WATER-RESOURCES ACTIVITIES IN ARKANSAS, 1988-91

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U.S. GEOLOGICAL SURVEY

Open-File Report 91-229

Little Rock, Arkansas

1991

U.S. DEPARTMENT OF THE INTERIOR
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MESSAGE FROM ARKANSAS DISTRICT CHIEF

Programs and activities of the Arkansas District, Water Resources Division, U.S. Geological Survey continued to evolve during 1988-91 in response to cooperator needs for hydrologic information. USGS projects in Arkansas are conducted in cooperation with local, State, and other Federal agencies and include hydrologic data collection, investigations, and research. Although several data-collection projects are continuous, most investigative and research projects are of fairly short duration (1 to 5 years). This report summarizes the objectives and progress of principal USGS projects in Arkansas during 1988-91. In addition, sources of USGS data and publications are given and a list of reports published by the Arkansas District during 1988-91 is included.

Noteworthy progress was made on a number of USGS hydrologic projects in Arkansas during 1988-91. Emphasis on near real-time computation of daily streamflows using a satellite-relay system and efficient computer processing continued. Testing of pressure transducers and data loggers for sensing and storing hydrologic data was initiated. Three automatic-sampling, daily-sediment stations and five continuous, satellite-relay, water-quality stations were installed. In excess of 40,000 water-diversion reports are stored annually in the Arkansas District water-use data base. A ground-water contamination study for Little Rock Air Force Base was completed. Flow models for the alluvial and Sparta aquifers were completed. A conjunctive use, sustained-yield analysis of the alluvial aquifer in eastern Arkansas was begun. A statewide Geographic Information System (GIS) for Arkansas was implemented. A Project Office for conducting geohydrologic research in northwestern Arkansas was established on the University of Arkansas campus, Fayetteville, Arkansas. Water-quality monitoring and modeling of Lakes Maumelle and Winona in central Arkansas was begun. A water-quality assessment of stormwater runoff in Little Rock, Arkansas, was initiated.

Early in 1991, the Arkansas District was selected to host a study team for USGS's National Water Quality Assessment (NAWQA) of the Ozark Plateaus in Arkansas, Missouri, Kansas, and Oklahoma. In addition, the Arkansas District was selected to implement a Computer Coding Shop for USGS's National Water Information System (NWIS-II). Finally, the Arkansas District was selected to host an Area Assistant Regional Hydrologist for Lower Mississippi Programs (Arkansas, Louisiana, Mississippi, and Missouri).

I am proud of the many accomplishments of the Arkansas District during the 1980's. I look forward to the challenges of the 1990's with great enthusiasm and to the opportunity to assist our many cooperators with their water-information needs in Arkansas. I am honored to serve as District Chief of the Arkansas District during these exciting times.

E.E. "Gene" Gann
District Chief

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.

ORGANIZATION OF THE ARKANSAS DISTRICT

A new organizational structure has been adopted for the Arkansas District (fig. 1) so that the District may more effectively meet its assigned responsibilities and make more effective use of its staff. A description of the functions of each organizational unit (fig. 2) 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 a Project Office, a NAWQA Program Office, a Water Quality Services unit, an Information Management Section, an Administrative Service Section, and two major technical sections. Section chiefs service 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.

Project Office, Fayetteville--This office conducts geohydrologic research and provides academic liaison for northwestern Arkansas. A senior staff professional is in charge of the office; he may also serve as a project chief or member.

NAWQA Program Office--This office is responsible for all aspects of the National Water Quality Assessment program administered by the District. A senior staff professional is in charge of all NAWQA related activities and exercises a wide latitude of independent action in supervision, training, and technical guidance; he may also serve as a project chief or member.

Water Quality Services Unit--This unit provides water-quality data-collection, analysis, quality assurance, and laboratory support for all District water-quality activities. A senior staff professional is in charge; he may also serve as a project chief or member.

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.

Hydrologic Surveillance Section--This section is responsible for all hydrologic data collection and publication for the District's data program. The major aspects are the measurement, compilation, publication, and quality control of all streamflow, and ground-water data; the monitoring and documentation of hydrologic events; and the preparation and publication of the annual data report. 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 Operations Unit--This unit provides technical support for surface-water data-collection activities throughout the District.

Field Office, Fort Smith--This office provides hydrologic data-collection support for west-central Arkansas.

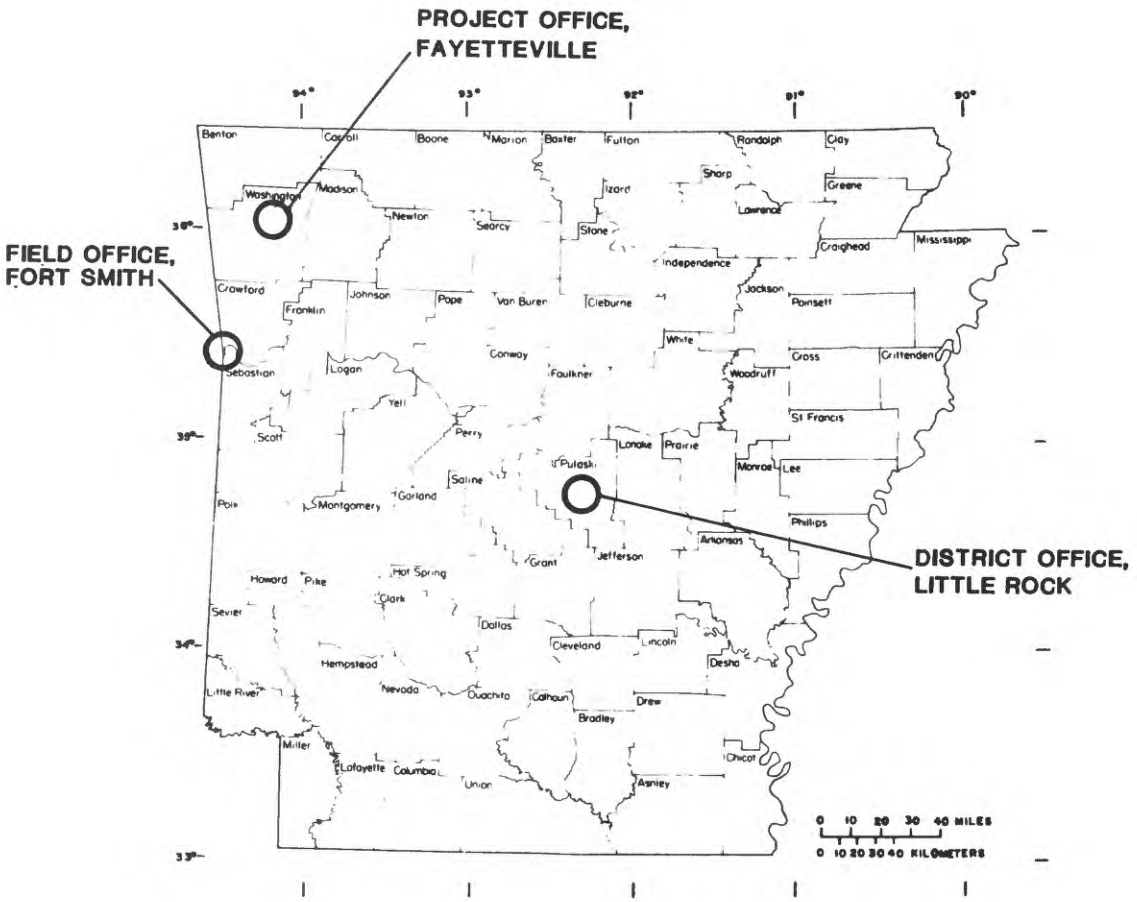
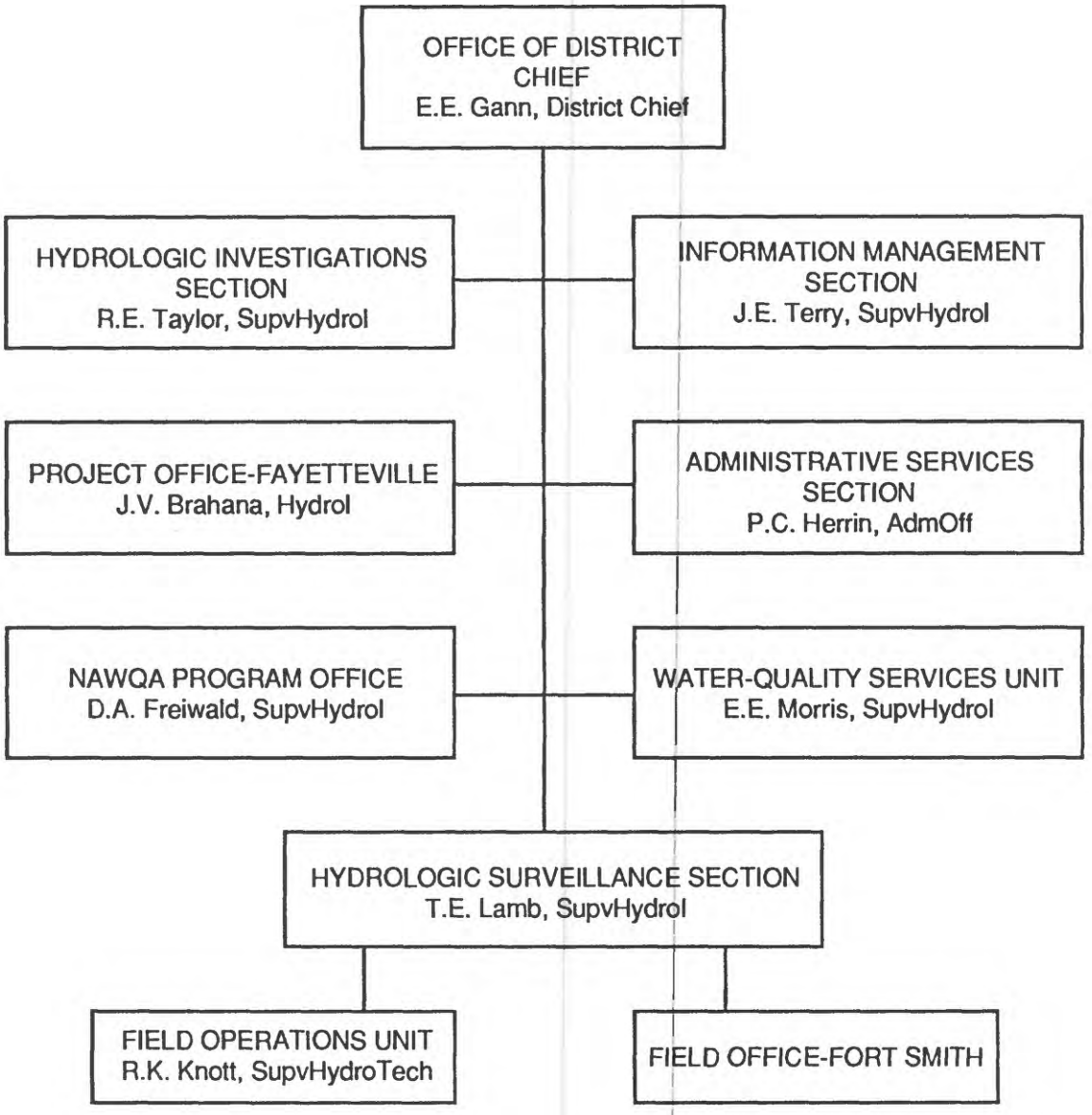


Figure 1.--U.S. Geological Survey offices in Arkansas.



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Fayetteville, AR 72701
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Figure 2.--Arkansas District organization.

TYPES OF FUNDING

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

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

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

3. Cooperative program which includes investigations supported by services or funds provided by State and local agencies, matched on a 50-50 basis by Federal funds. A list of agencies participating in the other Federal agencies and cooperative programs can be found in table 1.

For the year 1990 the financial support for the programs in Arkansas was about $3 million and was distributed as shown in figure 3 below:

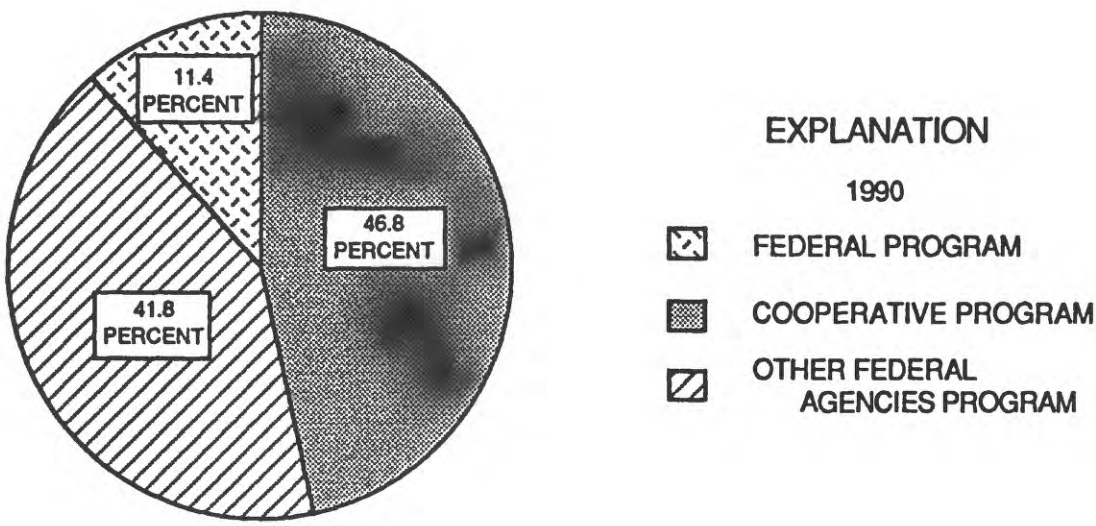


Figure 3.--Arkansas District program source of funds.

