



U.S. Geological Survey Programs in Tennessee



U.S. Department of the Interior ■ U.S. Geological Survey

The U.S. Geological Survey (USGS), which was established in 1879, provides earth-science information to aid in the understanding, development, management, and protection of the Nation's land, water, mineral, biological, and energy resources. The results of that work—maps, reports, data, and other information—are used every day by persons at all levels of government, universities, research institutions, industries, businesses, and individual citizens and citizen groups.

The USGS works in all 50 States, frequently in cooperation with others. This Fact Sheet describes some of the current USGS programs in Tennessee.

Collection of Hydrologic Data

The USGS, in cooperation with numerous Federal, State, and local agencies, collects hydrologic data to meet the needs of many users. These data document present conditions and provide the cornerstone for understanding hydrologic systems and solving hydrologic problems. In Tennessee, the USGS records streamflow continuously at 121 gaging stations equipped with recorders and makes instantaneous measurements of streamflow at numerous other stations (fig. 1). Ground-water levels are monitored statewide, and the physical, chemical, and biological characteristics of surface and ground waters are analyzed. Records of water use are compiled and updated and data for the national baseline network, water-quality network, and atmospheric-deposition programs are provided.

The data are used for many purposes. For example, satellite-transmitted data that describe present river conditions are used to manage and operate the reservoir systems on the Tennessee and the Cumberland Rivers, to respond quickly to floods, and for certain cities and towns along the rivers, to determine permissible windows of time for waste disposal. The longer term record of data—going back in time for

more than 100 years—is used for various engineering purposes and to manage river flood-plain development, to determine flood-insurance rates, to determine trends in water availability and quality, to project and plan for future water demand, and to conduct interpretive studies of water-related problems that may benefit many thousands of people.

Minerals Resource Data System

The Minerals Resource Data System (MRDS), which is a digital data base that lists all known mineral sites worldwide, has been developed by the USGS, in cooperation with many agencies, to provide up-to-date information on mineral occurrences and related data. The MRDS supports USGS research and mineral-resource assessments and is a principal tool for providing mineral-related information to Federal and State agencies, industry, and the public. The data base contains information on more than 110,000 sites; almost 1,650 of them are in Tennessee.

Index of Subjects

- Collection of Hydrologic Data
- Minerals Resource Data System
- Topographic Mapping
- Geologic Mapping
- Mineral-Resource Potential of Southeastern Tennessee
- National Assessment of Gold, Silver, Copper, Lead, and Zinc Deposits
- National Coal Assessment
- Earthquake Studies in the Central Mississippi River Valley
- Hydrogeologic Investigations at Military Bases
- Effects of Agricultural Practices on Water Quality in West Tennessee
- Fecal Contamination of Water in Bedford County
- National Water-Quality Assessment Program
- Earth Science Information Centers

The USGS, in cooperation with the Tennessee Division of Geology, has prepared mineral records for Tennessee. Most of the Tennessee data describe occurrences of barium, iron, zinc, sand and gravel, and phosphate.

Work currently is in progress to transfer information in the MRDS to a CD-ROM.



Figure 1. USGS field crew prepares to measure streamflow of a Tennessee river.

Topographic Mapping

Maps and digital cartographic data have innumerable applications, and the requirements for this information are expanding dramatically. The National Mapping Program, which is conducted in cooperation with numerous State and Federal agencies, strives to ensure that map data in graphic and digital forms are available to the public through timely and effective data-collection and revision procedures.

The 1:24,000-scale topographic maps (1 inch on the map represents 2,000 feet on the ground) are among the most popular and versatile products of the USGS. These maps are widely used by scientists and engineers and have long been favorites with the general public for recreational purposes. In addition to showing topography, they depict the natural and cultural features of the landscape, such as lakes and streams, highways and railroads, boundaries, and geographic names. Tennessee is covered by 803 maps at this scale. Digital coverages for boundary, hydrography, and transportation features are available for about 25 percent of these maps, and digital elevation model coverages are available for about 90 percent.

Geologic Mapping

The USGS, in cooperation with the National Park Service, is conducting field studies in the Great Smoky Mountains National Park to provide geologic map data that will be used to help manage the Nation's most heavily visited National Park. Study results are being compiled in digital files that can be accessed by computers that have geographic information system (GIS) software. GIS provides an efficient method for storing and manipulating large amounts of data for this 520,004-acre park.

