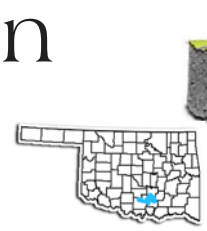
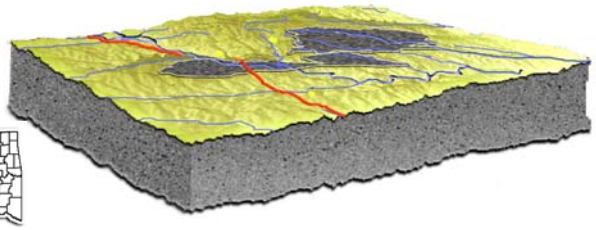
Arbuckle-Simpson Hydrology Study

Newsletter





THE OKLAHOMA WATER RESOURCES BOARD June 2005

Geochemistry Unlocking Mysteries of Aquifer's Flow System

Data collected during last fall's geochemical sampling effort is providing researchers with a better understanding of the flow paths of Arbuckle-Simpson waters.

Estimates of the rate of groundwater movement through the Arbuckle-Simpson aquifer's highly-fractured system are made by calculating the age of groundwater in different locations based on the concentration of environmental tracers. Investigators have employed a computer simulation to project path lines and travel times of water moving through the aquifer. As a tool to age-date groundwater in the aquifer, water samples have been analyzed for levels of naturally occurring helium.

Preliminary results of the study data estimate that water from Vendome Well, an artesian well issuing from the Arbuckle-Simpson aquifer in Sulphur, is very old, possibly more than 10,000 years. In addition, USGS researchers calculate that the sampled water entering the aquifer at that time had a temperature approximately eight degrees cooler than that of the present day. The difference corresponds to mean annual air temperatures that existed in the area about 10,000 to 14,000 years ago.

Laboratory analysis of the water samples, collected last October and November, will also be used to determine the general water quality of the aquifer and identify possible water quality problems. More detailed geochemical analyses will also be conducted.

Native blue stem grass overlying the Arbuckle's Hunton Anticline region.

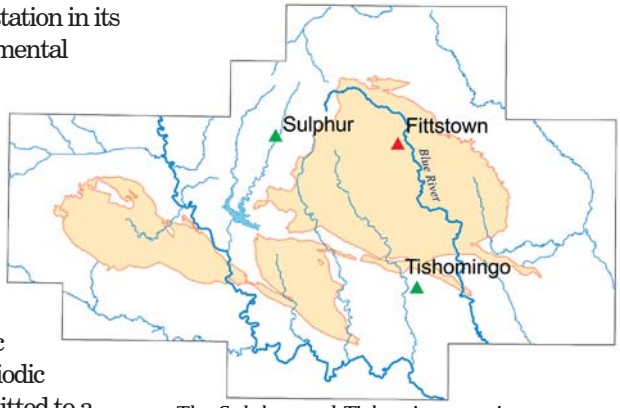
Top left, an old postcard depiction of Vendome Well, in the Chickasaw National Recreation Area in Sulphur, as it looked shortly after it was drilled in 1922. At right, Vendome Well as it appears today.

Climatological Survey, OWRB Add Mesonet Station

In cooperation with the Oklahoma Climatological Survey (OCS), the OWRB has established a Mesonet weather recording station over the Arbuckle-Simpson aquifer. The station will transmit conventional real-time Mesonet climate data over the Internet, but will also provide information that will be essential to the understanding of the Arbuckle-Simpson aquifer and how it responds to variations in precipitation and other factors.

Fittstown Mesonet

The new Fittstown site houses the 117th Oklahoma Mesonet station in its world-class network of environmental monitoring stations located throughout the state. At each site, the environment is measured by a set of instruments located on or near a 10-meter-tall tower. Measurements of precipitation, temperature, soil moisture and temperature, and other climatic variables are packaged into periodic observations, which are transmitted to a central facility every 15 minutes, 24 hours per day year-round.



The Sulphur and Tishomingo stations are nearby, but the new Fittstown Mesonet station is the only one situated on top of the aquifer.

The Fittstown Mesonet site was selected because the location is on top of the aquifer and in the watershed of the Blue River. The location satisfies OCS Mesonet siting requirements related to accessibility, geography, and vegetation. In addition, the area contains few obstructions and the site maintains consistency with spatial distribution of other Mesonet stations. An observation well may also be drilled at the site to provide local groundwater level data.