Table 1.--*Agencies supporting water-resources investigations during 1988-91 in the Arkansas District*

Federal Agencies

U.S. Air Force
U.S. Department of Agriculture
  Soil Conservation Service
U.S. Department of the Army
  Corps of Engineers
    Little Rock District
    Memphis District
    Tulsa 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 Department of Health
Arkansas Department of Pollution Control and Ecology
Arkansas Game and Fish Commission
Arkansas Geological Commission
Arkansas-Oklahoma Arkansas River Compact Commission
Arkansas Soil and Water Conservation Commission
Arkansas State Highway and Transportation Department
University of Arkansas - Fayetteville
University of Arkansas - Little Rock

Local Agencies

Arkansas Power and Light Company
City of Little Rock
City of Rogers
Independence County
Little Rock Municipal Water Works

PROJECT DESCRIPTIONS

AR-001 SURFACE-WATER STATIONS

DATE PROJECT BEGAN: October 1927

DATE PROJECT ENDS: Continuing

PROJECT CHIEF: T.E. Lamb

LOCATION: Statewide

COOPERATING AGENCIES: Arkansas Geological Commission; Arkansas Department of Pollution Control and Ecology; U.S. Army Corps of Engineers, Little Rock, Tulsa, and Vicksburg Districts; Arkansas Power and Light Co.; Arkansas Soil and Water Conservation Commission; Arkansas State Highway and Transportation Department; Arkansas Game and Fish Commission; Independence County; and City of Rogers

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

OBJECTIVE: 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 and pollution control discharge data to accompany water-quality measurements, compact and legal requirements, and 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, estuaries, and other bodies of water, for use in planning and design.

APPROACH: Standard methods of data collection will be used as described in the publications series, "Techniques of Water-Resources Investigations of the U.S. Geological Survey." Partial-record gaging will be used instead of complete-record gaging where it serves the required purpose. Non-standard methods will be used where standard methods are not feasible.

PROGRESS DURING 1990: The statewide network of streamflow stations was continued and records were published. Statewide network of crest-stage gages and partial-record stations for water-quality sampling was continued. Operated 68 satellite data collection platforms (DCPs) and 42 rain gages. A complete list of stations is given in table 2 and a list of discontinued gaging stations is given in table 3. Locations of water-quality stations are shown in figure 4. Annual Arkansas River Compact report was published.

PLANS FOR 1991: Continue operation of present network. Publish all records. Operate 71 DCPs. Install two new gaging stations.

REPORTS:

Fitzpatrick, D.J., and Westerfield, P.W., 1990, Hydrologic data collected in the vicinity of the proposed gamma-ray and neutrino detector site, Hot Spring County, Arkansas, 1988-89: U.S. Geological Survey Open-File Report 89-623, 17 p.

Lamb, T.E., Porter, J.E., Lambert, B.F., and Plafcan, Maria, 1988, Water resources data for Arkansas--water year 1987: U.S. Geological Survey Water-Data Report AR-87-1, 575 p.

Moore, M.A., Porter, J.E., Westerfield, P.W., and Young, Karen, 1989, Water resources data for Arkansas--water year 1988: U.S. Geological Survey Water-Data Report AR-88-1, 622 p.

_____ 1990, Water resources data for Arkansas--water year 1989: U.S. Geological Survey Water-Data Report AR-89-1, 581 p.

Moore, M.A., Lamb, T.E., and Hauth, L.D., 1989, Annual yield and selected hydrologic data for the Arkansas River basin compact, Arkansas-Oklahoma, 1988 water year: U.S. Geological Survey Open-File Report 89-54, 36 p.

_____ 1990, Annual yield and selected hydrologic data for the Arkansas River basin compact, Arkansas-Oklahoma, 1989 water year: U.S. Geological Survey Open-File Report 90-131,35 p.

Neely, B.L., Jr., in press, Extreme events and floods and droughts, Arkansas, in National Water Summary 1988-89: U.S. Geological Survey Water-Supply Paper 2355.

Porter, J.E., Westerfield, P.W., and Lambert, B.F., 1991, Water resources data for Arkansas--water year 1990: U.S. Geological Survey Water-Data Report AR-90-1, 585 p.

Table 2.--*Daily discharge and surface-water quality stations operated by the Arkansas District*

[Type of data: D, discharge; QW, water quality; S, sediment; T, temperature]

Station name	Station number	Drainage area (square miles)	Period of record	Type of data
Mississippi River at Memphis, Tenn.	07032000	932,800	1933-90	D
			1973-90	QW
St. Francis River at Fisk, Mo.	07040000		1977-90	QW
St. Francis River near Glennonville, Mo.	07040060		1977-90	QW
Wilhelmina Cutoff near Campbell, Mo.	07040070		1977-90	QW
St. Francis River at St. Francis, Ark.	07040100		1969-90	QW, S
St. Francis River near Piggott, Ark.	07040110	1,776	1977-90	QW
St. Francis River at Holly Island, Ark.	07040130	1,788	1977-90	QW
St. Francis River at Lake City, Ark.	07040450	2,374	1974-90	QW
Cockle Burr Slough Ditch near Monette, Ark.	07040496		1979-90	QW
Right Hand Chute of Little River at Rivervale, Ark.	07046600	2,106	1977-90	QW
St. Francis River at Parkin, Ark.[1]	07047800	Indeterminate	1965-82; 1985-90	D
			1973-90	QW
St. Francis River Floodway near Marked Tree, Ark.	07047810		1977-90	QW
Cross County Ditch near Birdeye, Ark.	07047815		1977-90	QW
St. Francis Bay at Riverfront, Ark.[1]	07047900	Indeterminate	1965-82; 1984-90	D
			1973-90	QW
Clark Corner Cutoff near Colt, Ark.	07047904		1977-90	QW
St. Francis River at Madison, Ark.[2]	07047907		1977-90	QW
L'Anguille River near Colt, Ark.	07047942	535	1970-90	D, QW
Second Creek near Palestine, Ark.[2]	07047947		1983-90	QW
L'Anguille River at Marianna, Ark.[2]	07047964		1974-90	QW
West Fork White River east of Fayetteville, Ark.[2]	07048550		1974-90	QW
White River near Fayetteville, Ark.	07048600	400	1963-90	D
White River near Goshen, Ark.[2]	07048700	412	1969-73; 1974-90	QW
Holman Creek near Huntsville, Ark.[2]	07048980		1984-85	QW
Beaver Lake near Eureka Springs, Ark.	07049690	1,192	1968-71; 1973-90	QW
White River at Beaver Dam near Eureka Springs, Ark.	07049691	1,192	1946; 1950-53; 1967-90	QW
Osage Creek southwest of Berryville, Ark.[2]	07050390		1983-90	QW
Osage Creek west of Berryville, Ark.[2]	07050420		1983-90	QW
Kings River near Berryville, Ark.[2]	07050500	527	1953-60; 1971-90	QW
Long Creek near Denver, Ark.[2]	07053230		1983-90	QW
Table Rock Lake near Branson, Mo.	07053400	4,020	1973-90	QW

Table 2.--*Daily discharge and surface-water quality stations operated by the Arkansas District*--Continued

Station name	Station number	Drainage area (square miles)	Period of record	Type of data
White River below Table Rock Dam near Branson, Mo.	07053450	4,020	1978-90	QW
Bull Shoals Lake near Flippin, Ark.	07054500	6,051	1954-60; 1972; 1973-90	QW
White River at Bull Shoals Dam near Flippin, Ark.	07054501	6,051	1954-68; 1970-71; 1973-90	QW
Crooked Creek at Harrison, Ark.[2]	07055565		1983-90	QW
Crooked Creek near Harrison, Ark.[2]	07055569		1983-90	QW
Crooked Creek at Yellville, Ark.[2]	07055608	406	1978-88; 1985-88; 1988-90	D
			1979-90	QW
Buffalo River near St. Joe, Ark.[2]	07056000	829	1939-90	D
			1954-57; 1974-90	QW
Hicks Creek near Mountain Home, Ark.[2]	07057310		1983-90	QW
White River near Norfork, Ark.[2]	07057370		1974-90	QW
Norfork Lake near Norfork, Ark.	07059500	1,808	1968-69; 1971-72; 1973-90	QW
North Fork River at Norfork Dam, near Norfork, Ark.	07060000	1,808	1946-71; 1973-90	QW
White River at Calico Rock, Ark.	07060500	9,978	1939-90	D
			1966-90	QW
Mill Creek near Melbourne, Ark.[2]	07060590		1983-90	QW
North Sylamore Creek near Fifty-Six, Ark.	07060710	58.1	1965-90	D
			1966-90	QW
White River at Batesville, Ark.	07061000	11,070	1937-58; 1986-90	D
White River at Oil Trough, Ark.[2]	07061105	11,234	1974-83; 1984-85	QW
Clearwater Lake at Clearwater Dam, Mo.	07061990	898	1978-90	QW
Black River at Clearwater Dam, Mo.	07062010	898	1978-90	QW
Black River near Corning, Ark.	07064000	1,749	1938-90	D
Current River near Pocahontas, Ark.[2]	07068850	2,606	1955-58; 1970-90	QW
Black River at Pocahontas, Ark.[2]	07069000	4,845	1965-66; 1977-90	QW
Mammoth Spring at Mammoth Spring, Ark.	07069200		1981-90	D
South Fork Spring River at Saddle, Ark.[2]	07069295		1974-90	QW
Spring River at Ravenden, Ark.[2]	07069370		1974-90	QW
Spring River at Imboden, Ark.	07069500	1,183	1936-90	D

Table 2.--*Daily discharge and surface-water quality stations operated by the Arkansas District*--Continued

Station name	Station number	Drainage area (square miles)	Period of record	Type of data
Eleven Point River near Ravenden Spring, Ark.	07072000	1,134	1929-33; 1935-90	D
Eleven Point River near Pocahontas, Ark.[2]	07072100	1,192	1974-90	QW
Black River at Black Rock, Ark.	07072500	7,369	1929-31; 1939-90	D
			1946; 1953; 1967-90	QW
Strawberry River near Poughkeepsie, Ark.	07074000	473	1936-90	D
Strawberry River near Smithville, Ark. [2]	07074100	539	1974-90	QW
White River at Newport, Ark.	07074500	19,860	1927-31; 1937-90	D
			1946-61; 1978 1978-90	QW
Middle Fork Little Red River near Shirley, Ark.[2]	07074990		1974-90	QW
South Fork Little Red River at Clinton, Ark.	07075300	148	1961-90	D
Greers Ferry Lake near Heber Springs, Ark.	07075900	1,153	1970-72; 1973-90	QW
Little Red River near Heber Springs, Ark.	07076000	1,153	1949-52; 1955-71; 1973-90	QW
Little Red River near Searcy, Ark.	07076620	1,648	1983-90	D
Little Red River above Searcy, Ark.[2]	07076626		1983-90	QW
Little Red River below Searcy, Ark.[2]	07076632		1983-90	QW
Wattensaw Bayou near Hazen, Ark.[2]	07076950	192	1983-90	QW
White River at DeValls Bluff, Ark.[1,2]	07077000	23,431	1927-45; 1949-70; 1988-90	D
			1967-70; 1974-90	QW
Cache River at Egypt, Ark.	07077380	701	1964-90	D
Cache River at Patterson, Ark.	07077500	1,037	1952-55; 1975-90	QW S
Cache River near Cotton Plant, Ark.	07077555	1,172	1987-90	D, S
Bayou DeView near Gibson, Ark.[2]	07077660		1974-90	QW
Bayou DeView at Morton, Ark.	07077700	421	1973-90	QW
White River at St. Charles, Ark.[2]	07077820	25,809	1974-90	QW
Boat Gunwale Slash near Holly Grove, Ark.[2]	07077862		1983-90	QW
Big Creek at Poplar Grove, Ark.	07077950	448	1970-90	D
Prairie Cypress Creek near Cross Roads, Ark.[2]	07077980		1983-90	QW
McKisic Creek Tributary near Bentonville, Ark.[2]	07188800		1983-90	QW

Table 2.--*Daily discharge and surface-water quality stations operated by the Arkansas District*--Continued

