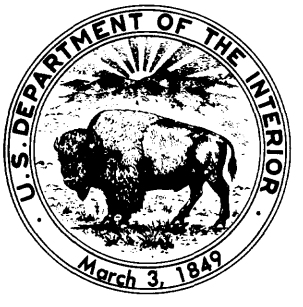
CURRENT WATER RESOURCES ACTIVITIES IN ARKANSAS, 1986-87

By Bobbie L. Louthian and E.E. Gann

U.S. GEOLOGICAL SURVEY

Open-File Report 88-338



Little Rock, Arkansas

1988

DEPARTMENT OF THE INTERIOR

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U.S. GEOLOGICAL SURVEY

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MESSAGE FROM ARKANSAS DISTRICT CHIEF

Hydrologic information is essential for planning the wise use, development, and conservation of the Nation's water resources. Since 1927, the U.S. Geological Survey, Water Resources Division, has cooperated with local, State, and other Federal agencies in providing hydrologic information concerning Arkansas' water resources. These cooperative activities have provided the basic knowledge for our present understanding of the availability and quality of the State's surface and ground-water resources. Although many hydrologic questions remain, the USGS will continue to play an important role in providing hydrologic answers.

During 1986-87, significant progress was made on a number of USGS data-collection, investigation, and research activities in Arkansas. Daily flows are currently computed on a near real-time basis for several gaging stations using a satellite-relay system and efficient computer processing. An accoustical velocity meter provides continuous flow data for the Arkansas River at Dardanelle. A statewide flood-frequency study was completed and a statewide low-flow study was initiated. Flow models for the alluvial and Sparta aquifers are near completion. A local study of ground-water contamination for a shallow aquifer in northwestern Arkansas was initiated and a wetland research study in eastern Arkansas was begun. Software development for efficient storage, processing, and dissemination of hydrologic data continued.

This is an exciting time for water scientists in Arkansas. I sense a true spirit of cooperation among water agencies, public officials, and concerned individuals. I am honored to be directing the activities of the Arkansas District, USGS, at this time and I look forward to continued cooperation with local, State, and other Federal agencies in meeting Arkansas' future water-information needs.

E.E. "Gene" Gann
District Chief
U.S. Geological Survey, WRD
Little Rock, Arkansas

U.S. GEOLOGICAL SURVEY ORIGIN

The U.S. Geological Survey was established by an act of Congress on March 3, 1879, to provide a permanent Federal agency to conduct the systematic and scientific "classification of the public lands, and examination of the geological structure, mineral resources, and products of national domain." An integral part of that original mission includes publishing and disseminating the earth-science information needed to understand, to plan the use of, and to manage the Nation's energy, land, mineral, and water resources.

Since 1879, the research and fact-finding role of the USGS has grown and been modified to meet the changing needs of the Nation it serves. As part of that evolution, the USGS has become the Federal Government's largest earth-science research agency, the Nation's largest civilian mapmaking agency, the primary source of data on the Nation's surface- and ground-water resources, and the employer of the largest number of professional earth scientists. Today's programs serve a diversity of needs and users. Programs include:

- Conducting detailed assessments of the energy and mineral potential of the Nation's land and offshore areas.
- Investigating and issuing warnings of earthquakes, volcanic eruptions, landslides, and other geologic and hydrologic hazards.
- Conducting research on the geologic structure of the Nation.
- Studying the geologic features, structure, processes, and history of the other planets of our solar system.
- Conducting topographic surveys of the Nation and preparing topographic and thematic maps and related cartographic products.
- Developing and producing digital cartographic data bases and products.
- Collecting data on a routine basis to determine the quantity, quality, and use of surface and ground water.
- Conducting water-resource appraisals in order to describe the consequences of alternative plans for developing land and water resources.
- Conducting research in hydraulics and hydrology, and coordinating all Federal water data acquisition.
- Using remotely sensed data to develop new cartographic, geologic, and hydrologic research techniques for natural resources planning and management.
- Providing earth-science information through an extensive publications program and a network of public access points.

Along with its continuing commitment to meet the growing and changing earth-science needs of the Nation, the USGS remains dedicated to its original mission to collect, analyze, interpret, publish, and disseminate information about the natural resources of the Nation--providing "Earth Science in the Public Service."

WATER RESOURCES DIVISION
BASIC MISSION AND PROGRAM

The mission of the Water Resources Division is to provide the hydrologic information and understanding needed for the optimum utilization and management of the Nation's water resources for the overall benefit of the people of the United States.

This is accomplished, in large part, through cooperation with other Federal and non-Federal agencies, by:

- Collecting, on a systematic basis, data needed for the continuing determination and evaluation of the quantity, quality, and use of the Nation's water resources.

- Conducting analytical and interpretive water-resources appraisals describing the occurrence, availability, and the physical, chemical, and biological characteristics of surface and ground water.

- Conducting supportive basic and problem-oriented research in hydraulics, hydrology, and related fields of science to improve the scientific basis for investigations and measurement techniques and to understand hydrologic systems sufficiently well to quantitatively predict their response to stress, either natural or manmade.

- Disseminating the water data and the results of these investigations and research through reports, maps, computerized information services, and other forms of public releases.

- Coordinating the activities of Federal agencies in the acquisition of water data for streams, lakes, reservoirs, estuaries, and ground waters.

- Providing scientifc and technical assistance in hydrologic fields to other Federal, State and local agencies, to licensees of the Federal Power Commission, and to international agencies on behalf of the Department of State.

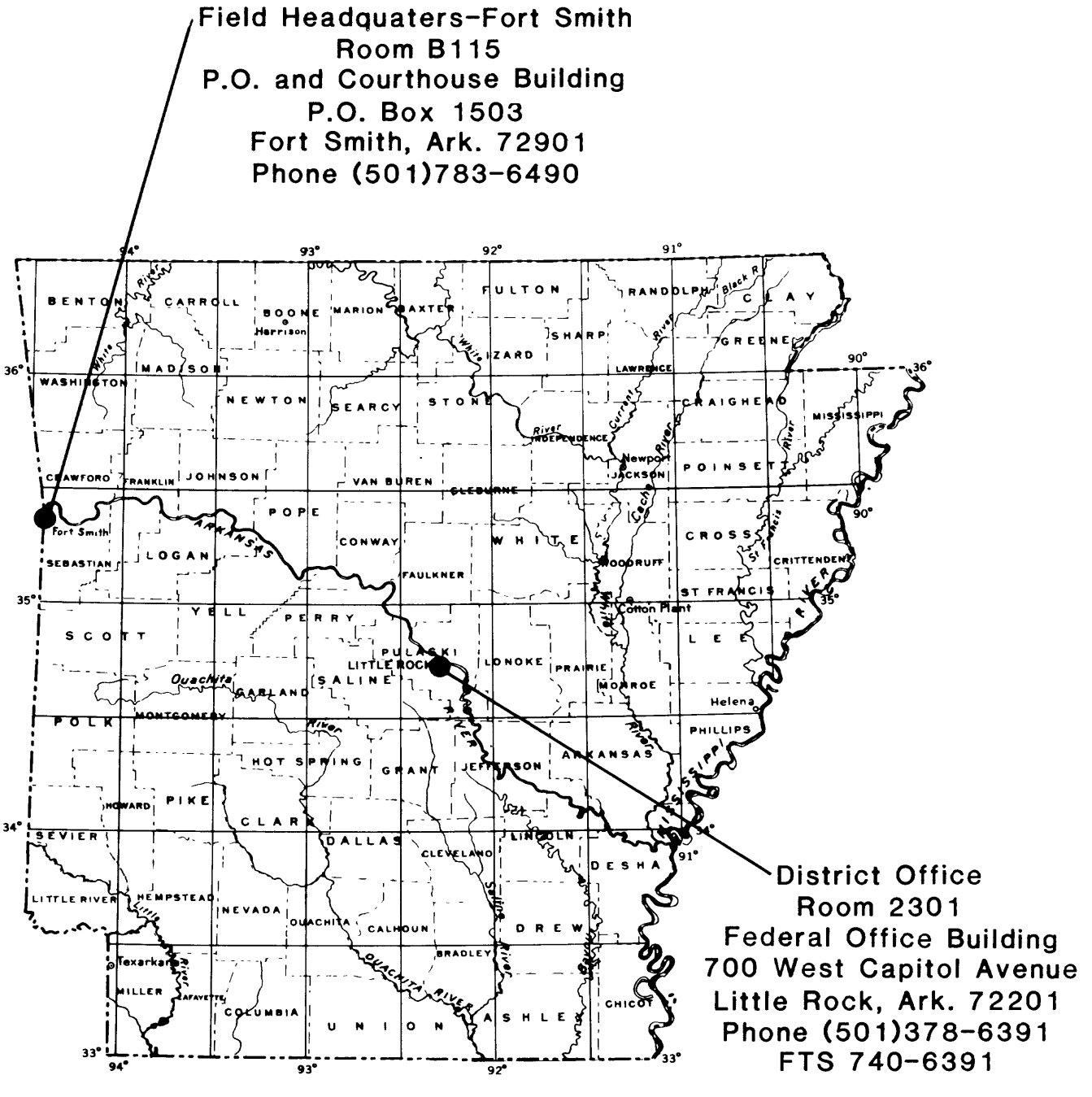


Figure 1.--U.S. Geological Survey, Water Resources Division offices in Arkansas.

ORGANIZATION OF THE ARKANSAS DISTRICT

The Arkansas District of the Water Resources Division consists of four operating sections and three support units. Water-resources projects conducted by the District are assigned to one of the operating sections with responsibility for a project assigned to a project chief. The Arkansas District consists of persons based at the District Office in Little Rock and at a Field Headquarters in Fort Smith (fig. 2). A description of the functions of each is given below.

Office of the District Chief--The office of the District Chief has full responsibility for the scientific, technical, and administrative direction of water-resources investigations made by the Arkansas District. The District Chief's office is supported by an Administrative Services Section, an Information Management Section, and by two technical sections. Section chiefs serve as an advisory group to the District Chief and share in various collateral duties as assigned. Section Chiefs or other senior professionals may act in the absence of the District Chief if so designated. Discipline specialists in the technical sections may serve as advisors and technical consultants to the District staff as needed.

Information Management Section--This section is responsible for developing, implementing, and maintaining information management systems including quality assurance procedures and dissemination of hydrologic data and related information for the District. A senior staff professional is in charge and exercises a wide latitude of independent action in supervision, training, and technical guidance; he may also serve as a project chief or member.

Administrative Services Section--This section provides administrative and clerical support to the activities of the District concerning fiscal and budgetary affairs, serves as staff counselor concerning the Privacy Act and ensures that the District's filing system conforms to the requirements of this Act.

