

# United States Geological Survey

## Programs in Arkansas

Fact Sheet



*The USGS provides maps, reports, and information to help others meet their needs to manage, develop, and protect America's water, energy, mineral, and land resources. We help find natural resources needed to build tomorrow, and supply scientific understanding needed to help minimize or mitigate the effects of natural hazards and environmental damage caused by human activities. The results of our efforts touch the daily lives of almost every American.*

The U.S. Geological Survey (USGS) has offices in every State and Commonwealth. This widely distributed network of scientific personnel is known for its impartial data collection and research. As the Nation's leading earth science agency, the USGS works cooperatively with local, State, and Federal agencies, enabling resource planners and others to make informed decisions based on objective information. This Fact Sheet describes a few of the USGS activities in Arkansas.

### Critical Ground-Water Areas

Pumping from the most productive aquifers in Arkansas, the Mississippi River Valley alluvial aquifer and the Sparta aquifer, has led to declining water levels throughout the Gulf Coastal Plain region of southern and eastern Arkansas (fig. 1). These aquifers are the principal source of water for irrigation, industrial, and public supplies in this region. Citizens have become concerned about the declining water levels, reduced well yields, and deterioration of the chemical quality of water in a number of areas in the region. The State Legislature has passed a bill that allows the Arkansas Soil

and Water Conservation Commission (ASWCC) to define critical ground-water areas and to restrict water use within them.

The ASWCC and the USGS have joined in a cooperative study to define these critical areas. A part of ASWCC's definition for a critical ground-water area involves the degree to which water levels are declining with respect to the top of the supplying aquifer and how rapidly water levels are declining on an annual basis. The USGS can provide this type of information because of its long-term records of water-level measurements, expertise in hydrology, and the ability to analyze data by using geographic information systems techniques.

Additionally, the USGS, in cooperation with the ASWCC, is developing digital computer models of the alluvial aquifers in eastern Arkansas. By using these models, a water manager will be able to estimate, for an area as small as 1 square mile, how much ground water can be pumped from the aquifer without unacceptable drawdowns, how much can be withdrawn from surface water sources, and how much of the proposed demand for water can be met by these sources.

### National Water-Quality Assessment Program

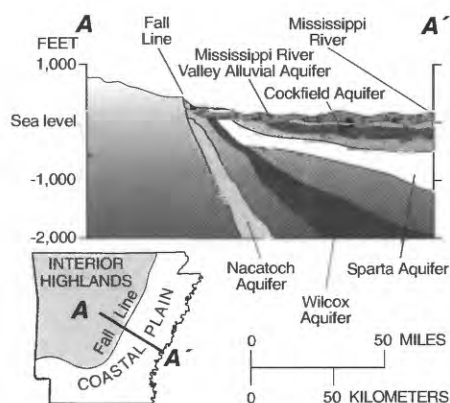
The USGS's National Water-Quality Assessment (NAWQA) Program began full-scale implementation in 1991 to provide policymakers and managers nationally consistent information describing the status and trends in the quality of the Nation's ground- and surface-water resources on a local, regional, and national level. In providing this information, USGS scientists are analyzing data describing climatological, geological,

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biological, land-use, and agricultural processes that may affect water quality and will help identify water-quality issues that affect specific hydrologic regions of the United States.

Currently (1995), there are two NAWQA Program study units within Arkansas—the Ozark Plateaus, implemented in 1991, and the Mississippi Embayment, implemented in 1994 (fig. 2). Specific issues being addressed in Arkansas include the effects of nutrients, bacteria, and pesticides from the application of animal manure, chemical fertilizers, and pesticides; septic tanks and point-source discharge from sewage-treatment plants; trace elements from lead, zinc, and coal mining operations;



**Figure 1.** Generalized hydrogeologic section of the Arkansas portion of the Coastal Plain.



**Figure 2.** National Water-Quality Assessment Program study units in Arkansas.

and encroaching or upwelling of saline ground water in areas of large ground-water withdrawals. The USGS is collecting 3 years of intensive field data and conducting a comprehensive analysis of historical water-quality data in each study area. In conducting these studies, the USGS is working in cooperation with over a dozen State agencies, universities, and Federal agencies within Arkansas.

