. M. Pope

Problem -- Assessment of the water-quality characteristics of selected public water-supply lakes in eastern Kansas can be used to evaluate their suitability as drinking-water supplies. The use of lakes for various activities can affect the quality of water in such a manner that may accelerate natural eutrophication processes, which, in turn could increase the concentrations of organic substances in the water. The contribution of nutrients (nitrogen and phosphorus) by inflow from lake drainage areas can enhance the growth of the phytoplankton populations and algae, which can also accelerate the eutrophication processes. The increased concentrations of organic substances, nutrients, phytoplankton, and algae can cause taste, odor, and turbidity problems and pose a potential for the formation of organohalides as by-products of the interaction of disinfectants with natural organic substances.

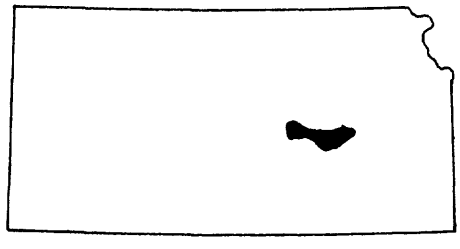
Objectives -- The purpose of this investigation is to evaluate the effects of multipurpose use on the water quality of selected public water-supply lakes. Specific objectives of the investigation are to: (1) Identify tify and quantify organic chemicals, nutrients, and phytoplankton populations, (2) determine seasonal and spatial variations in organic chemicals, nutrients, phytoplankton populations, and dissolved oxygen; (3) select lakes

representative in size, age, trophic state, and degree of water-quality degradation for an intensive 3- to 5-year investigation.

Approach -- A reconnaissance survey of selected public water-supply lakes was made in eastern Kansas. The selection of lakes was based on variations in size and management practices. Water samples were collected during low-flow conditions when water-quality degradation was most apparent and when water-treatment plants were experiencing taste and odor problems. Water samples were collected at inflow and outflow points of the lake and at points within the lake selected by determinations of spatial variation in temperature, dissolved oxygen, pH, specific conductance, and turbidity. The water samples were analyzed for dissolved solids, nutrients, chlorophyll-a, and total and organic carbon. The resultant water-quality data were analyzed and used to select lakes for more intensive study.

Significant milestones -- The project was completed during 1985.

Reports -- Pope, L.M., Arruda, J.A., and Vahsholtz, A.E., 1985, Water-quality reconnaissance of selected water-supply lakes in eastern Kansas: U.S. Geological Survey Water-Resources Investigations Report 85-4058, 47 p.



PROJECT TITLE: Transit loss, traveltimes, and related hydraulic and hydrologic characteristics of selected stream-aquifer systems

PROJECT NUMBER: KS-134

COOPERATING AGENCY: Kansas Water Office

PROJECT CHIEF: P. R. Jordan

Problem -- For most stream reaches downstream from major water-supply reservoirs in Kansas, little is known of losses or gains of streamflow to or from bank storage, ground water, and evapotranspiration. The components of the natural system must be evaluated during various combinations of natural conditions and reservoir releases in order to provide information for the sound planning and management of water supplies.

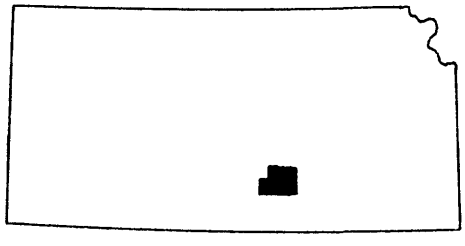
Objectives -- (1) Define the hydraulic and hydrologic characteristics of selected stream-aquifer systems. (2) Quantify the movement of water between stream, aquifer, and atmosphere. (3) Evaluate the effects of

changes in natural hydrologic conditions and of specific water-management alternatives.

Approach -- The project began with selection of a model after examination of the available stream-aquifer models through literature review and consultation with knowledgeable individuals. Existing data were assembled and interpreted. New data were collected where needed. The model was calibrated, then used to simulate a variety of conditions that might occur naturally or be imposed.

Significant milestones -- The project was completed during 1985.

Reports -- Jordan, P.R., and Hart, R.J., 1985, Transit losses and traveltimes for water-supply releases from Marion Lake during drought conditions, Cottonwood River, east-central Kansas: U.S. Geological Survey Water-Resources Investigations Report 85-4263, 41 p.



PROJECT TITLE: Water resources of Sedgwick County, Kansas

PROJECT NUMBER: KS-136

COOPERATING AGENCIES: Sedgwick County and the City of Wichita

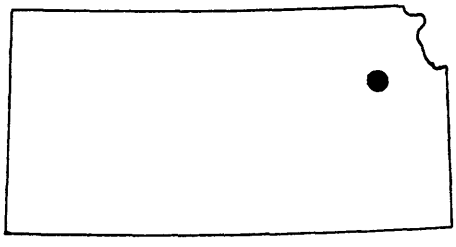
PROJECT CHIEF: H. E. Bevans

Problem -- Increasing population in Sedgwick County, the most populous county in Kansas, and in Wichita, its principal city, requires careful management of county water resources to provide adequate supplies for domestic, industrial, and irrigation use. The county and city currently (1984) are relying on information from a 1965 geohydrologic study to manage their water resources. Current information regarding the availability and quality of ground- and surface-water resources is necessary to determine changes since 1965 and to assess future impacts.

Objectives -- This study will be directed towards: (1) Inventorying the current quantity and quality of surface- and ground-water resources in Sedgwick County; (2) evaluating the water resources with respect to supplies required for domestic, industrial, and irrigation uses; and (3) determining trends with respect to the quantity and quality of the water resources during the past 20 years in order to assess future impacts.

Approach -- A thorough review of available data and literature will be used to establish a frame of reference for determining trends in county water resources and to determine additional data needs. Hydrologic data will be collected for developing a water-table contour map, describing water-quality characteristics of ground and surface water, quantifying ground- and surface-water resources available for county supplies, and determining trends by comparisons to historical data.

Significant milestones -- Streamflow measurements and water samples were collected and analyzed for 54 sites. Ground-water samples (including some for volatile-organic and pesticide analysis) were collected from 101 wells. Water-quality samples were collected from 14 selected surface-water impoundments. Water-level measurements were made at 350 wells. Data-collection activities for the investigation have been completed.



PROJECT TITLE: Instrumentation of a dry-pond detention structure for determining effects on the quality of urban runoff

PROJECT NUMBER: KS-142

COOPERATING AGENCY: Federal

PROJECT CHIEF: L. M. Pope

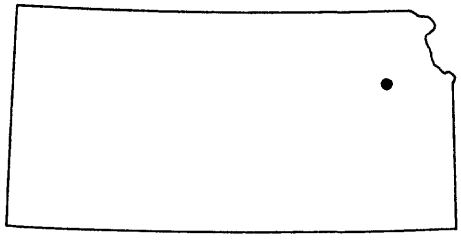
Problem -- Temporary storage of urban runoff in dry-pond detention structures is known to be an effective method of controlling flooding in urban areas; however, the effect that "dry pond" detention has on urban-runoff water quality is poorly understood. Flow-monitoring and sampling instrumentation of "dry-pond" inflows and outflows require sophistication and state-of-the-art technology, particularly for in-pipe flows. Monitoring and sampling flows in storm-sewer pipes require custom design, installation, maintenance of flumes, constrictions, velocity meters, and automatic equipment, all of which are time consuming and expensive.

Objective -- To instrument, operate, and maintain the necessary flumes, constrictions, velocity meters, and automatic-sampling equipment to monitor and sample flows in two inflow and one outflow storm-sewer pipes to a dry-pond detention structure in Topeka, Kansas.

Approach -- All necessary pipe diameters, lengths, and slopes will be measured at the study site. Instrumentation will be fabricated by the

the U.S. Geological Survey's Hydrologic Instrumentation Facility in Bay St. Louis, Mississippi. Instrumentation will be installed and operated in conjunction with a rainfall- and urban-runoff study for 2.5 years. Necessary and preventive maintenance will be performed throughout the duration of the study.

Significant milestones -- Gaging and sampling shelters were installed at the selected "dry pond" during FY86. To determine discharges, Palmer-Bowlus[1] type flumes were installed in each of the two 24-inch concrete inflow pipes, and a manhole flume was installed in the outflow riser box. Pressure transducers were used to determine flow head at each discharge location. Micro data loggers are used to record measurement and precipitation data and to control the operation of three automatic water samplers.



PROJECT TITLE: Evaluation of the effects of dry-pond detention storage on the quality of runoff from urban areas

PROJECT NUMBER: KS-143

COOPERATING AGENCY: Kansas Department of Health and Environment

PROJECT CHIEF: L. M. Pope

Problem -- Runoff from urban areas may contain relatively large concentrations of trace elements such as cadmium, chromium, copper, lead, mercury, and zinc, as well as other water-quality constituents such as biochemical oxygen demand (BOD), chemical oxygen demand (COD), total organic carbon (TOC), various nutrients, and suspended sediment. Temporary storage of urban runoff in dry-pond detention structures is known to be an effective method of controlling flooding in urban areas; however, the effects that the ponds have on reducing the concentrations and loads of undesirable water-quality constituents are less clear and in need of further research.

Objectives -- The primary objective of this study is to evaluate the effects of dry-pond detention storage on the quality of storm runoff from urban areas in the Topeka metropolitan area. A secondary objective is to

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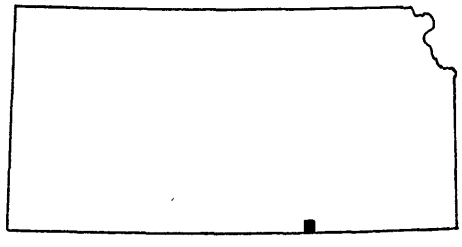
[1] The use of brand names in this report is for identification purposes only and does not imply endorsement by the U.S. Geological Survey or its cooperators.

evaluate procedures for predicting loads of selected water-quality constituents in storm runoff from storm-related characteristics.

Approach -- Discharge and water-quality data will be collected at sites on the inflows and outflow of a selected "dry pond." Each of these sites will be instrumented with continuously recording flow- and automatic-sampling equipment as described in project KS-142. Also, physiographic, land-use, climatic, and storm-characteristic data will be collected at the study location. Total loads of selected constituents will be compared graphically and statistically to determine the effects of detention storage. Multiple regression analysis will be used to define relationships between storm loads and storm characteristics.

Significant milestones -- During FY86 all necessary instrumentation was installed. Rainfall-runoff data and water-quality samples were collected for six storms with total precipitation ranging from 0.06 to 2.15 inches.



PROJECT TITLE: Reconnaissance of Arkansas City dump site, Arkansas City, Kansas

PROJECT NUMBER: KS-147

COOPERATING AGENCY: Kansas Department of Health and Environment

PROJECT CHIEF: T. B. Spruill

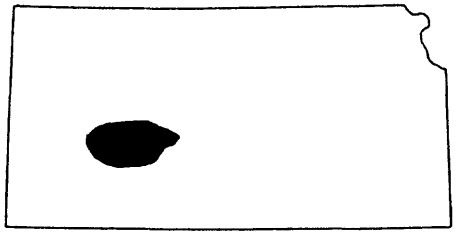
Problem -- The Arkansas City dump site has been used as a city landfill as well as for disposal of wastes from an oil refinery. Carcinogenic polyaromatic hydrocarbons and large concentrations of lead, chloride, sulfate, and nitrate have been identified in soil and ground-water samples onsite. Available information is inadequate to define the source and extent of soil and water contamination. Before environmental hazards may be fully evaluated, composition, quantity, and mobility of the wastes need to be characterized. In addition, the relationship of the aquifer and the Arkansas River need to be determined, and initial estimates of soil and water contamination made.

Objectives -- (1) To identify the location, extent, and volume of the principal sources of waste on the site. (2) To define the chemical and physical characteristics of the wastes. (3) To evaluate possible alter-

natives regarding remedial action for known waste sites. (4) To obtain preliminary information on the extent of soil and ground-water contamination on and adjacent to the site. (5) To define the hydrology of the immediate vicinity. (6) To determine possible effects of seepage from the site on the Arkansas River.

Approach -- Locate the surface and subsurface waste boundaries by magnetometer surveys and test-hole drilling. Determine the chemical and physical characteristics of wastes from the site and of soil and water samples. Determine source and extent of contamination and factors governing contaminant mobility. Collect samples from the Arkansas River up- and downstream from the waste site to determine impact of the site on river-water quality.

Significant milestones -- All field work has been completed. A U.S. Geological Survey Water-Supply Paper is being prepared.



PROJECT TITLE: Recharge from floodflows along the Pawnee River and its tributaries

PROJECT NUMBER: KS-148 and 149

COOPERATING AGENCY: U.S. Soil Conservation Service, Pawnee Watershed District No. 81, Southwest Kansas Groundwater Management District No. 3

PROJECT CHIEF: J. B. Gillespie

Problem -- Information on natural recharge to alluvial aquifers along the ephemeral streams during periods of peak discharge when the channel and part of the flood plain are inundated is needed. The benefits of flood-retarding structures on ground-water resources need to be determined for the Pawnee Watershed District. Information concerning infiltration, unsaturated and saturated flow of water to the water table, and aquifer properties along the Pawnee River and its tributaries in west-central Kansas is needed by Groundwater Management Districts 3 and 4.

Objectives -- The amount of water entering the alluvial ground-water system during controlled and uncontrolled floodflows will be determined by simulating various streamflow hydrographs at points within the Pawnee River basin. The recharge process along the alluvial channels will be described, and factors controlling recharge will be measured.

Approach -- Channel and flood-plain infiltration will be measured at sites in the Pawnee River watershed. A 10- to 15-foot section of the ephemeral stream channel will be isolated by two cofferdams. Discharge hydrographs will be simulated by pumping water into and out of that section and measuring the loss of water volume due to infiltration. Duration curves for hydraulic gradient versus vertical infiltration will be developed, and from these curves, the amount of infiltration for the different hydrographs can be estimated. A computer model will be calibrated, and simulations of recharge will be performed.

Significant milestones -- Field work has been completed, and a report is in preparation.

PROJECT TITLE: Occurrence of agricultural pesticides in the Tuttle Creek Lake-stream system, Kansas

PROJECT NUMBER: KS-150

COOPERATING AGENCY: Kansas Department of Health and Environment

PROJECT CHIEF: H. E. Bevans

Problem -- Pesticides have been detected in Kansas lakes and streams that are current or future sources of public-water supplies. Atrazine, the most extensively used agricultural pesticide in Kansas, has been reported to occur in concentrations as large as 27 micrograms per liter in Tuttle Creek Lake. Although long-term impacts of atrazine and other pesticides on human health have not been fully determined, these pesticides pose a potential threat to the quality of water in lakes that provide public-water supplies. Additionally, the presence of pesticides in lake water may affect phytoplankton productivity.

Objectives -- This investigation of the occurrence of agricultural pesticides in the Tuttle Creek Lake-stream system will be directed towards (1) documenting the occurrence of pesticides in the lake-stream system, (2) describing the transport of pesticides through the lake-stream system, and (3) determining the impacts of atrazine on photosynthesis and carbon uptake of lake phytoplankton.

Approach -- Samples of water-sediment mixture will be collected during a 1-year period from Tuttle Creek Lake, lake tributaries, and the lake outflow. Concentrations of total pesticides, total organic carbon, and suspended sediment will be determined for all samples. Dissolved concentrations of pesticides and organic carbon also will be determined for the Big Blue River, the principal lake tributary. Experiments will be conducted using Tuttle Creek Lake samples and samples from a control lake, where pesticides are not present, to determine impacts of atrazine on lake phytoplankton. Interpretations of these data will be used to meet present objectives.

Significant milestones -- Data collection began in early April 1986, prior to pesticide application and is scheduled to conclude in March 1987. The Kansas Biological Survey completed data collection for two contracted experiments to determine impacts of atrazine on lake phytoplankton. As of October 1986, 87 samples have been collected from stream stations, and 39 samples have been collected from Tuttle Creek Lake.