"Karst Features": Why Are They Significant?

In general, karst (solution) features, such as sinkholes and caverns, enhance infiltration and recharge of water in an aquifer. About two-thirds of the Arbuckle-Simpson aquifer consists of carbonate rocks, such as limestone and dolomite, which are soluble. Rainwater, made acidic by carbon dioxide from the atmosphere and soil, infiltrates and slowly dissolves the rock, leading to the formation of solution channels and cavities along bedding planes, fractures, and faults.

Sinkhole near Mill Creek

A 65-foot-deep sinkhole near Honey Creek

Fractured, cavernous carbonate rock exposed on the surface of the Arbuckle-Simpson aquifer enhances groundwater circulation and allows for large quantities of water to enter the aquifer over a relatively short period of time. Recharge occurs primarily from precipitation.

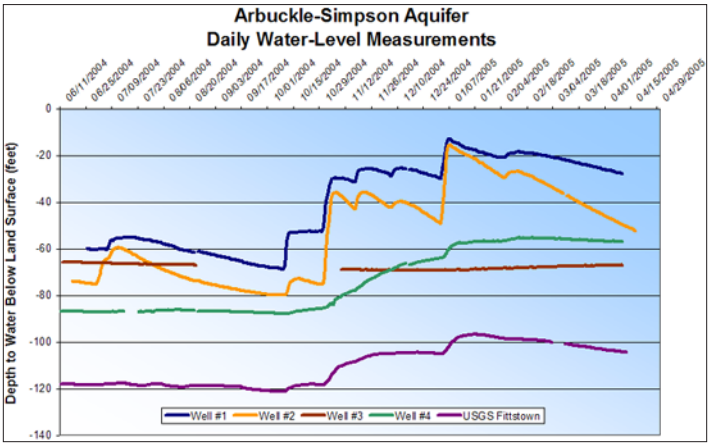
Monitoring Arbuckle Groundwater Levels

A major objective of the Arbuckle-Simpson aquifer study is to characterize the aquifer in terms of geologic setting, aquifer boundaries, hydraulic properties, groundwater levels, groundwater flow, recharge, discharge, and water budget. To collect the data required to answer these fundamental questions, the OWRB has installed continuous water-level recorders in local groundwater wells. The recorders, which measure the depth to groundwater in eight-hour intervals, will be used to determine seasonal fluctuation within the aquifer and its response to precipitation events.

To date, the OWRB had installed 10 water-level recorders in unused water wells in the eastern portion of the aquifer (Hunton Anticline). Five of these recorders have been in operation for a full year. In addition, real-time data is available from the USGS groundwater station southwest of Fittstown, established in 1958.

Water levels in the Arbuckle-Simpson aquifer fluctuate in response to recharge from precipitation and discharge from pumping and artesian wells. The magnitude and response time to a precipitation event in a particular well is partially dependent on the characteristics of the rocks in the subsurface. These characteristics include the amount of fractures, karst features, porosity, and permeability of the subsurface.

OWRB staff will continue to monitor the groundwater levels of the Hunton Anticline and will be adding additional sites to the groundwater-level recorder network in subsequent months. The Water Board plans to expand the network to other parts of the aquifer.



Information Still Needed

Arbuckle Study researchers continue to collect important information concerning the locations of artesian and other water wells, springs, and karst features (i.e., sinkholes, caves, etc.) in the study area. Citizens who have knowledge of these characteristics of the Arbuckle-Simpson aquifer region are asked to call Noel Osborn at 405-530-8800.

The OWRB also conducts synoptic water-level measurements, which provide "snapshots" of groundwater levels and flow conditions. On March 23-24, staff conducted a synoptic measurement on 64 wells in the Hunton Anticline. The latitude/longitude coordinates and elevations of the wells were surveyed utilizing high-accuracy global positioning (GPS) units. Data collected during the event will be used to construct water-level contour maps that will be incorporated into flow-path studies and computer models.

Quarterly synoptic measurements, including the next event in June, are planned to investigate seasonal changes within the aquifer.

Chris Neel sets up a GPS unit after measuring depth to water in an unused Arbuckle windmill.

State of Oklahoma
OWRB
Water Resources Board
the water agency

To join the Arbuckle-Simpson Study mailing list, call the OWRB at 405-530-8800.

For more information, visit the OWRB's Web site at www.owrb.state.ok.us.