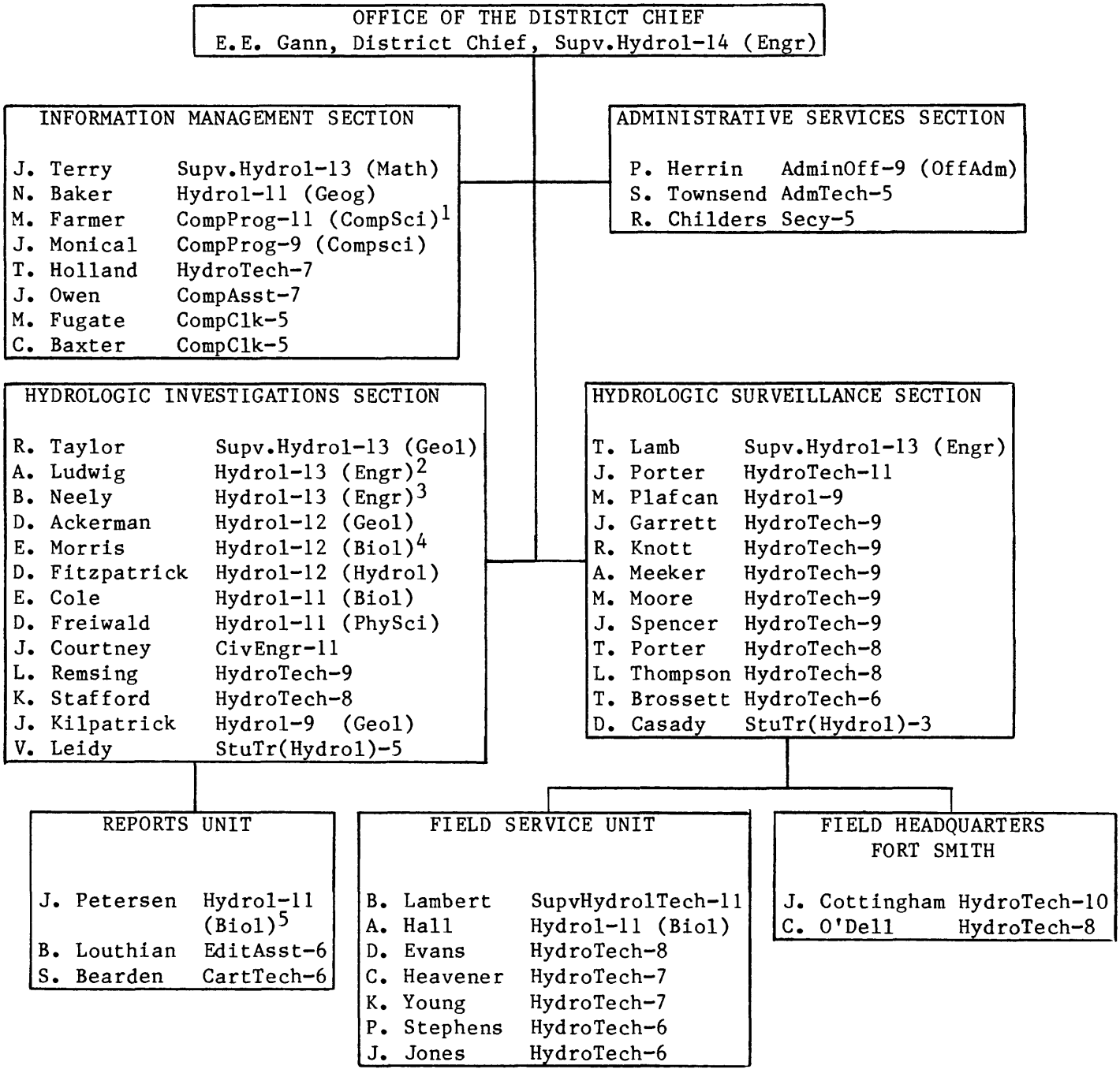
Hydrologic Investigations Section--This section is responsible for the District's water-resources investigations and applied research. Essentially all project work of the District is conducted by this section. A senior staff professional is in charge of all project chiefs and auxiliary staff and exercises a wide latitude of independent action in supervision, training, and technical guidance; he may also serve as a project chief or member.

Reports Unit--This unit provides support for the processing and publication of all reports. A senior staff professional is in charge of the unit; he may also serve as a project chief or member.

Hydrologic Surveillance Section--This section is responsible for all aspects of hydrologic data collection and publication in the District's program. The major aspects are the measurement, compilation, publication, and quality control of streamflow, chemical-quality, sediment, and ground-water data, and the monitoring and documentation of hydrologic events. A senior staff professional is in charge and exercises a wide latitude of independent action in supervision, training, and technical guidance; he may also serve as a project chief or member.

Field Service Unit--This unit provides local water-quality data-collection and laboratory support to the network operations and water-resources investigations.

Field Headquarters, Fort Smith--This field office is responsible for collection, computation, analysis, and assembly of streamflow, ground-water, and water-quality hydrologic records for annual publication with nearly full responsibility for timeliness, completeness, accuracy, and validity of results.



1 - Computer System Administrator
2 - Ground-Water Specialist
3 - Surface-Water Specialist
4 - Water-Quality Specialist
5 - Report Specialist

Figure 2.--Arkansas District organization.

TYPES OF FUNDING

Funding for programs of the Arkansas District falls into three categories:

1. Federal program which includes funds appropriated directly to the Geological Survey,

2. Other Federal Agencies program which includes funds transferred from other Federal agencies, and

3. Cooperative program which includes investigations supported by services and (or) funds provided by State and local agencies, matched on a 50-50 basis by Federal funds.

For fiscal year 1987 the financial support for the programs in Arkansas was about $2,800,000 and were distributed as shown in figure 3.

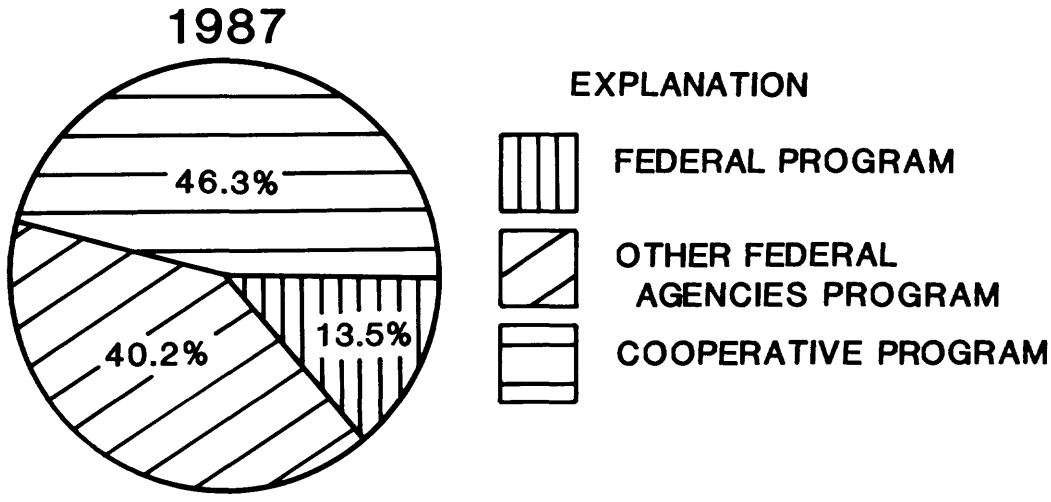


Figure 3.--Arkansas District Program source of funds.

Table 1.--Agencies supporting water-resources investigations during 1986 through 1987 in the Arkansas District

Federal Agencies

U.S. Department of Agriculture
- Soil Conservation Service
- Forest Service

U.S. Department of the Army
- Corps of Engineers
  - Little Rock District
  - Memphis District
  - Vicksburg District
  - Waterways Experiment Station

U.S. Department of Commerce
- National Weather Service

U.S. Department of Interior
- National Park Service

U.S. Environmental Protection Agency

State Agencies

Arkansas Geological Commission
Arkansas Department of Parks and Tourism
Arkansas Department of Pollution Control and Ecology
Arkansas Game and Fish Commission
Arkansas-Oklahoma Arkansas River Compact Commission
Arkansas Soil and Water Conservation Commission
Arkansas State Highway and Transportation Department

Local Agencies

Arkansas Power and Light Company
Independence County

WATER CONDITIONS IN ARKANSAS

Arkansas is divided physiographically into two almost equal areas - the Gulf Coastal Plain and the Interior Highlands (fig. 4). Precipitation is the source of recharge to the streams and aquifers in Arkansas. Precipitation averages 49 inches (1951-1980) annually. Of the 49 inches of precipitation that falls on the land surface, an average of about 2 inches recharges the ground-water system (Freiwald, 1985). Runoff ranges from about 12 to 22 inches. Average annual evaporation from shallow lakes ranges from about 36 inches in the southeast to about 44 inches in the southwest. The total estimated water use in the State in 1985 from both ground and surface water was approximately 65,800 million gallons per day (Mgal/d). The total water use for each county from both ground- and surface-water sources is shown in figure 5 (Holland, 1988).

Ground Water

Ground water plays a major role in satisfying the water-supply needs in Arkansas. The occurrence of ground water is associated with the types of rocks that underlie each physiographic area. Ground water is abundant in the Gulf Coastal Plain but is relatively scarce in the Interior Highlands. Ground-water sources provide a large percentage of the State's water for irrigation, public and rural supplies, and industrial uses. The largest withdrawal of ground water is for irrigation, mostly in the eastern part of the State.

Most of the ground-water supplies in the State are obtained from six aquifers or aquifer systems - the alluvial, the Cockfield, the Sparta Sand, the Wilcox, the Nacatoch Sand, and the Ozark (fig. 4). Although other ground-water sources may be important locally, these aquifers are regionally significant, and constitute the source of nearly all ground-water withdrawals in the State (Ludwig, 1985).

Water quality in the principal aquifers (fig. 4) is acceptable for most uses, but in many areas of the State the water contains undesirably large concentrations of iron and hardness.

Monitoring of ground-water quality is increasing. In 1937, the Arkansas Department of Health began a ground-water-quality monitoring program for public water supplies. This program currently (1986) includes 793 wells. In 1969, the U.S. Geological Survey, in cooperation with the Arkansas Geological Commission, established a water-quality network to monitor constituents in the principal aquifers of the State. These wells are sampled on a 5-year rotational basis. The Arkansas Department of Pollution Control and Ecology is now (1986) establishing a ground-water-quality network as part of its responsibilities in administering its Ground Water Protection Strategy.

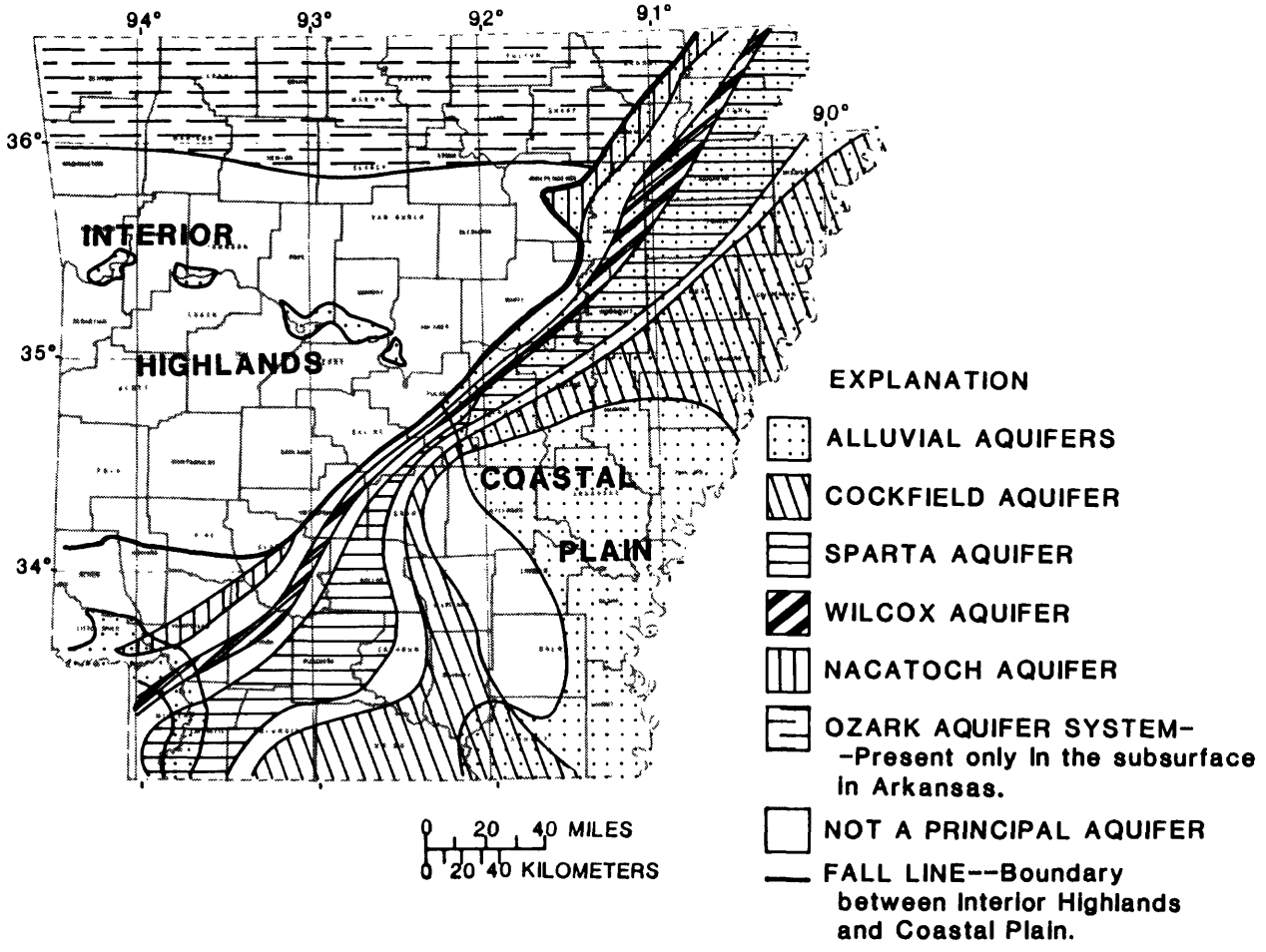


Figure 4.--Physiographic areas and principal aquifers in Arkansas.