PROJECT TITLE: Surface-water-quality assessment of the lower Kansas River basin, Kansas and Nebraska

PROJECT NUMBER: KS-152

COOPERATING AGENCY: Federal

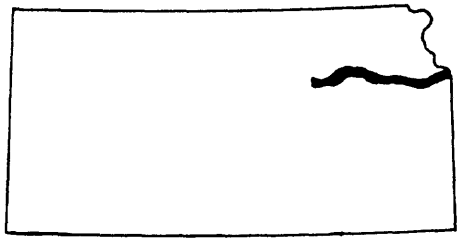
PROJECT CHIEF: J. K. Stamer

Problem -- Protecting and increasing the supply of good quality water in the Nation is national priority. The Nation's Midwest is a very productive agricultural grain belt. The lower Kansas River drainage is typical of this midwestern agricultural region that includes irrigated and nonirrigated land. The basin is also representative of water use--principally for irrigation, municipal, and industrial purposes. An assessment of the water quality and quantity of water in the lower Kansas River basin, which includes the Big Blue River basin in Nebraska and Kansas, is important.

Objectives -- (1) To define the existing water quality of the lower Kansas River basin, its major tributaries, and selected reservoirs. (2) To determine trends in water quality of the lower Kansas River basin, its major tributaries, and selected reservoirs. (3) To define cause-effect relationships for a selected subbasin or river reach. (4) To identify existing or potential water-quality problems.

Approach -- The approach will be divided into three elements: (1) Fixed-station studies to assess average annual constituent transport and water-quality trends; (2) synoptic studies to determine the surface-water quantity and quality during low flows, to determine trace elements and organic residues in the streambed sediments during low flows, and to calculate constituent transport at the fixed stations during high flows; and (3) intensive subbasin or river-reach studies to define cause-effect relationships, depending on time and resource constraints.

Significant milestones -- The U.S. Geological Survey is initiating seven national prototype water-quality assessment studies. Four of them are surface-water-quality studies, and the remaining three are ground-water-quality studies. The seven studies cover parts of Kansas, Nebraska, Kentucky, Washington, Illinois, Indiana, Wisconsin, Oklahoma, Nevada, Delaware, and Maryland. A liaison committee was formed for purposes of exchanging information and providing advice to the study team. The liaison committee consists of representatives of Federal, State, and local agencies and representatives of the University of Kansas and Kansas State University.



PROJECT TITLE: Ground-water and surface-water relationships in the Kansas River alluvium

PROJECT NUMBER: KS-153

COOPERATING AGENCY: U.S. Bureau of Reclamation

PROJECT CHIEF: R. J. Wolf

Problem -- The State of Kansas is developing a water-management plan for the Kansas River as a part of the purchase of water stored in Federal reservoirs. The impact of pumpage from the river valley alluvium on releases from the reservoir in time of drought needs to be determined. The area of study will be the valley alluvium along the main stem of the Kansas River.

Objectives -- The study will provide information needed to anticipate the effects of ground-water pumpage on reservoir releases. The primary objective of the study is to determine the effects of pumping on stream-flows during low-flow periods and transit losses and traveltimes of reservoir releases.

Approach -- Documentation of ground-water levels and streamflows will be used to determine the interaction between the river and the alluvial aquifer. Various analytical and digital-modeling techniques will be used to quantify the impacts of pumpage on the river during low-flow periods. Synoptic studies of stream discharge along the river will be conducted to determine the transit losses and traveltimes during reservoir releases at low flow.

Significant milestones -- This project is part of a total water-management study of the Kansas River conducted by the U.S. Bureau of Reclamation and the Kansas Water Office.

Research

PROJECT TITLE: Regional synthesis of the hydrogeology of the United States

PROJECT NUMBER: KS-137

COOPERATING AGENCY: Federal

PROJECT CHIEF: J. S. Rosenshein

Problem -- A need exists for a comprehensive but succinct up-to-date regional synthesis of the hydrology of the United States and adjacent areas. This need is being addressed by the preparation of a definitive volume on hydrogeology of North America. About one-half of this volume will concern the synthesizing of the hydrogeology of 28 ground-water regions of the United States and adjacent areas.

Objectives -- (1) To ensure that scientifically creditable and comprehensive treatment is given to the 28 ground-water regions of the United States and adjacent areas of North America. (2) To provide the coordination, organization, and guidance needed for preparation of the 28 chapters covering the ground-water regions. (3) To integrate the contributions of about 55 contributors to the regional synthesis part of the volume and to serve as editor for this part of the volume.

Approach -- Identify knowledgeable and qualified contributors for the chapters and assign responsibilities. Provide the guidelines and concepts for emphasis in preparation for the 28 chapters, and establish deadlines for outlines and drafts. Coordinate preparation effort and prepare personal contribution. Screen contributions for content and provide review where needed. Provide final technical editing and integration of the contributions.

Significant milestones -- Of the 28 chapters in part II of the volume on "Hydrogeology of North America," 20 are complete, and all U.S. Geological Survey contributions except 3 have been approved by the Director.

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3. Burnett, R.D., 1984, Predictive simulations of alternatives for managing the water resources of North Fork Solomon River valley between Kirwin Dam and Waconda Lake, north-central Kansas. U.S. Geological Survey Water-Resources Investigations Report 84-4249, 34 p.

4. Burnett, R.D., and Reed, T.B., 1985, Simulations of the effects of management alternatives on the stream-aquifer system, South Fork Solomon River valley between Webster Reservoir and Waconda Lake, north-central Kansas: U.S. Geological Survey Water-Resources Investigations Report 85-4200, 19 p.

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6. Carr, J.E., McGovern, H.E., and Gogel, Tony, 1986, Geohydrology of and potential for fluid disposal in the Arbuckle aquifer in Kansas: U.S. Geological Survey Open-File Report 86-491 (pending publication by the Kansas Geological Survey), 101 p.

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8. Combs, L.J., 1985, Water-resources activities of the U.S. Geological Survey in Kansas--Fiscal years 1983 and 1984: U.S. Geological Survey Water Open-File Report 85-178, 97 p.

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14. Dunlap, L.E., Lindgren, R.J., and Carr, J.E., 1984, Projected effects of ground-water withdrawals in the Arkansas River valley, 1980-99, Hamilton and Kearny Counties, southwestern Kansas: U.S. Geological Survey Water-Resources Investigations Report 84-4082, 168 p.

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HYDROLOGIC-DATA STATIONS IN KANSAS, 1986 WATER YEAR

Explanation of Table Symbols

Surface-Water Stations

Station Purpose, Complete-Record Gaging Stations

B - Benchmark.

C - Current purpose station.

F - Flood forecast (also used by National Weather Service).

H - A hydrologic station to meet objectives of defining regional streamflow characteristics.

I - Interstate Compact.

L - Long-term trend station to meet objectives of measuring principal unregulated streams.

P - Principal-stream station to meet objectives of measuring principal unregulated streams.

R - A station required for systems analysis of a regulated stream to meet objectives of defining regulated flow.

Type of Gage, Complete-Record Gaging Station

B - Bubble gage
C - Cableway
D - Digital recorder (stage)
Dp - Digital recorder (precipitation)
R - Graphic recorder
T - Telemetering equipment
W - Artificial control

Sampling Purpose, Water-Quality Stations

CHEM Chemical analysis: cations, anions, nutrients

METAL Trace metals analysis

BIOL Biological analysis: phytoplankton, periphyton

TOC Total organic carbon determination

SED Suspended sediment: concentration, discharge, particle size

BED Bed material: particle size

COLI Coliform count: total fecal, fecal streptococcal

FIELD Field measurements: discharge, water temperature, alkalinity, specific conductance, pH, dissolved oxygen

Cooperator or Supporting Program

CBR	Collection of basic records (Federal)
COMP	Arkansas River Compact Administration
DWR	Kansas State Board of Agriculture, Division of Water Resources
HAYS	City of Hays
KC-CE	Kansas City District, U.S. Army Corps of Engineers
KDHE	Kansas Department of Health and Environment
KDOT	Kansas Department of Transportation
KWO	Kansas Water Office
T-CE	Tulsa District, U.S. Army Corps of Engineers
USBR	U.S. Bureau of Reclamation
WICHITA	City of Wichita

Ground-Water Wells

Well Numbers

Well numbers in these listings indicate the location of wells according to the land subdivisions of the U.S. Bureau of Land Management (fig. 11). An example of a typical well number is 21S 34W 16AADA 02 in Finney County. The first two digits indicate the township, which in Kansas are nearly all south of the 40th parallel base line. The second two digits indicate the range east or west of the Sixth Principal Meridian. The last two digits indicate the section in which the well is located. The first letter after these digits denotes the quarter section or 160-acre tract; the second, the quarter-quarter section or 40-acre tract; the third, the quarter-quarter-quarter section or 10-acre tract; and the fourth, when used, the quarter-quarter-quarter-quarter section or 2 1/2-acre tract. The quarter sections, quarter-quarter sections, and so forth, are designated A, B, C, and D in a counterclockwise direction, beginning with A in the northeast quadrant. Wells located within the smallest subdivision indicated are numbered serially.

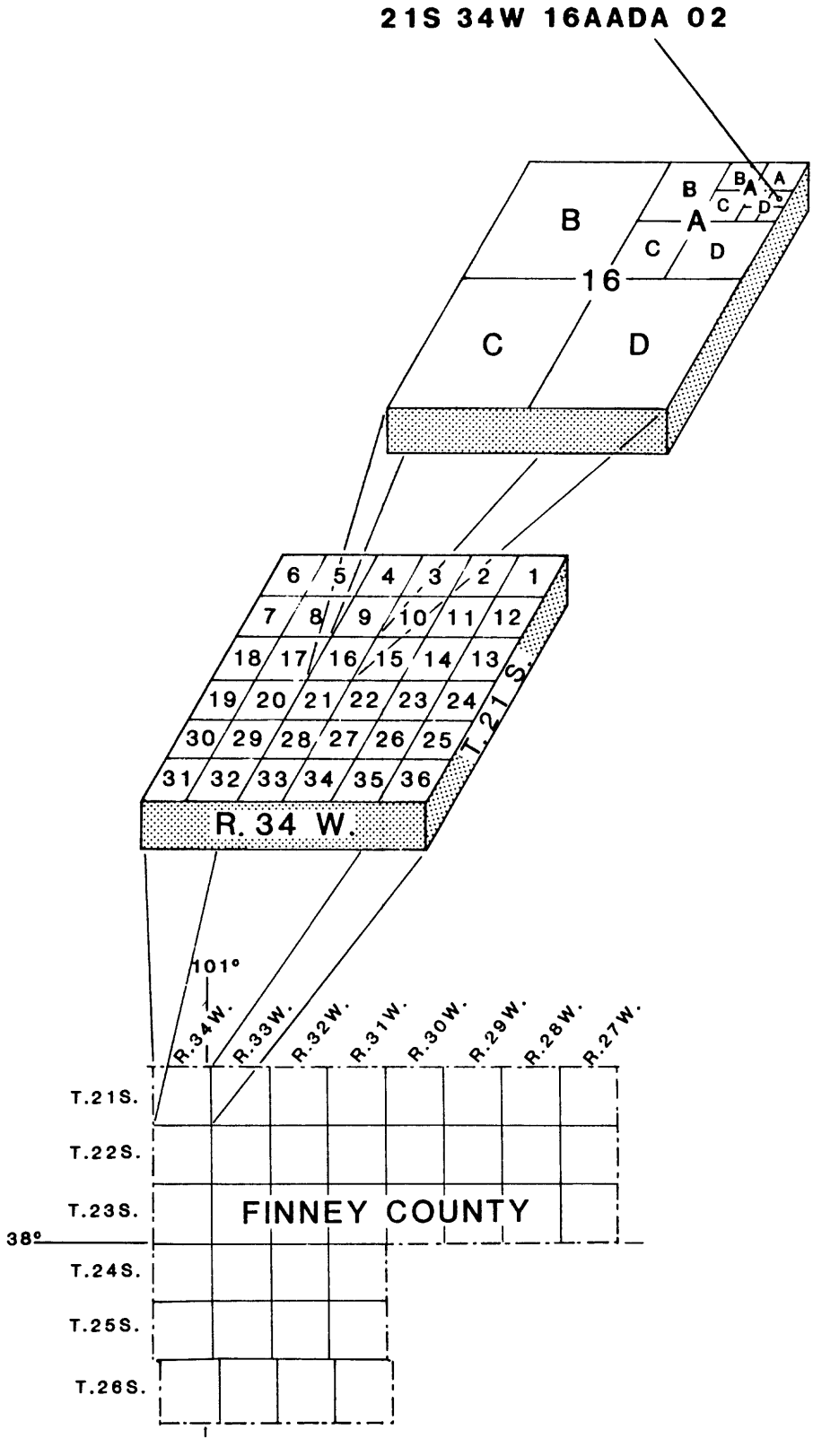

Figure 11.--Well-numbering system.

Table 1.--Complete-record streamflow-gaging stations, 1986 water year

Ident. no.	Station name	Station purpose	Location Sec.	T.	R.	Type of gage	Coop. or support
		Missouri River basin					
06-							
8140	Turkey Cr. nr Seneca	C,F,L,P	20	1S	12E	BDR	KWO
8447	S. Fk. Sappa Cr. nr Brewster	H,L	9	9S	37W	BDRDp	KWO
8449	S. Fk. Sappa Cr. nr Achilles	H,L	29	4S	30W	BDRDp	KWO
8465	Beaver Cr. at Cedar Bluffs	C,I,L,P	10	1S	29W	BDR	CBR
8479	Prairie Dog Cr. ab Keith Sebelius Lake	C,L,P	23	3S	25W	BCDRDpW	KC-CE
84795	Keith Sebelius Lake nr Norton		8	3S	23W	BR	KWO
8480	Prairie Dog Cr. at Norton	C,R	9	3S	23W	BDRW	KWO
8485	Prairie Dog Cr. nr Woodruff	C,I,L,R	9	1S	19W	BDRT	CBR/ KC-CE
8535	Republican R. nr Hardy, Nebr.	C,I,R	6	1S	5W	BDRT	CBR
8538	White Rock Cr. nr Burr Oak	C,L,P	7	2S	8W	BCDR	KC-CE
8539	Lovewell Res. nr Lovewell		6	2S	6W	BR	KWO
8540	White Rock Cr. at Lovewell	C,R	17	2S	6W	BDRW	KWO
8558	Buffalo Cr. nr Jamestown	C,F	14	5S	5W	BDR	KWO
8560	Republican R. at Concordia	C,R	28	5S	3W	BDRT	KC-CE
8566	Republican R. at Clay Center	C,R	17	8S	3E	BDRT	CBR/ KC-CE
85705	Milford Lake nr Junction City		20	11S	5E	RT	KC-CE
8571	Republican R. bl Milford Dam	C,R	--	--	--	BCDRT	KC-CE
8600	Smoky Hill R. at Elkader	C,L,P	34	14S	32W	BDRDp	KWO
8610	Smoky Hill R. nr Arnold	C,P	29	14S	24W	BDR	KC-CE
8615	Cedar Bluff Res. nr Ellis		36	14S	22W	BR	KWO
8620	Smoky Hill R. at Cedar Bluff Dam	C,R	1	15S	22W	BCRTW	KWO
8627	Smoky Hill R. nr Schoenchen	C,F,R	25	15S	19W	BDR	KWO
86285	Smoky Hill R. bl Schoenchen	C,R	27	15S	18W	BDR	HAYS
8635	Big Cr. nr Hays	C,F,L	30	14S	17W	BDR	KWO
8639	N. Fk. Big Cr. nr Victoria	C,L	27	13S	17W	BR	KWO
86405	Smoky Hill R. nr Bunker Hill	C,R	33	14S	13W	BDRT	KC-CE
8645	Smoky Hill R. at Ellsworth	C,R	20	15S	8W	BDRT	KC-CE
8650	Kanopolis Lake nr Kanopolis		3	17S	6W	BRT	KC-CE
8655	Smoky Hill R. nr Langley	C,R	35	16S	6W	BDRT	KC-CE
8665	Smoky Hill R. nr Mentor	C,R	29	14S	2W	BDRT	KC-CE
8669	Saline R. nr WaKeeney	H,P	10	11S	23W	BDR	KWO
8670	Saline R. nr Russell	C,F,L	34	12S	14W	BDR	KWO
8681	Wilson Lake nr Wilson		36	12S	11W	RT	KC-CE
8682	Saline R. at Wilson Dam	C,R	25	12S	11W	BDRT	KC-CE
8695	Saline R. at Tescott	C,F,R	16	12S	5W	BDRT	KWO/ KC-CE