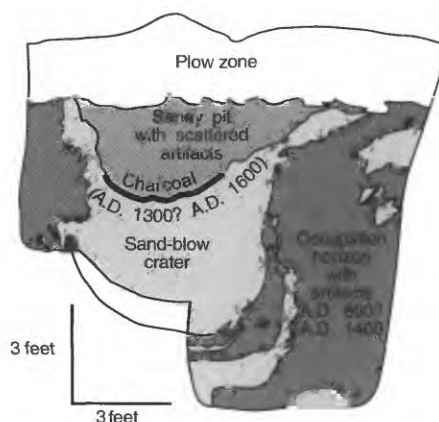
The interagency cooperation and multiscale approach of the NAWQA Program ensures that many critical water-resource concerns will be identified and addressed.

## Earthquake Hazards

Researchers from the USGS, the University of Arkansas, and the University of Maryland have been applying geological, archeological, and soil science methods to document large prehistoric earthquakes in northeastern Arkansas and southeastern Missouri. This region is the area that was most severely affected by the great New Madrid earthquakes of 1811–12. Although the modern rates of seismicity indicate that great earthquakes might occur every 550 to 1,200 years, widespread evidence of past earthquakes has been lacking. The new evidence, in the form of earthquake-generated, liquefied sand deposits, shows that at least three large earthquakes have occurred in the 2,000 years before 1811 (fig. 3). This is consistent with the record of past earthquakes at the nearby Reelfoot scarp in northwestern Tennessee. Continuing studies should result in a chronology of large earthquakes for the region, a critical aspect in the determination of earthquake hazards.

## Hydrologic Surveillance of Reservoirs

The USGS and Little Rock Municipal Water Works (LRMWW) have been working cooperatively since 1989 as partners in investigating the water quality of two water-supply reservoirs in central Arkansas, Lakes Maumelle and Winona (fig. 4). As part of this program, a comprehensive data base of water quantity and quality has been established and continues to be developed. The quality of water in these reservoir systems has been



**Figure 3.** Section of a trench wall at a site about 4 miles north of Blytheville, Arkansas, showing a prehistoric sand-blow crater cross-cutting a thick Native American occupation horizon containing artifacts. This sand-blow crater formed between A.D. 800 and A.D. 1400.

assessed relative to drinking water standards, other regional streams and reservoirs, and current trophic status.

Current study activities include mathematical and empirical modeling of the reservoirs. Applications of these modeling efforts include diagnostic and predictive measures of water-quality dynamics and the sensitivity of these water bodies to changes in chemical loading.

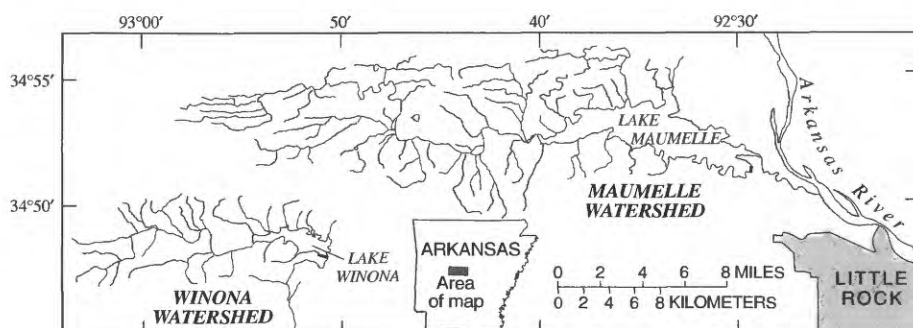
Additionally, the USGS has been conducting a detailed investigation to determine the characteristics, sources, and origin of the dissolved organic carbon (DOC) in the waters of the two reservoirs. Once DOC components have been characterized and the sources identified, LRMWW will be able to test chlorination and other treatment techniques within their pilot treatment plant. These findings will provide the LRMWW, as well as other drinking water utilities across the

State and Nation, with a better understanding of the necessary techniques in removing and (or) eliminating treatment byproducts from their finished product.