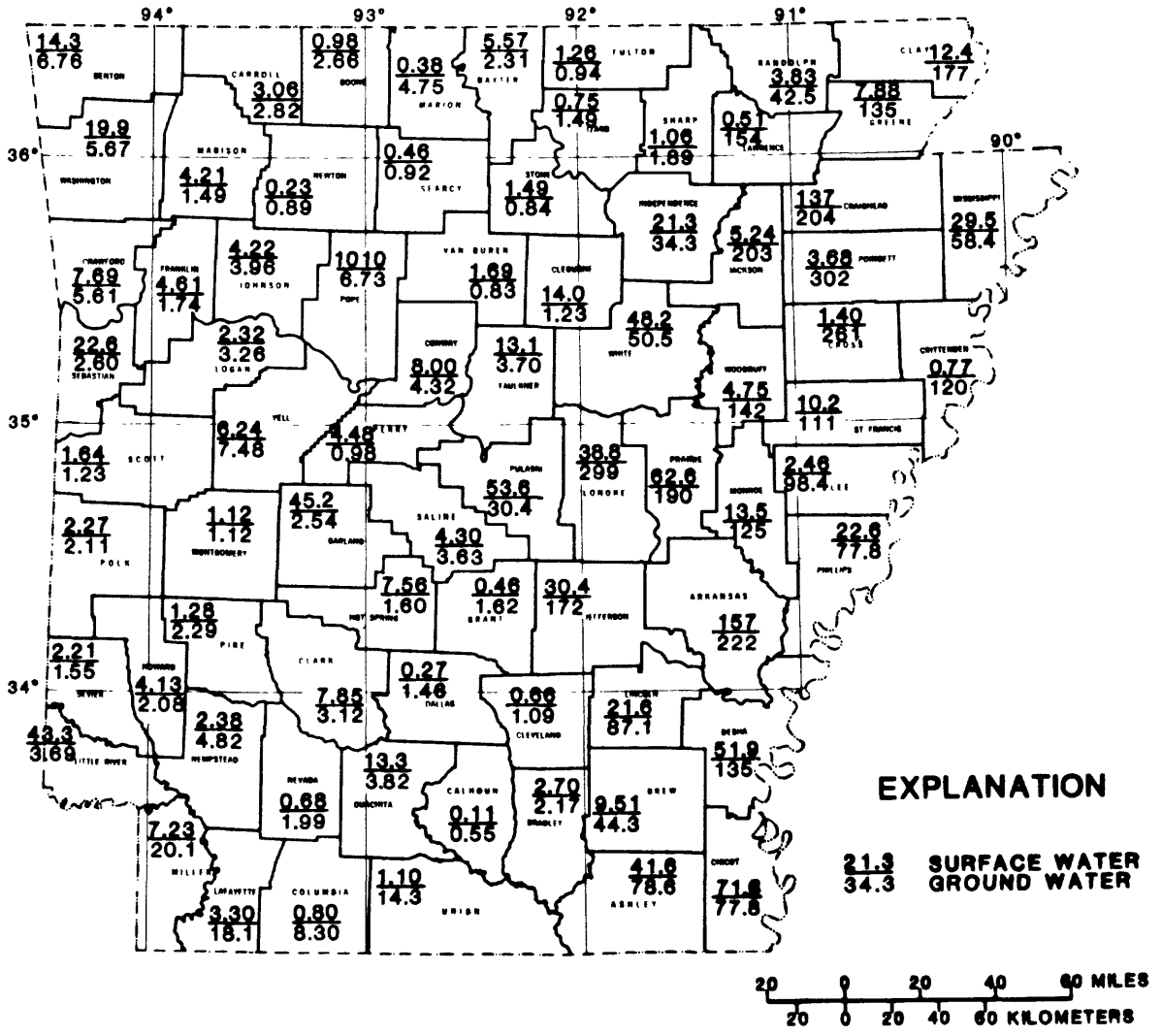


Figure 5.--Total water use (in million gallons per day) in Arkansas counties from ground- and surface-water sources (Holland, 1988).

Surface Water

Arkansas has abundant surface-water resources but periodic droughts severely limit the resource at times. Surface water in Arkansas generally is of excellent quality, although treatment is required for most uses except irrigation and recreation. Dissolved salts, sediment, and local contamination restrict the use of surface water in some parts of the State, particularly in the eastern part. Degradation of water quality in some streams and surface-water bodies that receive municipal and industrial waste-water and nonpoint-source discharges is a concern in the western part of the State. These discharges have adversely affected the suitability of the water for drinking, recreation, and aquatic life in local areas.

Flooding of low areas, which sometimes destroys crops and buildings, is a major concern in the State. Much of the farmland in eastern Arkansas is in the flood plains of major streams (Neely, 1986).

Flood-prone areas are identified for cities and towns having a population of more than 2,500 and for adjacent areas for which adequate maps were available and flood-frequency drainage-area relations could be determined. These areas are shown on the map in figure 6. A total of 219 flood-prone area maps have been published for Arkansas. A list of the maps is found in table 2.

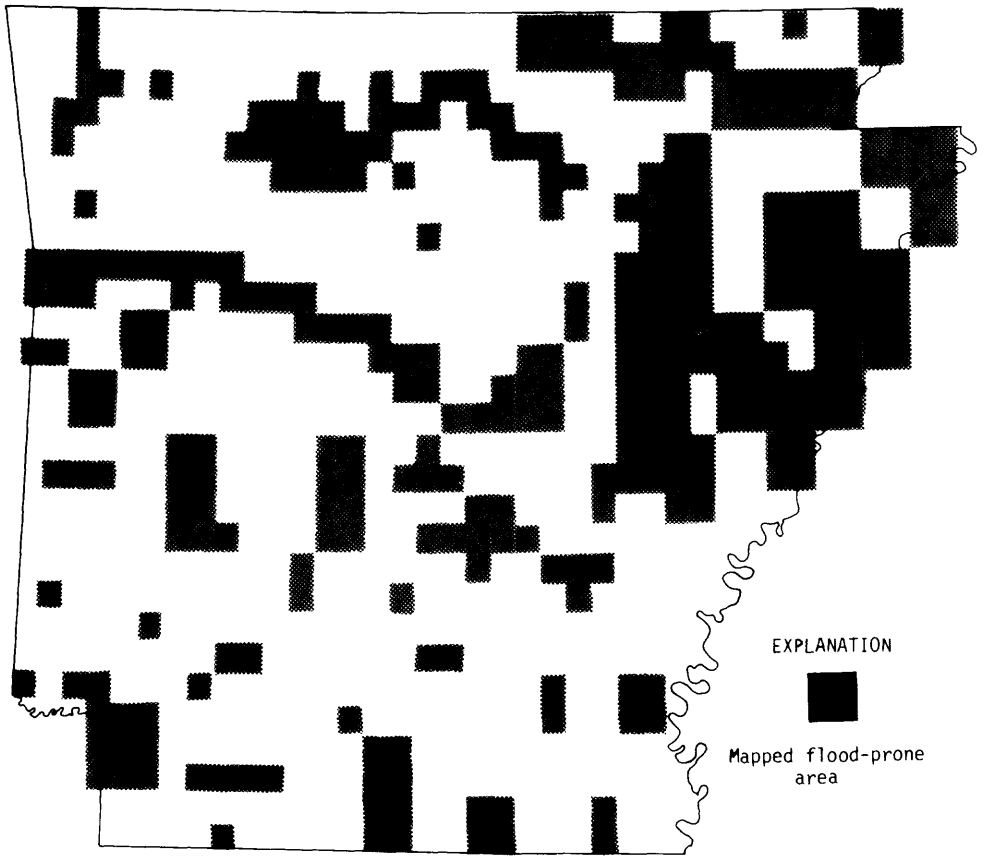


Figure 6.--Locations of flood-prone area maps for Arkasas.

Table 2.--Flood-prone area maps for Arkansas

[Maps shown with * are 15-minute quadrangles, all others are 7.5 minute]

Agnos
*Alicia
Alma
Amagon
Amity
Arkadelphia
Ashdown East
Ashdown West
Atkins
*Augusta
Auvergne

Barling
Batesville
Beebe
Benton
Bentonville No.
Bentonville So.
Bethesda
Big Flat
*Blytheville
Board Camp
*Booneville
Boswell
Boxley
Brinkley
Bryant
Buckner
Buffalo City

Cabot
Cades
Caddo Valley
Calico Rock
Calion
Camden
Camp
Carthage
Cecil
*Clarendon
Clarksville
Clinton
Coal Hill
Concord
Congo
Conway
Cord
Cornerstone
Corning
Cotton Plant
Cozahome
Crocketts Bluff

Dalton
Deckerville
*Dee
Delaware
DeQueene
Des Arc East
DeValls Bluff
DeValls Bluff SE
Domino

*Edmondson
*El Dorado

Fayetteville
*Felsenthal
Fletcher Lake
Fordyce
Foreman
Forrest City
Fort Smith
Fouke
Fouke NE
Fouke SE
Fountain Lake
Fourche
Fourche SW
Fulton

*Gainesville
Georgetown
Gleason
*Glenwood
Goosepond Mtn.
Gregory
Gregory SW
Grubbs
Guion

Hardy
Harrison
Hartford
Hartman
Haskell
Hasty
Haynes
Hindsville
Holla Bend
Holly Grove
Homan
Hope
*Horseshoe Lake
Houston
*Hunter
Huntington

Imboden

Jacksonport
Jacksonville
Jasper
Jericho
Judsonia

Keevil
Kensett
Kingsland
Lake Norrell
Latour
Lavaca
Leslie
Lewisville
*Lonoke
Lonsdale
Lonsdale NE

Madison
Magnolia
*Malvern
Mammoth Spring
Mandeville
*Manila
*Marianna
*Marked Tree
*Marmaduke
Marshall
Martindale
Maumee
Mayflower
McAlmont
*McGehee
McRae
Mena
Monroe
Monticello No.
Monticello So.
Morrilton East
Morrilton West
Moscow
Mountainburg
*Mt. Ida
*Mt. Judea
Mt. Pleasand
Mulberry
Murray

Nashville
Newark
New Blaine
Newport
Norfork
Norfork Dam So.
No. Little Rock
Northwest Memphis

Ogden
*Osceola
Ozark

Paris
Park Grove
*Park Place
*Pastoria
*Piggott
Pine Bluff NW
Pine City
Ponca
Portland
Potter
Poyen
Prague
Prairie Grove
Prattsville
Prescott East
Prescott West
*Princedale

Ravenden
Ravenden Springs
Ravenden Springs SE
Reydell
Rob Roy
Rusellville East
Russellville West

*Salem
Sheridan
Sitka
Smackover
Smackover NE
*Snowball
Snow Hill
Sonora
South Fort Smith
Southwest Memphis
Springdale
Spring Lake
Stuart
Stuttgart No.
Stuttgart So.
Sylamore

Taylor
Texarkana
*Tilton
Traskwood
Tuckerman
Tull
Turner
Van Buren

Waldo
*Waldron
*Walnut Ridge
Warm Springs
Western Grove
West Memphis
Wheeler
Williford
Wilmot
*Wynne

Vellville

CURRENT PROJECT DESCRIPTIONS

Collection of Surface-Water Data

COOPERATING AGENCIES: Arkansas Geological Commission, Arkansas Department of Pollution Control and Ecology, U.S. Army Corps of Engineers, Arkansas Power and Light Company, Arkansas Soil and Water Conservation Commission, Arkansas State Highway and Transportation Department, Arkansas Game and Fish Commission, Independence County, National Weather Service (NOAA)

PROJECT CHIEF: T.E. Lamb

PERIOD OF PROJECT: Continuous since October 1927

LOCATION: Statewide

Problem.--Surface-water information is needed for surveillance, planning, design, hazard warning, operation, and management in water-related fields such as water supply, hydroelectric power, flood control, irrigation, bridge and culvert design, wildlife management, pollution abatement, flood-plain management, water-resources development, and waste disposal. An appropriate data base is necessary to provide this information.

Objectives.--Collect surface-water data to satisfy needs for current-purpose uses, such as assessment of water resources, operation of reservoirs or industries, forecasting, disposal of wastes, pollution control, discharge data to accompany water-quality measurements, compact and legal requirements, and research or special studies. Collect data necessary for analytical studies needed to understand cause-effect relations and define the trends and statistical properties of streamflow.