Table 1.--Complete-record streamflow-gaging stations, 1986 water year--

Continued

Ident. no.	Station name	Station purpose	Location Sec.	T.	R.	Type of gage	Coop. or support
06-							
8702	Smoky Hill R. at New Cambria	C,R	1	14S	2W	BDRT	CBR/ KC-CE
8710	N. Fk. Solomon R. at Glade	C,P	25	4S	18W	BDR	KC-CE
8715	Bow Cr. nr Stockton	C,F,L	1	6S	18W	BDR	KWO
8717	Kirwin Res. at Kirwin		33	4S	16W	BR	KWO
8718	N. Fk. Solomon R. at Kirwin	C,R	33	4S	16W	R	KWO
8725	N. Fk. Solomon R. at Portis	C,R	5	6S	12W	BDRT	KC-CE
8730	S. Fk. Solomon R. ab Webster Res.	C,P	8	8S	20W	BDR	KC-CE
8731	Webster Res. nr Stockton		27	7S	19W	BR	KWO
8732	S. Fk. Solomon R. bl Webster Res.	C,R	26	7S	19W	BCDR	KWO
87346	S. Fk. Solomon R. at Woodston	C,R	16	7S	16W	BDR	CBR
8740	S. Fk. Solomon R. at Osborne	C,F,R	20	7S	12W	BDRT	KWO/ KC-CE
8742	Waconda Lake at Glen Elder		27	6S	9W	BR	USBR
8759	Solomon R. nr Glen Elder	C,F,R	2	7S	9W	BCDRW	KWO
8767	Salt Cr. nr Ada	C,F	36	10S	5W	BDR	KWO
8769	Solomon R. at Niles	C,R	31	12S	1W	BDRT	KC-CE
8776	Smoky Hill R. at Enterprise	C,R	20	13S	3E	BDRT	KC-CE
8780	Chapman Cr. nr Chapman	F,L	1	12S	3E	BDR	KWO
8791	Kansas R. at Ft. Riley	C,R	33	11S	6E	BDRT	KC-CE
87965	Kings Cr. nr Manhattan	B	18	11S	8E	BCDRDp	CBR
88251	Big Blue R. at Marysville	C,P	32	25S	7E	BDRT	KC-CE
8842	Mill Cr. at Washington	F,H	1	3S	3E	BDR	KWO
8844	Little Blue R. nr Barnes	C,P	22	3S	5E	BDRT	KC-CE
8855	Black Vermillion R. nr Frankfort	C,P	20	4S	9E	BDRT	KC-CE
8869	Tuttle Creek Lake nr Manhattan		24	9S	7E	BRT	KC-CE
8870	Big Blue R. nr Manhattan	C,R	30	9S	8E	BDRT	KC-CE
8875	Kansas R. at Wamego	C,R	9	10S	10E	BDRT	KC-CE
88835	Kansas R. nr Belvue	C	13	10S	11E	BDRT	DWR
8885	Mill Cr. nr Paxico	C,F,L	27	11S	11E	BDRT	KWO
8890	Kansas R. at Topeka	C,R	28	11S	16E	BDRT	KC-CE
8891	Soldier Cr. nr Goff	C,H	16	5S	13E	BDRDp	KWO

Table 1.--Complete-record streamflow-gaging stations, 1986 water year--

Continued

Ident. no.	Station name	Station purpose	Location Sec.	T.	R.	Type of gage	Coop. or support
06-							
88912	Soldier Cr. nr Bancroft	C,H	28	5S	13E	BDRDp	KWO
88914	Soldier Cr. nr Soldier	C,H	4	6S	13E	BDRDp	KWO
88916	Soldier Cr. nr Circleville	C,H	10	7S	13E	BDRDp	KWO
8892	Soldier Cr. nr Delia	C,H	8	10S	14E	BDR	KWO
8895	Soldier Cr. nr Topeka	C,P	14	11S	15E	BDR	KC-CE
8901	Delaware R. nr Muscotah	C,L	16	6S	17E	BDRT	KC-CE
890898	Perry Lake nr Perry		9	11S	18E	R	KC-CE
8909	Delaware R. bl Perry Dam	C,R	9	11S	18E	CR	KC-CE
8910	Kansas R. at Lecompton	C,R	35	11S	18E	BDRT	KC-CE
891478	Clinton Lake nr Lawrence		8	13S	19E	BRT	KC-CE
8915	Wakarusa R. nr Lawrence	C,R	23	13S	19E	BDRT	KC-CE
8920	Stranger Cr. nr Tonganoxie	C,L	7	11S	22E	BDRT	KC-CE
89235	Kansas R. at DeSoto	C,F,R	28	12S	22E	BDRT	KWO/ KC-CE
89308	Blue R. nr Stanley	C,H	19	14S	25E	BDR	KWO
8933	Indian Cr. at Overland Park	C,H	6	13S	25E	BDR	KWO
9108	Marais des Cygnes R. nr Reading	C,P	15	17S	13E	BDRT	KC-CE
910997	Melvern Lake nr Melvern		1	18S	15E	RT	KC-CE
9115	Salt Cr. nr Lyndon	C,F,L	34	16S	16E	BDR	KWO
9119	Dragoon Cr. nr Burlingame	C,H	27	15S	14E	BDR	KC-CE
91249	Pomona Lake nr Quenemo		19	16S	17E	RT	KC-CE
9125	Hundred and Ten Mile Cr. nr Quenemo	C,R	20	16S	17E	BCDRT	KC-CE
9130	Marais des Cygnes R. nr Pomona	C,R	7	17S	18E	BDRT	KC-CE
9135	Marais des Cygnes R. nr Ottawa	C,R	36	16S	19E	BDRT	KC-CE
9140	Pottawatomie Cr. nr Garnett	C,F,L	6	20S	20E	BDRT	KWO
914995	Hillsdale Lake nr Hillsdale		17	16S	23E	BRT	KC-CE
9150	Big Bull Cr. nr Hillsdale	C,R	20	16S	23E	BCDRT	KC-CE
9158	Marais des Cygnes R. at at La Cygne	C,R	32	19S	24E	BDRT	KWO
9166	Marais des Cygnes R. nr Kansas-Missouri State Line	C,F,R	16	21S	25E	BDRT	KWO/ KC-CE
9170	Little Osage R. at Fulton	C,F,L	25	23S	24E	BDR	KWO
91738	Marmaton R. nr Marmaton	C,F,L	4	26S	24E	BCDRT	KC-CE

Table 1.--Complete-record streamflow-gaging stations, 1986 water year--

Continued

Ident. no.	Station name	Station purpose	Location Sec.	T.	R.	Type of gage	Coop. or support
		Arkansas River basin					
07-							
1370	Frontier Ditch nr Coolidge	C,I	21	23S	43W	BDRTW	CBR/ COMP
1375	Arkansas R. nr Syracuse	C,I,R	26	23S	43W	BDRT	CBR/ COMP
1380	Arkansas R. at Syracuse	C,F,R	18	24S	40W	BDRDpT	KWO
13865	Whitewoman Cr. nr Leoti	C,H	23	18S	38W	BRDp	KWO
1395	Arkansas R. at Dodge City	C,R	35	26S	25W	BDRT	T-CE/ CBR
1398	Mulberry Cr. nr Dodge City	C,H,L,P	24	28S	25W	BDR	KWO
1400	Arkansas R. nr Kinsley	C,R	26	24S	19W	BDRT	T-CE
14085	Pawnee R. nr Burdett	H,L,P	21	21S	21W	BDR	KWO
1412	Pawnee R. nr Larned	C,F,L,P	30	21S	18W	BDRW	KWO
1413	Arkansas R. at Great Bend	C,R	33	19S	13W	BDRT	T-CE
14178	Walnut Cr. nr Rush Center	C,H,P	24	18S	19W	BDR	KWO
1419	Walnut Cr. at Albert	C,L,P	29	18S	15W	R	KWO
1423	Rattlesnake Cr. nr Macksville	H,P	16	25S	14W	BDR	KWO
142575	Rattlesnake Cr. nr Zenith	H,P	26	22S	11W	BDR	KWO
14262	Rattlesnake Cr. nr Raymond	H,P	15	21S	10W	BDR	KWO
1433	Cow Creek nr Lyons	C,F,L,R	15	20S	8W	BDRT	KWO/ T-CE
14333	Arkansas R. nr Hutchinson	C,F,R	21	24S	4W	BDRT	KWO/ T-CE
143665	Little Ark. R. at Alta Mills	H,P	30	22S	2W	BDR	KWO
1442	Little Ark. R. at Valley Center (floodway)		34	25S	1W	BR	KWO
1442	Little Ark. R. at Valley Center (main stem)	C,L	36	25S	1W	BDR	KWO
1443	Arkansas R. at Wichita (floodway)		11	27S	1W	BR	KWO
1443	Arkansas R. at Wichita (main stem)	C,F,P	5	28S	1E	BDRT	KWO
14455	Arkansas R. at Derby	C,P	12	29S	1E	BDRT	T-CE
14478	N. Fk. Ninnescah R. ab Cheney Reservoir	C,P	25	25S	6W	BDR	WICH-ITA
14479	Cheney Reservoir nr Cheney		6	27S	4W	BRT	WICH-ITA/ T-CE

Table 1.--Complete-record streamflow-gaging stations, 1986 water year--

Continued

Ident. no.	Station name	Station purpose	Location Sec.	T.	R.	Type of gage	Coop. or support
07-							
144795	N. Fk. Ninnescah R. at Cheney Dam	C,R	6	27S	4W	DW	WICH-ITA
14491	S. Fk. Ninnescah R. nr Pratt	H,P	2	28S	13W	BDR	KWO
1452	S. Fk. Ninnescah R. nr Murdock	C,F,L	34	28S	5W	BDRT	KWO/ T-CE
1455	Ninnescah R. nr Peck	C,R	10	30S	1W	BDRT	T-CE
1457	Slate Creek at Wellington	H,P	23	32S	1W	BDR	KWO
1465	Arkansas R. at Arkansas City	C,L,P	35	34S	3E	BDRT	CBR/ T-CE
146622	El Dorado Lake nr El Dorado		30	25S	6E	RT	T-CE
146623	Walnut R. bl El Dorado Lake	C,R	25	25S	5E	R	T-CE
14683	Walnut R. at Hwy. 54 east of El Dorado	C,R	1	26S	5E	BDRT	T-CE
14707	Whitewater R. at Towanda	C,F,P	8	26S	4E	BDRT	KWO/ T-CE
1478	Walnut R. at Winfield	C,L	33	32S	4E	BDRT	T-CE
1490	Medicine Lodge R. nr Kiowa	L,P	36	34S	11W	BDR	KWO
1515	Chikaskia R. nr Corbin	F,P	36	33S	3W	BDR	KWO
15559	Cimarron R. nr Elkhart	H	4	34S	42W	BDR	KWO
15601	N. Fk. Cimarron R. at Richfield	H	16	32S	41W	BR	KWO
1561	Sand Arroyo Cr. nr Johnson	H	25	29S	41W	BDRDp	KWO
15622	Bear Cr. nr Johnson	H	12	28S	41W	BDR	KWO
1575	Crooked Cr. nr Nye	F,L	1	35S	27W	BDR	KWO
1659	Toronto Lake nr Toronto		36	26S	13E	RT	T-CE
1660	Verdigris R. nr Coyville	C,R	8	27S	14E	DRT	T-CE
1665	Verdigris R. nr Altoona	C,R	29	29S	16E	BDRT	T-CE
1675	Otter Cr. at Climax	H,L	8	27S	11E	BDR	KWO
1680	Fall River Lake nr Fall River		3	28S	12E	BRT	T-CE
1685	Fall R. nr Fall River	C,R	2	28S	12E	DRT	T-CE
1695	Fall R. at Fredonia	C,R	24	29S	14E	BDRT	T-CE
1698	Elk R. at Elk Falls	C,H	3	31S	11E	BDR	KWO
17005	Elk City Lake nr Independence		9	32S	15E	BRT	T-CE
17006	Elk R. bl Elk City Lake	C,R	9	32S	15E	BDR	T-CE
1705	Verdigris R. at Independence	C,R	32	32S	16E	BDRT	T-CE
170695	Big Hill Lake nr Cherryvale		7	32S	18E	BRT	T-CE

Table 1.--Complete-record streamflow-gaging stations, 1986 water year--

Continued

Ident. no.	Station name	Station purpose	Location Sec.	T.	R.	Type of gage	Coop. or support
07-							
1707	Big Hill Cr. nr Cherryvale	C,H	7	32S	18E	BDRT	T-CE
1720	Caney R. nr Elgin	C,L	16	35S	10E	BDR	KWO
1794	Council Grove Lake nr Council Grove		10	16S	8E	BRT	T-CE
1795	Neosho R. at Council Grove	C,R	14	16S	8E	BDRT	T-CE
17973	Neosho R. nr Americus	C,R	24	18S	10E	BDRT	T-CE
179794	Marion Lake nr Marion		27	19S	3E	BRT	T-CE
179795	Cottonwood R. bl Marion Lake	C,R	27	19S	3E	BCDRT	T-CE
1802	Cottonwood R. at Marion	C,R	31	19S	4E	BDRT	T-CE
1804	Cottonwood R. nr Florence	C,R	10	21S	5E	BDRT	T-CE
1805	Cedar Cr. nr Cedar Point	C,L	25	21S	5E	DR	KWO
18225	Cottonwood R. nr Plymouth	C,R	13	19S	9E	BDRT	T-CE
18245	John Redmond Res. nr Burlington		9	21S	15E	BRT	T-CE
18251	Neosho R. at Burlington	C,R	26	21S	15E	BDRT	T-CE
1830	Neosho R. nr Iola	C,L,R	9	25S	18E	BCDRT	T-CE
1835	Neosho R. nr Parsons	C,F,L,R	33	31S	21E	BDRTW	KWO/ T-CE
1840	Lightning Cr. nr McCune	H,L,P	7	32S	22E	BDR	KWO