Station name	Station number	Drainage area (square miles)	Period of record	Type of data
Butler Creek near Sulphur Springs, Ark.[2]	07188910	34.9	1968-90	QW
Spavinaw Creek near Cherokee City, Ark.[2]	07191179	104	1968-72; 1978-90	QW
Illinois River at Savoy, Ark.[2]	07194800	167	1974-90	QW
Clear Creek at Johnson, Ark.[2]	07194810		1986-87	QW
Osage Creek near Elm Springs, Ark.[2]	07195000	130	1974-90	QW
Illinois River near Siloam Springs, Ark.[2]	07195400	509	1983-90	QW
Flint Creek at Springtown, Ark.	07195800	14.2	1961-90	D
Flint Creek near West Siloam Springs, Okla.	07195855	59.8	1979-90	D
Baron Fork at Dutch Mills, Ark.[2]	07196900	40.6	1958-90	D
			1960-61; 1968-90	QW
Poteau River at Waldron, Ark.[2]	07246940		1983-90	QW
Poteau River northwest of Waldron, Ark.[2]	07246950		1983-90	QW
Poteau River at Cauthron, Ark.	07247000	203	1939-90	D
James Fork near Hackett, Ark.[2]	07249400	147	1958-90	D,QW
Lee Creek near Van Buren, Ark.	07250000	426	1930-37; 1950-90	D
Arkansas River at Van Buren, Ark.[2]	07250500	150,482	1945-70; 1974-90	QW
Arkansas River at James W. Trimble Lock and Dam near Van Buren, Ark.	07250550	150,547	1927-90	D
			1969-90	QW
Mulberry River near Mulberry, Ark.	07252000	373	1938-90	D
Mulberry River at I-40 near Mulberry, Ark.[2]	07252030		1983-90	QW
Arkansas River at Ozark Dam at Ozark, Ark.[2]	07252406	151,801	1962-63; 1965-66; 1974-90	QW
Short Mountain Creek west of Paris, Ark.[2]	07256040		1986-90	QW
Short Mountain Creek north of Paris, Ark.[2]	07256046		1986-90	QW
Big Piney Creek near Dover, Ark.	07257000	274	1950-90	D
Big Piney Creek at Highway 164 near Dover, Ark.[2]	07257006		1983-90	QW
Illinois Bayou near Dover, Ark.[2]	07257690		1983-90	QW
Arkansas River at Dardanelle, Ark.[2]	07258000	153,670	1937-90	D
			1949-61; 1961-63; 1971-90	QW T
Whig Creek near Dardanelle, Ark.[2]	07258015		1986-87	QW
Petit Jean River near Booneville, Ark.[2]	07258500	241	1974-90	QW
Blue Mountain Lake near Waveland, Ark.	07259000	488	1975-90	QW
Petit Jean River near Waveland, Ark.	07259001	488	1975-90	QW
Dutch Creek at Shark, Ark.[2]	07260020	107	1983-90	QW

Table 2.--*Daily discharge and surface-water quality stations operated by the Arkansas District*--Continued

Station name	Station number	Drainage area (square miles)	Period of record	Type of data
Petit Jean River at Danville, Ark.	07260500	764	1916-90	D
Chickalah Creek at Chickalah, Ark.[2]	07260620	39.1	1983-90	QW
Arkansas River at Dam No. 9 near Oppelo, Ark.[2]	07260660	154,949	1974-90	QW
White Oak Creek near Atkins, Ark.[2]	07260675		1983-90	QW
Cadron Creek near Guy, Ark.	07261000	169	1954-90	D
Arkansas River at Toad Suck Ferry Dam near Conway, Ark.[2]	07261260	156,386	1974-90	QW
Fourche LaFave River near Gravelly, Ark.[2]	07261500	410	1939-90	D
			1974-90	QW
Nimrod Lake near Nimrod, Ark.	07262000	680	1975-90	QW
Fourche LaFave River near Ninrod, Ark.	07262500	684	1957-60	QW
			1975-90	
South Fourche LaFave River at Hollis, Ark.[2]	07262985	127	1983-90	QW
South Fourche LaFave River near Hollis, Ark.	07263000	210	1941-90	D
Stone Dam Creek near Conway, Ark.[2]	07263240		1983-90	QW
Maumelle River at Williams Junction, Ark.	07263295	46.1	1989-90	QW
Maumelle River near Crossroads, Ark.	07263296		1989-90	QW
Lake Maumelle at Crossroads, Ark.	07263297		1989-90	QW
Lake Maumelle near Crossroads, Ark.	07263298		1989-90	QW
Lake Maumelle near Little Italy, Ark.	07263299		1989-90	QW
Lake Maumelle near Natural Steps, Ark.	072632995		1989-90	QW
Arkansas River at Murray Dam at Little Rock, Ark.[2]	07263450	158,030	1927-90	D
			1970-90	QW
Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	07263620	158,288	1969-90	QW
Arkansas River at Lock and Dam 5 near Wright, Ark.[2]	07263640	158,542	1983-90	QW
Arkansas River at Lock and Dam 4 near Pine Bluff, Ark.[2]	07263706	158,542	1983-90	QW
Bayou Meto near North Little Rock, Ark.[2]	07263920		1983-90	QW
Bayou Meto near Jacksonville, Ark.[2]	07263935		1983-90	QW
Bayou Meto near Lonoke, Ark.	07264000	207	1954-90	D
Bayou Meto near Bayou Meto, Ark.[2]	07265099	794	1974-83;	QW
			1984-90	
Arkansas River at Dam No. 2 near Gillett, Ark.[2]	07265283	160,475	1969-90	QW
Mississippi River near Arkansas City, Ark.	07265450	1,130,600	1974-90	QW
Red River near Foreman, Ark.[2]	07336860	47,648	1974-90	QW
Red River at Index, Ark.	07337000	48,030	1936-90	D
			1947-56;	QW
			1980-90	

Table 2.--*Daily discharge and surface-water quality stations operated by the Arkansas District*--Continued

Station name	Station number	Drainage area (square miles)	Period of record	Type of data
Mountain Fork near Hatfield, Ark.[2]	07338720		1968-74; 1979-90	QW
DeQueen Lake near DeQueen, Ark.	07339450	169	1981-90	QW
Rolling Fork below DeQueen Lake near DeQueen, Ark.	07339452	169	1981-90	QW
Bear Creek near Horatio, Ark.[2]	07339795		1983-90	QW
Little River near Horatio, Ark.[2]	07340000	2,662	1930-90	D
			1954-59; 1969-78; 1979-90	QW
Cossatot River near Vandervoort, Ark.	07340300	89.6	1967-90	D
			1967-68; 1989-90	QW
Cossatot River near Umpire, Ark.[2]	07340400	142	1983-90	QW
Gillham Lake near Gillham, Ark.	07340450	273	1981-90	QW
Cossatot River below Gillham Dam near Gillham, Ark.	07340452	273	1981-90	QW
Saline River near Burg, Ark.[2]	07340945	47.4	1983-90	QW
Dierks Lake near Dierks, Ark.	07340990	113	1981-91	QW
Saline River below Dierks, Ark.	07340992	113	1981-90	QW
Holly Creek east of Dierks, Ark.[2]	07341070		1986-87	QW
Holly Creek at Dierks, Ark.[2]	07341080		1986-87	QW
Saline River near Lockesburg, Ark.	07341200	256	1963-90	D
Millwood Lake near Ashdown, Ark.	07341300	4,119	1981-90	QW
Little River at Millwood Dam near Ashdown, Ark.	07341301	4,119	1979-90	QW
Sulphur River south of Texarkana, Ark.	07344275	3,540	1968-90	QW
Days Creek southeast of Texarkana, Ark.[2]	07344300	78.5	1973-90	QW
Red River near Spring Bank, Ark.[2]	07344350	56,909	1968-90	QW
Bayou Dorcheat near Taylor, Ark.[2]	07348650	389	1973-90	QW
Bodcau Creek near Lewisville, Ark[2].	07349440		1974-77; 1978-90	QW
Prairie Creek near Mena, Ark.[2]	07355825		1983-90	QW
Ouachita River near Mount Ida, Ark.[2]	07356000	414	1941-90	D
			1950-52; 1974-90	QW
Ouachita River near Malvern, Ark.[2]	07359500	1,585	1903-05; 1922-25; 1925-27; 1928-90	D
			1947-50; 1970-90	QW

Table 2.--*Daily discharge and surface-water quality stations operated by the Arkansas District*--Continued

Station name	Station number	Drainage area (square miles)	Period of record	Type of data
Ouachita River near Donaldson, Ark.[2]	07359580	1,732	1974-90	QW
Caddo River near Caddo Gap, Ark.	07359610	136	1988-90	D
South Fork Caddo River at Fancy Hill, Ark.[2]	07359653		1983-90	QW
Caddo River near Amity, Ark.[2]	07359770	291	1972-90	QW
Little Missouri River near Langley, Ark.[2]	07360200	68.4	1974-90	QW
Prairie Creek at Murfreesboro, Ark.[2]	07361022		1983-90	QW
Prairie Creek near Murfreesboro, Ark.[2]	07361025		1983-90	QW
Antoine River at Antoine, Ark.	07361500	178	1954-90	D
Little Missouri River near Boughton, Ark.[2]	07361600	1,068	1948-55 1973-90	QW
Ouachita River at Camden, Ark.	07362000	5,357	1928-60; 1965-90	D
			1947-52; 1974-90	QW
Ouachita River below Camden, Ark.[2]	07362065	5,676	1969-72; 1983-90	
Smackover Creek near Smackover, Ark.	07362100	385	1961-90	D
Smackover Creek north of Smackover, Ark.[2]	07362110	411	1974-90	QW
Jug Creek near Fordyce, Ark.[2]	07362480		1986-87	QW
Moro Creek near Banks, Ark.[2]	07362550	385	1974-78; 1979-90	QW
Alum Fork Saline River near Reform, Ark.	07362587		1989-90	QW
Lake Winona downstream from Stillhouse Creek near Reform, Ark.	07362588		1989-90	QW
Lake Winona downstream from Gillis Branch near Reform, Ark.	07362589		1989-90	QW
Lake Winona at Reform, Ark.	07362590		1989-90	QW
Saline River west of Benton, Ark.[2]	07363002	550	1974-90	QW
Saline River near Shaw, Ark.[2]	07363054		1983-90	QW
Saline River near Sheridan, Ark.[2]	07363200	1,123	1983-90	QW
Hurricane Creek near Sardis, Ark.[2]	07363270	66.0	1974-76; 1977-90	QW
Hurricane Creek near Sheridan, Ark.	07363300	204	1957-61; 1961-90	D
Big Creek near Sheridan, Ark.[2]	07363337		1986-87	QW
Big Creek near Pansy, Ark.[2]	07363465	157	1983-90	QW
Saline River near Rye, Ark.	07363500	2,102	1937-90	D
Saline River near Fountain Hill, Ark.[2]	07364012		1972-90	QW
Bayou Bartholomew near Ladd, Ark.[2]	07364115		1974-90	QW
Bayou Bartholomew at Garrett Bridget, Ark.	07364133	380	1987-90	D

Table 2.--*Daily discharge and surface-water quality stations operated by the Arkansas District*--Continued

Station name	Station number	Drainage area (square miles)	Period of record	Type of data
Bayou Bartholomew near McGehee, Ark.	07364150	576	1938-42; 1945-90	D
Bayou de Loutre near El Dorado, Ark.[2]	07364600		1970-90	QW
Cornie Bayou near Three Creeks, Ark.[2]	07365800	180	1950-62; 1970-74; 1979-90	QW
Bayou Macon at Eudora, Ark.[1]	07369680	500	1988-90	D

[1] Records furnished by the U.S. Army Corps of Engineers.
[2] Records furnished by Arkansas Department of Pollution Control and Ecology.