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

Progress.--The statewide network of streamflow stations was continued and records were published. The network consisted of continuous-record stream-gaging stations and partial-record sites where occasional flow measurements are made for water-quality sampling or peak stages are recorded to determine the annual maximum peak at each site. The Arkansas District also operates data collection platforms, an accoustical velocity meter, and measures flow through gates at two dams.

Station Classification	Number of Stations
Continuous record-daily discharge	47
Crest-stage partial-record stations	58
Water-quality	19
Peak stage	47
Data collection platform	54
Accoustical velocity meter	1

Plans.--Continue operation of continuous-record stream-gaging stations and sites as needed for water-quality sampling. Operate and maintain peak-stage network. Make discharge measurements to verify stage-discharge relations in range of shifting controls. Operate data collection platforms and accoustical velocity meter. Install one accoustical velocity meter and several new stations for flow definition on selected streams.

Reports.--

Lamb and others, 1986, Water resources data for Arkansas--water year 1985: U.S. Geological Survey Water-Data Report AR-85-1, 523 p.

----- 1987, Water resources data for Arkansas--water year 1986: U.S. Geological Survey Water-Data Report AR-86-1, 533 p.

Collection of Ground-Water Data

COOPERATING AGENCIES: Arkansas Geological Commission, Arkansas Soil and Water Conservation Commission

PROJECT CHIEF: Maria Plafcan

PERIOD OF PROJECT: Continuous since July 1945

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

Objectives.--Collect water-level data to provide a minimum long-term data base so that the general responses of the hydrologic system to natural climatic variations and induced stresses are known and 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 provide an assessment of the ground-water resource, allow prediction of future conditions, detect and define contamination and supply problems, and provide the data necessary for management of the resource.

Approach.--Evaluation of regional geology allows broad, general definition of aquifer systems and their boundary conditions. Within this framework, and with some knowledge of the stress on the system in time and space and the hydrologic properties of the aquifers, a subjective decision can be made on the most advantageous locations for observation of long-term system behavior. This subjective network will be refined as records become available and detailed areal studies of the ground-water system more closely define the aquifers, their properties, and the stresses to which they are subjected.

Progress.--Water levels were measured in 720 wells (fig. 7) throughout the State as part of the U.S. Geological Survey-Arkansas Geological Commission ground-water data-collection program. Seven reports showing ground-water levels in Arkansas were completed.

Plans.--Continue water-level monitoring. Prepare the ground-water section of "Water Resources Data for Arkansas, Water Year 1987" and publish water-level data for principal aquifers.

Reports.--

Edds, Joe, and Fitzpatrick, D.J., 1985, Maps showing altitude of the potentiometric surface and changes in water levels of the Sparta Sand and Memphis Sand aquifer in eastern Arkansas, spring 1984: U.S. Geological Survey Water-Resources Investigations Report 85-4223, 1 sheet.

Edds, Joe, and Fitzpatrick, D.J., 1986, Maps showing altitude of the potentiometric surface and changes in water levels in the aquifer in the Sparta and Memphis Sands in eastern Arkansas, spring 1985: U.S. Geological Survey Water-Resources Investigations Report 86-4084, 1 sheet.

----- 1988, Altitude of the potentiometric surface and changes in water levels in the Sparta-Memphis aquifer in eastern and southern Arkansas, spring 1986: U.S. Geological Survey Water-Resources Investigations Report 88-4042 (in press).

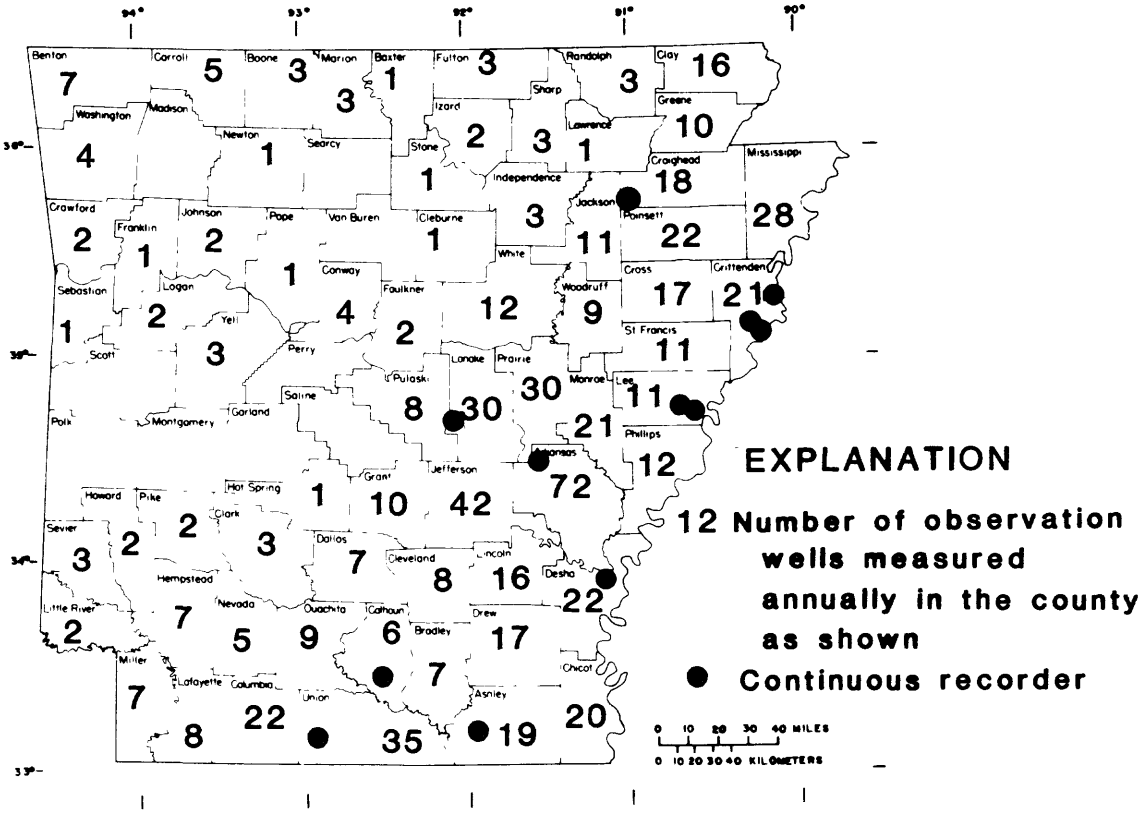
Edds, Joe, and Remsing, L.M., 1986, Ground-water levels in Arkansas, spring 1986: U.S. Geological Survey Open-File Report 86-406W, 62 p.

Freiwald, D.A., and Grosz, G.D., 1987, Effects on ground-water levels in the alluvial aquifer in response to fluctuating pool stages in the lower Arkansas River, Arkansas: U.S. Geological Survey Water-Resources Investigations Report 87-4279 (in press).

Freiwald, D.A., and Plafcan, Maria, 1987, Ground-water levels in Arkansas, spring 1987: U.S. Geological Survey Open-File Report 87-459, 66 p.

Lamb and others, 1986, Water resources data for Arkansas--water year 1985: U.S. Geological Survey Water-Data Report AR-85-1, 523 p.

----- 1987, Water resources data for Arkansas--water year 1986: U.S. Geological Survey Water-Data Report AR-86-1, 533 p.



Collection of Water-Quality Data

COOPERATING AGENCIES: Arkansas Geological Commission, Arkansas Department of Pollution Control and Ecology, U.S. Army Corps of Engineers

PROJECT CHIEF: B. Frank Lambert

PERIOD OF PROJECT: Continuous since July 1945

LOCATION: Statewide

Problem.--Water-resource planning and water-quality assessment require a statewide and nationwide base of relatively standardized information. For intelligent planning and realistic assessment of the water resources, the chemical and physical quality of streams and lakes must be defined and monitored.

Objectives.--Provide a National and State bank of water-quality data for planning-and-action programs, and provide data for State and Federal management of intrastate and interstate waters.

Approach.--Operate a network of water-quality stations to measure concentrations, loads, and time trends, as required by planning and management agencies.

Progress.--Water-quality samples were collected at 9 National Stream Quality Accounting Network stations, 2 Benchmark Network stations, 5 cooperative stations, and 87 sites on 13 lakes. From 6 to 59 parameters were determined for samples from each station. The Arkansas Department of Pollution Control and Ecology collects and analyzes water-quality samples at approximately 100 stations. Data from the Geological Survey and the Arkansas Department of Pollution Control and Ecology are published annually by the Geological Survey.

Plans.--Continue to operate water-quality stations and continue to update stations and parameters needed to meet present and long-term needs.

Reports.--

Lamb and others, 1986, Water resources data for Arkansas--water year 1985: U.S. Geological Survey Water-Data Report AR-85-1, 523 p.

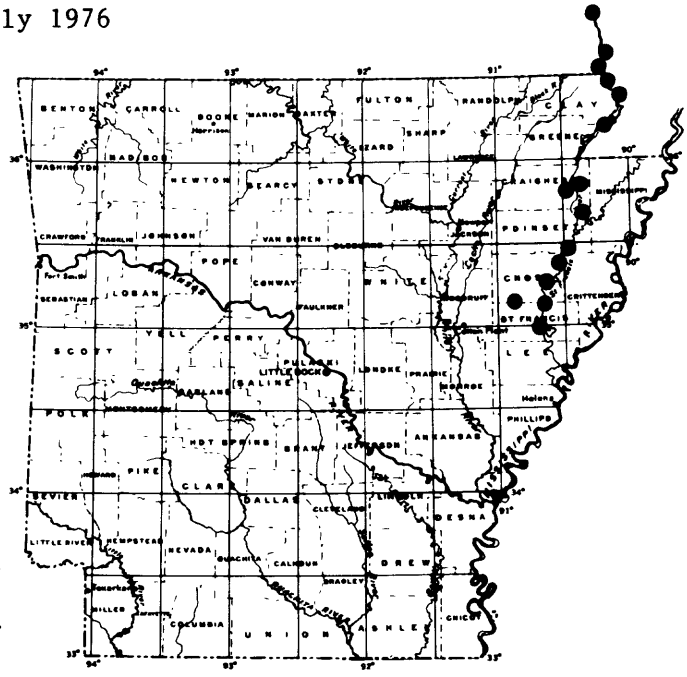
----- 1987, Water resources data for Arkasas--water year 1986: U.S. Geological Survey Water-Data Report AR-86-1, 533 p.

Sediment Stations

COOPERATING AGENCY: U.S. Army Corps of Engineers

PROJECT CHIEF: B. Frank Lambert

PERIOD OF PROJECT: Continuous since July 1976



Problem.--Water-resource planning and water-quality assessment require a nationwide base level of relatively standardized information. Sediment concentrations and discharges in Arkansas rivers and streams must be defined and monitored.

Objectives.--Provide a national bank of sediment data for use in Federal and State planning-and-action programs, including State and Federal management of intrastate and interstate waters.

Approach.--Establish and operate a network of sediment stations to estimate spatial and temporal averages and trends of sediment concentration, sediment discharge, and particle size of sediment being transported by rivers and streams.

Progress.--Sediment samples were collected at 15 stations on the St. Francis River and selected tributaries. Samples were collected on a daily and monthly basis at one station and analyzed for sediment concentration. Samples were collected monthly only at six stations and eight times annually at the remaining stations. These samples were analyzed for concentration and for particles greater than 62 microns in diameter.

Plans.--Collect and analyze samples collected daily and monthly at one station, and eight times per year at the remaining stations.

Reports.--

Lamb and others, 1986, Water resources data for Arkansas--water year 1985: U.S. Geological Survey Water-Data Report AR-85-1, 523 p.

----- 1987, Water resources data for Arkasas--water year 1986: U.S. Geological Survey Water-Data Report AR-86-1, 533 p.

Arkansas River Basin Annual Flows for Arkansas-Oklahoma Compact

COOPERATING AGENCIES: Arkansas-Oklahoma Arkansas River Compact Commission, Arkansas Soil and Water Conservation Commission

PROJECT CHIEF: T.E. Lamb

PERIOD OF PROJECT: Continuous since July 1977

Problem.--The Arkansas River Basin Compact between Arkansas and Oklahoma requires that annual yields be determined from five specific subbasins.