Table 2.--Partial-record streamflow-gaging stations, 1986 water year

High Flow

Ident. no.	Station name	Location Sec.	T.	R.	Coop. or support
	Missouri River basin				
06-					
8137	Tennessee Cr. trib. nr Seneca	2	3S	12E	KDOT
8157	Buttermilk Cr. nr Willis	30	3S	18E	KDOT
81826	White Clay Cr. at Atchison	1	6S	20E	KC-CE
8448	S. Fk. Sappa Cr. trib. nr Goodland	36	8S	39W	KDOT
8451	Long Branch Draw nr Norcatur	6	2S	25W	KDOT
8460	Beaver Cr. at Ludell	30	2S	32W	KWO
8462	Beaver Cr. trib. nr Ludell	2	3S	32W	KDOT
8476	Prairie Dog Cr. trib. at Colby	6	8S	33W	KDOT
8482	Prairie Dog Cr. trib. nr Norton	26	2S	23W	KDOT
8561	West Cr. nr Talmo	36	4S	3W	KDOT
85632	Elk Cr. at Clyde	26	5S	1W	KC-CE
8568	Moll Cr. nr Green	8	8S	4E	KDOT
8585	N. Fk. Smoky Hill R. nr McAllaster	17	12S	36W	KWO
8605	Hackberry Cr. nr Gove	1	13S	29W	KWO
8630	Smoky Hill R. at Pfeifer	30	15S	16W	KC-CE
8634	Big Cr. trib. nr Ogallah	11	13S	22W	KDOT
8637	Big Cr. trib. nr Hays	7	14S	17W	KDOT
8643	Smoky Hill R. trib. at Dorrance	12	14S	12W	KDOT
8647	Spring Cr. nr Kanopolis	24	15S	8W	KDOT
86649	Dry Cr. at Mentor	24	15S	3W	KC-CE
8668	Saline R. trib. at Collyer	32	11S	25W	KDOT
8683	Coon Cr. trib. nr Luray	19	10S	12W	KDOT
8684	Wolf Cr. nr Lucas	33	11S	11W	KWO
8689	Bullfoot Cr. trib. nr Lincoln	30	12S	7W	KDOT
86995	Mulberry Cr. nr Salina	9	14S	3W	KC-CE
8726	Oak Cr. at Bellaire	15	3S	12W	KDOT
8733	Ash Cr. trib. nr Stockton	18	7S	18W	KDOT
8745	East Limestone Cr. nr Ionia	21	4S	9W	KDOT
8758	Limestone Cr. nr Glen Elder	15	6S	9W	KWO
87712	Mud Cr. at Abilene	17	13S	2E	KC-CE

Table 2.--Partial-record streamflow-gaging stations, 1986 water year--

Continued

Ident. no.	Station name	Location Sec.	T.	R.	Coop. or support
06-					
8775	Turkey Cr. nr Abilene	26	14S	2E	KWO
8792	Clark Cr. nr Junction City	14	12S	6E	KWO
879815	Wildcat Cr. at Manhattan	14	10S	7E	KWO
8841	Mulberry Cr. trib. nr Haddam	10	3S	1E	KDOT
8843	Mill Cr. trib. nr Washington	5	3S	4E	KDOT
8849	Robidoux Cr. at Beattie	20	2S	9E	KDOT
8865	Fancy Cr. at Winkler	2	7S	5E	KWO
8872	Cedar Cr. nr Manhattan	19	9S	8E	KDOT
8876	Kansas R. trib. nr Wamego	14	10S	10E	KDOT
8883	Rock Cr. nr Louisville	14	9S	9E	KWO
8889	Blacksmith Cr. trib. nr Valencia	11	12S	14E	KDOT
88955	Indian Cr. nr Topeka	5	11S	16E	KC-CE
88963	Shunganunga Cr. at Topeka	6	12S	16E	KC-CE
89105	Stone House Cr. at Williamstown	30	11S	19E	KDOT
89165	Naismith Cr. at Lawrence	12	13S	19E	KWO
8928	Turkey Cr. at Merriam	13	12S	24E	KWO
89294	Turkey Cr. at Kansas City	27	11S	25E	KWO
9123	Dragoon Cr. trib. nr Lyndon	6	16S	16E	KDOT
9137	Middle Cr. nr Princeton	13	18S	19E	KDOT
91425	S. Fk. Pottawatomie Cr. trib. nr Garnett	7	21S	20E	KDOT
9151	Big Bull Cr. at Paola	17	17S	23E	KC-CE
9167	Middle Cr. nr Kincaid	11	23S	20E	KDOT
9171	Marmaton R. nr Bronson	3	25S	21E	KDOT
9174	Marmaton R. trib. nr Fort Scott	9	26S	24E	KDOT
	Arkansas River basin				
07-					
1386	White Woman Cr. trib. nr Selkirk	34	17S	39W	KDOT
1397	Arkansas R. trib. nr Dodge City	11	27S	25W	KDOT
1403	Whitewoman Cr. nr Bellefont	33	24S	21W	KDOT
1406	Pawnee R. trib. nr Kalvesta	12	23S	28W	KDOT
1416	Long Branch Cr. nr Ness City	32	18S	23W	KDOT

Table 2.--Partial-record streamflow-gaging stations, 1986 water year--

Continued

Ident. no.	Station name	Location Sec.	T.	R.	Coop. or support
07-					
1418	Otter Cr. nr Rush Center	15	19S	18W	KDOT
1421	Rattlesnake Cr. trib. nr Mullinville	20	28S	19W	KDOT
1427	Salt Cr. nr Partridge	22	23S	7W	KDOT
14286	Cow Cr. nr Claflin	6	18S	11W	KWO
1429	Blood Cr. nr Boyd	34	17S	14W	KWO
1431	Cheyenne Cr. trib. nr Claflin	28	18S	11W	KDOT
1436	Little Arkansas R. nr Little River	8	19S	6W	KWO
1449	S. Fk. Ninnescah R. trib. nr Pratt	27	27S	13W	KDOT
1453	Clear Cr. nr Garden Plain	33	27S	3W	KDOT
1458	Antelope Cr. trib. nr Dalton	11	32S	1E	KDOT
14702	Whitewater R. trib. nr Towanda	26	25S	3E	KDOT
14799	Cedar Cr. trib. nr Cambridge	26	31S	7E	KDOT
1481	Grouse Cr. nr Dexter	31	32S	7E	KWO
1516	Rush Cr. nr Harper	21	32S	7W	KDOT
1559	N. Fk. Cimarron R. trib. nr Elkhart	9	33S	42W	KDOT
1566	Cimarron R. trib. nr Moscow	20	31S	34W	KDOT
1567	Cimarron R. trib. nr Satanta	17	32S	33W	KDOT
1571	Crooked Cr. nr Copeland	36	28S	30W	KDOT
1574	Crooked Cr. trib. at Meade	2	32S	28W	KDOT
1577	Kiger Cr. nr Ashland	3	33S	24W	KDOT
1579	Cavalry Cr. at Coldwater	14	32S	19W	KWO
1662	Sandy Cr. nr Yates Center	26	25S	14E	KDOT
1708	Mud Cr. nr Mound Valley	9	33S	18E	KDOT
1717	Spring Branch nr Cedar Vale	7	34S	9E	KDOT
1718	Cedar Cr. trib. nr Hooser	7	34S	8E	KDOT
1803	Spring Cr. trib. nr Florence	32	21S	5E	KDOT
1815	Middle Cr. nr Elmdale	13	19S	6E	KWO
1826	N. Big Cr. nr Burlington	27	22S	15E	KDOT
1838	Limestone Cr. nr Beulah	28	30S	23E	KDOT
1845	Labette Cr. nr Oswego	11	33S	20E	KWO

Table 2.--Partial-record streamflow-gaging stations, 1986 water year--

Continued

Ident. no.	Station name	Location Sec.	T.	R.	Coop. or support
	Flood Hydrograph				
	Missouri River basin				
06-					
8703	Gypsum Cr. nr Gypsum	15	16S	1W	KWO
	Arkansas River basin				
07-					
1390	Arkansas R. at Garden City	19	24S	32W	KWO
	Rating Forecast				
	Missouri River basin				
06-					
88549	Black Vermillion R. at Frankfort (Hwy 99)	16	4S	9E	KC-CE
8884	Kansas R. at Maple Hill	1	11S	12E	KC-CE
89185	Stranger Cr. at Easton	19	8S	21E	KC-CE
	Low Flow				
	Arkansas River basin				
07-					
14257	Rattlesnake Cr. ab. Little Salt Marsh nr Hudson	31	22S	11W	KWO
14265	Peace Cr. nr Sylvia	4	23S	10W	KWO
14267	Peace Cr. nr Sterling	7	22S	8W	KWO
14274	Salt Cr. nr Hutchinson	1	23S	7W	KWO
14459	N. Fk. Ninnescah R. nr Sylvia	27	24S	10W	KWO
14462	N. Fk. Ninnescah R. ab Silver Cr. nr Arlington	25	25S	8W	KWO
14464	Silver Cr. nr Landon	8	26S	9W	KWO
14489	S. Fk. Ninnescah R. at Pratt	3	28S	13W	KWO
14513	S. Fk. Ninnescah R. nr Calista	1	27S	9W	KWO
	Continuous Stage				
	Missouri River basin				
06-					
8785	Lyon Cr. nr Woodbine	31	13S	5E	KC-CE
87982	Kansas R. at Manhattan	27	10S	8E	KC-CE
89295	Kansas R. at Kansas City	14	11S	25E	KC-CE
9114	Marais des Cygnes R. at Quenemo	22	17S	17E	KC-CE

Table 2.--Partial-record streamflow-gaging stations, 1986 water year--

Continued

Ident. no.	Station name	Location Sec.	T.	R.	Coop. or support
	Arkansas River basin				
07-					
146895	Walnut R. at Augusta	27	27S	4E	T-CE
17971	Neosho R. nr Dunlap	24	17S	9E	T-CE
1832	Neosho R. nr Chanute	4	27S	18E	T-CE

Table 3.--Precipitation-record gaging stations, 1986 water year

Ident. no.	Station name	Location Sec.	T.	R.	Coop. or support
	Missouri River basin				
06-					
8447	S. Fk. Sappa Cr. nr Brewster	9	9S	37W	KWO
8449	S. Fk. Sappa Cr. nr Achilles	29	4S	30W	KWO
84568	Little Beaver Cr. nr Goodland	28	5S	39W	KWO
8460	Beaver Cr. at Ludell	30	2S	32W	KWO
8479	Prairie Dog Cr. ab Keith Sebelius Lake	23	3S	25W	KWO
8585	N. Fk. Smoky Hill R. nr McAllaster	17	12S	36W	KWO
8600	Smoky Hill R. at Elkader	34	14S	32W	KWO
8605	Hackberry Cr. nr Gove	1	13S	29W	KWO
8668	Saline R. trib. at Collyer	32	11S	25W	KWO
87965	Kings Cr. nr Manhattan	18	11S	8E	CBR
8891	Soldier Cr. nr Goff	16	5S	13E	KWO
88912	Soldier Cr. nr Bancroft	28	5S	13E	KWO
88914	Soldier Cr. nr Soldier	4	6S	13E	KWO
88916	Soldier Cr. nr Circleville	10	7S	13E	KWO
01450700	Ladder Cr. nr Tribune	5	16S	40W	KWO
	Arkansas River basin				
07-					
1380	Arkansas R. nr Syracuse	18	24S	40W	KWO
1386	White Woman Cr. trib. nr Selkirk	34	17S	39W	KWO
13865	White Woman Cr. nr Leoti	23	18S	38W	KWO
1388	Lion Cr. trib. nr Modoc	22	18S	34W	KWO
1406	Pawnee R. trib. nr Kalvesta	12	23S	28W	KWO
1414	S. Fk. Walnut Cr. trib. nr Dighton	16	18S	28W	KWO
1416	Long Branch Cr. nr Ness City	32	18S	23W	KWO
1561	Sand Arroyo Cr. nr Johnson	25	29S	41W	KWO
15625	Bear Cr. nr Big Bow	14	27S	39W	KWO
1571	Crooked Cr. nr Copeland	36	28S	30W	KWO
011603	James Draw nr Lakin	10	22S	36W	KWO
012222	Cimarron R. trib. nr Hugoton	17	33S	37W	KWO
002822	Gray Co. landfill nr Ingalls	10	26S	29W	KWO
010518	Playa Lake nr Satanta	19	28S	34W	KWO

Table 4.--Ground-water-level observation wells, 1986 water year

County	Well number
Allen	24S 18E 28CDD 01
Barber	32S 12W 04DBC 01
Barton	18S 15W 28CCC 03
	19S 11W 19BDD 01
	19S 11W 26BDA 01
	19S 12W 06ADA 01
	19S 13W 08BAD 01
	19S 13W 33DDB 01
	19S 14W 06BBB 01
	19S 14W 29DDB 01
	19S 14W 36BBC 01
	20S 11W 06CCC 01
	20S 11W 26AAC 01
	20S 12W 03DAC 01
	20S 12W 06AAC 01
	20S 12W 23CCA 01
	20S 13W 17DDC 01
	20S 13W 24DCB 01
	20S 14W 22DCB 01
	20S 15W 24DBD 01
	20S 15W 33ADD 01
Bourbon	25S 24E 36AAC 01
Cherokee	34S 25E 13BAC 01
Cheyenne	01S 38W 02CDC 01
	01S 38W 08DCC 01
	01S 38W 30BDC 01
	01S 39W 25CBC 01
	02S 37W 33DCC 01
	02S 39W 27BBB 01
	02S 40W 28DBA 01
	02S 40W 32BCB 01
	02S 41W 27BBD 01
	02S 41W 33DBC 01
	03S 37W 19BBC 01
	03S 37W 21DDD 01
	03S 37W 36ADB 01
	03S 38W 04BCC 01
	03S 38W 21BCB 01
Cheyenne (continued)	03S 38W 25BBB 01
	03S 39W 04CCC 01
	03S 39W 20DAC 01
	03S 39W 24DDD 01
	03S 39W 32BDB 01
	03S 40W 09BAA 02
	03S 40W 35AAC 01
	03S 41W 33ABB 01
	03S 42W 04AAA 01
	03S 42W 26CCD 01
	04S 37W 17AAC 01
	04S 37W 25DCA 01
	04S 38W 04BAC 01
	04S 38W 20CCC 01
	04S 38W 21ADC 01
	04S 40W 22BCB 01
	04S 41W 16DAA 01
	04S 41W 23AAA 01
	04S 41W 25BCB 01
	04S 41W 31ACA 01
	04S 42W 02BCC 01
	04S 42W 16CDD 01
	05S 37W 15DBB 01
	05S 38W 13BAD 01
	05S 38W 22ACB 01
	05S 39W 06DAA 01
	05S 39W 11CBC 01
	05S 39W 18CCC 01
	05S 39W 25CDA 01
	05S 40W 14BCD 01
	05S 41W 20DAA 01
	05S 42W 14CBC 01
Clark	30S 23W 06AAA 01
	33S 22W 30CBC 01
Clay	06S 01E 02BCD 01
	06S 02E 29DAC 01
	08S 02E 02CCA 01
Cloud	05S 02W 01BAC 01

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number	County	Well number
Comanche	31S 18W 19ACB 01	Dickinson	13S 01E 23DAB 01
			13S 01E 26DDC 01
Crawford	29S 23E 24DBA 01		
	30S 24E 19ADD 01	Douglas	12S 20E 07CBC 01
			12S 20E 17CCB 01
Decatur	01S 26W 18DDB 01		15S 19E 15AAD 01
	01S 29W 03DDB 01		
	01S 29W 19BDD 01	Edwards	23S 19W 22CCC 01
	01S 30W 34DDD 01		24S 16W 12CBC 01
	02S 26W 11BBA 01		24S 17W 20ADC 01
			24S 17W 24DDD 01
	02S 28W 13ABA 01		24S 18W 13DAC 01
	02S 30W 26DCC 01		
	03S 26W 30CBB 02		24S 18W 17ABD 01
	03S 27W 32ABA 01		24S 18W 28DAC 01
	03S 28W 06DCB 01		24S 18W 36DDC 01
			24S 19W 34ADD 01
	03S 28W 32BCA 01		25S 16W 02BBB 01
	03S 29W 12BBA 01		
	03S 29W 17DCB 01		25S 16W 27AAC 01
	03S 29W 31DCC 01		25S 16W 31DCC 01
	03S 30W 03CBA 01		25S 17W 01DAB 01
			25S 17W 17AAC 01
	03S 30W 26BBB 01		25S 17W 31BBD 01
	04S 26W 08DDD 01		
	04S 26W 19DCA 01		25S 18W 09AAA 01
	04S 27W 17DAC 01		25S 18W 33CDC 01
	04S 27W 33BBB 01		25S 19W 08BDD 01
			25S 19W 26DDB 01
	04S 28W 30DDD 01		25S 19W 31CAB 01
	04S 30W 07BBB 01		
	05S 26W 05ADD 01		25S 20W 03BCD 01
	05S 26W 26DDA 01		25S 20W 27ACA 01
	05S 26W 33DCC 01		25S 20W 34CCC 01
			26S 16W 10CCC 01
	05S 27W 21CCA 01		26S 16W 31CCA 01
	05S 28W 07BBC 01		
	05S 28W 10BBB 01		26S 16W 34ABC 01
	05S 28W 14ADD 01		26S 17W 04AAC 01
	05S 28W 17DAC 01		26S 17W 14BAA 01
			26S 17W 33DDB 01
	05S 29W 11BAA 01		26S 18W 15DCB 01
	05S 29W 22CBB 01		
	05S 30W 15CCB 01		26S 18W 31CCC 01
	05S 30W 35BCB 01		26S 19W 12ABB 02
			26S 19W 16BCB 01
			26S 19W 31BAC 01
			26S 19W 34BBD 01