Table 3.--*Discontinued gaging stations*

Station number	Station name	Drainage area (square miles)	Period of record
07047000	St. Francis River floodway near Marked Tree (Dam), Ark.	4,644	1934-65
07047500	St. Francis River at Marked Tree, Ark.	5,148	1934-73
07047810	St. Francis River floodway near Marked Tree, Ark.	4,651	1965-70
07048000	West Fork White River at Greenland, Ark.	83.1	1945-83
07048500	West Fork White River near Fayetteville, Ark.	118	1937-45
*07049000	War Eagle Creek near Hindsville, Ark.	263	1952-70
07049500	White River near Rogers, Ark.	1,020	1952-63
07050500	Kings River near Berryville, Ark.	527	1939-75
*07055000	White River near Flippin, Ark.	6,081	1928-80
07057000	Buffalo River near Rush, Ark.	1,096	1928-70
07057250	White River at Shipps Ferry, Ark.	8,007	1963-64
07068890	Fourche River above Pocahontas, Ark.	229	1964-70
*07069000	Black River at Pocahontas, Ark.	4,845	1936-70
07073000	Strawberry River near Evening Shade, Ark.	217	1939-79
*07073500	Piney Fork at Evening Shade, Ark.	99.2	1939-84
*07075000	Middle Fork of Little Red River at Shirley, Ark.	302	1939-84
*07076000	Little Red River near Heber Springs, Ark.	1,153	1927-80
07076850	Cypress Bayou near Beebe, Ark.	166	1961-76
07077930	Big Creek near Moro, Ark.	77.4	1961-70
07078000	LaGrue Bayou near Stuttgart, Ark.	176	1935-54
07194760	Illinois River near Viney Grove, Ark.	80.7	1986
07194800	Illinois River at Savoy, Ark.	167	1980-81, 1986
17195000	Osage Creek near Elm Springs, Ark.	130	1950-75
07195400	Illinois River near Siloam Springs, Ark.	509	1980-81, 1986
*07249500	Cove Creek near Lee Creek, Ark.	35.3	1950-70
*07251000	Frog Bayou near Mountainburg, Ark.	74.2	1936-61
*07251500	Frog Bayou at Rudy, Ark.	216	1950-70
07252500	Sixmile Creek Subwatershed No. 6 near Chismville, Ark.	4.23	1960-70
07253000	Sixmile Creek at Chismville, Ark.	24.1	1954-70
07253500	Sixmile Creek near Branch, Ark.	36.7	1954-70
07254000	Sixmile Creek Subwatershed No. 5 near Chismville, Ark.	2.76	1960-70
07254500	Sixmile Creek Subwatershed No. 2 near Caulksville, Ark.	5.81	1960-70
07255000	Sixmile Creek at Caulksville, Ark.	104	1954-70
07255100	Sixmile Creek near Subwatershed No. 23 near Branch, Ark.	4.49	1960-70
07255500	Hurricane Creek near Branch, Ark.	17.2	1954-70
07256000	Hurricane Creek near Caulksville, Ark.	53 0	1954-70
*07256500	Spadra Creek at Clarksville, Ark.	61.1	1952-70
07257500	Illinois Bayou near Scottsville, Ark.	241	1948-70
*07258500	Petit Jean River near Booneville, Ark.	241	1938-84
*07259500	Petit Jean River near Waveland, Ark.	516	1939-80

Table 3.--*Discontinued gaging stations*--Continued

Station number	Station name	Drainage area (square miles)	Period of record
*07260000	Dutch Creek at Waltreak, Ark.	81.4	1945-75
*07262500	Fourche LaFave River near Nimrod, Ark.	684	1936-80
07264500	Bayou Meto near Stuttgart, Ark.	574	1935-54
07265000	Crooked Creek near Humphrey, Ark.	79.2	1940-54
*07339500	Rolling Fork near DeQueen, Ark.	182	1948-80
*07340500	Cossatot River near DeQueen, Ark.	360	1938-80
*07341000	Saline River near Dierks, Ark.	121	1938-80
07349430	Bodcau Creek at Stamps, Ark.	234	1958-70
07356500	South Fork Ouachita River at Mount Ida, Ark.	64.0	1949-70
07358000	Ouachita River near Hot Springs, Ark.	1,405	1922-30
07359700	Caddo River at Glenwood, Ark.	201	1988
07361000	Little Missouri River near Murfreesboro, Ark.	380	1928-31, 1937-77
*07362500	Moro Creek near Fordyce, Ark.	240	1951-83
*07363000	Saline River at Benton, Ark.	550	1950-79
*07363200	Saline River near Sheridan, Ark.	1,123	1970-81
07364000	Saline River near Warren, Ark.	2,476	1928-31, 1937-40
07365800	Cornie Bayou near Three Creeks, Ark.	180	1956-87
07365900	Three Creeks near Three Creeks, Ark.	50.3	1956-71

* Converted to a partial-record station.

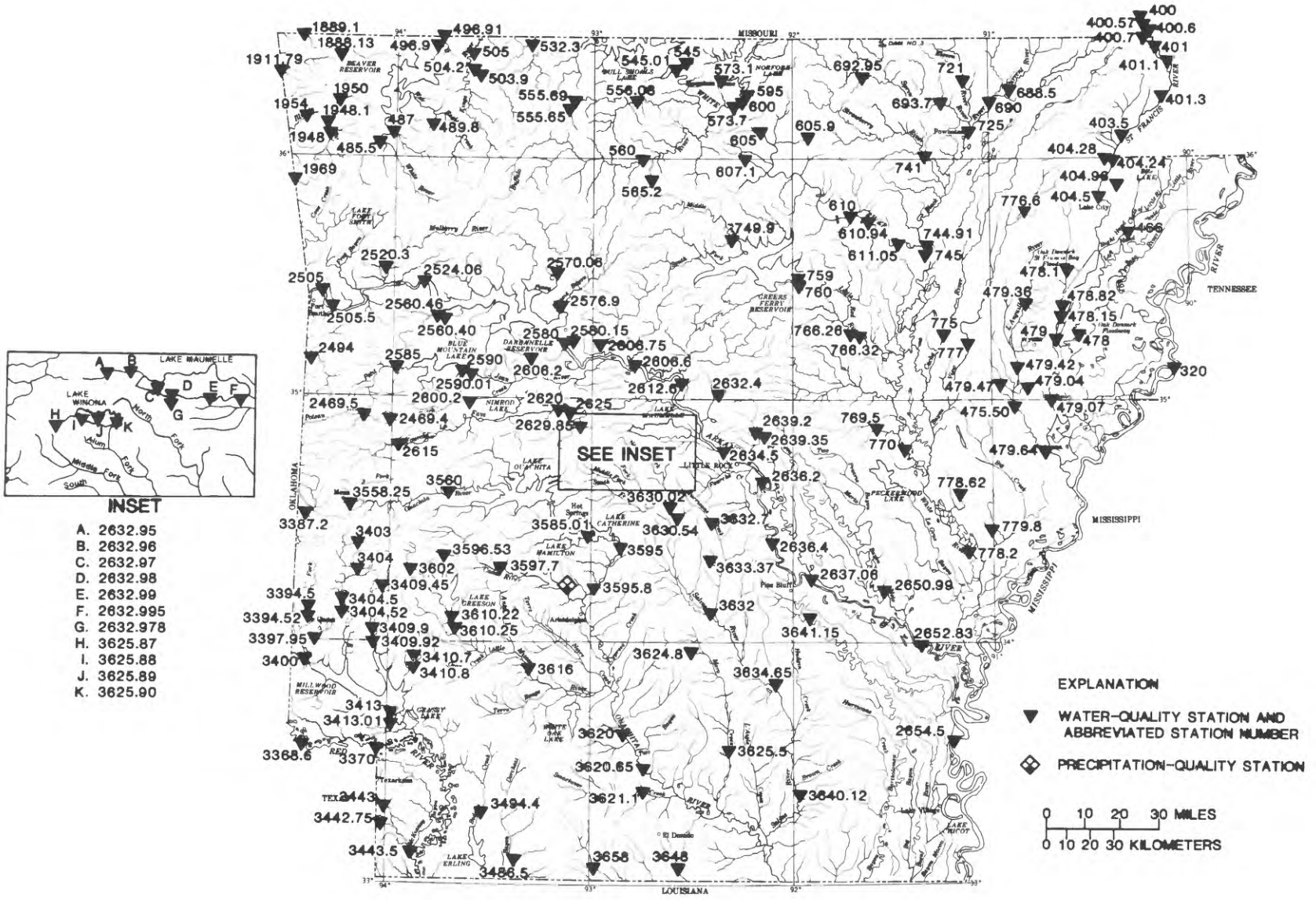


Figure 4.--Location of water-quality stations in Arkansas.

AR-002 GROUND-WATER STATIONS

DATE PROJECT BEGAN: July 1945

DATE PROJECT ENDS: Continuing

PROJECT CHIEF: P.W. Westerfield

LOCATION: Statewide

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

PROBLEM: Long-term water-level records are needed to evaluate the effects of climatic variations on the 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.

OBJECTIVE: 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 DURING 1990: Water-level measurements were made in 553 wells throughout the State as part of the continuing Federal-State ground-water data collection program. Water samples have been collected and analyzed for five master wells for the 1990 water year. Logged one well.

PLANS FOR 1991: Continue the water-level monitoring and water-quality sampling program. Prepare the ground-water section of the "Water resources data for Arkansas--water year 1990" and complete map reports. Log wells where needed, revise the continuous well data collection network, and make changes in site selection and instrumentation where needed. Make site visits to all new municipal and industrial wells in the State and determine their suitability for inclusion in the ground-water monitoring network.

REPORTS:

Kilpatrick, J.M., and Ludwig, A.H., 1990, Ground-water resources of the Arkansas River basin in Arkansas: U.S. Geological Survey Open-File Report 88-725, 45 p.

_____ 1990, Ground-water resources of the upper White River basin in Arkansas: U.S.Geological Survey Open-File Report 88-724, 48 p.

Lamb, T.E., Porter, J.E., Lambert, B.F., and Plafcan, Maria, 1988, Water resources data for Arkansas--water year 1987: U.S. Geological Survey Water-Data Report AR-87-1, 575 p.

Moore, M.A., Porter, J.E., Westerfield, P.W., and Young, Karen, 1989, Water resources data for Arkansas--water year 1988: U.S. Geological Survey Water-Data Report AR-88-1, 622 p.

_____ 1990, Water resources data for Arkansas--water year 1989: U.S. Geological Survey Water-Data Report AR-90-1, 581 p.

Porter, J.E., Westerfield, P.W., and Lambert, B.F., 1991, Water resources data for Arkansas--water year 1990: U.S. Geological Survey Water-Data Report AR-90-1, 585 p.

Taylor, R.E., 1988, U.S. Geological Survey ground-water studies in Arkansas: U.S. Geological Survey Open-File Report 88-123, 1 sheet.

Westerfield, P.W., 1989, Ground-water levels in the alluvial aquifer in eastern Arkansas, 1987: U.S. Geological Survey Open-File Report 89-64, 32 p.

_____ 1990, Ground-water levels in Arkansas, spring 1990: U.S. Geological Survey Open-File Report 90-377, 62 p.

_____ 1990, Water-level maps of the Mississippi River Valley alluvial aquifer in eastern Arkansas, 1987: U.S. Geological Survey Water-Resources Investigations Report 90-4089, 1 sheet.

Westerfield, P.W., and Baxter, C.R., 1990, Ground-water levels in the alluvial aquifer in eastern Arkansas, 1988: U.S. Geological Survey Open-File Report 90-383, 32 p.

Westerfield, P.W., and Gonthier, G.J., 1990, Ground-water levels in Arkansas, spring 1989: U.S. Geological Survey Open-File Report 90-121, 69 p.

Westerfield, P.W., and Plafcan, Maria, 1988, Ground-water levels in Arkansas, spring 1988: U.S. Geological Survey Open-File Report 88-706, 72 p.

AR-003 WATER-QUALITY STATIONS

DATE PROJECT BEGAN: July 1945

DATE PROJECT ENDS: Continuing

PROJECT CHIEF: E.E. Morris

LOCATION: Statewide

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

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.

OBJECTIVE: 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 (fig. 4) to measure chemical concentrations, loads, and time trends as required by planning and management agencies.

PROGRESS DURING 1990: Water-quality samples were collected and analyzed at 9 National Stream Quality Accounting Network (NASQAN) stations, 2 Benchmark Network stations, 5 cooperative stations, 91 sites on 16 lakes, and 30 wastewater effluent sites. Samples were analyzed for common constituents and trace materials.

PLANS FOR 1991: Continue to operate water-quality stations, and continue to update stations to meet current and long-term needs.

REPORTS:

Lamb, T.E., Porter, J.E., Lambert, B.F., and Plafcan, Maria, 1988, Water resources data for Arkansas--water year 1987: U.S. Geological Survey Water-Data Report AR-87-1, 575 p.

Moore, M.A., Porter, J.E., Westerfield, P.W., and Young, Karen, 1989, Water resources data for Arkansas--water year 1988: U.S. Geological Survey Water-Data Report AR-88-1, 622 p.

_____ 1990, Water resources data for Arkansas--water year 1989: U.S. Geological Survey Water-Data Report AR-90-1, 581 p.

Morris, E.E., 1988, Arkansas ground-water quality, in National Water Summary 1986--Hydrologic Events and Ground-Water Quality: U.S. Geological Survey Water-Supply Paper 2325, p. 165-172.

Porter, J.E., Westerfield, P.W., and Lambert, B.F., 1991, Water resources data for Arkansas--water year 1990: U.S. Geological Survey Water-Data Report AR-90-1, 585 p.

AR-004 SEDIMENT STATIONS

DATE PROJECT BEGAN: July 1976

DATE PROJECT ENDS: Continuing

PROJECT CHIEF: E.E. Morris

LOCATION: Statewide

COOPERATING AGENCY: U.S. Army Corps of Engineers

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

OBJECTIVE: Provide a national bank of sediment data for use in Federal and State planning and action programs, including State and Federal management of interstate and international waters.

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

PROGRESS DURING 1990: Sediment samples were collected at 15 sites in the St. Francis River basin and analyzed for concentration, and for particle size on sand fractions of particles greater than 62 micrometers in diameter. Automatic samplers were installed at 3 of the 15 sites to collect continuous record.

PLANS FOR 1991: Collect and analyze samples monthly at 15 stations in the St. Francis River basin. Collect and analyze samples daily at 4 of the 15 stations.

REPORTS:

Lamb, T.E., Porter, J.E., Lambert, B.F., and Plafcan, Maria, 1988, Water resources data for Arkansas--water year 1987: U.S. Geological Survey Water-Data Report AR-87-1, 575 p.

Moore, M.A., Porter, J.E., Westerfield, P.W., and Young, Karen, 1989, Water resources data for Arkansas--water year 1988: U.S. Geological Survey Water-Data Report AR-88-1, 622 p.