## Geohydrologic Studies in Northwestern Arkansas

The USGS has a long tradition of working cooperatively with colleges and universities on studies that provide not only a learning experience for students but expand the general pool of earth science knowledge and methods necessary to solve problems within Arkansas and the Nation. At the University of Arkansas–Fayetteville, 13 cooperative studies are currently underway including the following:

- A study to develop remote sensing and image-processing applications to map hydrologic resources by using geographic information and global positioning systems. These tools offer excellent potential to identify major springs in the remote areas of the southern Ozarks and are a cost-effective means to supplement spring data in the USGS's Ground-Water Site Inventory data base;
- A study to examine the structural and tectonic control on ground-water flow in the Boone–St. Joe aquifer in northwestern Arkansas. This study explores the hydrogeology along major faults, particularly with regard to large springs, surface karst features, and areas of major stream loss, helping further define the flow mechanics of large springs; and
- A study to develop a new methods for assessing the effects of land-use practices on water quality by tracing viruses that are specific to poultry.



**Figure 4.** Little Rock Municipal Water Works' reservoirs, and Lakes Maumelle and Winona, and their respective watersheds.

This virus-tracing technique offers excellent promise as a hydrologic tool for determining if non-point source pollutants from poultry operations are entering ground water and surface water.

## Wetland Research Project

The Mississippi River Valley alluvial aquifer is important to the success of agriculture in Arkansas' Gulf Coastal Plain (see fig. 1). In the past few decades, ground-water levels have been declining and 72 percent of Arkansas' original wetlands have been lost to agriculture and other land uses. Wetlands are valuable resources, functioning to improve surface-water quality, and serving as wildlife habitat. Wetlands in the Mississippi Alluvial Plain also provide optimal hydrogeologic conditions for the recharge of surface water into the underlying Mississippi River Valley alluvial aquifer.

The USGS is the largest cooperator, with the U.S. Army Corps of Engineers' Waterways Experiment Station, in a multidiscipline effort to study wetland functions at the Black Swamp bottomland, hardwood wetland. The purpose of the wetland research project is to determine wetland functions and how they benefit agricultural and recreational interests. The USGS has been collecting and analyzing surface- and ground-water and sediment-load data. The ground-water data base is one of the most comprehensive for bottomland, hardwood wetlands in the Nation. The Black Swamp study has greatly improved our understanding of how the wetland surface water interacts with the alluvial aquifer and the mechanics of sediment deposition.

## Water-Use Program

The Arkansas Soil and Water Conservation Commission and the USGS are implementing an education and information program based, in part, on 32 reports summarizing irrigation and agricultural information. These reports display reported water-use data for irrigation and agriculture and function as a medium for informing the public of the existence of laws requiring the reporting of water use in the State.

The USGS has developed computer software that allows Conservation District personnel to enter and retrieve irrigation and agricultural water-use data into and from the USGS water-use data base. This software will eliminate the paper processing, entry, and printing of about 54,000 irrigation and agricultural water-use registration forms, reminder cards, and mailing labels.

## National Mapping Program

Among the most popular and versatile products of the USGS are its topographic maps at the scale of 1:24,000 (1 inch on the map represents 2,000 feet on the ground). These maps depict basic natural and cultural features of the landscape, such as lakes and streams, highways and railroads, boundaries, and geographic names. Contour lines are used to depict the elevation and shape of terrain. Arkansas is covered by 917 maps at this scale, which are used for civil engineering, land-use planning, natural resource monitoring, many other technical applications and have long been favorites with the general public for a wide variety of outdoor activities.

The USGS currently has a cooperative agreement with the Arkansas Geological Commission (AGC) for the revision of 1:24,000-scale topographic maps. The AGC has been a cooperative partner with the USGS for many years in the initial production and the subsequent revision of topographic maps that are used by the AGC as a base for geologic mapping.

Additionally, the USGS has a cooperative agreement with the University of Arkansas at Fayetteville's Center for Advanced Spatial Technologies for the production of computerized elevation data for numerous geographic information systems and mapping projects in Arkansas.

## Hydrologic Data Collection

Five types of basic hydrologic data—streamflow, ground-water level, water quality, water use, and sediment—are collected by the USGS in cooperation with local, State, and Federal agencies in Arkansas.

The USGS collects information on a continuous basis at more than 7,000 stream-gaging stations nationwide. Currently (1995), in Arkansas, information is collected at 86 stream-gaging stations on a continuous basis, and historical information is available from more than 200 additional sites (fig. 5). More than one half of all stream-gaging stations provide current information (mostly via satellite telemetry) to agencies that operate water-resource systems and form the core of the National Flood Forecasting Network. Real-time USGS stream-gaging data are used several times a year in various sections of the State and Nation, to forecast catastrophic floods and allow people and property to be evacuated before an area becomes inundated.