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number
Edwards (continued)	26S 20W 20BBC 01
Ellis	13S 18W 29CCC 01
	14S 18W 12AAD 01
	14S 18W 12ABB 01
	15S 18W 25CCD 01
	15S 19W 25CAB 01
Ellsworth	17S 09W 20BCD 01
	17S 09W 21BCC 01
	17S 09W 28CBB 02
	17S 09W 31AAB 01
	17S 09W 31ADC 01
Finney	21S 29W 36CCB 01
	21S 30W 05BBB 01
	21S 31W 08ABB 01
	21S 31W 26CCC 01
	21S 32W 08ABD 01
	21S 32W 20CBD 01
	21S 32W 26DAA 01
	21S 33W 07DDAA01
	21S 33W 29BBC 01
	21S 34W 14DBB 01
	21S 34W 16AADA02
	22S 27W 14ADC 01
	22S 31W 08CCC 01
	22S 31W 16ADD 01
	22S 31W 29DCC 01
	22S 32W 08ACB 01
	22S 32W 21CDC 01
	22S 33W 22BAA 01
	22S 33W 36AAA 02
	22S 34W 08BCB 01
	22S 34W 10AAA 01
	22S 34W 18CDD 01
	22S 34W 26CCC 01
	23S 27W 12CCC 01
	23S 27W 22DAB 01
Finney (continued)	23S 28W 22DCD 01
	23S 28W 34DDC 01
	23S 29W 30BBB 01
	23S 29W 34CDD 01
	23S 30W 04CAC 01
	23S 30W 19CCB 01
	23S 31W 03DCD 01
	23S 31W 17ABA 01
	23S 31W 35CCC 01
	23S 32W 11ADC 01
	23S 32W 31CBD 01
	23S 33W 17BBB 01
	23S 33W 26ABB 01
	23S 33W 28CDC 01
	23S 34W 17CCC 01
	23S 34W 21DDC 01
	24S 31W 27CCB 01
	24S 32W 03DAC 01
	24S 33W 09CCD 01
	24S 33W 09CCD 02
	24S 33W 09CCD 03
	24S 33W 18BDB 02
	24S 33W 19DBB 02
	24S 33W 22BCC 01
	24S 33W 22DCA 01
	24S 33W 28DAA 01
	24S 33W 34CAC 01
	24S 34W 01BCBB01
	25S 31W 21CAB 01
	25S 31W 35DBA 01
	25S 32W 22DBC 01
	25S 32W 31DDC 01
	25S 32W 35ADB 01
	25S 33W 03BCC 01
	25S 33W 05ABD 01
	25S 33W 09ABD 01
	25S 33W 15DAC 01
	25S 33W 16DCC 01
	25S 33W 17DBD 01
	25S 33W 33CDA 01

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number
Finney (continued)	25S 33W 35DBD 01
	25S 34W 06AAA 01
	25S 34W 10ABB 01
	25S 34W 34DBD 01
	26S 31W 01DDA 01
	26S 31W 06BBBB01
	26S 31W 31CDC 01
	26S 31W 36CAB 01
	26S 32W 22ABB 01
	26S 33W 17DBD 01
	26S 33W 26ABB 01
	26S 34W 05ADC 01
	26S 34W 21BBD 01
	26S 34W 30BD 01
Ford	25S 22W 20AAA 01
	25S 22W 27CCD 01
	25S 23W 11CCC 01
	25S 23W 12BBB 01
	25S 23W 14ADD 01
	25S 25W 32CDD 01
	25S 25W 32DAD 01
	25S 26W 25CDD 01
	25S 26W 30ABC 01
	26S 21W 17DBC 01
	26S 21W 23ADA 01
	26S 21W 25CCC 01
	26S 22W 21DCD 01
	26S 23W 02ABB 01
	26S 23W 10DAD 01
	26S 24W 29DDD 01
	26S 24W 31DDA 01
	26S 24W 32CBA 01
	26S 24W 33CDA 01
	26S 25W 16DCC 01
	26S 26W 18CCB 01
	26S 26W 32DCC 01
	26S 26W 36DCC 01
	27S 21W 10DBB 01
	27S 22W 09DAB 01

County	Well number
Ford (continued)	27S 23W 24BCB 01
	27S 23W 28AAA 01
	27S 23W 36CCC 01
	27S 24W 03BBD 01
	27S 24W 03CDD 01
	27S 24W 04BBC 01
	27S 24W 09AAD 01
	27S 24W 16BDB 01
	27S 24W 26DAA 01
	27S 25W 09ACA 01
	27S 25W 25BBB 01
	27S 26W 21DAA 01
	28S 21W 10DDD 01
	28S 21W 23DBC 01
	28S 21W 25ABB 01
	28S 22W 05ADD 01
	28S 22W 12CAC 01
	28S 22W 32BAB 01
	28S 23W 18BAB 01
	28S 23W 24ABB 01
	28S 24W 08DCC 01
	28S 24W 22CDA 01
	28S 24W 35CAB 01
	28S 25W 06ABB 01
	28S 25W 19BBB 01
	28S 26W 06AAB 01
	28S 26W 10BAA 01
	28S 26W 13CAA 01
	29S 21W 05BBB 01
	29S 21W 20CAD 01
	29S 22W 17DAD 01
	29S 22W 36ACA 01
	29S 23W 12BAC 01
	29S 24W 01ABA 01
	29S 24W 13BCA 01
	29S 24W 18BAA 01
	29S 25W 03ADA 01
	29S 25W 10BBBC01
	29S 26W 01CDD 01
	29S 26W 20BDD 01

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number	County	Well number
Ford	29S 26W 29ABB 01	Graham	07S 25W 33DDD 01
(continued)	29S 26W 36BBB 01	(continued)	08S 21W 17ABB 01
			08S 22W 18CDC 01
Geary	11S 06E 27CBB 01		08S 24W 23ACC 01
			08S 25W 24BAB 01
Gove	11S 26W 04CDC 01		
	11S 27W 04CCD 01		09S 22W 19BBB 01
	11S 27W 13ABB 01		09S 24W 12BCC 01
	11S 27W 36BCC 01		09S 24W 22BAA 01
	11S 28W 08AAA 01		09S 25W 14DDD 01
	11S 28W 17DDC 01	Grant	27S 35W 17ADD 01
	11S 28W 26ABA 01		27S 35W 25CAB 01
	11S 29W 04DAD 01		27S 36W 18DCB 01
	11S 29W 33BBA 01		27S 36W 21DCC 01
	11S 30W 27ABB 01		27S 36W 25CC 01
	11S 30W 28CBA 01		27S 37W 04ABB 01
	11S 30W 36CBB 01		27S 37W 11ABA 01
	11S 31W 12AAB 01		27S 37W 16AAD 01
	11S 31W 27ADC 01		27S 37W 21BDD 01
	11S 31W 35BDC 01		27S 38W 12ADC 01
	12S 26W 12BCC 01		27S 38W 15BBB 01
	12S 27W 10CCB 01		27S 38W 22CBB 01
	12S 27W 12ABB 01		27S 38W 23CBB 01
	12S 28W 07DDD 01		27S 28W 32BCC 01
	12S 28W 12DDD 01		28S 35W 03DBB 01
	13S 26W 20CBC 01		28S 35W 05BCC 01
			28S 35W 15CBB 01
Graham	06S 21W 19CDC 01		28S 35W 36ABC 01
	06S 22W 19CCC 01		28S 36W 02CDD 02
	06S 22W 28ACA 01		28S 36W 18ABC 01
	06S 23W 13BBB 01		
	06S 23W 17CCA 01		28S 36W 21CDD 01
			28S 37W 02BBB 04
	06S 24W 14AAA 01		28S 37W 10BCD 02
	06S 24W 28BAB 01		28S 38W 07BBB 01
	06S 24W 35DDD 01		28S 38W 12DDD 01
	06S 25W 12CCC 01		
	06S 25W 28CBC 01		28S 38W 17AAA 01
			28S 38W 33BDB 01
	07S 22W 10BBC 01		29S 35W 07CBD 01
	07S 22W 19BBB 01		29S 35W 24BAA 01
	07S 23W 17BBC 01		29S 35W 28ACC 01
	07S 24W 08CBA 01		
	07S 25W 24BBB 01		

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number	County	Well number
Grant (continued)	29S 36W 19BCB 01	Gray (continued)	26S 29W 35CCC 01
	29S 36W 33ADB 01		26S 30W 01ABC 01
	29S 37W 03CDB 01		26S 30W 24DDD 01
	29S 37W 08CBA 01		27S 27W 01BAA 01
	29S 37W 29BBA 01		27S 27W 07ADC 01
	29S 38W 20CDC 01		27S 27W 10CDB 01
	29S 38W 35CCD 01		27S 27W 25CCD 01
	30S 35W 02DBC 01		27S 28W 05AAA 01
	30S 35W 19BCD 01		27S 28W 30CCA 01
	30S 36W 01BBB 01		27S 29W 27CAA 01
	30S 36W 04ABB 01		27S 30W 08BBB 01
	30S 36W 32BBC 01		27S 30W 23BBA 01
	30S 37W 02BAA 02		27S 30W 34CCC 01
	30S 37W 03DBA 01		28S 27W 03BBB 01
	30S 37W 20CBC 01		28S 28W 07CDD 01
	30S 38W 13CCC 01		28S 28W 20ADD 02
	30S 38W 15DBC 01		28S 29W 16ACC 01
	30S 38W 30ACA 01		28S 30W 10DDD 01
			28S 30W 17BBA 01
Gray	24S 27W 08CCC 01		28S 30W 24BAB 01
	24S 27W 14ABB 01		
	24S 27W 29BCC 01		29S 27W 30BCC 01
	24S 28W 28BBA 01		29S 28W 28CDC 01
	24S 28W 31DD 01		29S 29W 10ABB 01
			29S 29W 27BCB 01
	24S 28W 36ACA 01		29S 30W 22BBC 01
	24S 29W 16DCA 01		
	24S 29W 18CCB 01		29S 30W 35ACD 01
	24S 30W 15CCC 01		
	24S 30W 33ADD 01	Greeley	16S 39W 02BDC 01
			16S 39W 22DCB 01
	25S 27W 33ABB 01		16S 40W 15ACC 01
	25S 29W 07BCB 01		16S 40W 17CBC 01
	25S 29W 14ABB 01		16S 40W 18DBA 01
	25S 29W 27CCB 01		
	25S 30W 20BCB 01		16S 40W 26ADA 01
			16S 41W 20BAD 01
	26S 27W 13BBC 01		16S 41W 33AAB 01
	26S 27W 27CDD 01		16S 42W 22BCB 01
	26S 28W 06DDB 01		17S 39W 02BAA 01
	26S 28W 10ACB 02		
	26S 29W 15BCA 01		

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number	County	Well number
Greeley (continued)	17S 39W 22ABB 01	Hamilton (continued)	25S 40W 26BBB 01
	17S 39W 34CCB 01		25S 43W 03ABB 01
	17S 40W 15CCB 01		25S 43W 21AAB 01
	17S 40W 17BBA 01		25S 43W 25CCD 01
	17S 40W 31BBA 01		26S 41W 12DCC 01
	17S 42W 27CBB 01		26S 41W 20BBD 01
	18S 39W 07BBD 01		26S 41W 32DDB 01
	18S 39W 19CDA 01		26S 41W 36CCC 01
	18S 39W 23CCB 01		26S 42W 10BB 02
	18S 39W 24AAC 01		26S 42W 17CBB 01
Hamilton	21S 39W 07CBA 01		26S 42W 22CDB 01
	22S 39W 03BBB 01		26S 43W 10DBB 01
	22S 39W 08DDD 01		26S 43W 25DCC 01
	23S 39W 15ADD 01		
	23S 40W 29DDB 01	Harper	32S 06W 01DDD 01
	23S 42W 19CBB 01	Harvey	22S 02W 05CBD 01
	23S 42W 26DCA 01		22S 03W 02DCD 01
	23S 42W 27DDB 01		22S 03W 29BAD 01
	23S 42W 34CBB 01		22S 03W 35AAA 01
	23S 43W 21ABA 01		23S 01W 19AAC 01
	23S 43W 23BCB 01		23S 01W 28AAD 01
	23S 43W 25CBD 02		23S 02W 22CCD 01
	23S 43W 26BCC 01		23S 02W 34DCC 01
	24S 39W 19CBC 01		23S 03W 06DDD 01
	24S 39W 22CCB 01		23S 03W 14AAC 01
	24S 39W 30BBD 01		23S 03W 32DCC 02
	24S 39W 30CAD 01		24S 01W 05AAB 01
	24S 39W 35BAC 01		24S 01W 19BCC 01
	24S 39W 35CBA 01		24S 01W 22BCC 01
	24S 40W 07CBB 01		24S 02W 16BAA 01
	24S 40W 17BBB 01		24S 02W 28DDD 01
	24S 40W 23AAB 01		24S 03W 14BBB 01
	24S 40W 31BBB 01		
	24S 41W 01DAD 01	Haskell	27S 31W 24CDC 01
	24S 42W 04AAD 01		27S 31W 31BCC 01
			27S 32W 03CBB 01
	24S 42W 28DDD 01		27S 32W 06CBB 01
	24S 43W 14CBB 01		27S 32W 19CCD 01
	25S 39W 02CAD 01		
	25S 39W 23BDD 01		
	25S 40W 01CA 01		

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number
Haskell (continued)	27S 33W 29DAA 01
	27S 34W 16DDD 01
	27S 34W 28DAA 02
	28S 31W 35CCB 01
	28S 32W 18BBB 01
	28S 32W 24BCC 01
	28S 33W 20DDD 01
	28S 33W 21BCB 01
	28S 34W 13BBB 01
	28S 34W 15DAB 01
	29S 31W 09CB 01
	29S 31W 34BCA 01
	29S 32W 04AAA 01
	29S 32W 19CCC 01
	29S 32W 26CBB 02
	29S 33W 01AAB 01
	29S 33W 05ACA 01
	29S 33W 28BCB 01
	29S 33W 34DDD 01
	29S 34W 11ADD 02
	29S 34W 11CCC 01
	30S 31W 24BBC 01
	30S 31W 26ABB 01
	30S 32W 11BBB 01
	30S 32W 31BAB 01
	30S 33W 06DBD 01
	30S 33W 30CBD 01
	30S 34W 05BBB 01
	30S 34W 30ADD 02
Hodgeman	21S 22W 12BCB 01
	22S 22W 13CCC 01
	22S 23W 31ADD 01
	22S 24W 14BBC 01
	22S 24W 15BDA 01
	22S 24W 16ADB 02
	22S 24W 24DDD 01
	22S 24W 25DDC 01
	22S 24W 26DDA 01
	22S 24W 35DAC 01
Hodgeman (continued)	23S 22W 07DAA 01
	23S 23W 04AAD 01
	23S 23W 04DCA 01
	23S 23W 12ABD 01
	23S 24W 11DAA 01
	23S 25W 22DBB 01
	23S 26W 07CCC 01
	23S 26W 20CCC 01
	23S 26W 26AAD 01
	23S 26W 31CDD 01
	24S 21W 20CBB 01
	24S 23W 03CCC 01
	24S 23W 06AAB 01
	24S 24W 02CCC 01
	24S 24W 20CCC 01
	24S 25W 22BAB 01
	24S 26W 35CBC 01
Jackson	06S 15E 27BAB 01
Jefferson	11S 16E 25CBA 01
	11S 17E 27BBC 01
	11S 18E 08DAC 01
	11S 19E 29CCA 01
Johnson	12S 22E 25BCCB01
	12S 22E 29BBD 01
Kearny	22S 35W 23CDD 01
	22S 36W 28DCC 01
	22S 37W 34BBC 01
	23S 35W 05ACC 01
	23S 35W 12CCC 01
	23S 35W 16BBC 01
	23S 35W 25BBB 02
	23S 36W 04CBB 01
	23S 36W 32BBB 01
	23S 36W 35BBB 01
	23S 37W 04ABC 01
	23S 37W 19CCC 01
	23S 37W 28CCB 01
	24S 35W 09CCC 01
	24S 35W 13CCC 02