_____ 1990, Water resources data for Arkansas--water year 1989: U.S. Geological Survey Water-Data Report AR-90-1, 581 p.

Porter, J.E., Westerfield, P.W., and Lambert, B.F., 1991, Water resources data for Arkansas--water year 1990: U.S. Geological Survey Water-Data Report AR-90-1, 585 p.

AR-005 NATIONAL TRENDS NETWORK (NTN) FOR MONITORING ATMOSPHERIC DEPOSITION (MAD)

DATE PROJECT BEGAN: July 1983

DATE PROJECT ENDS: Continuing

PROJECT CHIEF: James C. Petersen

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.

OBJECTIVE: 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 that are part of the National Atmospheric Deposition Program/ National Trends Network (NADP/NTN). The other sites are operated by other agencies or corporations.

PROGRESS DURING 1990: Median pH (December 1983 - September 1990) is approximately 4.6. Data approved by National Atmospheric Deposition Program/National Trends Network and placed in National Data Storage and Retrieval System (WATSTORE) and published for water years 1987-89 in "Water resources data for Arkansas."

PLANS FOR 1991: 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 are published in the annual "Water resources data for Arkansas" (see Lamb and others, 1988; Moore and others, 1989; 1990). Approved data for all sites in the NADP/NTN are published quarterly by the National Atmospheric Deposition Program.

AR-007 WATER USE

DATE PROJECT BEGAN: April 1979

DATE PROJECT ENDS: Continuing

PROJECT CHIEF: Nancy T. Baker

LOCATION: Statewide

COOPERATING AGENCY: Arkansas Soil and Water Conservation Commission

PROBLEM: Because of the large increase (more than 500 percent since 1960) in the use of water in Arkansas in recent years, there is a need for real-time water-use data as a management tool. Increasing numbers of requests from state and municipal planners for water-use data point out the fact that these data are increasingly significant. As competition increases among users, the need for water-use information will become more essential in determining how much water remains available for increased use.

OBJECTIVE: The objectives of the water-use data program are to establish a statewide water- use data collection system on a continuing basis to document the amount of water used, and to develop a data-storage and retrieval system that will permit recall and publication of the information as desired.

APPROACH: Water-use data will be collected statewide for storing and disseminating by the U.S. Geological Survey (USGS) in cooperation with the Arkansas Soil and Water Conservation Commission. The State Water Use Data System (SWUDS) will be maintained on the Arkansas District PRIME for storing water-use data. Water use reported to cooperator will be entered and stored in SWUDS. Data will be reviewed and supplemented by USGS and permanently stored on the Arkansas District PRIME. Periodic data and map reports will be published to summarize water use in Arkansas. Detailed investigations of water use for selected categories and areas will be made to refine water-use data base for the State.

PROGRESS DURING 1990: Prepared a summary and analysis of water-use data collection in eastern Arkansas. Began a study to investigate water-use reporting by municipal suppliers. Compiled an inventory of municipal suppliers in Arkansas. Continued working on techniques for collection and management of water-use data for Southeastern Region.

PLANS FOR 1991: Complete investigation of water-use reporting by municipal suppliers. Complete documentation of techniques for collection and management of water-use data for the Southeastern Region.

REPORTS:

Baker, N.T., 1991, Summary and analysis of water-use data collection in eastern Arkansas: U.S. Geological Survey Water-Resources Investigations Report 90-4177, 25 p.

Baker, N.T., Cole, E.F., and Holland, T.W., 1990, Water supply and use, Arkansas, in National Water Summary 1987--Hydrologic Events and Water Supply and Use: U.S. Geological Survey Water-Supply Paper 2350, p. 165-172.

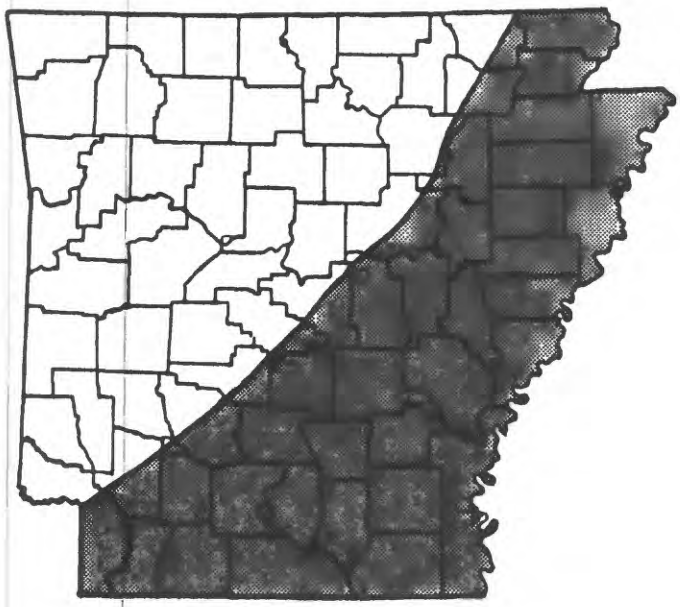
Baker, N.T., and Manning, C.A., 1991, Summary of reported water use for Arkansas counties, 1989: U.S. Geological Survey Open-File Report 91-203, 19 p.

AR-044 WEST GULF COAST REGIONAL AQUIFER SYSTEM ANALYSIS

DATE PROJECT BEGAN: March 1982

DATE PROJECT ENDS: September 1990

PROJECT CHIEF: D.J. Ackerman



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.

OBJECTIVE: (1) Describe the hydrologic system, including aquifer designation, hydraulic characteristics, and quality of the water within the regional aquifers. (2) Create a data base, including water use, water levels, lithologic logs, geophysical logs, and chemical analyses of water samples. (3) Describe historic, present, and future problems associated with use of water. (4) Evaluate aquifers system responses to future conditions.

APPROACH: (1) Compile and analyze hydrologic, geologic, and water-quality data. (2) Collect and analyze new data where needed and if feasible. (3) Develop computer models of the aquifers or aquifer systems. (4) Evaluate past and future impacts on the system resulting from development of ground water.

PROGRESS DURING 1990: Report was approved by the Director as an Open-File Report and Professional Paper. Project was completed.

REPORTS:

Ackerman, D.J., 1987, 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: Water Resources Investigations Report 87-4282, 1 sheet.

_____ 1989a, Hydrology of the Mississippi River Valley alluvial aquifer, south-central United States--A preliminary assessment of the regional flow system: Water-Resources Investigations Report 88-4028, 74 p.

_____ 1989b, Potentiometric surfaces of the Mississippi River Valley alluvial aquifer, eastern Arkansas, spring 1972 and 1980: Water-Resources Investigations Report 88-4075, 1 sheet.

_____ 1990, Hydrology of the Mississippi River Valley alluvial aquifer, south-central United States: U.S. Geological Survey Open-File Report 90-358, 115 p.

AR-050 ESTIMATING SCOUR AT BRIDGE PIERS ON STREAMS IN ARKANSAS

DATE PROJECT BEGAN: April 1985

DATE PROJECT ENDS: September 1991

PROJECT CHIEF: Rodney E. Southard

LOCATION: Statewide

COOPERATING AGENCY: Arkansas State Highway and Transportation Department

PROBLEM: Adequate definition of potential scour at bridge piers is essential to proper design, construction, and maintenance of hydraulic structures. Several formulas for predicting scour are available, but the large range in predicted scour depths (0 to 30 feet) have 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.

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

APPROACH: Select about 20 sites on streams that are not undergoing channel adjustments, preferably at gaging stations. During flood events bed profiles will be defined below the upstream and downstream handrails as well as 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 10 equal width sections to define the average natural suspended sediment. Regression analyses will be made to relate maximum scour to physical characteristics of the stream.

PROGRESS DURING 1990: Scour data have been collected at 2 of the 21 sites. The mobile scour monitoring system was tested during the extreme flooding that occurred in the Red River basin in May 1990. The results indicated that as much as 15 feet of scour had occurred in the main channel at the U.S. 71 crossing. Scour data were collected at three crossings of the Red River for use in the scour project.

PLANS FOR 1991: Maintain readiness for future scour events, evaluate scour on nonproject sites, and do a preliminary evaluation of existing scour equations.

REPORTS:

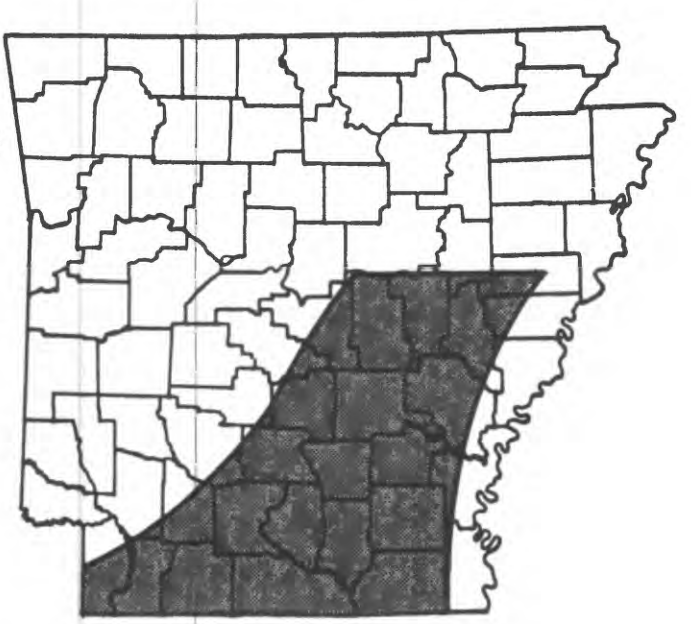
Southard, R.E., 1989, A mobile scour monitoring system for use at bridges: Bridge Scour Symposium, October 1989, Proceedings.

AR-051 GEOHYDROLOGIC CHARACTERISTICS OF THE SPARTA AQUIFER IN SOUTH-CENTRAL ARKANSAS

DATE PROJECT BEGAN: January 1985

DATE PROJECT ENDS: October 1988

PROJECT CHIEF: Daniel J. Fitzpatrick



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

PROBLEM: Locally heavy pumpage has resulted in significant drawdown cones in the Sparta aquifer in southern and south-central Arkansas. Water levels have been drawn down as much as 300 feet since pre-aquifer development. Projections indicated water levels decreasing to below the top of the aquifer in some areas by 1990. In addition to potentially decreasing water availability, declining water levels also increase the potential for ground-water contamination. There is currently no means by which the impact of additional pumping stresses on water-level declines in the Sparta aquifer can be determined for water management uses.

OBJECTIVE: Simulate ground-water flow in the Sparta aquifer using a digital model for the purpose of evaluating the effect of present and future pumping stresses on the aquifer within the areas of concern. The model would be used by water managers as a tool in assessing the feasibility of proposed withdrawals from the Sparta aquifer.

APPROACH: (1) Assemble and evaluate existing data to define the hydrogeologic system as it relates to model input. (2) Develop appropriate input schemes to the new Water Resources Division three-dimensional flow model. (3) Make model runs.

PROGRESS DURING 1990: Project is completed.

REPORTS:

Fitzpatrick, D.J., Kilpatrick, J.M., and McWreath, Harry, 1990, Geohydrologic characteristics and simulated response to pumping stresses in the Sparta aquifer in east-central Arkansas: U.S. Geological Survey Water-Resources Investigations Report 88-4201, 50 p.

AR-052 WATER PLAN FOR ARKANSAS

DATE PROJECT BEGAN: June 1985

DATE PROJECT ENDS: June 1991

PROJECT CHIEF: Valarie A. Leidy

LOCATION: Statewide

COOPERATING AGENCY: Arkansas Soil and Water Conservation Commission

PROBLEM: Water legislation passed by the 1985 Arkansas Legislature requires that a determination of the State's water needs be made by the Arkansas Soil and Water Conservation Commission (ASWCC) prior to the 1987 legislative session. The ASWCC has determined that the State Water Plan for Arkansas, initially completed in 1975, should be updated prior to January 1987 using all available hydrologic information in the State. The cooperative program between U.S. Geological Survey (USGS) and ASWCC is an effective mechanism for providing hydrologic information and expertise to assist State agencies in meeting their water-information needs.

OBJECTIVE: To provide hydrologic assistance to the ASWCC for the pending State Legislative session, and to provide hydrologic information as needed for water resources planning and management.

APPROACH: Perform data retrieval from USGS data bases and apply appropriate data analysis techniques for interpretation.

PROGRESS DURING 1990: All State Water Plan reports have been published, including the Executive Summary. Technical assistance was provided to the cooperator in obtaining flow information to use when setting minimum streamflows for the Arkansas River.