Objectives.--Determine annual streamflow yields from five subbasins and deficiency for the compact area as defined in the Arkansas River Basin Compact.

Approach.--Data will be collected at five stream-gaging stations in three subbasins and one water-quality station. Additional data will be furnished by the Oklahoma District of the Water Resources Division and the U.S. Army Corps of Engineers. Annual reports will give the annual yield of each subbasin using the data to develop results.

Progress.--Streamflow measurements were made at five stream-gaging stations and daily discharges were computed.

Plans.--Data collection will continue at existing stream-gaging stations. Annual yields will be computed and published. Available water-quality data will be included.

Reports.--

Moore, M.A., and Lamb, T.E., 1986, Annual yield and selected hydrologic data for the Arkansas River basin compact, Arkansas-Oklahoma, 1985 water year: U.S. Geological Survey Open-File Report 86-66, 39 p.

Moore, M.A., Lamb, T.E, and Blumer, S.P., 1987, Annual yield and selected hydrologic data for the Arkansas River basin compact, Arkansas-Oklahoma, 1986 water year: U.S. Geological Survey Open-File Report 87-203, 38 p.

Moore, M.A., Lamb, T.E., and Hauth, L.D., 1988, Annual yield and selected hydrologic data for the Arkansas River basin compact, Arkansas-Oklahoma, 1987 water year: U.S. Geological Survey Open-File Report 88-301, 33 p.

National Trends Network Acid Precipitation Site

COOPERATING AGENCY: None

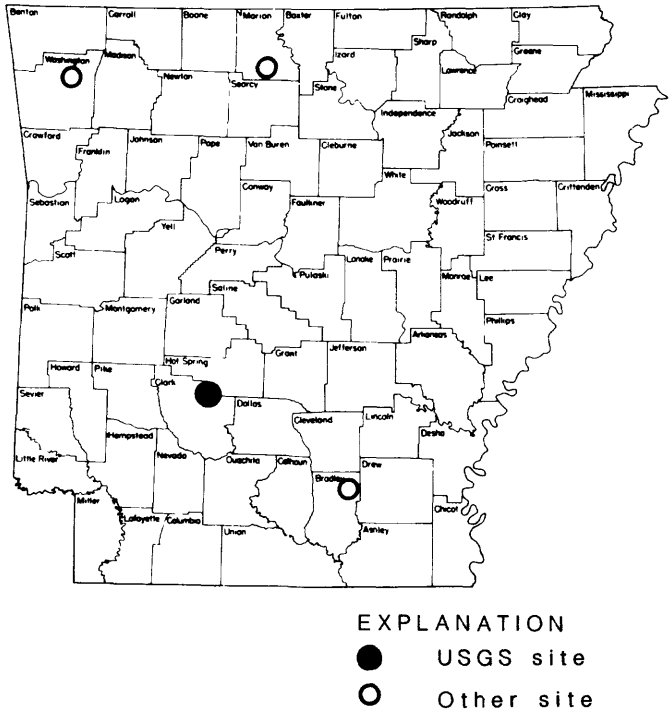
PROJECT CHIEF: James C. Petersen

PERIOD OF PROJECT: Continuous since December 1983

Problem.--Acidic precipitation has potential detrimental effects on aquatic and terrestrial systems. Data concerning the extent and severity of acidic precipitation in the United States are limited.

Objectives.--To increase the amount of precipitation quality data for Arkansas and to provide data for use in regional and national analyses.

Approach.--A wetfall collector and two precipitation gages (one recording gage) are used to collect weekly (7-day accumulations) samples of precipitation at one site near DeGray Dam and Caddo Valley, Arkansas. This site is one of four sites in Arkansas which are part of the National Atmospheric Deposition Program/National Trends Network (NADP/NTN). The other sites are operated by other agencies or corporations.



Progress.--The site has been operated since December 1983. Field pH values (calendar years 1984 through 1987) have ranged from 3.4 to 5.3 with a median of 4.6. Field specific conductance values have ranged from 6 to 151 with a median of 14 microsiemens per centimeter.

Plans.--The NADP/NTN is a long-term monitoring and research effort. Operation of this site will continue indefinitely.

Reports.--As the data for the Caddo Valley site are approved by the NADP Coordinator they will be published in the annual Water-Data Reports of the U.S. Geological Survey (see reference Lamb and others, 1986). Approved data for all sites in the NADP/NTN are published quarterly by the National Atmospheric Deposition Program.

Water-Use Data for Arkansas

COOPERATING AGENCY: Arkansas Soil and Water Conservation Commission

PROJECT CHIEF: Nancy T. Baker

PERIOD OF PROJECT: Continuous since April 1979

LOCATION: Statewide

Problem.-- e in ease (more than 500 percent since 1960) in the use of water in Arkansas in recent years, water-use data are needed as a management tool. Requests from State and municipal planners for water-use data are increasing. As competition increases among users, the need for water-use information becomes essential in determining the amount of water available.

Objectives.--Maintain and upgrade a Statewide continuing water-use data-collection system that will document the amount of water used. Prepare summary map reports annually and in-depth reports at 5-year intervals.

Approach.--Water-use data will be collected Statewide for storing and dissemination by the U.S. Geological Survey in cooperation with the Arkansas Soil and Water Conservation Commission (ASWCC). Data will be made available by the implementation of the State Water Use Data System (SWUDS). Data collection, report preparation and distribution will be handled by the U.S. Geological Survey with support from the ASWCC.

Progress.--In cooperation with ASWCC, 1985 data on over 18,000 water-diversion operations were entered into SWUDS. Questionaires were sent out by ASWCC to collect 1986 data on water-diversion operations. A report on use of water in Arkansas for 1982 has been published as a Water-Resources Investigations map report. Text for the Arkansas portion of the 1987 National Water Summary that deals with water use has been submitted. A 1985 report on use of water in Arkansas was published as a Water Resources Summary of the Arkansas Geological Commission. Water-use data are being collected for the next water year.

Plans.--Work with the ASWCC to enter and update 1986 data into SWUDS will be continued. An evaluation of the 1985 SWUDS data will be made. "Water Supply and Demand in Arkansas" will be published in the 1987 National Water Summary. Water-use data will continue to be collected. Plans to develop methods of improving estimates of water-use data will be initiated.

Reports.--

Holland, T.W., and Hall, A.P., 1986, Water use in Arkansas, 1982: U.S. Geological Survey Water-Resources Investigations Report 85-4282, 1 sheet.

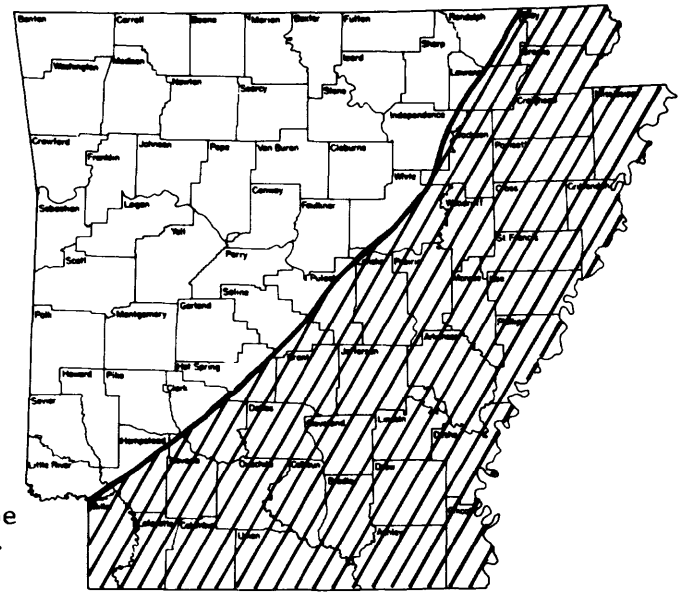
Holland, T.W., 1987, Use of water in Arkansas, 1985: Arkansas Geological Commission Water Resources Summary 16, 27 p.

West Gulf Coast Regional Aquifer System Analysis in Arkansas

COOPERATING AGENCY: None

PROJECT CHIEF: D.J. Ackerman

PERIOD OF PROJECT: March 1982 through September 1988



Problem.--Coastal plain deposits are important sources of freshwater for municipal, industrial, and irrigation use in the southeastern half of Arkansas. Knowledge of the direction and rate of water flow in these sediments is needed for evaluation of aquifers for efficient use. Protection from contamination is highly important.

Objectives.--Describe the hydrologic system, including aquifer designation, hydraulic characteristics and quality of the water within the regional aquifers. Create a data base including water use, water levels, lithologic logs, geophysical logs, and chemical analyses of water samples. Describe historic, present, and future problems associated with use of water.

Approach.--Compile and analyze hydrologic, geologic, and water-quality data. Collect and analyze new data where needed and if feasible. Develop a computer model of the alluvial aquifer. Evaluate past impacts on the regional flow system resulting from development of ground water.

Progress.--Completed the predevelopment water-table map for the uppermost geologic unit in southeastern Arkansas. Completed 1980 potentiometric maps for aquifers in the alluvium, Sparta Sand and Cockfield Formation. Completed the data bases for Arkansas. Completed water-use data base for all model layers in the regional project area. Completed screening data from the computer files for accuracy and completeness. Finished preliminary calibration of steady-state model.

Plans.--Calibrate transient model of the Mississippi River Valley alluvial aquifer. Analyze and compare pre- and post-development flow systems.

Reports.--

Ackerman, D.J., 1988, Generalized potentiometric surface of the aquifers in the Cockfield Formation, southeastern Arkansas, spring 1980: U.S. Geological Survey Water-Resources Investigations Report 87-4212, 1 sheet.

----- 1988, Generalized potentiometric surface of the Sparta-Memphis aquifer, eastern Arkansas, spring 1980: U.S. Geological Survey Water-Resources Investigations Report 87-4282, 1 sheet.

----- 1988, Hydrology of the Mississippi River Valley alluvial aquifer, south-central United States--A preliminary assessment of the regional flow system: U.S. Geological Survey Water-Resources Investigations Report 88-4028, (in press).

----- 1988, Potentiometric surfaces of the Mississippi River Valley alluvial aquifer, eastern Arkansas, spring 1972 and 1980: U.S. Geological Survey Water-Resources Investigations Report 88-4075 (in press).

Statistical Summaries of Surface-Water Quality Data for Arkansas

COOPERATING AGENCY: Arkansas Geological Commission

PROJECT CHIEF: James C. Petersen

PERIOD OF PROJECT: October 1984 through September 1988

LOCATION: Statewide

Problem.--A large amount of water-quality data for Arkansas has been collected by the U.S. Geological Survey and the Arkansas Department of Pollution Control and Ecology and stored in the U.S. Geological Survey's WATSTORE computer system. Much of these data have never been statistically summarized and published.

Objectives.--Statistically summarize existing water-quality data for selected surface-water stations in Arkansas.

Approach.--Descriptive statistics (mean, median, range, standard deviation, and quartiles) will be calculated for approximately 115 stations. Water-quality data summarized will include data for discharge, pH, dissolved oxygen, specific conductance, total alkalinity, common ions, turbidity, fecal coliform and fecal streptococci bacteria, heavy metals, phosphorus and nitrogen. Regression equations for estimation of alkalinity, dissolved solids, and several ions from specific conductance values will be calculated.

Progress.--Statistical calculations have been completed and results have been tabulated for all stations.

Report.--

Petersen, J.C., 1988, Statistical summary of selected water-quality data (water years 1975 through 1985) for Arkansas rivers and streams: U.S. Geological Survey Water-Resources Investigations Report.

Flood Frequency and Hydraulics

COOPERATING AGENCY: Arkansas State Highway and Transportation Department

PROJECT CHIEF: Braxtel L. Neely, Jr.

PERIOD OF PROJECT: October 1984 through September 1986

LOCATION: Statewide

Problem.--Adequate definition of flood discharge and frequency is essential to proper design, construction, and maintenance of hydraulic structures in Arkansas. The Arkansas State Highway and Transportation Department uses this type of data throughout the State in the design of highway structures. They requested that the flood frequency report for Arkansas be revised and updated based on the additional data.

Objectives.--The objectives of the project were (1) to present available flood-peak data for streams in Arkansas, and (2) to derive equations and graphs by which the magnitude and frequency of floods on streams in Arkansas can be evaluated. Make hydrologic and hydraulic analyses of floodflow characteristics at specific bridge sites.