Additionally, geologic maps for 368 7.5-minute quadrangles, mostly for middle Tennessee, have been converted to GIS coverages; these coverages can be widely used for local and regional studies and for management purposes. The coverages were made by the USGS in cooperation with the Tennessee Department of Environment and Conservation, the U.S. Army Corps of Engineers, the Tennessee Valley Authority, and the Natural Resources Conservation Service (formerly the Soil Conservation Service).

As part of the National Geologic Mapping Program, the USGS, in cooperation with the Tennessee Division of Geology, is mapping the geology of the Greenville, the Johnson City, and the Bristol 7.5-minute quadrangles in the northeastern part of the State. Parts of these areas are underlain by limestone in which solution cavities have developed. One of the objectives of mapping is to provide geologic information that addresses regional concerns about the transport of hazardous substances from Superfund sites in ground water that flows through cavernous limestone.

Mineral-Resource Potential of Southeastern Tennessee

Economic growth and development in Tennessee depend on the availability of local sources of minerals and materials used in construction, industry, and manufacturing and for maintaining and upgrading the State's infrastructure. In 1993, the USGS published an inventory of known mineral resources in the 8,027-square-mile area of the Chattanooga 1° by 2° quadrangle in southeastern Tennessee and maps that show potential areas for undiscovered deposits. Five tracts that are favorable for the occurrence of mineral resources, including metals, industrial minerals, and fuels were delineated. Construction and industrial materials, especially limestone, dolomite, sand, and gravel, were shown to have the greatest potential for increased development to meet current needs and the requirements of future population growth, industrial expansion, and new markets. The report and maps are being used by Federal and State land-management agencies, land-use planners, industry, and local governments to help ensure that adequate supplies of these minerals remain available and to promote resource development at the lowest possible cost.

National Assessment of Gold, Silver, Copper, Lead, and Zinc Deposits

A prototype quantitative national assessment of mineral resources is being completed for five commonly used metals—gold, silver, copper, lead, and zinc. Objectives of this effort are to list significant known deposits, to identify areas with mineral potential, and to estimate the quantity of each metal that is likely to be present.

Although Tennessee does not have known economically important deposits of gold, silver, or copper, the State does have geologic terrains that are favorable for hosting zinc and lead deposits. Tracts that have known deposits and potential for deposits are outlined on maps on the basis of information in the MRDS and on geologic maps. The national assessment will enable the USGS to respond quickly to requests for information from Congress, Federal and State agencies, industry, and the public about mineral resources throughout the country. The results also will be useful to land-use planners who are concerned with resource-management issues.

National Coal Assessment

The USGS is conducting a National Coal Assessment (NCA). Coal is an important energy source, which accounts for about 25 percent of the total energy used and about 56 percent of the electricity generated in the United States. In 1995, about 2.7 million of the 1.02 billion tons of coal produced nationally were mined in Tennessee. It is expected that coal will continue to serve as a major energy source as the Nation enters the next century, and that the quality requirements for this material will become even more stringent as new technologies that use coal come on line. Objectives of the NCA are to provide details on the location, quantity, and quality of coal that can be mined throughout the country during the next 20 years, classified by best intended use.

In a related study, the USGS, in cooperation with the Tennessee Division of Geology, is systematically revising, one quadrangle at a time, coal-reserve maps and reserve estimates for selected areas in the Tennessee coal field. Data are being entered in the National Coal Resources Data System. The ultimate goal is to publish an up-to-date coal-reserve estimate for Tennessee's 20 coal-bearing counties that can be periodically revised and updated as needed.

Earthquake Studies in the Central Mississippi River Valley

The largest earthquakes known to have occurred within the interior of the United States struck the central Mississippi River Valley during winter 1811–12. They were centered in the New Madrid, Missouri,

region and were felt as far away as Quebec. This region continues to have the highest level of seismicity east of the Rocky Mountains. Two critical needs for determining regional earthquake hazards are the development of an accurate chronology of past large earthquakes and the location of buried faults along which past movement has occurred.