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number
Kearny (continued)	24S 35W 24BCB 01
	24S 36W 23CBB 02
	25S 35W 02BAA 01
	25S 35W 04BDD 01
	25S 35W 17AAA 01
	25S 35W 26BAB 01
	25S 36W 14B 01
	25S 36W 28BBD 01
	25S 37W 15ABA 02
	25S 37W 25BAD 02
	25S 38W 02BDA 01
	25S 38W 08CAA 01
	25S 38W 20ACC 01
	25S 38W 26ACC 01
	26S 35W 06ACC 01
	26S 35W 29BBD 01
	26S 36W 04BDA 01
	26S 36W 22CCA 01
	26S 37W 06ACB 01
Kingman	27S 05W 24CDC 01
	27S 05W 33ABB 02
	27S 06W 12CCD 01
	27S 06W 16CCB 01
	27S 07W 03ADC 01
	27S 07W 23BCC 01
	27S 08W 17DAB 01
	27S 08W 25DAD 01
	27S 08W 30AAA 02
	27S 08W 35CBC 01
	27S 09W 15ABA 01
	27S 09W 29AAA 01
	27S 10W 03DDD 01
	27S 10W 17DDD 01
	27S 10W 24DAD 01
	28S 07W 29CDD 01
	28S 07W 35CCD 01
	28S 08W 21BBB 01
	28S 08W 26ABC 01
	28S 09W 01BCC 01
Kingman (continued)	28S 09W 21AAA 01
	28S 09W 29CCC 01
	28S 09W 34AAB 01
	28S 10W 16BCB 01
Kiowa	27S 16W 10BAC 01
	27S 16W 19BBD 01
	27S 16W 28CDD 01
	27S 17W 21ADC 01
	27S 18W 13AAA 01
	27S 18W 18DDC 01
	27S 18W 22ADC 01
	27S 19W 28CBD 01
	27S 20W 26ABD 01
	27S 20W 32ABD 01
	28S 16W 12BCA 01
	28S 16W 17AAC 01
	28S 16W 31DCA 01
	28S 17W 01CAB 01
	28S 17W 05DDB 01
	28S 17W 15DDB 01
	28S 18W 09BAC 01
	28S 18W 19CCB 01
	28S 18W 26DCA 01
	28S 19W 10AAC 01
	28S 19W 30CBC 01
	28S 19W 33CBD 01
	28S 20W 12BBD 01
	28S 20W 30ACA 01
	29S 17W 04ABC 01
	29S 18W 02ACC 01
	29S 18W 07BBD 01
	29S 19W 22BAA 01
	29S 20W 11CDD 01
Labette	31S 21E 15CCC 02
Lane	16S 29W 26CCD 01
	16S 30W 24DCC 01
	16S 30W 29CDD 01
	16S 30W 34DAB 01
	17S 27W 20CCC 01

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number
Lane (continued)	17S 27W 26CCC 01
	17S 28W 07BBB 01
	17S 28W 15BBC 01
	17S 28W 26ABB 01
	17S 28W 34CBB 01
	17S 29W 03BDC 01
	17S 29W 36BAA 01
	17S 30W 13CBB 01
	17S 30W 20BBB 01
	18S 27W 13CCC 01
	18S 28W 18ACC 01
	18S 29W 04DAD 01
	18S 30W 02AAA 01
	18S 30W 04BAB 01
	18S 30W 23AAA 01
Leavenworth	12S 22E 21BCD 01
	12S 22E 22CAA 01
Logan	11S 32W 04ACD 01
	11S 32W 19AAB 01
	11S 32W 31CCD 01
	11S 32W 36ABA 01
	11S 33W 10BDD 01
	11S 33W 14DCC 01
	11S 34W 13AAB 01
	11S 34W 16CDB 01
	11S 35W 01DCC 01
	11S 36W 06ADD 02
	11S 37W 01DCD 01
	15S 37W 29AAA 01
McPherson	17S 03W 04BBB 01
	17S 04W 25DDD 01
	17S 05W 07CBB 01
	17S 05W 22BAA 01
	18S 03W 30CCC 01
	18S 04W 21CCC 01
	19S 01W 32DAC 01
	19S 03W 16BCB 01
	19S 03W 31BBA 01
	20S 01W 22BBB 01
McPherson (continued)	20S 01W 29DDD 01
	20S 03W 22DAA 01
	20S 03W 30BBA 01
	20S 04W 15BDD 01
	20S 04W 27DAC 01
	21S 02W 12BBB 01
	21S 02W 36ACA 01
	21S 03W 06CBD 01
	21S 03W 22BBB 01
	21S 03W 33BBC 01
	21S 04W 26CDC 01
Meade	30S 26W 04CBB 01
	30S 26W 13ABB 01
	30S 26W 32DDD 01
	30S 27W 20ABA 01
	30S 27W 23ABB 01
	30S 27W 27BBB 01
	30S 27W 32DDD 01
	30S 28W 17ABB 01
	30S 28W 33AAA 01
	30S 29W 23CAD 01
	30S 29W 28BBB 01
	30S 30W 06CCC 01
	30S 30W 28ABB 01
	31S 26W 30BBB 01
	31S 27W 20AAA 02
	31S 28W 02CCC 01
	31S 28W 10BCB 01
	31S 28W 26ABB 01
	31S 29W 02DBB 01
	31S 29W 25AAA 02
	31S 29W 30AAA 01
	31S 30W 16BBC 01
	32S 28W 04ADD 01
	32S 29W 05CC 01
	32S 29W 27AAB 02

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number
Meade (continued)	32S 29W 32DDD 01
	32S 30W 09CCC 01
	32S 30W 28BBC 01
	33S 28W 29BCB 01
	33S 29W 30ACB 01
	33S 29W 36AAB 01
	33S 30W 21ACC 01
	33S 30W 35CBB 01
	34S 28W 05BDA 01
	34S 30W 22CBC 01
	35S 30W 10CDA 01
Morton	31S 39W 18CCC 01
	31S 39W 33BCC 01
	31S 40W 01DA 01
	31S 40W 29ABB 01
	31S 41W 07CDD 01
	31S 41W 31CBB 01
	31S 42W 29AAB 01
	31S 43W 03CB 01
	31S 43W 14DDC 01
	31S 43W 20CBB 01
	32S 40W 07BDC 01
	32S 40W 21ADB 01
	32S 41W 15CDC 01
	32S 41W 35DCC 01
	32S 42W 14CCC 01
	32S 42W 21BCC 01
	32S 42W 26CDD 01
	32S 43W 08CBD 01
	32S 43W 17DCC 01
	32S 43W 28BBC 01
	33S 39W 04DBB 01
	33S 39W 16ABB 01
	33S 40W 27CCC 01
	33S 41W 03AAD 01
	33S 41W 33DDD 01
Morton (continued)	33S 42W 01AA 01
	33S 42W 05DCC 01
	33S 42W 21BCB 01
	33S 43W 08BDA 01
	33S 43W 09DBA 01
	34S 39W 06CCA 01
	34S 40W 16ABB 01
	34S 41W 26DCD 01
	34S 41W 28CBA 01
	34S 42W 05BDC 01
	34S 42W 22CDB 01
	34S 43W 07BDD 01
	35S 39W 06CDD 01
	35S 40W 03BBB 01
	35S 41W 16CCD 01
	35S 42W 02DBB 01
	35S 43W 04AAC 01
	35S 43W 13BDB 01
Ness	16S 24W 15ABB 01
	18S 21W 25AAB 01
	18S 21W 31CAA 01
	18S 24W 36ADB 01
	18S 25W 33BBC 01
	18S 26W 06BAB 02
	19S 23W 01CCB 01
	19S 23W 08CBB 01
	20S 22W 20CCC 01
	20S 22W 35BCC 01
	20S 23W 32CDA 01
	20S 26W 07BDC 01
Norton	01S 21W 17AAA 01
	01S 23W 15AAA 01
	01S 24W 13BCB 01
	01S 25W 25BBB 01
	02S 21W 35CCC 01

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number
Norton (continued)	02S 23W 22AAA 01
	02S 25W 14AAA 01
	04S 23W 03DDD 01
	04S 23W 26CCC 01
	04S 25W 13CCC 01
	05S 21W 10AAA 01
	05S 22W 18CCD 01
	05S 24W 21AAA 01
Osborne	06S 12W 23CDC 01
	07S 12W 28ABA 01
	07S 15W 10CCC 01
Pawnee	21S 15W 11CBB 01
	21S 15W 31BAD 01
	21S 16W 14ADC 01
	21S 18W 32DAA 01
	21S 19W 27CCC 01
	21S 19W 30BCC 01
	21S 20W 29BBB 01
	22S 15W 03AAA 01
	22S 15W 03AAA 02
	22S 15W 13DCA 01
	22S 15W 20CDC 01
	22S 15W 33DDD 01
	22S 16W 03CBC 02
	22S 16W 06BBA 01
	22S 16W 23AAA 01
	22S 16W 32CDD 01
	22S 17W 05BBC 02
	22S 17W 18AAD 01
	22S 17W 24CBC 01
	22S 19W 07AAA 01
	22S 19W 10BBA 01
	23S 15W 12DDB 01
	23S 15W 18DDB 01
	23S 16W 16BAB 01
	23S 16W 35CCD 02
	23S 17W 07ACC 01
Pawnee (continued)	23S 17W 10CDB 01
	23S 17W 25ADC 01
	23S 17W 33CCA 01
	23S 18W 28DAD 01
	23S 18W 36DAC 01
Phillips	04S 18W 23CDC 01
	04S 19W 35DDD 01
Pottawatomie	09S 11E 19CDB 01
	09S 11E 27CAA 01
	09S 11E 31DCC 01
	09S 11E 32ADC 01
	09S 11E 34CAB 01
	09S 11E 35DDD 01
	10S 08E 14CBA 01
	10S 10E 10DBC 01
	10S 11E 01CBC 01
	10S 11E 03BCA 01
	10S 11E 04ACB 01
	10S 12E 07BBC 01
Pratt	26S 11W 01DDB 01
	26S 11W 27AAC 01
	26S 11W 29BCB 01
	26S 12W 02DBD 01
	26S 12W 17CCA 01
	26S 12W 34CDC 01
	26S 12W 34CDC 02
	26S 13W 16DAA 01
	26S 13W 19BBD 01
	26S 13W 34BCB 01
	26S 14W 17DCB 01
	26S 15W 18DAB 01
	27S 11W 12CBC 01
	27S 11W 31DAA 01
	27S 12W 12DAA 01
	27S 12W 33CBA 01
	27S 13W 13DDC 01
	27S 14W 03DAC 01
	27S 14W 12DDD 01
	27S 14W 21CAB 01

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number	County	Well number
Pratt (continued)	27S 15W 02ABC 01	Rawlins (continued)	03S 35W 24CBB 01
	27S 15W 08BBD 01		03S 36W 14CBB 01
	27S 15W 32CCA 01		03S 36W 17CCC 01
	27S 15W 36ADD 01		04S 31W 16ABD 01
	28S 11W 12ACC 01		04S 31W 25DDD 01
	28S 11W 20CAC 01		04S 33W 10ABC 01
	28S 12W 21BAD 01		04S 33W 18DDA 01
	28S 13W 02DDC 01		04S 33W 28DCA 01
	28S 13W 17AAA 01		04S 34W 33CBC 01
	28S 13W 26DCB 01		04S 35W 06DCD 01
	28S 14W 14CCC 01		04S 35W 13DAD 01
	28S 15W 23CCD 01		04S 35W 29DDD 01
	29S 11W 06AAA 01		04S 36W 06BBB 01
	29S 11W 09ADD 01		04S 36W 23CBB 01
	29S 11W 29AAD 01		04S 36W 23DCA 01
	29S 12W 20CCD 01		05S 31W 10DDA 01
	29S 13W 12ABB 01		05S 31W 20CCA 01
	29S 13W 31CAA 01		05S 31W 23DDD 01
	29S 14W 12ABB 01		05S 32W 14CDD 01
	29S 14W 17DBD 01		05S 32W 20DDC 01
	29S 15W 02CCA 01		05S 33W 29BDA 01
	29S 15W 18ADA 01		05S 34W 01BBB 01
	29S 15W 25ABB 02		05S 34W 28ADC 01
			05S 35W 10CDD 01
Rawlins	01S 33W 29CCC 01		05S 35W 30CBC 01
	02S 31W 03CAD 01		
	02S 32W 20DCD 01		05S 36W 21BCD 01
	02S 33W 26DCC 01		
	02S 35W 13ABB 01	Reno	22S 04W 12CDA 01
			22S 04W 32BBC 01
	02S 35W 34CAA 01		22S 05W 17BCC 01
	02S 36W 13DDD 01		22S 05W 33DBD 01
	02S 36W 15CDD 01		22S 06W 18BCB 01
	02S 36W 36BAA 01		
	03S 31W 07CBD 01		22S 06W 28CCB 01
			22S 07W 17DCB 01
	03S 31W 23BBB 01		22S 08W 09DBB 01
	03S 33W 03DCC 01		22S 08W 23DAD 01
	03S 33W 08CDC 01		22S 08W 33CCD 01
	03S 34W 03ABB 01		
	03S 34W 26BAC 01		

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number	County	Well number
Reno (continued)	22S 09W 03BBD 01	Reno (continued)	25S 09W 01DCD 01
	22S 09W 17BAB 01		25S 09W 17BBC 01
	22S 09W 25BBA 01		25S 09W 30DDA 01
	22S 10W 02DCC 01		25S 10W 14BBB 01
	22S 10W 08BBB 01		25S 10W 19ABD 01
	22S 10W 30DAA 01		26S 06W 13BAB 01
	23S 04W 03BAB 02		26S 06W 34BBC 01
	23S 04W 16BBB 01		26S 07W 12DCC 01
	23S 04W 30BAA 01		26S 07W 21DDC 01
	23S 06W 15BAC 01		26S 08W 09ABA 01
	23S 06W 31DCB 01		26S 08W 30DCB 01
	23S 07W 01ABA 01		26S 09W 10DDB 01
	23S 07W 05ABA 01		26S 09W 18AAA 01
	23S 07W 13DDD 01		26S 09W 31DCC 01
	23S 08W 18AAD 01		26S 09W 34DBD 01
	23S 09W 05CBD 01		26S 10W 18CDC 01
	23S 09W 21DDB 01		26S 10W 32BBD 01
	23S 09W 35CCC 01		
	23S 10W 02BAB 01	Republic	01S 03W 01CCA 01
	23S 10W 25CAC 01		01S 03W 09CBD 01
			01S 04W 15AAA 01
	24S 04W 05CDB 01		
	24S 04W 14DAC 01	Rice	18S 09W 04BCC 01
	24S 04W 25BBD 01		18S 10W 24BBB 01
	24S 04W 31DAB 01		20S 08W 22AAA 01
	24S 05W 10CCA 01		20S 09W 12DDA 01
			20S 10W 27BBB 01
	24S 06W 14ABB 01		
	24S 06W 23CBA 01		20S 10W 36ACD 01
	24S 07W 08ADA 01		21S 07W 04AAC 01
	24S 07W 28AAA 01		21S 07W 26CBD 01
	24S 08W 04AB 01		21S 08W 09CBD 01
			21S 08W 25ABB 01
	24S 08W 18BAC 01		
	24S 08W 34DAC 01		21S 08W 32DBB 01
	24S 09W 19DDB 01		21S 09W 02DDA 01
	24S 10W 06DBB 01		21S 09W 15AAC 02
	24S 10W 17DDC 01		21S 10W 21ADB 01
	24S 10W 31CBC 01	Riley	10S 09E 17BDD 01
	25S 04W 02ABB 01		
	25S 07W 07BBD 01	Rooks	07S 17W 24BBB 01
	25S 07W 36CCC 01		07S 19W 23CDB 01
	25S 08W 19ADB 01		