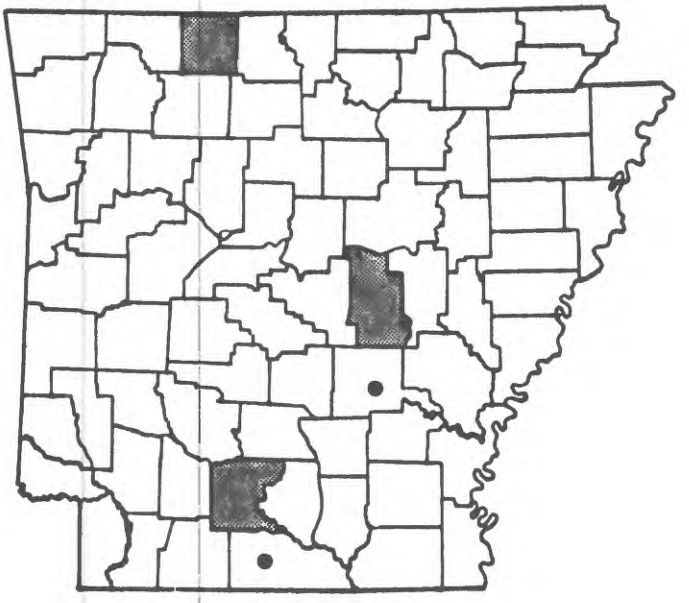
PLANS FOR 1991: Continue to assist ASWCC in obtaining flow information to aid in setting minimum streamflows. Conduct data retrievals and analyses as needed in order that ASWCC continues its mission of water-resource planning and management in Arkansas.

AR-053 GROUND-WATER PROTECTION STRATEGY FOR ARKANSAS

DATE PROJECT BEGAN: September 1985

DATE PROJECT ENDS: September 1991

PROJECT CHIEF: E.E. Morris



COOPERATING AGENCY: Arkansas Department of Pollution Control and Ecology

PROBLEM: The State of Arkansas, as part of their Ground-Water Protection Strategy, has designated five areas in the State as prototype study areas. These five prototype areas were selected as representative of either a particular geologic region, aquifer recharge area, or community water supply, or economic activity common in the State. These are as follows: a portion of Ouachita County, a recharge area of the Sparta aquifer; a portion of Lonoke County, an agricultural community in the Mississippi River alluvial plain; the city of Pine Bluff, Jefferson County, a community supply system in the Arkansas River Valley; northern Boone County, a karst area; and the city of El Dorado, Union County, an industrialized urban center in the oil-producing area of Arkansas. Other study areas will be investigated as mutually selected to address specific or potential ground- water problems.

OBJECTIVE: To determine ambient ground-water quality from five prototype ground-water monitoring areas and potential contamination problem areas as defined by the Arkansas Department of Pollution Control and Ecology.

APPROACH: Assist the Arkansas Department of Pollution Control and Ecology personnel in well selections and sampling at approximately 80 wells in five prototype areas and in potential contamination problem areas.

PROGRESS DURING 1990: Report discussing the hydrology, geochemistry, and potential for contamination of water in the shallow aquifers of northwestern Boone County has been completed. The karst terrain of Boone County represents one of five areas selected by the Arkansas Department of Pollution Control and Ecology for prototype environmental studies. The Lonoke County report has been completed and printed. This prototype environmental study area represents an intense agricultural development locality in the Mississippi River Alluvial Plain. Ten wells were sampled for pesticides in northeast Arkansas as part of a continuing surveillance of possible ground-water contamination because of agricultural activities.

PLANS FOR 1991: Select appropriate wells in five counties of northeastern Arkansas for obtaining water samples from the Mississippi River Valley alluvial aquifer for analyses of pesticides.

REPORTS:

Leidy, V.A., and Morris, E.E., 1990, Ground-water quality and preliminary assessment of the potential for contamination beneath agricultural lands in central Lonoke County, Arkansas: U.S. Geological Survey Water-Resources Investigations Report 90-4099, 31 p.

____ 1991, Hydrogeology and quality of ground water in the Boone Formation and Cotter Dolomite in karst terrain of northwestern Boone County, Arkansas: U.S. Geological Survey Water-Resources Investigations Report 90-4066, 57 p.

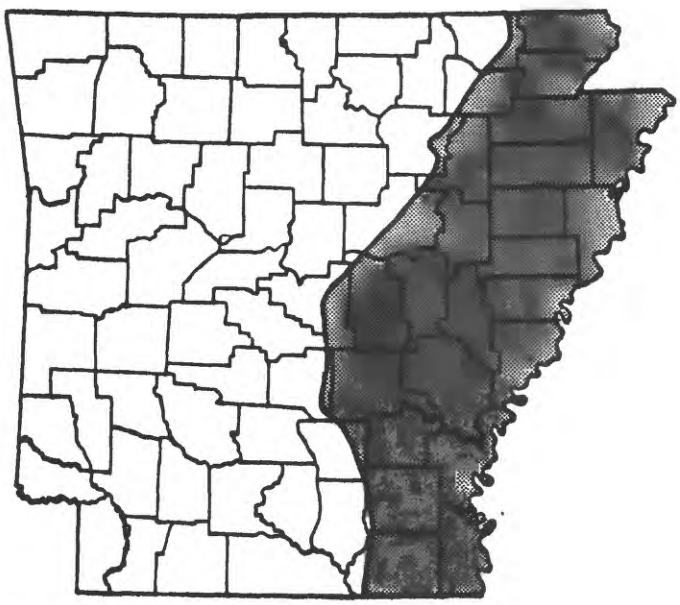
AR-055 EAST ARKANSAS COMPREHENSIVE STUDY

DATE PROJECT BEGAN: October 1985

DATE PROJECT ENDS: September 1995

PROJECT CHIEF: Gary L. Mahon

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



PROBLEM: The alluvial aquifer in eastern Arkansas is heavily used for irrigation of rice, cotton, and soybeans. In 1981, 4,300 million gallons per day of water were withdrawn from approximately 35,000 wells that tap the aquifer. The extensive use of water has caused increasing competition among water users for the remaining supplies and a lowering of the potentiometric surface with resulting increase in pumping lift. In places, only 20 feet of saturated thickness remain. Water users need the best information possible concerning quantities of water that can be withdrawn without causing adverse effects to the aquifer.

OBJECTIVE: First, to define the existing hydrologic conditions in the alluvial aquifer; second, to simulate these conditions through digital modeling at a scale sufficiently definitive for evaluating local pumping strategies; third, to provide the cooperator with the means to assess the hydrologic and economic impacts of future ground-water development in the alluvial aquifer; and fourth, to perform a conjunctive use-sustained yield pumping analysis for the alluvial aquifer to define areas of deficient ground water for which surface water supplies will be required to meet future demands.

APPROACH: Phase 1 will refine the broad regional conceptual model that was developed as part of the Gulf Coast Regional Aquifer System Analysis (RASA) study. Phase 2 will be conducted by University of Arkansas personnel and will consist of a review and comparison of existing methodologies designed to optimize ground-water management methodologies with respect to conjunctive use, sustained yield and ground-water mining. Phase 3 will involve simulation of the flow system in the aquifer using standard USGS models. This phase may require development of either one or two models depending on computer storage requirements. Phase 4 will involve demonstrating the application of selected optimization methodologies to hypothetical critical-resource areas similar to those in eastern Arkansas to assess the validity of the techniques. The most promising technique will then be linked to the hydrologic model or models in the study area. The final phase of the study will be the preparation of an interpretive report or reports summarizing results of the combined flow and management analysis. One of the reports will discuss results of the comparative analysis of existing conjunctive use-sustained yield pumping strategies conducted as part of phase 2.

PROGRESS: Calibration of digital flow models for the areas north and south of the Arkansas River was completed at a 1x1 mile grid. Pumpage data were compiled and evaluated from actual 1988 water-use data. The actual 1988 water-use distribution was extrapolated backward in time to test pumpage stresses in earlier periods of ground-water development in the northern area. Pumpage stress in the south model was applied as a county average-per-cell value for each county in the south area. Both models are calibrated against the 1972 potentiometric surface and selected well hydrographs for the seven stress periods. A report comparing accuracy and computational requirements for steady-state and transient optimization model results was approved for publication in the "Selected Papers in the Hydrologic Sciences" series. These results provide a framework for sustained-yield analysis of optimized ground-water withdrawals.

PLANS: Complete a report summarizing the ground-water flow modeling north and south of the Arkansas River at a 1x1 mile cell size. Data compilation will begin for modeling the optimal use of surface and ground water in both study areas at a 1x1 mile cell size. Optimization modeling will begin with the area north of the Arkansas River and west of Crowleys Ridge. A 2-year effort will be required to complete the consumptive use, sustained yield analysis. The Soil Conservation Service and the Memphis and Vicksburg Districts, Corps of Engineers have been requested to provide technical assistance.

REPORTS:

Mahon, G.L., and Ludwig, A.H., 1990, Simulation of ground-water flow in the Mississippi River Valley alluvial aquifer in eastern Arkansas: U.S. Geological Survey Water-Resources Investigations Report 89-4145, 26 p.

Mahon, G.L., Terry, J.E., and Peralta, R.C., 1989, Water-resources development alternatives for the Mississippi Alluvial Plain in eastern Arkansas: American Water Resources Association, Conference Proceedings, September 1989, Tampa, Fla.

Peralta, R.C., Cantiller, R.R.A., and Mahon, G.L., in press, Maximizing sustainable ground-water withdrawals: comparing accuracy and computational requirements for steady- and unsteady-state digital modeling approaches: U.S. Geological Survey Water-Supply Paper series, "Selected Papers in Hydrologic Sciences."

Westerfield, P.W., 1989, Ground-water levels in the alluvial aquifer in eastern Arkansas, 1987, U.S. Geological Survey Open-File Report 89-64, 32 p.

_____ 1990, Water-level maps of the Mississippi River Valley alluvial aquifer in eastern Arkansas, 1987: U.S. Geological Survey Water-Resources Investigations Report 90-4089, 1 sheet.

Westerfield, P.W., and Baxter, C.R., 1990, Ground-water levels in the alluvial aquifer in eastern Arkansas, 1988: U.S. Geological Survey Open-File Report 90-383, 32 p.

AR-056 FLOOD HYDROGRAPHS

DATE PROJECT BEGAN: October 1986

DATE PROJECT ENDS: September 1989

PROJECT CHIEF: Braxtel L. Neely, Jr.

LOCATION: Statewide

COOPERATING AGENCY: Arkansas State Highway and Transportation Department

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.

OBJECTIVE: Investigate existing methods or develop new methods for determining flood- frequency discharges.

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) determine procedure 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 by Georgia in a similar study. If there are no serious deviations, the dimensionless hydrographs developed by Georgia will be used in this study. The major effort in this study will be to determine lag time.

PROGRESS DURING 1990: Report published. A method is presented for estimating typical hydrographs for streams in Arkansas. Project was completed.

REPORTS:

Neely, B.L., Jr., 1989, Estimating flood hydrographs for Arkansas streams: U.S. Geological Survey Water-Resources Investigations Report 89-4109, 19 p.

_____ 1990, Flood of December 1987 in central and eastern Arkansas: U.S. Geological Survey Water-Resources Investigations Report 89-4188, 16 p.

AR-057 INSTALLATION RESTORATION PROGRAM - PHASE II, STAGE 1 CONFIRMATION/QUANTIFICATION, LITTLE ROCK AIR FORCE BASE, LITTLE ROCK, ARKANSAS

DATE PROJECT BEGAN: November 1986

DATE PROJECT ENDS: September 1990

PROJECT CHIEF: David A. Freiwald

COOPERATING AGENCY: U.S. Air Force

PROBLEM: Past and present activities at the Little Rock Air Force Base (LRAFB) 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. Twenty potentially contaminated sites have been identified, which required a hydrogeologic contamination investigation to confirm if an environmental hazard exists.

OBJECTIVE: (1) Conduct a remedial investigation to determine the presence or absence of contamination in the areas immediately surrounding the 20 identified sites on the Little Rock Air Force Base. (2) If contamination exists, the contaminants will be identified and their potential for migration assessed by performing a qualitative risk assessment. (3) Conduct a feasibility study to develop preliminary remedial action alternatives consistent with the National Contingency Plan for those sites that pose a threat to human health and welfare or the environment.

APPROACH: Surface geophysics will be used to locate landfill boundaries and contaminated ground-water plumes. A soil gas survey using a portable gas chromatograph will be used onsite to locate a jet fuel pipeline leak. Approximately 87 shallow (30 feet) and eight deep (80 feet) monitoring wells will be installed adjacent to potentially contaminated areas. Soil, bed material, and surface and ground-water samples will be obtained and analyzed for petroleum hydrocarbons, volatile organic compounds, priority pollutant metals, extractable priority pollutants and pesticides. All data collected are to be analyzed by U.S. Environmental Protection Agency (EPA) guidelines and presented in Air Force format.

PROGRESS DURING 1990: Project was completed.

AR-058 WETLAND RESEARCH PROJECT, BLACK SWAMP, CACHE RIVER, WOODRUFF COUNTY, ARKANSAS

DATE PROJECT BEGAN: October 1986

DATE PROJECT ENDS: September 1992

PROJECT CHIEF: Gerard J. Gonthier

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

PROBLEM: The Corps of Engineers (COE) has the responsibility to regulate activities in wetlands of the United States under Section 404 of the Clean Water Act. Existing 404b(1) guidance requires the Corps, along with the Environmental Protection Agency (EPA) and State pollution agencies to consider the water quality and hydrologic impacts of dredge and fill projects. Wetland hydrologic and sedimentologic budgets have been poorly documented and are a prerequisite for a detailed water-quality study. Wetlands are presumed to affect water quality through element cycling, sediment deposition, ion adsorption or transformation, and temperature modification; however, their actions are generally poorly understood and may be most poorly understood in bottomland hardwood systems found in the lower Mississippi Valley.