In addition to their use in flood forecasting, data from USGS gaging stations are fundamental to the study of the water cycle, including the prediction of flood and drought magnitudes and frequencies, and the study of the effects of changes in climate or land-use on water resources. Statistical analyses of streamflow have extensive applications to the design of the State's and Nation's water resources and transportation infrastructures, including water-supply systems, flood-hazard mitigation measures, highway bridges, culverts, navigation systems, and many others. Streamflow information is critical to the setting of waste-discharge permits that assure the maintenance of acceptable water quality.

The USGS also collects ground-water-level data at approximately 700 wells throughout Arkansas. These long-term

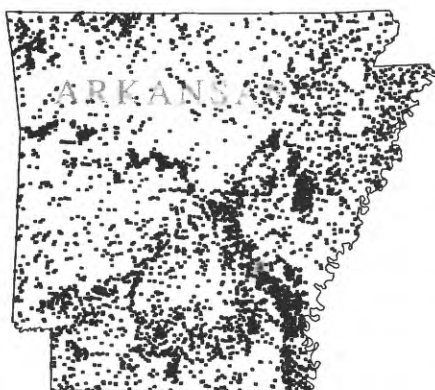


**Figure 5.** Surface-water data-collection sites in Arkansas.



data provide hydrologists with a measure of the current status of Arkansas' ground water and a means of assessing the general response of the hydrologic systems to stresses. This aids in identifying potential problems early enough to allow proper planning and management. These data also provide a data base against which the short-term records acquired in areal studies can be analyzed.

Arkansas' streams, rivers, and lakes provide an abundant supply of good quality water. The USGS collects samples at about 150 surface-water sites and maintains a computerized data base of more than 700 water-quality sampling stations, monitoring the chemical and physical qualities of these waters (fig. 6). Water-quality data from USGS stations provide a long-term data base that allows scien-



**Figure 6.** Water-quality data-collection sites in Arkansas.

tists, planners, and managers to determine trends, to identify potential problems, and to make informed decisions when issuing waste-discharge permits.

Since 1960, water use in Arkansas has increased by more than 500 percent. To meet ever-increasing requests from State and municipal planners for water-use data, the USGS has developed a statewide data-collection system to document water use on a continuous basis. The USGS maintains computerized water-use data bases that allow retrieval and publication of information.

The USGS collects and analyzes sediment samples from a network of 15 stations in Arkansas to provide spatial and temporal averages and to monitor trends of sediment concentration, sediment discharge, and particle size of sediment being transported in the State's rivers and streams. The sediment data are used in Federal and State planning and action programs and to provide data for Federal management of interstate and international waters.

## Cooperative Programs

The USGS has been the Nation's principal collector, repository, and interpreter of earth science data for more than a century. In this capacity, the USGS in Arkansas works in partnership with county and municipal public works departments, public health agencies, natural-resource agencies, water and sanitation districts,

other Federal agencies and many others. Cooperative activities include mapping and geographic information system projects, seismic studies, geomorphological studies, water-resources-data collection, and interpretive studies of water availability and water quality. When local and State agencies are involved, activities typically are funded on a matching (50:50) basis. In addition to the agencies mentioned above, the USGS in Arkansas is working with the Arkansas Department of Parks and Tourism; the Arkansas Department of Pollution Control and Ecology; the Arkansas Game and Fish Commission; the Arkansas-Oklahoma Arkansas River Compact Commission; the Arkansas State Highway and Transportation Department; the University of Arkansas—Little Rock; the Cities of Fort Smith and Little Rock; the U.S. Army Corps of Engineers; the U.S. Department of Defense, Fort Chaffee Army Environmental Branch; the U.S. Department of Agriculture—Natural Resources Conservation Service and the Forest Service; the U.S. Environmental Protection Agency; and the National Park Service.

The USGS provides technical and financial support to the Arkansas Water Resources Research Center. The Center conducts a program of research, education, and information and technology transfer.

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### For more information contact any of the following:

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Additional earth science information can be found by accessing the USGS "Home Page" on the World Wide Web at "<http://www.usgs.gov>".

For more information on all USGS reports and products (including maps, images, and computerized data), call 1-800-USA-MAPS.