A team of USGS research geologists stationed at the University of Memphis is investigating prehistoric movement along the Reelfoot Fault near Tiptonville (fig. 2). The scarp caused by this Fault forms the western shore of Reelfoot Lake, which was created by the great New Madrid earthquakes. The team's trenching studies have confirmed earlier work by the USGS that suggested that two strong earthquakes occurred within a 2,000-year period before 1811. The most recent data indicate that the dates of the earthquakes are about 900 and 1400. These dates are consistent with evidence for those of past earthquakes found by other researchers working in nearby Arkansas and Missouri.

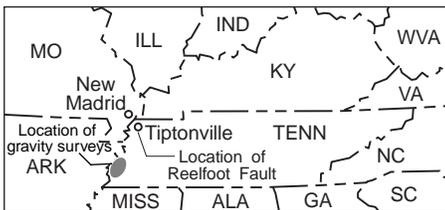


Figure 2. Locations of earthquake research studies.

As part of the National Earthquake Hazards Reduction Program, the USGS, in cooperation with the Tennessee Division of Geology and Vanderbilt University, is conducting gravity surveys in Lauderdale and Tipton Counties. The information that results from this work will enable scientists to locate buried faults and other geologic features associated with earthquakes more precisely and will improve the ability to predict which areas are most likely to sustain significant damage by a major seismic event.

Hydrogeologic Investigations at Military Bases

The USGS, in cooperation with the U.S. Air Force, the U.S. Navy, and the U.S. Army, is conducting hydrogeologic investigations at three military bases in Tennessee.

The purpose of the investigations is to provide resource managers with the geologic and hydrologic information necessary to protect water quality at each facility.

A study at Arnold Air Force Base has provided an overview of the regional hydrology and a computer model that simulates the ground-water flow system. A detailed study is being made of an area where continual pumpage of a 250-foot-deep cylindrical excavation, which is used for testing rocket motors, has dewatered aquifers and induced the transport of contaminants through them. An investigation at the Naval Air Station in Memphis has defined the stratigraphy that underlies the northern part of the base to a depth of about 1,000 feet and summarized the hydrogeologic character of each formation. Similar work is continuing for the southern part of the base. The primary objective of a recently started study at Fort Campbell is to provide information on the occurrence and movement of ground water at the base and adjacent counties in Tennessee and Kentucky. One of the goals is to delineate the recharge area of Boiling Spring, which supplies about 6 million gallons of water per day and is the principal source of drinking water for the base, so that protective measures may be implemented.

Effects of Agricultural Practices on Water Quality in West Tennessee

Agricultural activities are a major contributor to nonpoint-source pollution; that is, pollution that cannot be traced to a single point of origin. In Tennessee, agriculture has been cited as one of the five leading causes of water impairment. Attempts have been made to reduce the extent of impairment in some areas by implementing conservation-related measures termed "best-management practices" (BMP's).

The USGS is conducting a study to evaluate the effect of agricultural activities on water quality and the effectiveness of agricultural BMP's in the 95,000-acre Beaver Creek watershed of West Tennessee. The project is being conducted jointly with other Federal, State, and county agencies, the farming community, and academic institutions in support of the U.S. Department of Agriculture's Hydrologic Unit Area Program.

Sediment transport that results from soil erosion has been determined to be the major water-quality problem in the watershed. Some other significant findings are that higher nitrate concentrations are measured in water from wells near septic tanks and confined animal facilities than in wells near fertilized fields, and wells deeper than about 150 feet do not appear to be as affected by surface or near-surface nitrate sources as those of shallower depth. The horizontal transport of aldicarb sulfoxide, which is a metabolite (daughter product) of the pesticide aldicarb, was negligible, and the downward transport was minimal, with none being detected below a depth of 2.5 feet. Nonbiological reactions appear to be important mechanisms for the rapid degradation of aldicarb metabolites in the soil profile. The findings will be useful for evaluating and improving the BMP's, reducing soil loss from this very fertile area, and improving the quality of water in wells and streams.