OBJECTIVE: (1) To define the surface water budget of the Black Swamp wetland; (2) to define the sediment budget of the wetland; (3) to evaluate the ground-water flow system of the wetland; (4) to assist in collection of water-quality data; and (5) to assist in interpretation to the total functions of the wetlands.

APPROACH: (1) Establish one continuous discharge station and compute daily discharges for an existing Corps gage on the Cache River (the principle stream in the study area) and also establish four stage stations with periodic discharge measurements; (2) establish two daily sediment stations on the Cache River, collect periodic sediment samples at four tributary stations, and collect water-quality samples for analysis by the Corps' contractor; (3)establish a network of monitoring wells using existing irrigation and domestic wells and USGS placed wells; and (4) evaluate results of data collected by all parties.

PROGRESS DURING 1990: Collected discharge and sediment at two continuous record stations and stage data at one station. Collected ground-water levels at 123 wells every month. Drilled and set 32 monitoring wells. Established 10 staff gages.

REPORTS:

Hupp, C.R., and Morris, E.E., 1990, A dendrogeomorphic approach to sedimentation in a forested wetland, Black Swamp, Arkansas: Wetlands, v. 10, no. 1, p. 107-124.

Kleiss, B.A., and others, 1988, A comparison of methods for calculating chemical loading rates for a bottomland hardwood stream: 9th Annual Meeting of the Society of Wetland Scientists, Washington, D.C. (abstract).

_____ 1989, Preliminary results of chemical loading studies for a river adjacent to a bottomland-hardwood wetland in east-central Arkansas: 10th Annual Meeting of the Society of Wetland Scientists, May-June 1989, Orlando, Fla. (abstract).

Kleiss, B.A., and others, 1990, Modification of riverine water quality by an adjacent bottomland hardwood wetland: American Water Resources Association, Conference Proceedings, September 1989, Tampa, Fla.

Kleiss, B.A., Theriot, R.F., and Morris, E.E., 1989, Capacity of a bottomland-hardwood wetland to remove riverine suspended solids: Nonpoint Source Conference, April 1989, St. Louis, Mo. (abstract).

Morris, E.E., Kleiss, B.A., and Nix, J.F., 1989, The capacity of a bottomland-hardwood wetland to modify the chemical and sediment composition of an adjacent riverine system: U.S. Geological Survey National Symposium on Water Quality Conference Proceedings, November 1989, Orlando, Fla. (abstract).

AR-059 LOW-FLOW CHARACTERISTICS OF ARKANSAS STREAMS

DATE PROJECT BEGAN: August 1987

DATE PROJECT ENDS: September 1991

PROJECT CHIEF: A.H. Ludwig

LOCATION: Statewide

COOPERATING AGENCY: Arkansas Soil and Water Conservation Commission

PROBLEM: Specific information on low flow in streams is essential to State water-management agencies such as the Soil and Water Conservation Committee and the Arkansas Department of Pollution Control and Ecology (ADPCE) 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.

OBJECTIVE: (1) To update 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 III method and (or) a graphical method; (2) low-flow data will be collected during the project in order 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 climate 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 DURING 1990: All discharge measurements for partial-record stations, including historic records, were put into the computer (ADAPS). Computed low-flow frequency and duration values for all current daily discharge stations through water year 1989 and for the period of record for discontinued daily discharge stations. Correlated low-flow measurements from approximately 100 partial-record stations with index stations.

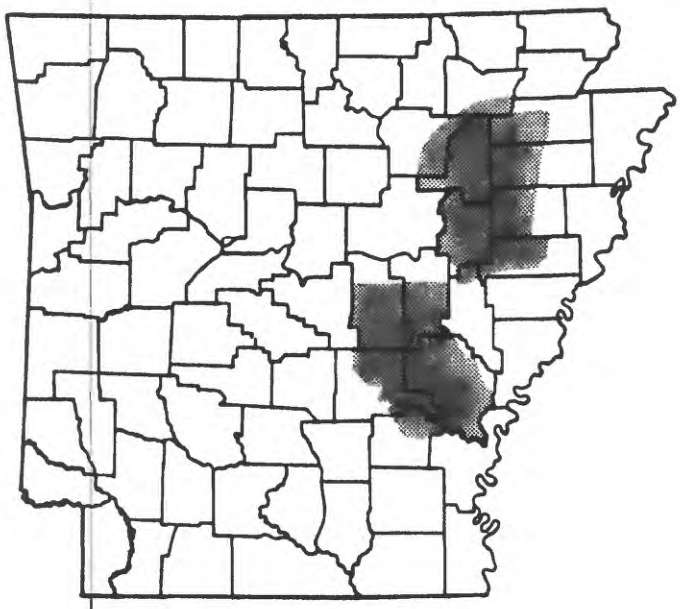
PLANS FOR 1991: Complete data analysis and prepare report on low-flow characteristics of Arkansas streams. Develop regression equations for estimating low flows at ungaged sites and prepare a report on the same. Develop a method for evaluating low-flow characteristics of streams in the Mississippi River Alluvial Plain (eastern Arkansas).

AR-060 ARTIFICIAL RECHARGE--EASTERN ARKANSAS

DATE PROJECT BEGAN: January 1988

DATE PROJECT ENDS: September 1990

PROJECT CHIEF: Daniel J. Fitzpatrick



COOPERATING AGENCY: Arkansas Soil and Water Conservation Commission

PROBLEM: Heavy pumpage for irrigation from the alluvial aquifer in eastern Arkansas has resulted in significant drawdown in some areas. The most severe of these are located in Arkansas, Prairie, and Cross Counties. Numerous wells have failed in the past as a result of water levels declining below intake pumps. The potential for shortages of ground-water supplies has become of increasing concern to farmers in eastern Arkansas, as well as to water managers. As a result, alternate water supplies to meet future demands are being examined. The artificial recharge of surplus water to the alluvial aquifer are among the options being considered.

OBJECTIVE: (1) Perform a preliminary assessment of the potential for recharging of the alluvial aquifer through artificial means in areas where critical drawdown has occurred. (2) Perform a semi-quantitative cost comparison of selected methods. (3) Formulate a proposal for detailed investigation, such as field testing of individual methods(s) determined to have potential for enlarging water availability within the study area.

APPROACH: Project objectives will be accomplished by first evaluating geohydrologic characteristics of the alluvial aquifer with regard to artificial recharge potential. Individual recharge methods will be evaluated with regard to local geohydrologic conditions. Methods deemed applicable will be evaluated based on a relative cost comparison. Cost estimates will be based on assumptions of recharge rates, rates needed to achieve target water levels, and water treatment needs. A preliminary assessment of the potential impact of artificial recharge on ground-water quality will consist of summarizing both quality-water characteristics of potential recharge sources as well as effects on ground-water quality as determined from past studies.

PROGRESS DURING 1990: Project was completed.

REPORTS:

Fitzpatrick, D.J., 1991, A preliminary assessment of the potential for artificial recharge in eastern Arkansas: U.S. Geological Survey Water-Resources Investigations Report 90- 4123, 32 p.

AR-061 STATEWIDE SURFACE-WATER QUALITY TRENDS

DATE PROJECT BEGAN: November 1987

DATE PROJECT ENDS: September 1991

PROJECT CHIEF: James C. Petersen

LOCATION: Statewide

PROBLEM: Statewide, a systematic investigation of trends in water-quality data during the last 15 years and probable cause of these trends has not been performed.

OBJECTIVE: To investigate water-quality data time trends of Arkansas streams.

APPROACH: (1) Use computerized system for analysis of time trends of water-quality data to analyze data at approximately 100 stations. (2) Evaluate preliminary results and related information for evidence of field or laboratory bias which may affect any detected trends. (3) Eliminate biased data from the datasets and reanalyze affected data for trends. (4) Summarize the results in tables and illustrations to show the magnitude and geographic distribution of trends.

PROGRESS DURING 1990: Preliminary analyses have been completed for approximately 25 water-quality properties and for two time periods (1975-86 and 1975-90). Data, which are suspected to be biased by field or laboratory procedures, have been eliminated from data sets for several properties. Evaluation of data for other properties is continuing.

PLANS FOR 1991: Finalize trend analysis of stations and prepare report.

AR-062 GEOGRAPHIC INFORMATION SYSTEM (GIS)--ARKANSAS

DATE PROJECT BEGAN: October 1988

DATE PROJECT ENDS: September 1991

PROJECT CHIEF: Jim E. Monical

LOCATION: Statewide

COOPERATING AGENCY: Arkansas Soil and Water Conservation Commission

PROBLEM: Water managers and planners make interpretations and decisions based on various kinds of water resources related data. In Arkansas, these data collected by Federal, State, and local government agencies are stored in different formats as well as different physical locations. This makes visual inspection and comprehensive interpretation by water resources managers difficult. Much of these water-related data need to be in an easily accessible data base with supporting software so that quick and meaningful displays and interpretations can be made.

OBJECTIVE: (1) Develop GIS coverages of the most recent data relating to ground-water and surface-water withdrawals from data available in the USGS New Site Specific Water Use Data System (NEWSWUDS), (2) develop GIS coverage of all rural water delivery systems in Arkansas using map data from the Arkansas Soil and Water Conservation Commission (ASWCC), and (3) develop GIS coverage of public water supply wells throughout Arkansas from data available in NEWSWUDS.

APPROACH: This project will be conducted in cooperation with the ASWCC. The initial coverage for the first objective will be completed the first year. A NEWSWUDS retrieval will be used to build an ASCII file containing location and attribute information for ground-water and surface-water withdrawal sites and to build the GIS coverage. The ASWCC will provide map data of all rural water delivery systems throughout Arkansas. These data will be digitized at 1:100,000 scale on a county-by-county basis into a GIS layer. Transportation and hydrography layers will be obtained from National Mapping Division at the 1:100,000 scale. These data will be paneled into complete quad coverage. They will then be clipped into the individual county coverage. The third coverage will be completed by the end of the third year. This will be developed in much the same way as the coverage in objective one. Location and attribute data will be retrieved from NEWSWUDS and will be used to build the point coverage of public water supply wells.

PROGRESS DURING 1990: Map-joined all the necessary DLG coverages and then constructed all the county road network coverages and county stream coverages that will be used in the project. Finished digitizing all of the county boundaries for the state and creating the county boundary coverages. Have begun developing coverages for ground-water and surface-water withdrawals using data from NEWSWUDS.

PLANS FOR 1991: Finish digitizing rural water delivery systems. Finish software development phase of the project and begin testing and implementing the software.

AR-063 TWO-DIMENSIONAL FLOW MODEL FOR BRIDGE SITES IN ARKANSAS

DATE PROJECT BEGAN: January 1989

DATE PROJECT ENDS: December 1989

PROJECT CHIEF: Braxtel L. Neely, Jr.

LOCATION: Statewide

COOPERATING AGENCY: Arkansas State Highway and Transportation Department

PROBLEM: Adequate information on flow through bridges is essential to proper design and construction of bridges on flood plains in Arkansas. It is important to know the changes in water surface elevations caused by the construction of bridges such as the amount of backwater created by the construction. The position and length of relief bridges on the flood plain is needed to assure that the optimum balance is obtained when passing the flow through the structure. The amount of velocity at selected points through the structure is needed for the proper design of piers and piles.

OBJECTIVE: To develop a two-dimensional flow model using the momentum and continuity equations for computing velocities, water surface elevations, and distribution of flow among bridges on flood plains in Arkansas. Input for the model will be ground elevations, roughness coefficients, bridge geometry, and design discharge. The model will be tested and guidelines for inputting data to the model will be documented. The final results will be a table and map showing water surface elevations and velocity magnitude and direction at each grid point.

APPROACH: The method for describing geometry of the flood plain, highway, and bridges is to establish a grid system that overlies the flow. The grid system will extend from about one valley width upstream from the highway to about one valley width downstream. At each grid point, the x and y coordinates, ground elevation, and roughness coefficient will be assigned. Water surface elevations will also be assigned to the grid points along the extreme downstream end of the grid system. The solution to the problem is achieved by balancing heads around each grid using the momentum equation.

PROGRESS DURING 1990: Additional computer runs were made to verify model results. Project is complete except report.

PLANS FOR 1991: Complete and publish report.

REPORT:

Neely, B.L., Jr., in review, Two-dimensional relaxation method flow model (RMFM) program for bridge sites: U.S. Geological Survey Water-Resources Investigations Report.

AR-064 HYDROLOGIC SURVEILLANCE OF LAKES MAUMELLE AND WINONA IN CENTRAL ARKANSAS

DATE PROJECT BEGAN: May 1989

DATE PROJECT ENDS: April 1992

PROJECT CHIEF: William R. Green

COOPERATING AGENCY: Little Rock Municipal Water Works

PROBLEM: Lakes Maumelle and Winona are municipal water supplies for the city of Little Rock and surrounding areas. Maintaining the quality of water in the lakes to meet drinking water regulations and to prevent increased water treatment costs is important. Changes in land use such as timber clearcutting and sod farming in the watersheds have caused concern about the effects of these changes on the quality of water and the rate of sedimentation in the lakes. Sufficient data are currently not available, however, to assess the impacts of these land use practices on Lakes Maumelle and Winona.