Approach.--Discharge-frequency curves were determined for all gaging stations that had at least 10 years of record. This was done for all stations in Arkansas and for nearby streams in adjoining states. Each discharge-frequency curve was derived with annual peak discharge data using the log-Pearson type III analysis following methods outlined in WRD Bulletin No. 17B. All climatic and basin parameters that affect peak discharge and that can be reasonably measured were determined for each drainage basin. Analyzed floodflow characteristics at specific bridge sites by using standard methods of indirect computation of peak flows.

Progress.--Project was completed.

Reports.--

Neely, B.L., Jr., 1987, Magnitude and frequency of floods in Arkansas: U.S. Geological Survey Water-Resources Investigations Report 86-4335, 51 p.

----- 1987, Annual peak discharges and stages through 1984 for gaging stations in Arkansas: U.S. Geological Survey Open-File Report 87-208, 125 p.

Estimating Scour at Bridge Piers on Streams in Arkansas

COOPERATING AGENCY: Arkansas State Highway and Transportation Department

PROJECT CHIEF: J.L. Courtney

PERIOD OF PROJECT: April 1985 through September 1988

LOCATION: Statewide

Problem.--An adequate definition of potential scour at bridge piers is needed for proper design, construction, and maintenance of hydraulic structures in Arkansas. Several formulas for predicting scour are available, but the large range in predicted scour depths has prevented bridge engineers from using any of the formulas with confidence. Adequate and sufficient data need to be collected to verify existing scour depth formulas or to develop a new formula that can be used with confidence on streams in Arkansas.

Objectives.--The objectives of this project are: (1) collect scour data during flood events, (2) evaluate existing formulas for predicting scour, and (3) modify existing formulas or develop a new formula that can be used on streams in Arkansas.

Approach.--Select 20 sites on streams that are not undergoing channel adjustments (which may be the result of man-made changes upstream or downstream of the bridge site), preferably at gaging stations. During flood events bed profiles will be defined below the upstream and downstream handrails as well as at several points upstream from the pier to define the limits of scour. Suspended sediment samples will be taken near the piers and near the middle of the stream away from the piers. Vertically integrated sediment samples will be taken at about ten equal width sections to define the average sediment concentration. Regression analyses will be made to relate maximum scour to physical characteristics of the stream.

Progress.--Completed second survey of channel cross sections at bridge guardrails and determined cross sections four bridge lengths upstream and downstream of bridge crossings. Data have been collected on 10 of the 21 scour sites (at 3 sites data have been collected for 2 events). However, these were not large events with only one of the events being greater than a 2-year event--all others less than a 2-year event.

Only a small amount of scour occurred because of small discharges. Two forms of a preliminary scour equation for local scour and two forms of a preliminary scour equation for contraction scour have been generated with the scour data collected. Again, it must be stressed that these equations are based on limited data that were collected on small flow events. Also, comparison of other scour equations has been done to evaluate which equation best models the Arkansas data.

Unbiased data sets were used to analyze the preliminary local pier scour equations and the current most widely used 13 scour equations to determine how well the Arkansas equations compare with the other 13 equations. A report entitled "Preliminary analysis of bridge pier scour equations for streams in Arkansas" is currently in review. This report summarizes the status of this project.

A multi-stage conductivity probe is being tested at one site for measuring channel scour during flood events. A simpler scour measuring device is also being evaluated.

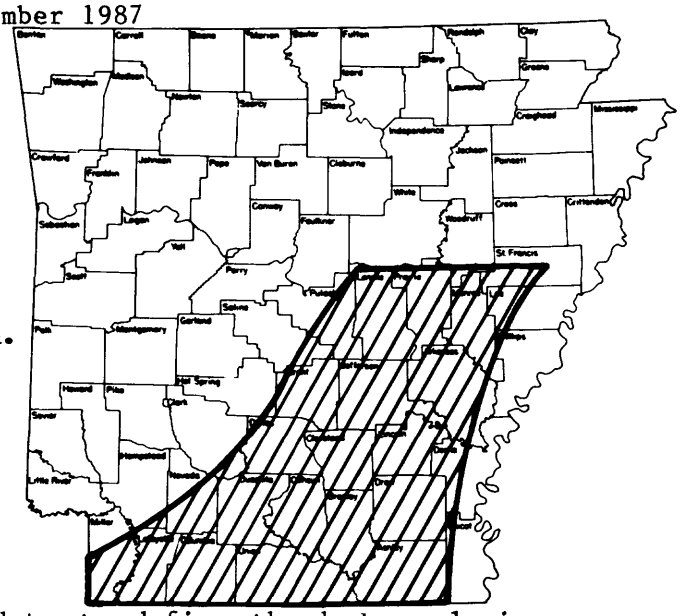
Plans.--Analyze the scour data collected for constriction scour (the original project was for local pier scour) and evaluate the current constriction scour equations available. Submit preliminary report for Director's approval. Continue collection of scour data during significant storm events. Continue monitoring scour probe for events that will produce scour at the probe and explore other sites where the scour probe can be moved. Continue exploring the opportunity of using new equipment for measuring scour.

Sparta Model

COOPERATING AGENCIES: Arkansas Soil and Water Conservation Commission and Arkansas Geological Commission

PROJECT CHIEF: Daniel J. Fitzpatrick

PERIOD OF PROJECT: January 1985 to September 1987



Problem.--Locally heavy pumping has resulted in significant water-level declines in the Sparta aquifer in southern and south-central Arkansas. Water levels have been drawn down as much as 300 feet in places. The condition of declining water levels could affect water availability, as well as increase the potential for saltwater intrusion.

Objectives.--Simulate ground-water flow in the Sparta Sand aquifer using a digital model for the purpose of evaluating the effect of present and future pumping stresses on the aquifer within the principle areas of concern.

Approach.--Assemble and evaluate existing data to define the hydrogeologic system as it relates to model input. Calibrate a 3-dimensional flow model to effectively simulate aquifer responses. Make sample model runs and prepare reports.

Progress.--Data assembly and evaluation for model input as well as preparation of the preliminary model have been completed. Model calibration and sensitivity analysis have been completed.

Plans.--Report completion is planned by the end of the year.

An Updated Water Plan for Arkansas

COOPERATING AGENCY: Arkansas Soil and Water Conservation Commission

PROJECT CHIEF: Elizabeth F. Cole

PERIOD OF PROJECT: June 1985 through June 1988

LOCATION: Statewide

Problem.--The Arkansas Soil and Water Conservation Commission (ASWCC) is the agency responsible for water resources planning at the State level. The ASWCC is authorized to prepare a comprehensive State Water Plan of sufficient detail to serve as the basic document for defining water policy for the protection, development, and management of the State's water resources. Water legislation passed by the 1985 Arkansas Legislature (Act 1051) requires that a determination of the State's current and projected water needs be made by ASWCC. In order to accomplish this task, ASWCC has determined that the State Water Plan, first completed in 1975, should be updated using all available hydrologic information in the State. The cooperative program between the Geological Survey and ASWCC is an effective tool for providing hydrologic information and expertise to assist State agencies in meeting their water-information needs.

Objectives.--The objective of this project is to provide hydrologic assistance to ASWCC for updating the State Water Plan for Arkansas. The objectives of the current update of the State Water Plan are: (1) to compile an inventory of the State's ground- and surface-water resources using the most current data available, (2) to address the requirements of Act 1051 of 1985, (3) to identify and evaluate surface- and ground-water quantity and quality problems, and (4) to assist ASWCC in their effort to present specific solutions and recommendations to meet future water needs.

Approach.--A USGS hydrologist has been assigned full time to the project to work closely with ASWCC personnel and is physically located in their office for the project period. The updated State Water Plan will consist of eight basin reports and a Statewide executive summary. Determination of the following items will be made and addressed in reports for each of the basins in the State: (1) current and projected surface- and ground-water use in the State, (2) determination of instream flow requirements and establishment of minimum streamflows, (3) determination of excess surface water available in each basin, and (4) definition and delineation of critical surface- and ground-water areas in each basin. Information in the basin reports will be summarized in the Statewide executive summary. The executive summary will set forth the basic water-resource concerns in the State and will present recommendations and proposed legislation directed toward a comprehensive State water policy.

Progress.--Three of the eight basin reports (lower Ouachita basin, Red River basin above Fulton, and Red River basin below Fulton) have been completed and are published. In addition, preliminary draft reports for three basins (upper White River basin, Arkansas River basin, and upper Ouachita basin) have been completed and are being reviewed.

Plans.--All basin reports will be completed in 1988. Public hearings will then be conducted in selected areas throughout the State for additional comments. The executive summary will be prepared for presentation to the Legislature in 1989.

An Investigation of Possible Ground-Water Contamination in a Karst Environment in Arkansas

COOPERATING AGENCY: Arkansas Department of Pollution Control and Ecology

PROJECT CHIEF: E.E. Morris

PERIOD OF PROJECT: January 1987 through September 1987

Problem.--The study area (Boone County) is located in the Ozark Plateaus province. Geologic units that underlie the Ozark Plateaus province consist mostly of consolidated limestone, dolomite, sandstone, and shale. Ground water associated with these rock units is usually found in secondary openings such as fractures, joints, bedding planes, and solution channels. Most rural residents obtain water from these rock units.

Recharge to the ground-water system in the study area occurs primarily from the infiltration of rainfall and losing streamflow. Recharge occurs fairly rapidly due to the size and types of openings where the rocks are exposed or where the overlying soil zone is thin. Because recharge does occur with ease, there is concern that contamination of the ground water may result from the leaching of wastes by infiltrating recharge water.

Objectives.--Collect samples from a ground-water quality monitoring network in an area where the geohydrologic environment is vulnerable to contamination. This network has an emphasis on sampling springs now used for drinking water supply with some shallow wells included. Provide a base of water-quality data in a karst area to be built upon by future studies.

Approach.--Locate and sample 10 to 15 springs, preferably those used for drinking water. Also sample three to seven shallow wells. The samples will be analyzed for common constituents, trace metals, bacteria, and some organics.

Progress.--Fifteen springs and six wells have been sampled for common constituents, trace metals, bacteria, and a limited number of organics.

Plans.--Sample additional springs and wells, map the water table. Publish water-resources investigations report at the end of the project.

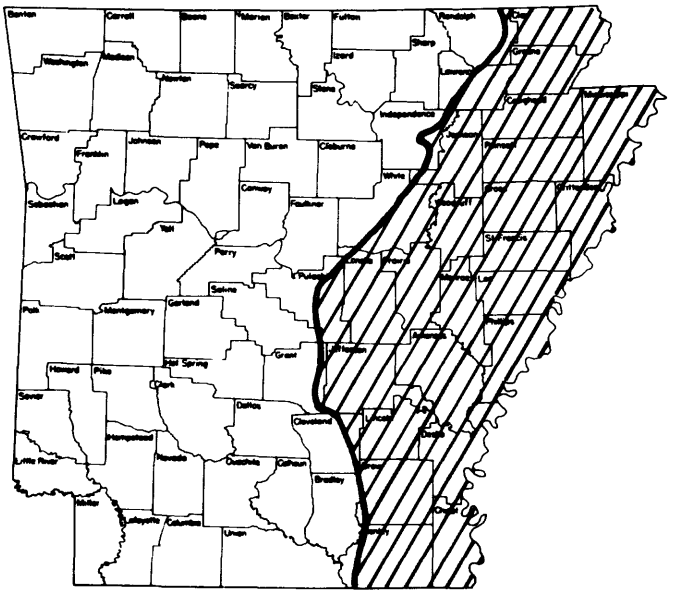
Eastern Arkansas Water Conservation Project

COOPERATING AGENCIES: Arkansas Soil and Water Conservation Commission, local Conservation Districts, U.S. Soil Conservation Service, U.S. Army Corps of Engineers, Arkansas Geological Commission and University of Arkansas

PROJECT CHIEF: A.H. Ludwig

PERIOD OF PROJECT: April 1984 through September 1989

Problem.--Farmers in eastern Arkansas rely heavily on the alluvial aquifer in the region as a source of water for irrigation of rice, cotton, and soybeans and for flooding thousands of acres of fish and minnow farms. Water users are becoming increasingly concerned about the prospect of ground-water shortages and quality deterioration of irrigation supplies. Since the drought of 1980, numerous wells have failed because pumping water levels have dropped below intake pipes, forcing owners to lower their pumps. In some parts of the Grand Prairie only about 20 feet of saturated thickness remain in the alluvial aquifer. Nearly 7,000 wells have been drilled since 1980 in eastern Arkansas. This represents a 33 percent increase in the total number of wells in place at that time. Compounding the water-supply problem is the fact that there has been an increasing number of incidents of saltwater encroachment in the alluvium. Among the problems facing irrigators in eastern Arkansas are (1) increasing competition among water users as overall demand increases, (2) lowering of the potentiometric surface with resulting increase in pumping lift, and (3) movement of saline water into parts of the aquifer that were previously fresh.