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number
Rush	18S 16W 23DCC 01
	18S 16W 23DCC 02
	18S 17W 14BCC 01
	18S 17W 22AAD 01
	18S 17W 23BCC 01
	18S 18W 27AAC 01
	18S 19W 20ADD 01
	18S 20W 14CCC 01
	18S 20W 19AAD 01
Saline	13S 01W 23BCB 02
	13S 02W 18CCC 01
	13S 02W 33DDC 01
	15S 03W 33DCD 01
Scott	16S 31W 17DDD 01
	16S 31W 31BCB 01
	16S 33W 19CBB 01
	16S 33W 33BAA 01
	16S 34W 09CCB 01
	16S 34W 29CBB 01
	17S 31W 04DCC 01
	17S 31W 19CDA 01
	17S 31W 35CCB 01
	17S 32W 16BBB 01
	17S 32W 27BBB 01
	17S 32W 31BCB 01
	17S 33W 07BBB 01
	17S 33W 14ACB 01
	17S 34W 06BCB 01
	17S 34W 16ACB 01
	17S 34W 25DBB 01
	18S 31W 24BCB 01
	18S 31W 27ABA 01
	18S 32W 14BBB 01
	18S 32W 17ABA 02
	18S 33W 03CCB 01
	18S 33W 05CCC 01
	18S 33W 11ABB 01
	18S 33W 15DDD 01
Scott (continued)	18S 33W 26DAD 02
	18S 33W 34ADB 01
	18S 34W 05CBB 01
	18S 34W 25BBD 01
	18S 34W 34BBC 01
	19S 32W 06CCB 01
	19S 32W 32ACB 01
	19S 33W 06DBB 01
	19S 33W 12DDC 01
	19S 33W 15DBD 01
	19S 33W 29CBB 02
	19S 34W 19DCCC01
	20S 32W 16DAD 01
	20S 32W 30BCD 01
	20S 33W 02DBB 01
	20S 33W 09BBB 01
	20S 33W 17BAB 01
	20S 33W 21ABD 01
	20S 33W 35DBA 01
	20S 34W 15BAA 01
	20S 34W 36CCD 01
Sedgwick	25S 01W 07ABD 01
	25S 01W 26DBD 01
	25S 01W 28DBA 01
	25S 02W 16DDA 01
	25S 02W 23DBD 01
	25S 03W 03DDD 01
	25S 03W 15CCC 01
	26S 01W 12BAD 01
	26S 01W 19ABA 01
	26S 01W 31CCC 02
	26S 01W 31CCD 01
	26S 02W 02DDD 02
	26S 02W 07AAA 02
	26S 02W 08AAB 01
	26S 02W 10BBB 01

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number
Sedgwick (continued)	26S 02W 10DAA 01
	26S 02W 13ACA 01
	26S 02W 14DDD 01
	26S 02W 15DBB 01
	26S 02W 23CCC 01
	26S 02W 29AAA 01
	26S 03W 02AAC 01
	28S 01W 11BCB 01
	28S 01W 15ACA 02
	29S 01E 16DDD 01
Seward	31S 31W 08BCC 01
	31S 31W 13BBC 01
	31S 31W 32DCC 01
	31S 32W 03DAD 01
	31S 32W 31BBB 01
	31S 33W 06CBD 01
	31S 33W 20DBB 01
	31S 34W 18BBB 01
	32S 31W 02BBB 01
	32S 31W 08BBB 01
	32S 31W 26CAA 01
	32S 31W 31ACC 01
	32S 32W 14BBB 01
	32S 32W 19BAB 01
	32S 33W 04BAA 01
	32S 33W 21CDB 01
	32S 33W 32DBD 01
	32S 34W 10DAA 01
	32S 34W 17DCC 01
	32S 34W 32BBB 01
	33S 31W 28DDB 01
	33S 32W 28CDD 02
	33S 33W 12AAD 01
	33S 33W 20BCC 01
	33S 33W 25DCC 01
	33S 34W 17DCC 01
	34S 31W 30BBB 01
	34S 32W 29BAA 01
	34S 32W 35ADA 01
	34S 33W 04BCD 01
Seward (continued)	34S 33W 07CCB 01
	34S 34W 16DAA 01
	34S 34W 26BCA 01
	35S 31W 10AAC 01
	35S 31W 18BBA 01
	35S 32W 06CBB 01
	35S 33W 16BCA 01
	35S 34W 03CBC 01
	35S 34W 10BBB 01
Shawnee	11S 12E 01ABA 01
	11S 13E 04ADA 01
	11S 14E 13BBB 01
	11S 14E 15ABB 01
	11S 14E 18CBB 01
	11S 14E 22CCC 01
	11S 15E 13DBC 01
	11S 15E 16DCA 01
	11S 15E 23DBD 02
	11S 16E 29ACA 01
Sheridan	06S 26W 26CBB 01
	06S 27W 05CBB 01
	06S 27W 08DCA 01
	06S 27W 19DAB 01
	06S 27W 27BCC 01
	06S 29W 10DBC 01
	06S 29W 24ABB 01
	06S 29W 33CDA 01
	06S 30W 13BAA 01
	06S 30W 14CCD 01
	07S 26W 06AAB 01
	07S 26W 12BAC 01
	07S 26W 19BBC 01
	07S 26W 28CAB 01
	07S 27W 22DAC 01
	07S 28W 08BDC 01
	07S 28W 21ABB 01
	07S 28W 36ABA 01
	07S 29W 05BBB 01
	07S 29W 27CCC 01

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number	County	Well number
Sheridan (continued)	07S 29W 30ABA 01	Sherman (continued)	06S 40W 10AAC 01
	07S 30W 08CBB 01		06S 40W 13CBC 01
	08S 26W 14DAA 01		06S 40W 30DCC 01
	08S 27W 11DCD 01		06S 41W 01ABB 01
	08S 27W 35CBB 01		06S 41W 19DBD 01
	08S 28W 09ABC 01		06S 41W 27DBD 01
	08S 28W 11DAA 01		06S 42W 02AAA 01
	08S 29W 01DCB 01		06S 42W 08CBB 01
	08S 30W 11CBC 01		06S 42W 22DCC 01
	08S 30W 13DAA 01		06S 42W 30ADA 01
	08S 30W 30ABC 01		07S 37W 04BBC 01
	09S 26W 22BBB 01		07S 37W 05CCB 01
	09S 27W 12CCC 01		07S 38W 28DAA 01
	09S 27W 19DDD 01		07S 39W 01DCD 01
	09S 27W 27DAA 01		07S 39W 09BBB 01
	09S 28W 04BCC 01		07S 39W 24BAA 01
	09S 29W 03AAA 01		07S 40W 06ADB 01
	09S 29W 17BAB 01		07S 40W 29BBA 01
	09S 29W 26BAA 01		07S 40W 35BBB 01
	09S 30W 03AAB 02		07S 40W 36BAB 01
	09S 30W 35BBB 01		07S 41W 07BCB 01
	10S 26W 08BAA 01		07S 41W 16ADC 01
	10S 26W 12AAD 01		07S 41W 28DBB 01
	10S 26W 13CBB 01		07S 42W 07DAA 01
	10S 27W 20CBC 01		07S 42W 17CCC 01
	10S 27W 22DBA 01		07S 42W 27AAB 01
	10S 28W 05DDB 01		08S 37W 03ADB 01
	10S 28W 29DAA 01		08S 37W 21CCC 01
	10S 29W 02DDD 01		08S 37W 32ABB 01
	10S 29W 20CAA 01		08S 38W 17CDD 01
	10S 30W 08DDD 01		08S 38W 24AAB 01
	10S 30W 12ADA 01		08S 39W 15CCC 01
			08S 40W 12DBA 01
Sherman	06S 37W 07BBA 01		08S 40W 17CDB 01
	06S 37W 16CDD 01		08S 40W 20CCC 01
	06S 37W 19ABB 01		
	06S 38W 09ABD 01		08S 40W 25AAC 01
	06S 39W 09DDD 01		08S 41W 17CBA 01
			08S 41W 25BBC 01
			08S 42W 15DDB 01
			08S 42W 19ABB 01

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number
Sherman (continued)	08S 42W 31DCD 01
	09S 37W 07DDB 01
	09S 38W 13BCC 01
	09S 39W 01DBA 01
	09S 39W 02BAB 01
	09S 39W 10CCB 01
	09S 39W 19CCC 01
	09S 40W 13CDC 01
	09S 40W 29BBB 01
	09S 41W 05DCC 01
	09S 41W 14BBC 01
	09S 41W 28AAA 01
	09S 41W 34BAB 01
	09S 42W 08AAA 01
	09S 42W 14AAA 01
	09S 42W 29CBB 01
	09S 42W 35ABB 01
	10S 37W 23ABB 01
	10S 40W 10ADC 01
	10S 41W 15CAD 01
	10S 42W 20ABB 01
	10S 42W 21BBB 01
	10S 42W 24BAB 01
Stafford	21S 11W 07BBB 01
	21S 12W 10CDD 01
	21S 13W 27DDD 02
	21S 14W 22AAC 01
	21S 14W 32BAC 01
	22S 11W 07BBB 01
	22S 12W 05BBD 01
	22S 12W 30BBD 01
	22S 12W 36BBB 02
	22S 13W 05CBC 01
	22S 13W 12CAC 01
	22S 13W 29DAD 01
	22S 14W 14CCA 01
	22S 14W 35DDB 01
	23S 11W 02BBB 01
Stafford (continued)	23S 11W 22BCC 01
	23S 12W 07DBD 01
	23S 12W 22BCC 01
	23S 12W 36BBC 01
	23S 13W 08CCB 01
	23S 13W 30CBB 01
	23S 13W 35CCA 01
	23S 14W 15ADD 01
	23S 14W 30BBB 01
	24S 11W 14CAB 01
	24S 11W 17DDB 01
	24S 12W 17CAB 01
	24S 12W 34ABC 01
	24S 13W 16ACA 01
	24S 13W 30BCB 01
	24S 13W 36DDD 01
	24S 14W 17AAC 01
	24S 14W 31BBD 01
	24S 15W 10BAB 01
	24S 15W 32DBC 01
	25S 11W 02ACB 01
	25S 11W 23DDD 01
	25S 12W 11AAA 01
	25S 12W 24DDB 01
	25S 13W 16AAC 01
	25S 13W 31DDA 01
	25S 13W 36DCC 01
	25S 14W 04AAD 01
	25S 14W 21DDB 01
	25S 14W 30CDB 01
	25S 15W 11BCB 01
	25S 15W 29BBD 01
Stanton	27S 39W 02BBB 01
	27S 39W 27BBA 01
	27S 40W 07ABB 01
	27S 40W 16CCC 01
	27S 40W 25CBC 01

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number	County	Well number
Stanton (continued)	27S 41W 31CCB 02	Stevens	31S 35W 15BAA 01
	27S 41W 35CCC 01		31S 35W 19CCC 01
	27S 42W 11DBD 01		31S 35W 26DCC 01
	27S 42W 17CCC 01		31S 36W 02CDD 01
	27S 42W 31CCC 01		31S 36W 27BCB 01
	27S 43W 02BBD 01		31S 37W 09BCC 01
	28S 39W 14BBC 01		31S 37W 22BCC 01
	28S 39W 16CCC 01		31S 37W 30DDB 01
	28S 39W 33ACC 01		31S 38W 17CDA 01
	28S 39W 36ABB 01		31S 39W 23BBB 01
	28S 40W 04CCC 01		32S 35W 08DDD 01
	28S 40W 12DDD 02		32S 36W 21AAC 01
	28S 40W 23ACC 01		32S 36W 27DDD 01
	28S 40W 32CCB 01		32S 37W 10DCC 01
	28S 41W 02CCC 01		32S 37W 26BAC 01
	28S 41W 19CBB 01		32S 38W 11ADA 01
	28S 41W 31BDD 01		32S 38W 23BDD 01
	28S 42W 08CCC 01		32S 39W 02BBB 01
	28S 42W 20BCC 01		32S 39W 14DDD 01
	28S 42W 32BBB 01		33S 35W 23CBB 01
	29S 39W 17BCB 01		33S 36W 03ACA 01
	29S 39W 21DBD 01		33S 36W 26DDD 01
	29S 39W 24DDA 01		33S 37W 17CCC 01
	29S 40W 28ABB 01		33S 37W 23CDB 01
	29S 41W 13ACC 01		33S 38W 06AAB 01
	29S 41W 31CBD 01		33S 38W 10ACC 01
	29S 42W 08CDC 01		33S 38W 20DAD 01
	29S 42W 24CCC 01		34S 35W 03DCC 01
	29S 43W 33CDB 01		34S 35W 07CBB 01
	30S 39W 18BBB 01		34S 35W 26ACC 01
	30S 39W 23BBB 01		34S 36W 10CAC 01
	30S 40W 12BBB 01		34S 36W 21DBD 01
	30S 40W 24CDC 01		34S 37W 08DAC 01
	30S 40W 33CCB 01		34S 37W 27ABC 01
	30S 41W 13CCC 02		34S 37W 29BBD 01
	30S 41W 23DDB 01		34S 37W 35AAD 01
	30S 42W 12ACC 01		34S 38W 02CAC 01
	30S 42W 16BDB 01		34S 38W 34CAA 01
	30S 43W 34BBB 01		34S 39W 02CCA 01
	30S 43W 36BB 01		34S 39W 15CAD 01