OBJECTIVE: (1) To assess the present water quality of Lakes Maumelle and Winona, and (2) to establish a comprehensive hydrologic data base that can be used by the Little Rock Municipal Water Works and others to evaluate the impact of future land use practices in the watersheds.

APPROACH: Sampling network consists of six sites in Lake Maumelle and of four sites in Lake Winona watersheds. Stage data at two sites in each watershed transmitted by telemetry. Water samples collected quarterly and during three high streamflow events each year at two Maumelle and one Winona sites. Triannual vertical profiles determined at four Maumelle and three Winona sites. Lake-bottom profiles determined at four Maumelle and three Winona sites. Water-budget analysis based on data at daily discharge stations. Summary report written in third year of study.

PROGRESS DURING 1990: Water-quality data from both Lakes Maumelle and Winona continued to remain at or below levels typical of undisturbed watersheds in the area. Both lakes exhibit typical annual physical and chemical events (stratification and thermal breakdown).

PLANS FOR 1991: Continue quarterly and triannual sampling as planned; conduct three high streamflow event sampling when conditions permit. Obtain lake-bottom profiles for Lake Winona. Continue processing of discharge and water-quality data for annual report and end-of-project interpretative water-resources investigations.

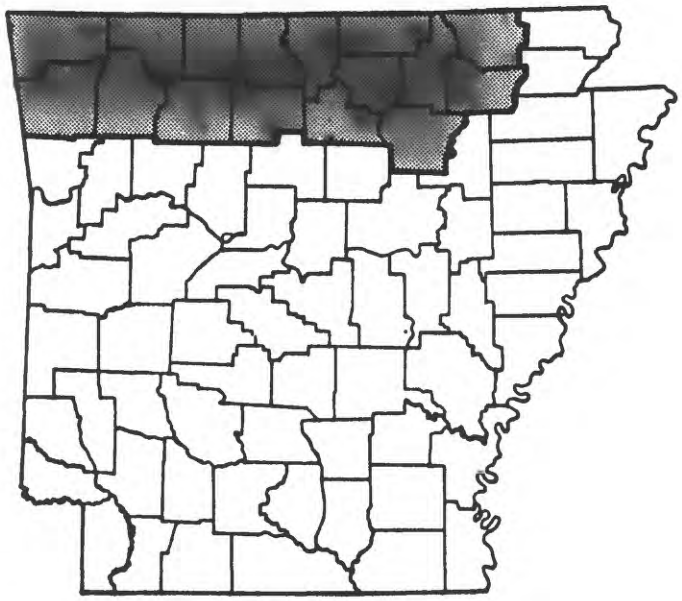
AR-065 HYDROLOGIC STUDIES--NORTHWEST ARKANSAS

DATE PROJECT BEGAN: October 1989

DATE PROJECT ENDS: September 1993

PROJECT CHIEF: John V. Brahana

COOPERATING AGENCIES: University of Arkansas and Arkansas Soil and Water Conservation Commission



PROBLEM: Little is really known or understood about the hydrologic flow systems or the geochemistry of the contained water in the karst-terrain environment. Flow of water in and between the shallow aquifers is complicated and unknown. Ground-water and surface-water systems are strongly interrelated. Industrial and land-use changes have an important effect on geochemistry and quality of water in the shallow hydrologic systems. Flow systems are becoming subjected to more and more potential contamination. Quantification of the deeper hydrologic flow systems is lacking. Sources and extent of unacceptably high levels of fluoride and radionuclides are unknown.

OBJECTIVE: Locate and identify wells, springs, sinkholes, and caves in order to establish water-level and water-sampling networks and to compile hydrologic databases. Assemble land- and water-use information. Initiate tests and site studies to begin quantification of the hydrologic systems. Identify areas readily susceptible to non-point source contamination and determine effects on the hydrologic systems. Document sources and extent of water-quality aberrations. Identify hydrologic anomalies for research to resolve specific questions-problems and to contribute to a better understanding of the complex flow systems. Use hydrologic databases and GIS coverage to better comprehend and manage the hydrologic flow systems.

APPROACH: To accomplish the wide-ranged scope of this planned long-term study will necessitate contributions from various Federal, State, local, and private entities. Project Chief's affiliation with the University of Arkansas at Fayetteville will facilitate use of additional resources. Measuring, sampling, and testing will be accomplished by joint-participation efforts under guidance of USGS. University and USGS personnel will conduct site-specific and problem-specific investigations. Information will be available in USGS computer database and files, and used to establish GIS coverage. Reports will be written in order to share results with other investigators, concerned agencies, and public.

PROGRESS DURING 1990: More than 80 wells and springs have been located and identified with reference to potential for future water level and water quality sampling in Boone County. Karst features, particularly point input sources such as sinkholes, swallets, and losing stream reaches have been identified with reference to potential for dye-tracing studies. Preliminary data and literature searches have been completed, and two reports are in progress. Structural contour maps on key horizons necessary to identify aquifers have been developed, and data have been field checked prior to input into GIS.

PLANS FOR 1991: Continue locating and identifying wells, springs, and surface point-source karst features throughout northwest Arkansas, with emphasis on key hydrologic boundaries. Initiate data-collection program in Carroll County using input/assistance from local cooperator to identify key hydrologic features. Complete data report and preliminary conceptual model of flow in the study area, and present results of preliminary findings to relevant scientific symposia. Initiate quantitative testing of hypotheses, constraining conceptual model with flow data, geochemistry, isotopes, flow tracing, and age-dating, where feasible. Continue investigation into natural radionuclide distribution in deep aquifers, focusing on source and area of occurrence.

AR-066 VULNERABILITY TO POTENTIAL SURFACE CONTAMINATION OF PUBLIC WATER-SUPPLY WELLS IN ARKANSAS

DATE PROJECT BEGAN: October 1989

DATE PROJECT ENDS: September 1990

PROJECT CHIEF: Valarie A. Leidy

COOPERATING AGENCY: Arkansas Department of Health

PROBLEM: More than 800 public water-supply wells exist in Arkansas and some may be vulnerable to surface or near surface contamination depending on the geohydrologic environment. Vulnerability of aquifer water to contamination is high for wells completed in an unconfined aquifer or in a karst environment. Even wells completed in a confined aquifer could be vulnerable depending on well construction, breach in the confining unit, availability of corroded well casings or open holes, faulting, and geohydrologic properties. Arkansas Department of Health needs an evaluation of these wells in relation to geohydrologic conditions to safeguard the public water-supply systems from surface contaminations.

OBJECTIVE: (1) Evaluate each public water-supply well or well field to determine its vulnerability to potential surface contamination, (2) define the recharge areas for the aquifers under consideration, (3) calculate time-of-travel based on hydrologic conditions around these wells or well fields with a high vulnerability, and (4) identify potential sources of contamination in relation to location of public water-supply wells.

APPROACH: Assemble and tabulate well and related data for Union County from various sources, including Arkansas Department of Health, Arkansas Geological Commission, and Arkansas Water Well Construction Commission. Visit each site to confirm location, usage, well construction, topographic setting, and local geologic and hydrologic conditions, and to obtain water-level measurements. Analytically determine vulnerability of each well or well field to potential surface contamination and, if high, calculate time-of-travel for contaminant based on local geohydrologic conditions. Public-supply wells and potential contaminant sites will be plotted on a map. Recharge areas to aquifer(s) of concern will be defined.

PROGRESS DURING 1990: All data have been collected and 51 public-supply well sites have been visited. Analytical computations have been made on the data. Project is complete except report.

PLANS FOR 1991: Obtain Director's approval of report and publish in 1991.

AR-067 NATIONAL WATER-QUALITY ASSESSMENT PROGRAM

DATE PROJECT BEGAN: October 1991

DATE PROJECT ENDS: Continuing

PROJECT CHIEF: David A. Freiwald

PROBLEM: The extensive karst features of the Ozark Plateau create a complex ground-water flow system and result in rapid and complex interactions between ground and surface water. The vast network of solution channels and conduits in the mostly carbonate aquifers is directly responsible for the fragile nature of the area. Surface contaminants are quickly transported from recharge areas, which often contain sinkholes and losing streams, and then are intercepted by wells or discharged at springs. Water-quality degradation has occurred in many areas as a result of land-use changes and increased agricultural-industrial activity. Poultry, cattle, and swine production along with septic tanks and sewage-treatment plants have impacted the water quality of the Ozark Plateaus region with nitrate, ammonia, and bacteria. Serious degradation has occurred in the ground and surface water because of abandoned lead and zinc mines from the early 1900's in the Tri-state area of Kansas, Missouri, and Oklahoma, and recent lead mining in southeastern Missouri. Elevated levels of radionuclides (radium 226 and 228) are evident in numerous public-water supply wells throughout the Ozark area, and highly saline ground water along the western boundary has caused wells to be abandoned.

OBJECTIVES: Describe the status and trends in the quality of the ground- and surface-water resources of the Ozark Plateau study unit. Provide a sound understanding of the natural and human factors that affect the quality of these resources. Integrate study unit results with regional and national synthesis activities to provide a foundation to assess specific water-quality issues of the Nation.

APPROACH: Compile and review available water-quality information for both ground- and surface-water resources for approximately the first 2 years. Intensively sample and analyze the water resources for a wide array of physical, chemical, and biological properties for a period of about 3 years. Create computer data bases of water-quality and ancillary information to effectively interpret and report the results. Intermittently monitor the water quality of the study unit for a period of about 5 years to establish trends using statistical and deterministic techniques.

PLANS FOR 1991: Form a 20-member liaison committee of Federal, State, and local agency personnel and meet to discuss study area problems and concerns. Evaluate existing reports and available data to assess the current understanding of the hydrology and water-quality resources. Begin to assemble a technical support staff for the study unit team.

REPORTS:

Freiwald, D.A. 1991, National water-quality assessment program--Ozark Plateaus study: U.S. Geological Survey Open-File Report 91-162, 1 sheet.

Petersen, J.C., and Freiwald, D.A., 1991, Planned biological aspects of the Ozark Plateaus NAWQA study: Arkansas Chapter of the American Fisheries Society (abstract).

AR-068 DETERMINATION OF STORMWATER RUNOFF QUALITY IN LITTLE ROCK, ARKANSAS

DATE PROJECT BEGAN: March 1991

DATE PROJECT ENDS: September 1993

PROJECT CHIEF: John M. Kilpatrick

COOPERATING AGENCY: City of Little Rock

PROBLEM: The quality of stormwater runoff has become a growing concern in and around the Nation's urbanized areas. Recently the U.S. Environmental Protection Agency focused even more attention on the problem when it finalized rules requiring the characterization of the quality of urban stormwater runoff in cities with populations of 100,000 or greater and selected urban unincorporated areas. As a result of these concerns and new rules the, city of Little Rock realized a need to characterize the quality of stormwater runoff in the city. The USGS in cooperation with the city initiated this study in the spring of 1991 to meet this need.

OBJECTIVE: (1) Characterize the quantity and quality of discharge from selected storm-sewer outfalls during periods of dry weather. (2) Characterize the quantity and the physical, chemical, and bacteriological quality of stormwater at 5 to 10 storm sewer outfalls, which drain areas of representative land uses. An estimation of annual constituent loading also will be made. (3) An attempt will be made to estimate annual constituent loading based on the information collected for item 2 and on regression equations that have previously been developed for this purpose.

APPROACH: Automatic samplers or field personnel will be used to collect representative stormwater samples at 5 to 10 sites. The validity of existing regional regression equations for estimation of constituent loads will be examined based on the data collected for the city of Little Rock. Once validated or adjusted, these equations will be used to estimate mean annual constituent loads for unsampled sites in the city of Little Rock.

PLANS FOR 1991: In the first year of the project, up to 250 stormwater outfalls will be screened during dry weather. Between 5 and 10 sites will be selected for representative stormwater sampling and gage installation during a later phase of this effort.

SOURCES OF WRD PUBLICATIONS AND INFORMATION

Publications of the U.S. Geological Survey

The Arkansas District has been preparing reports on water resources for several years. Professional Papers, Water-Supply Papers, and Bulletins are sold by the U.S. Geological Survey, Books and Open-File Reports; 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 the U.S. Geological Survey, Western Distribution Branch. Requests for topographic and geologic maps are often received by the Arkansas District. These maps are sold by the Arkansas Geological Commission for a nominal fee. U.S. Geological Survey Water-Resources Investigations Reports and Open-File Reports pertaining to Arkansas are available from the Arkansas District Office. In addition, these reports may be purchased as paper copy or microfiche from the Books and Open-File Reports.

Titles of new reports prepared by the Arkansas District are included in the free catalog Publications of the U.S. Geological Survey. To subscribe, write to:

New Publications of the Geological Survey
582 National Center
Reston, Virginia 22092

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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.

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

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 requester 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 Office

Public inquiries offices provide general information about the programs of the Geological Survey and its reports and maps. The Public Inquiries Office 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. The sell limited quantities of published maps and books over the counter and distribute circulars, nontechnical publications, catalogs, and indexes free of charge. Most maintain libraries of recent USGS book reports and are regional depositories for Open-File Reports.

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

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*U.S. Government Printing Office: 1991 — 531-124/40001