Objectives.--The objectives of the proposed study are: (1) compile, analyze, and publish water-level data collected by U.S. Soil Conservation Service and U.S. Geological Survey personnel, and (2) develop a series of calibrated digital models of the alluvial aquifer to be used by State and Federal agencies for assessing the impact of projected irrigation demands and for evaluating alternate pumping schemes that could involve the conjunctive use of surface and ground water.

Approach.--Water-level data collected by the U.S. Soil Conservation Service will be used to supplement U.S. Geological Survey data from Statewide observation well networks. The initial step in analyzing the alluvial aquifer flow system will be to develop a conceptual model of the study area. This will be accomplished primarily through an examination of results from the ongoing

West Gulf Coast Regional Aquifer System Analysis (RASA), and secondly through an evaluation of potentiometric and other data collected during previous aquifer studies as well as that being gathered as part of the current Eastern Arkansas Water Conservation Project. The second phase of the study will be to transform the conceptual model into working models. The third phase of the study will be the calibration process in which parametric adjustments will be made to accommodate the stress-response relationships in the aquifer system. The final phase will be to apply a conjunctive use-sustained yield pumping strategy to the theoretical development of the aquifer.

Progress.--Initial steady-state calibration runs have been completed for the 1-square mile grid area. The area currently being modeled includes the 24-county area north of the Arkansas River and is designated as Area 1. Data collection for Area 2, the area south of the Arkansas River, is underway. Initial work is underway to develop input data for transient simulations for Area 1. Water-level measurements are being collected from 11 recorders on wells adjacent to stream-gaging sites to collect data on stream-aquifer relationships. Maps showing the potentiometric surface in the alluvial aquifer for the springs and falls of 1984 and 1985 have been completed. Work on maps of the alluvial aquifer for 1986 and 1987 is in progress.

Plans.--Complete steady-state and transient calibration of Area 1. Complete steady-state calibration of Area 2. Publish potentiometric-surface maps for the springs and falls of 1986 and 1987. Complete a map showing the thickness of the clay confining layer over the aquifer for Areas 1 and 2.

Reports.--

Plafcan, Maria, 1985, Ground-water levels in the alluvial aquifer in eastern Arkansas, 1984: U.S. Geological Survey Open-File Report 85-569, 26 p.

----- 1986, Ground-water levels in the alluvial aquifer in eastern Arkansas, 1985: U.S. Geological Survey Open-File Report 86-242, 29 p.

----- 1987, Ground-water levels in the alluvial aquifer in eastern Arkansas, 1986: U.S. Geological Survey Open-File Report 87-545, 31 p.

Plafcan, Maria and Edds, Joe, 1986, Water level and saturated thickness maps of the alluvial aquifer in eastern Arkansas, 1984: U.S. Geological Survey Water-Resources Investigations Report 86-4014, 1 sheet.

Plafcan, Maria, and Fugitt, D.T., 1986, Water level maps of the alluvial aquifer in eastern Arkansas, 1985: U.S. Geological Survey Water-Resources Investigations Report 86-4178, 1 sheet.

Plafcan, Maria, and Remsing, L.M., 1988, Water-level maps of the Mississippi River Valley alluvial aquifer in eastern Arkansas, 1986: U.S. Geological Survey Water-Resources Investigations Report 88-4067 (in press).

Determining Flood Hydrographs for Arkansas Streams

COOPERATING AGENCY: Arkansas State Highway and Transportation Department

PROJECT CHIEF: Braxtel L. Neely, Jr.

PERIOD OF PROJECT: October 1986 through September 1988

LOCATION: Statewide

Problem.--The design of highway bridges and other hydraulic structures in smaller drainage basins requires the most accurate estimate of hydrologic conditions available. Drainage basins with steep channel slopes, numerous tributaries, unusual shape, flood control structures, upstream storage, routing, urban locations, flood-related risks to the drainage structure(s), and risks to surrounding property are some of the special conditions that require a more accurate hydrologic estimate. Discharge hydrographs associated with floods of specific recurrence intervals are often the only reasonable method to determine the flood peaks, storage, routing, and the inundation time. So the problem is to provide the highway engineer and other designers with a better and more accurate method to determine discharge hydrographs for floods of specific recurrence intervals.

Objectives.--The objectives are to investigate existing methods or develop new methods for determining flood hydrographs at rural and urban ungaged sites in Arkansas for selected design flood-frequency discharges. Drainage basins with less than 25 square miles of drainage area in rural locations and less than 10 square miles of drainage area in urban locations are the focus for this project where information is available. Larger drainage basins up to 500 square miles will also be included. This information is necessary for designing a more efficient and economic drainage structure and evaluating the risks associated with the design. The primary objective, therefore, is to provide the highway engineer and other designers with a method to estimate the shape of flood hydrographs, which can reasonably be expected to occur in Arkansas.

Approach.--The three major components of the study are to (1) develop dimensionless hydrographs, (2) determine average or typical duration of storm events, and (3) develop procedures for estimating lag time.

Dimensionless hydrographs developed for several states throughout the country are basically the same regardless of the different hydrologic conditions of each area. Dimensionless hydrographs will be computed for about 20 gaging stations in Arkansas. These 20 dimensionless hydrographs will be used to verify the dimensionless hydrographs used in a similar study.

The average duration of a storm event will be related to lag time and expressed in terms of lag time. Several generalized functions of duration will be tried and the one that gives the best fit will be used.

The major effort in this study will be to determine lag time. The lag time will be determined for each gaging station. An equation for determining lag time will be developed by multiple regression techniques. Lag time will be related to basin characteristics such as drainage area, stream length, slope, and urbanization parameters.

The Arkansas State Highway and Transportation Department has been collecting rainfall and associated runoff data at two stream crossings. The purpose of these data is to develop a more reliable hydrograph shape for small drainage basins. These data will be analyzed for possible inclusion in this project.

The final product for use in developing a typical hydrograph at an ungaged site will be a curve or table relating discharge divided by peak discharge to time divided by lag time.

Progress.--Lag time has been determined for 16 sites with drainage areas less than 14.2 square miles.

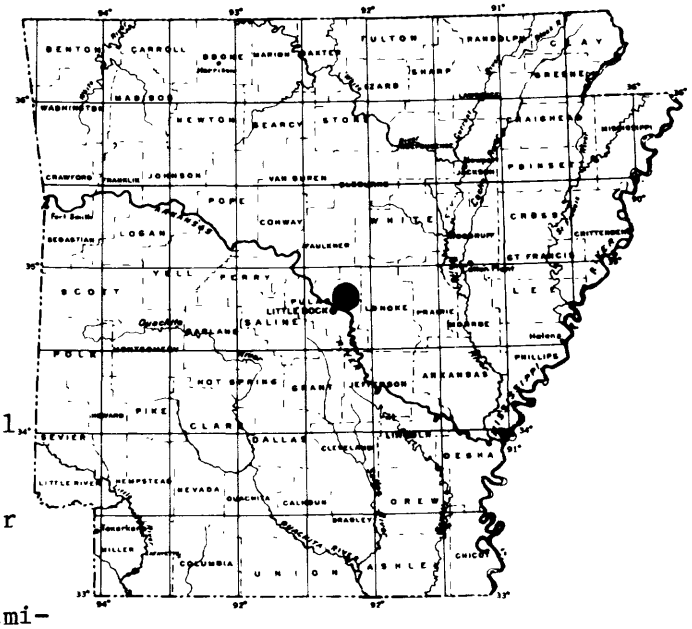
Plans.--Continue computing lag time at other sites. One Water-Resources Investigations Report is planned by the end of the project entitled, "Determining flood hydrographs for Arkansas streams." It will contain procedures for determining flood hydrographs with peak discharge for floods with recurrence intervals of 2 to 100 years on all streams in Arkansas.

Installation Restoration Program - Phase II, Stage 1 Confirmation/Quantification, Little Rock, Air Force Base, Little Rock, Arkansas

COOPERATING AGENCY: U.S. Air Force

PROJECT CHIEF: David A. Freiwald

PERIOD OF PROJECT: November 1986 through September 1989



Problem.--Previous operating activities at the Little Rock Air Force Base have resulted in the generation, accumulation, and disposal of potentially hazardous wastes. Industrial operations, waste storage and disposal areas, fuels management, petroleum spills and leaks, landfills, chemical use, and fire protection training activities on the base have the potential to create environmental contamination. Several potentially contaminated sites have been identified that require a hydrogeologic investigation to confirm if any environmental hazards exist.

Objectives.--(1) To determine the presence or absence of contamination in the areas immediately surrounding the identified sites on the Little Rock Air Force Base. (2) If contamination exists, the contaminants will be identified and their potential for migration assessed. (3) Conduct a feasibility study to develop preliminary remedial action alternatives for any sites that are considered to pose a threat to human health and welfare or the environment.

Approach.--Surface geophysics will be used to attempt to locate landfill boundaries and contaminated ground-water plumes. Approximately 80 shallow monitoring wells will be installed adjacent to the potentially contaminated sites. Soil, bed material, surface- and ground-water samples will be obtained and analyzed for petroleum hydrocarbons, volatile organics, priority pollutant metals, extractable priority pollutants, and pesticides. Data collected will be integrated into a feasibility study which includes risk analysis and remedial action plans.

Progress.--Submitted to the Air Force a Presurvey Report that outlines the technical approach to the first phase of the data collection for the hazardous waste study. Developed detailed work plan, quality assurance project plan and health and safety plan prior to field work. Surface geophysics and well drilling have been completed.

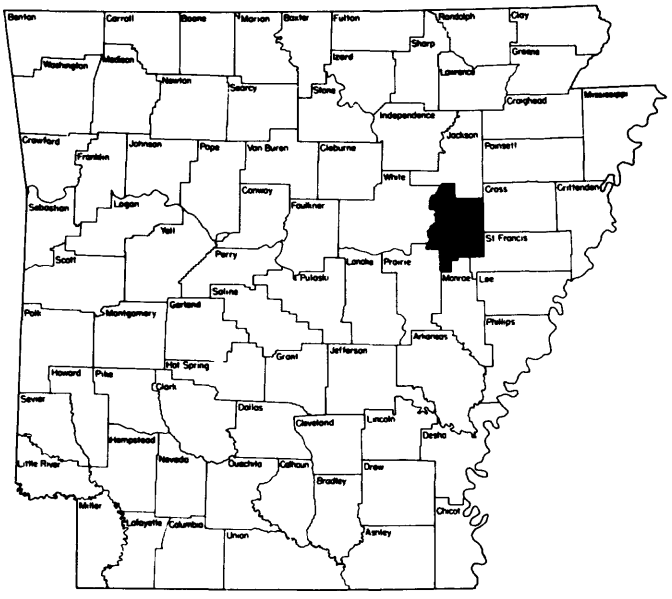
Plans.--Sample soil, bed material, and surface and ground water. Hydrogeologic and chemical data obtained during the field investigation will be analyzed to determine if a particular site needs additional field investigation to define the extent of contamination and assess the risk to the environment. Begin to develop alternative remedial action plans to implement cleanup of contaminated sites. Complete administrative report in Air Force format at the completion of the study.

Wetland Research Project, Black Swamp, Cache River, Woodruff County, Arkansas

COOPERATING AGENCY: U.S. Army Corps of Engineers Waterways Experiment Station

PROJECT CHIEF: E.E. Morris

PERIOD OF PROJECT: April 1987 through September 1989



Problem.--Section 404 of the Clean Water Act gave the U.S. Army Corps of Engineers the responsibility to regulate dredge and fill activities in wetlands of the United States. Dredge and fill operations alter the hydrology of wetlands and in many cases remove them. This study is designed to be a relatively complete assessment of the biologic, hydrologic, sedimentologic, climatologic and chemical factors and processes that may affect water quality and quantity through a wetland system; in this case a bottomland hardwood and cypress swamp.