Fecal Contamination of Water in Bedford County

The USGS, in cooperation with the Tennessee Department of Agriculture, recently began a study to determine the causes of water-quality impairment in the North Fork Creek and the Fall Creek watersheds in Bedford County, Middle Tennessee. Water quality is impaired by fecal contamination that has resulted in algal growths in the streams and a decline in the quality of drinking-water supplies. The watersheds are situated on karst (limestone) terrain, which is characterized by sinkholes, caves and conduit-type ground-water flow. As is typical of many karst terranes, water in streams and below ground readily interchange.

Preliminary results after 1 year of study show that nitrate-nitrogen in 90 samples of stream water approached but did not exceed the Tennessee standard for drinking water; the number of fecal bacteria colonies in 14 of 16 samples of stream water exceeded the Tennessee standard for recreational water use; samples from 4 of 7 streams tested positive for laundry brighteners, thus suggesting that septic tank outflow may contribute to the problem; and initial tests at the University of Memphis indicate that the ribonucleic acid (genetic material) of fecal bacteria has excellent potential for defining whether the bacteria are of human

or animal origin, and if of animal origin, which group of animals.

Results of the study will help managers make decisions to improve the quality of water in not only the two watersheds, but also in the receiving stream, the Duck River, which is the source of water for many communities. Additionally, if the use of ribonucleic acid proves successful for identifying the source of fecal contaminants, then the results will be applicable to similar contamination problems worldwide.

National Water-Quality Assessment Program

The National Water-Quality Assessment (NAWQA) Program was established to describe the status and trends in the quality of a large, representative part of the Nation's surface and ground waters and to identify the natural and human factors that affect the quality of these resources. Information produced will be used by policymakers and managers at local, State, and national levels for making decisions and managing the quality of much of the water resources of this country.

The national assessment will consist of 60 study units that encompass parts of most major river basins and aquifer systems in the Nation. Three of the study units include regions in Tennessee—the upper Tennessee River Basin, the lower Tennessee River Basin, and the Mississippi Embayment (fig. 3).

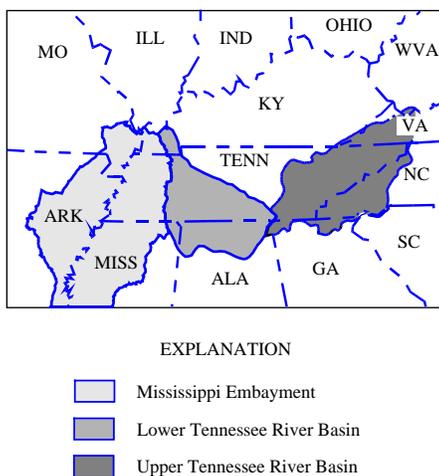


Figure 3. National Water-Quality Assessment Program study units that include Tennessee.

Water-quality assessment activities in the upper Tennessee River Basin and the Mississippi Embayment study units began in 1994. Meetings with public and private agencies resulted in an identification and prioritization of several water-quality issues of regional and local interest, a determination of sources of water-quality data and other information, and assistance in the design and scope of project elements. In the upper Tennessee River Basin study unit, most of the water-quality constituents of greatest concern are sediment related. Nutrient enrichment from agricultural activities also is a concern to environmental agencies. In the Mississippi Embayment study unit, the issues of greatest concern are the impacts of agricultural land use and agricultural chemicals on water quality. For the Metropolitan Memphis area, the effects of residential land use on water quality is a major issue. Although study of the lower Tennessee River Basin study unit is not scheduled to start until 1997, preliminary inquiry of Federal, State, and local agencies has ascertained that sedimentation, nutrient enrichment, and habitat degradation of surface water and bacterial contamination of ground water are the issues of greatest regional importance.

Earth Science Information Centers

The Earth Science Information Centers (ESIC's) provide information about USGS programs, products, and technological developments to the public. The ESIC in Knoxville was established under a cooperative agreement between the USGS and the University of Tennessee's Cartographic Information Center. The ESIC in Chattanooga is operated by the Tennessee Valley Authority. As part of the national ESIC network, these offices provide information on such earth science topics as cartography, geography, digital data, remote sensing, geology, geophysics, geochemistry, hydrology, geohydrology, aerial photography, and land use. The Chattanooga ESIC also sells maps that cover many Southeastern States. The ESIC's are supported by the USGS with reference materials, technical assistance, training and outreach activities, and access to USGS data bases.

For More Information

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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**

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

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