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number	County	Well number
Stevens (continued)	35S 35W 15BCC 01	Thomas (continued)	08S 33W 34BBC 01
	35S 36W 01AAA 01		08S 34W 01BAC 01
	35S 36W 15AAD 01		08S 34W 06CBC 01
	35S 37W 16BCC 01		08S 34W 23CBD 01
	35S 39W 10CAD 01		08S 34W 29CCC 01
Thomas	06S 31W 03ADB 01		08S 35W 04CCC 01
	06S 31W 33CCD 01		08S 36W 15CBB 01
	06S 32W 12CBC 01		08S 36W 18ABA 02
	06S 32W 29CDC 01		08S 36W 31BCD 01
	06S 33W 07BBB 01		09S 31W 10BBB 01
	06S 33W 23DDD 01		09S 31W 17CCC 01
	06S 34W 01DDD 01		09S 31W 36AAB 01
	06S 34W 11CDD 01		09S 32W 03AAA 01
	06S 34W 17CBC 01		09S 32W 27BCD 01
	06S 34W 22DCA 01		09S 33W 35AAD 01
	06S 34W 31CDB 01		09S 34W 11CCC 01
	06S 35W 02CDD 01		09S 34W 12ADA 01
	06S 35W 26ACB 01		09S 34W 17ABA 01
	06S 36W 06BCD 01		09S 35W 32DAA 01
	06S 36W 11ACC 01		10S 31W 26AAA 01
	06S 36W 30DCB 01		10S 31W 29AAB 01
	06S 36W 34DDB 01		10S 32W 11BAA 01
	07S 31W 01DCA 01		10S 32W 29DCB 01
	07S 32W 07ACA 01		10S 33W 03DBC 01
	07S 32W 13AAA 01		10S 33W 06BBC 01
	07S 32W 33BCB 01		10S 33W 19CBD 01
	07S 33W 07BDA 01		10S 34W 12BCD 01
	07S 33W 35ADD 01		10S 34W 29BBC 01
	07S 34W 08BBB 01		10S 35W 09ABB 01
	07S 34W 25AAA 01		10S 36W 16CCC 01
	07S 34W 26DBD 01		10S 36W 36ACC 01
	07S 35W 09CCC 01	Trego	12S 23W 20CCC 01
	07S 36W 17CCC 01		
	07S 36W 35CBB 01	Wabaunsee	10S 10E 15DCC 01
	08S 31W 03CDD 01		10S 12E 29ADD 01
	08S 31W 20CDD 01	Wallace	11S 38W 35CCC 02
	08S 32W 07BAA 01		11S 42W 08DDC 01
	08S 32W 12DBC 01		11S 42W 10AAD 01
	08S 32W 27DAB 01		13S 39W 33BBB 01
	08S 33W 07AAB 01		13S 42W 10BAC 01

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number	County	Well number
Wallace (continued)	13S 43W 36ABB 01	Wichita (continued)	16S 37W 17BBB 01
	14S 38W 21DCC 01		16S 37W 30BAB 01
	14S 40W 23ADD 01		16S 38W 10ABB 01
	14S 40W 29ABA 01		16S 38W 26BBB 01
	14S 41W 22BBC 01		17S 35W 02BBB 01
	14S 42W 10BAA 01		17S 35W 15CDC 01
	14S 42W 14DBD 01		17S 35W 18ACB 01
	14S 42W 30BCA 01		17S 35W 27CCC 01
	15S 38W 05CCB 01		17S 35W 30CBB 01
	15S 38W 14CCD 01		17S 36W 10CBB 01
	15S 38W 28DBB 01		17S 36W 23BCC 01
	15S 38W 36CBB 01		17S 36W 33BCB 01
	15S 39W 02BCD 01		17S 37W 08BAA 01
	15S 39W 06CBC 01		17S 37W 13CDD 01
	15S 39W 08ACC 01		17S 37W 28CCC 01
	15S 39W 26ACC 01		17S 38W 21BBB 01
	15S 40W 03BAB 01		17S 38W 24ACC 01
	15S 40W 09DCB 01		17S 38W 28CCC 01
	15S 40W 26CAB 01		18S 35W 08BBC 02
	15S 41W 05ACB 01		18S 35W 14DCD 01
	15S 41W 10BAB 01		18S 35W 31DDD 01
	15S 41W 27CBC 01		18S 36W 15DAD 01
	15S 41W 36DDB 02		18S 37W 01BBB 01
	15S 42W 02BBB 01		18S 37W 21BBB 01
	15S 42W 32BDA 01		18S 37W 36ABB 01
	15S 42W 36CDC 01		18S 38W 02BCC 01
			18S 38W 08BBD 01
Washington	01S 05E 05ADA 01		18S 38W 12BCC 01
	04S 02E 14CCC 01		18S 38W 20ACC 02
	05S 01E 20ADA 01		18S 38W 23BAB 01
	05S 01E 31DDD 01		18S 38W 31DBC 01
Wichita	16S 35W 06AAB 01		18S 38W 36DDD 01
	16S 35W 13CCC 01		19S 35W 01AAA 01
	16S 35W 20CCC 01		19S 35W 08BBB 01
	16S 36W 03DCC 01		19S 36W 15BAA 01
	16S 36W 07BCB 01		19S 37W 22AAB 01
	16S 36W 21CCC 01		19S 38W 26CCB 01
	16S 36W 30CBC 01		19S 38W 31CBC 01
	16S 36W 34CCC 02		20S 35W 15BBB 01
	16S 36W 36CBC 01		20S 36W 14DAD 01
	16S 37W 13BBC 01		

Table 4.--Ground-water-level observation wells, 1986 water year--Continued

County	Well number	County	Well number
Wichita (continued)	20S 37W 29DCC 01	Wyandotte	11S 24E 14BDA 01
	20S 38W 17CBD 01		11S 24E 32ABA 02
	20S 38W 33BBA 01		

Table 5.--Surface-water-quality stations, 1986 water year

Ident. no.	Station name	Sampling purpose	Coop. or support
	Missouri River basin		
06-			
8447	S. Fk. Sappa Cr. nr Brewster	SED	KWO
8465	Beaver Cr. at Cedar Bluffs	SED, BED	KWO
8479	Prairie Dog Cr. ab Keith Sebelius Lake	SED	KWO
8538	White Rock Cr. nr Burr Oak	SED	KWO
8566	Republican R. at Clay Center	CHEM, BIOL, TOC, METAL, COLI, FIELD, SED	CBR
8635	Big Cr. nr Hays	SED	KWO
8670	Saline R. nr Russell	SED	KWO
8710	N. Fk. Solomon R. at Glade	SED	KWO
8725	N. Fk. Solomon R. at Portis	CHEM, FIELD	CBR
8730	S. Fk. Solomon R. ab Webster Res.	SED	KWO
8740	S. Fk. Solomon R. at Osborne	CHEM, FIELD	CBR
8776	Smoky Hill R. at Enterprise	CHEM, BIOL, TOC, METAL, SED, BED, COLI, FIELD	CBR/KWO
8791	Kansas R. at Ft. Riley	SED	KC-CE
87965	Kings Cr. nr Manhattan	CHEM, METAL, TOC, FIELD, SED	CBR
8844	Little Blue R. nr Barnes	SED	KWO
8870	Big Blue R. nr Manhattan	CHEM, BIOL, TOC, METAL, SED, COLI, FIELD	CBR
8875	Kansas R. at Wamego	SED	KC-CE
8890	Kansas R. at Topeka	SED	KC-CE
8910	Kansas R. at Lecompton	SED	KC-CE
8911	Kansas R. at Eudora	SED	KC-CE
89235	Kansas R. at DeSoto	CHEM, BIOL, TOC, METAL, SED, BED, COLI, FIELD,	CBR/ KC-CE
9119	Dragoon Cr. nr Burlingame	SED	KWO
9140	Pottawatomie Cr. nr Garnett	SED	KWO
	Arkansas River basin		
07-			
1375	Arkansas R. nr Coolidge	CHEM, BIOL, TOC, METAL, COLI, FIELD, SED	CBR
1423	Rattlesnake Cr. nr Macksville	SED	KWO
1433	Cow Cr. nr Lyons	SED	KWO
143665	Little Ark. R. at Alta Mills	SED	KWO
1442	Little Ark. R. at Valley Ctr.	SED	T-CE

Table 5.--Surface-water-quality stations, 1986 water year--Continued

Ident. no.	Station name	Sampling purpose	Coop. or support
07-			
14478	N. Fk. Ninnescah R. ab Cheney Res.	SED, BED	KWO
14491	S. Fk. Ninnescah R. nr Pratt	SED	KWO
1452	S. Fk. Ninnescah R. nr Murdock	SED, BED	KWO
1457	Slate Creek at Wellington	SED	KWO
1465	Arkansas R. at Arkansas City	CHEM, BIOL, TOC, METAL, SED, BED, COLI, FIELD	CBR/ KWO
14707	Whitewater R. at Towanda	SED	KWO
1575	Crooked Cr. nr Nye	SED	KWO
1675	Otter Cr. at Climax	SED	T-CE
1698	Elk R. at Elk Falls	SED	T-CE
1707	Big Hill Cr. nr Cherryvale	SED	T-CE
1795	Neosho R. at Council Grove	SED	T-CE
17973	Neosho R. nr Americus	SED	T-CE
179795	Cottonwood R. bl Marion Lake	SED	T-CE
18225	Cottonwood R. nr Plymouth	SED	T-CE
1835	Neosho R. nr Parsons	CHEM, BIOL, TOC, METAL, SED, COLI, FIELD	CBR/ KWO
1840	Lightning Cr. nr McCune	SED	KWO

Table 6.--Ground-water-quality observation wells, 1986 water year

County	Well number	County	Well number
Atchison	05S 20E 18CDC	Comanche	32S 18W 07DCC
	06S 18E 22BCD		33S 20W 03BAB
Barber	31S 12W 24BDD	Cowley	32S 03E 25BBC
	32S 10W 21BBA		34S 03E 26BDA
	33S 11W 33ABB		
		Crawford	29S 23E 24ACD
Barton	20S 14W 27BCA		29S 25E 01ACB
			30S 25E 28DDA
Brown	01S 17E 07CBC		
	02S 17E 31DDC	Decatur	04S 27W 17DAC
Butler	24S 03E 17CAB	Dickinson	12S 04E 31AAD
	29S 03E 20BAB		13S 01E 18DCA
	29S 07E 07DDA		
		Doniphan	02S 19E 27CBC
Chase	19S 07E 27CBC		03S 21E 06BCC
	19S 08E 20AAA		
	22S 08E 05CCA	Douglas	11S 18E 34BDA
			12S 20E 19AAA
Cherokee	32S 23E 06AD		13S 21E 05DBB
	33S 23E 13ABB		14S 19E 21BBB
	33S 25E 18DAA		14S 20E 18ABB
	34S 24E 17DCC		
	34S 24E 35DAD	Edwards	24S 18W 25BDC
			25S 19W 01AC
	34S 24E 36BBA		25S 20W 07CAA
	34S 25E 23AAC		
		Ellis	14S 18W 03CCD
Cheyenne	05S 38W 22ACB		14S 18W 25AAB
			15S 18W 28CAC
Clark	31S 23W 07BBA		
	32S 23W 26DDD	Ellsworth	15S 08W 19BCD
	33S 23W 01DBB		17S 09W 16DAB
	34S 25W 36DC		
		Finney	21S 32W 08ABD
Clay	06S 01E 02BAC		23S 31W 03DCC
	07S 02E 03CDC		23S 33W 17BBB
	07S 04E 20ADC		24S 33W 07ACA
	08S 02E 11ADB		
	10S 01E 17DCC	Ford	26S 24W 20CCC
			26S 24W 29DDA
Cloud	05S 01W 26ABD		
	05S 03W 32ADA	Geary	12S 05E 01BBA
	08S 01W 17DBC		
	08S 05W 14ACD	Gove	11S 26W 04DCA

Table 6.--Ground-water-quality observation wells, 1986 water year--

Continued

County	Well number	County	Well number
Graham	07S 21W 02BCC	Kingman	27S 10W 32DCC
	08S 21W 17ACB		30S 05W 12DDC
	08S 25W 14DCC		30S 09W 10ADC
Gray	24S 29W 19BBB	Kiowa	28S 18W 19CCB
	26S 27W 17CCA		
	29S 28W 28CDC	Lane	18S 29W 13DBA
Greeley	17S 40W 15CCB	Leavenworth	08S 21E 19BAA
Hamilton	23S 42W 19CBB	Lincoln	10S 07W 12ACA
	24S 40W 19BBC		12S 06W 15CCB
			12S 07W 06AAA
Harper	32S 07W 02CDA		12S 10W 21DDD
	32S 08W 20BCB		
	33S 07W 28BBB	Logan	11S 32W 03ADB
			11S 36W 06DBB
Harvey	22S 01W 15AA		13S 35W 23ACD
	23S 01W 32BBC		
	23S 02W 29CDD	McPherson	17S 03W 17DBD
	23S 03W 29DBD		17S 05W 23DAB
	24S 03W 26ADA		20S 01W 11CCB
Hodgeman	21S 22W 03BBC	Marion	19S 01E 04ACC
	23S 23W 06CAB		22S 03E 04AA
Jackson	05S 16E 10BBA	Marshall	04S 06E 16DDD
			04S 09E 16AAB
Jefferson	07S 19E 29BBD		
	08S 19E 26CDA	Meade	32S 28W 11BA
	11S 16E 13CBD		35S 30W 10CDB
Jewell	02S 09W 23BAC	Mitchell	06S 09W 26CAD
	03S 06W 21CAB		
		Morris	14S 06E 34AAC
Johnson	12S 22E 25BBC		14S 08E 07DAC
Kearny	21S 37W 02CDD	Morton	32S 42W 14CCC
	23S 35W 24CCB		33S 43W 27CDC
	23S 37W 28CCB		
	24S 36W 16BAD	Nemaha	02S 12E 26CDA
	25S 36W 28BBD		04S 13E 35BAA
			05S 14E 11ACC

Table 6.--Ground-water-quality observation wells, 1986 water year--

Continued

County	Well number	County	Well number
Ness	19S 23W 05CCD	Rice	19S 06W 29CCD
	20S 23W 29DBB		19S 09W 31DAB
			20S 08W 16AA
Norton	02S 21W 08ADD		20S 08W 23ABA
	05S 24W 14CCA		21S 08W 21BAC
Osborne	06S 11W 28ACD	Riley	07S 06E 21CDD
	06S 13W 01DAA		09S 05E 01BCB
	07S 15W 02DCA		10S 07E 32DBD
	10S 15W 18AAA		11S 06E 12ADB
Ottawa	09S 04W 10BBC	Rooks	07S 18W 24BAD
	12S 03W 01DBA		09S 18W 35CCD
			09S 19W 34BBD
Phillips	01S 20W 23DDD		
	04S 16W 27CCA	Rush	16S 17W 16DCD
	04S 18W 23DCA		18S 16W 23AAA
	04S 20W 34CAB		18S 20W 20CDA
Pottawa-tomie	07S 07E 23BBA	Russell	11S 12W 07DDB
	10S 09E 09CDC		11S 14W 07CAA
	10S 10E 09BDB		14S 11W 07DBC
	10S 12E 09ADB		
		Saline	14S 03W 25BAD
Pratt	26S 11W 30ADD		
	27S 13W 08DDC	Scott	17S 32W 05ABB
	29S 14W 23BBA		18S 33W 24A
Rawlins	03S 36W 18DCC	Sedgwick	25S 01W 07BAA
			25S 01W 30ABB
Reno	22S 04W 12DDD		25S 01W 36ACB
	22S 07W 10CAA		25S 03W 14CCB
	23S 06W 13BBA		26S 01E 17AAB
	24S 10W 15CAB		
	25S 04W 05DAD		27S 02W 36BBB
			29S 01E 05CAA
	25S 08W 10BAD		29S 01E 08CBB
	26S 10W 05DD		29S 02W 23DDD
Republic	01S 02W 33DCD	Seward	31S 32W 03DAD
	01S 03W 02CCB		34S 33W 32AAC
	01S 04W 31BCC		
	03S 04W 17DAD	Shawnee	11S 15E 13BBC
	04S 01W 16ACC		
		Sheridan	08S 28W 15BBA

Table 6.--Ground-water-quality observation wells, 1986 water year--

Continued

County	Well number	County	Well number
Sherman	08S 39W 19DCA	Thomas	07S 33W 31DBB
	08S 42W 20CAC		
		Trego	12S 22W 08BAB
Smith	03S 15W 20DCC		14S 22W 36ADD
Stafford	23S 13W 33BDB	Washington	02S 03E 32ABB
	24S 15W 15CDA		04S 05E 09CAA
			05S 02E 12CBA
Stanton	28S 41W 36DB		
	30S 39W 23BBC	Wichita	18S 37W 13CAC
Stevens	33S 37W 16AC	Wyandotte	10S 25E 27DBD
			11S 23E 28CCA
Sumner	30S 02E 06CAB		11S 25E 20ABA
	31S 01E 04BDC		
	31S 02E 02BBB		
	31S 03W 05ACA		
	33S 02E 06BBA		
	34S 02W 21DAB		