Objectives.--The objectives of the study include: (1) the documentation and analysis of surface-water flow into, through, and out of the swamp; (2) the collection, analysis, and interpretation of sediment data into, through, and out of the swamp; (3) the construction of basic hydrologic and sedimentologic budgets for the swamp including the identification and interpretation of sites of sediment storage and sediment mobilization; (4) the collection of water-quality samples on a daily and storm event basis for analysis by the staff of Ouachita Baptist University; and (5) the use of U.S. Geological Survey generated data and those generated by other agencies to analyze and define the interrelated physical, chemical and biological environment and processes affecting water quality through and out of the swamp.

The scope of the U.S. Geological Survey part of the overall study involves surface-water hydrology and sediment transport and storage as they relate to bottomland hardwood and cypress swamps.

Approach.--(1) Continuous discharge stations will be maintained above and below Black Swamp on the Cache River. (2) Manually operated suspended sediment samplers will be operated at six gaging stations and samples will be collected daily, monthly, or during events according to type of gage and event. (3) Data obtained will be entered into WATSTORE. (4) Depth integrated samples will be collected by use of a fixed station sediment sampler at both the upstream and downstream sites on the Cache River.

Progress.--Established one continuous record streamflow station and four continuous stage recorder stations. Established two daily sediment stations.

Plans.--Collect storm event sediment samples. Rate gaging station. Provide a ground-water monitoring plan.

Reports.--Basic surface-water and sediment data will be published in the Geological Survey's water-data report. Major results and interpretation of U.S. Geological Survey data will be published in a U.S. Geological Survey Water-Supply or Professional Paper.

Low-Flow Characteristics of Arkansas Streams

COOPERATING AGENCY: Arkansas Soil and Water Conservation Commission

PROJECT CHIEF: Elizabeth F. Cole

PERIOD OF PROJECT: August 1987 through September 1990

LOCATION: Statewide

Problem.--Specific information on low flow in streams is essential to State water-management agencies when dealing with problems related to irrigation, municipal and industrial water supplies, fish and wildlife conservation, and dilution and conveyance of wastes. Determination of low-flow characteristics, which represent current streamflow conditions and development of a method to estimate low-flow characteristics at ungaged sites, will provide information necessary for optimum utilization and management of surface-water resources in the State.

Objectives.--(1) To update previous estimates of flow-duration and low-flow characteristics of gaged streams based on several years of additional data collection; (2) to derive regression equations for estimating low flow for selected frequencies using continuous-record streamflow data; and (3) to provide methods of estimating low flow in ungaged streams throughout the State.

Approach.--(1) Low-flow characteristics at continuous-record gaging stations will be computed using the log-Pearson type II method and(or) a graphical method; (2) low-flow data will be collected during the project to estimate the low-flow characteristics at partial-record stations; and (3) regression equations will be derived for estimating low flow in ungaged natural-flow streams Statewide. Basin and climatic characteristics that will be tested in the regression equations include streamflow recession index, drainage area, main channel slope, length of main channel, mean basin elevation, percent forest cover within the basin, and mean annual precipitation.

Progress.--Established low-flow data-collection network. Collected low-flow data at approximately 175 partial-record stations in the State.

Plans.--Collect low-flow data at partial-record stations in eastern Arkansas after irrigation ceases. Update low-flow frequencies for continuous-record gaging stations. Collect additional low-flow data at partial-record stations for estimating low-flow frequencies.

Reports.--Two reports are planned for the project.

SOURCES OF WRD PUBLICATIONS AND INFORMATION

Publications of the U.S. Geological Survey

Professional Papers, Water-Supply Papers, and Bulletins are sold by the U.S. Geological Survey, Eastern Distribution Branch, 604 South Pickett Street, Alexandria, Virginia 22304; single copies of circulars still in print are available upon request from that address. Hydrologic Investigations Atlases, hydrologic unit maps, and other maps pertaining to Arkansas are sold by U.S. Geological Survey, Western Distribution Branch, Box 25286, Federal Center, Denver, Colorado 80225.

U.S. Geological Survey Water-Resources Investigations Reports and Open-File Reports are available for inspection at the Arkansas District Office, Water Resources Division, 2301 Federal Office Building, Little Rock, Arkansas 72201. In addition, these reports may be purchased as paper copy or microfiche from the Books and Open-File Reports Section, U.S. Geological Survey, Box 25425, Federal Center, Denver, Colorado 80225.

New reports are announced monthly in "New Publications of the Geological Survey." Subscriptions are available upon request from the U.S. Geological Survey, 582 National Center, Reston, Virginia 22092.

Water-Data Program

Water-data stations at selected locations throughout the Nation are used by the Geological Survey to obtain records on stream discharge (flow) and stage (height), reservoir and lake storage, ground-water levels, well and spring discharge, and the quality of surface and ground water. These data provide a continuing record of the quantity and quality of the Nation's surface-water and ground-water resources, and thus provide the hydrologic information needed by Federal, State, and local agencies and the private sector for the development and management of land and water resources. All data collected are stored in the Survey's National Water Data Storage and Retrieval System (see WATSTORE for additional information) and also are published by water year for each State in a publications series entitled "U.S. Geological Survey Water-Data Reports" (see Reports Approved for Publication or Released during 1986-87 in the Arkansas District).

Information about the Water-Data Program can be obtained from the Assistant Chief Hydrologist for Operations, 441 National Center, Reston, Virginia 22092 or from the District Chief of the State of interest.

NAWDEX

The National Water Data Exchange was established to assist users of water data to identify, locate, and acquire needed data. It provides a nationwide service for indexing and describing the characteristics of data available from the entire spectrum of data-collection activities throughout the Federal and non-Federal water-data community.

NAWDEX maintains two data bases: (1) a Water-Data Sources Directory, which identifies organizations that are sources of water and water-related data and locations within these organizations from which data may be obtained, and (2) a Master-Data Index of data collection sites. For services or additional information, contact:

National Water Data Exchange
U.S. Geological Survey
421 National Center
Reston, Virginia 22092
(703) 860-6031

WATSTORE

Access to all types of water data is through the National Water Data Storage and Retrieval System. Data are grouped and stored on the basis of common characteristics and data-collection frequencies. These data are organized into seven files. They are: (1) Station Header File, (2) Ground-Water Site Inventory File, (3) Water-Use File, (4) Daily-Values File, (5) Peak-Flow File, (6) Water-Quality File, and (7) Unit-Values File.

All types of water data can be retrieved through the central computer facilities in Reston, Virginia from a number of localities nationwide. The requestor is charged a minimal fee plus the actual computer cost incurred in retrieving the data. Cost estimates and information about WATSTORE can be obtained from Water Resources Division district offices and from:

Chief Hydrologist
U.S. Geological Survey
437 National Center
Reston, Virginia 22092

Public Inquiries Offices

Public inquiries offices provide general information about the programs of the Geological Survey and its reports and maps. The Public Inquiries Offices answers requests made in person, by mail, or by telephone; recommend publications relating to specific subjects and areas; and refer requests for specific technical information to the appropriate people. They sell limited quantities of published maps and books over the counter and distribute circulars, nontechnical publications, catalogs and indexes free of charge. Most are depositories for Open-File Reports. The regional office address for Arkansas is:

Public Inquiries Office
U.S. Geological Survey
503 National Center
Room 1-C-402
12201 Sunrise Valley Drive
Reston, Virginia 22092
(703) 860-6167

LIST OF REPORTS APPROVED FOR PUBLICATION OR RELEASED

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----- 1988, Hydrology of the Mississippi River Valley alluvial aquifer, south-central United States--A preliminary assessment of the regional flow system: U.S. Geological Survey Water-Resources Investigations Report 88-4028, (in press).

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Cole, E.F., and Morris, E.E., 1986, Quality of water resources of the Ouachita National Forest, Arkansas: U.S. Geological Survey Water-Resources Investigations Report 86-4166, 1 sheet.

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Edds, Joe, and Fitzpatrick, D.J., 1985, Maps showing altitude of the potentiometric surface and changes in water levels of the Sparta Sand and Memphis Sand aquifers in eastern Arkansas, spring 1984: U.S. Geological Survey Water-Resources Investigations Report 85-4223, 1 sheet.

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Freiwald, D.A., and Grosz, G.D., 1987, Effects on ground-water levels in the alluvial aquifer in response to fluctuating pool stages in the lower Arkansas River, Arkansas: U.S. Geological Survey Water-Resources Investigations Report 87-4279 (in press).

Freiwald, D.A., and Plafcan, Maria, 1987, Ground-water levels in Arkansas, spring 1987: U.S. Geological Survey Open-File Report 87-459, 66 p.

Gilstrap, R.C., and Neely, B.L., Jr., 1986, Floodflow characteristics of Current River at Arkansas State Highway 328 near Reyno, Arkansas: U.S. Geological Survey Water-Resources Investigations Report 86-4061, 15 p.

Grosz, G.D., Terry, J.E., and Hall, A.P., 1988, Hydrology of the lower Little Red River, Arkansas, and a procedure for estimating available streamflow: U.S. Geological Survey Water-Resources Investigations Report 88-4008 (in press).

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Moore, M.A., and Lamb, T.E., 1986, Annual yield and selected hydrologic data for the Arkansas River basin compact Arkansas-Oklahoma, 1985 water year: U.S. Geological Survey Open-File Report 86-66, 39 p.

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Morris, E.E., 1988, Arkansas ground-water quality: U.S. Geological Survey Open-File Report 87-0714, 8 p.

Morris, E.E., and Bush, W.V., 1986, Extent and source of saltwater intrusion into the alluvial aquifer near Brinkley, Arkansas, 1984: U.S. Geological Survey Water-Resources Investigations Report 85-4322, 123 p.

Neely, B.L., Jr., 1987, Flood characteristics of the Buffalo River at Tyler Bend, Arkansas: U.S. Geological Survey Water-Resources Investigations Report 87-4180, 1 sheet.

----- 1987, Magnitude and frequency of floods in Arkansas: U.S. Geological Survey Water-Resources Investigations Report 86-4335, 51 p.

----- 1987, Annual peak discharges and stages through 1984 for gaging stations in Arkansas: U.S. Geological Survey Open-File Report 87-208, 125 p.

Plafcan, Maria, 1985, Ground-water levels in the alluvial aquifer in eastern Arkansas, 1984: U.S. Geological Survey Open-File Report 85-569, 26 p.

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Selected publications on water resources in Arkansas are listed below. Many of thse reports can be obtained from the District Office at the address shown on the title page. Professional Papers and Water-Supply Papers are sold by the U.S. Geological Survey, Eastern Distribution Branch, 604 South Pickett Street, Alexandria, Virginia 22304.

Professional Papers

424-C Relation between median grain size and permeability in the Arkansas River valley, Arkansas, by M.S. Bedinger, 1961.

448-C Cretaceous aquifers in the Mississippi embayment, by E.H. Boswell, G.K. Moore, L.M. MacCary, and others, *with discussions of* Quality of the water, by H.G. Jeffery, 1965.

448-D Tertiary aquifers in the Mississippi embayment, by R.L. Hosman, A.T. Long, T.W. Lambert, and others, *with discussions of* Quality of the water, by H.G. Jeffery, 1968.

448-E Quaternary aquifers in the Mississippi embayment, by E.H. Boswell, E.M. Cushing, R.L. Hosman *with a discussion of* Quality of the water by H.G. Jeffery, 1968.

448-F Low-flow characteristics of streams in the Mississippi embayment in northern Arkansas and in Missouri, by P.R. Speer, M.S. Hines, M.E. Janson, and others, 1966.

448-G Low-flow characteristics of streams in the Mississippi embayment in southern Arkansas, northern Louisiana, and northeastern Texas, by P.R. Speer, M.S. Hines, A.J. Calandro, and others, *with a section on* Quality of the water by H.G. Jeffery, 1966.

501-B Computing stream-induced ground-water fluctuation, by M.S. Bedinger and J.E. Reed, 1964.

501-D The Carrizo Sand, a potential aquifer in south-central Arkansas, by R.L. Hosman, 1964.

600-B Grand Prairie region, Arkansas--An example of stream alienation, by M.S. Bedinger, 1968.

750-C Forest species as indicators of flooding in the lower White River valley, Arkansas, by M.S. Bedinger, 1971.

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813-H Summary appraisals of the Nation's ground-water resources--Arkansas-White-Red Region, by M.S. Bedinger, and R.R. Sniegocki, 1976.

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1615-B Hydrology of a part of the Grand Prairie region, Arkansas, by R.T. Sniegocki, 1964.

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1615-H Laboratory study of aquifer properties and well design for an artificial-recharge site, by A.I. Johnson, R.P. Moston, and S.F. Versaw, 1966.

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