

OZARK AQUIFER REOPENING FOR APPROPRIATION

Since 2004, public water systems in Southeast Kansas have been in a holding pattern. Concerns were expressed that water demand in the three- or four-state region might be greater than supply. Anecdotal evidence suggested that in some locations, demand had already outstripped supply. When the Division of Water Resources' Chief Engineer closed a portion of Southeastern Kansas to new appropriations (or water rights), a six-year period of speculation resulted.

Prior to the moratorium, there was little concern about water quantity or the effect of new appropriations on existing quality. It has been known for quite a long time that water in the "Roubidoux Formation" (the popular, all-encompassing name for the aquifer and its geologic units) was unacceptable for municipal water supply purposes west of a line that generally ran from Moran to Parsons to Edna, Kansas. East of this line, concentrations of chloride were less bothersome and the quality increasingly improved in an easterly direction. It was also assumed that the abundant rainfall in Missouri, as compared to Kansas as a whole, was more than sufficient to meet pumping demand.

The United States Geological Survey (USGS) has redefined the naming system of groundwater resources in this four-state area of Missouri, Kansas, Oklahoma and

Arkansas. As a whole, it is now the Ozark Plateaus aquifer system. The hydrologic units of this system are, from top to bottom, the Springfield Plateau aquifer, the Ozark confining unit, the Ozark aquifer, the St. Francois confining unit, the

St. Francois aquifer and the Basement confining unit. The Roubidoux Formation is an important water-bearing part of the Ozark aquifer, but there are other important formations in the aquifer such as the Gasconade Dolomite, Eminence Dolomite and the Potosi Dolomite. In future discussions of groundwater in Southeast Kansas, the shallowest aquifer should be referred to as the Springfield Plateau aquifer and the deeper aquifer as the Ozark aquifer.

The geologic formations of limestone, dolomite (a rock with nearly equal amounts of calcium carbonate and magnesium carbonate) and sandstone, which store groundwater in Southeast

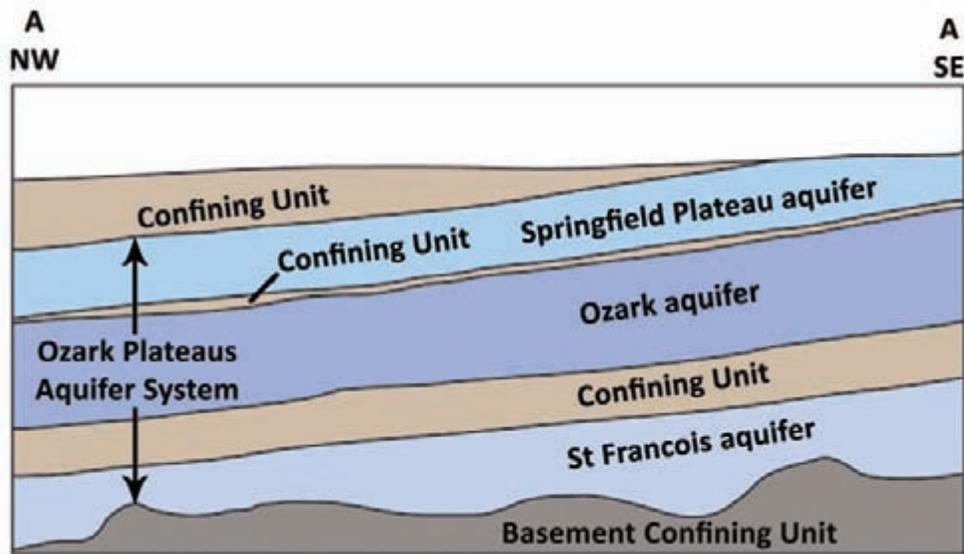
Kansas, generally dip from east to west from central Missouri to central Kansas. In Missouri's Ozarks, the rocks of these formations are exposed at the surface and readily accept precipitation for recharge. What may seem to be unusual is that on a regional basis, water levels had shown little change over time. What concerns water resource managers now are large cones of depression in areas of large withdrawals.

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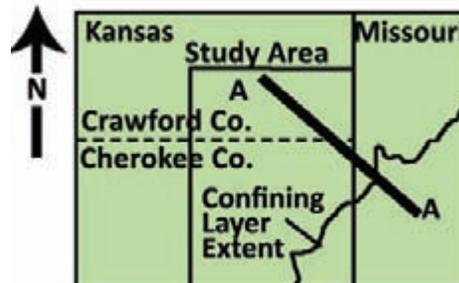
It is not clear who sounded the alarm, but it is known that on August 23, 2004, DWR's Chief Engineer declared a moratorium of approvals of water right permit applications for groundwater filed on or after that date. Any applications filed after that date were held until it could be determined that they could be approved without negative impacts to the aquifer and the previously existing water rights. A formal regulation was adopted (K.A.R. 5-3-29) on November 29, 2004. Generally, the affected area included all of Cherokee and Crawford Counties, the east halves of Labette and Neosho Counties, the south half of Bourbon County, and the southeast quarter of Allen County.

With the regulation in place declaring a moratorium, water planners and regulators needed to determine the extent of the water level problem. It was decided that a comprehensive evaluation of both water quantity and water quality was needed to fully understand the potential hazards to this important source of water. Kansans needed to ascertain recharge, groundwater flow and flowpaths, the effect of past lead mining, possible leakage of the Ozark Confining Unit and the locations of leakage, possible horizontal and vertical flow of chloride containing water, future well spacing considerations, and possible controls to be adopted by neighboring states. Some studies of the water resources in southeastern Kansas had been conducted in the past but they were not as comprehensive as they now needed to be. Even less information was available for the aquifers, and the presumed recharge areas, in Missouri. The regulation also provided a deadline of sorts, to have a study or studies completed, and a permanent decision made, by December 31, 2010.

The Kansas Water Office was able to secure funding for two separate studies to be



Generalized cross-section of the Ozark Plateaus Aquifer System in Crawford and Cherokee counties, Kansas, and Jasper County, Missouri. (Macfarlane, P.A., 2010, Kansas Geological Survey, Bulletin 258, part 3. <http://www.kgs.ku.edu/Current/2010/Macfarlane/index.html> (January 20, 2011).





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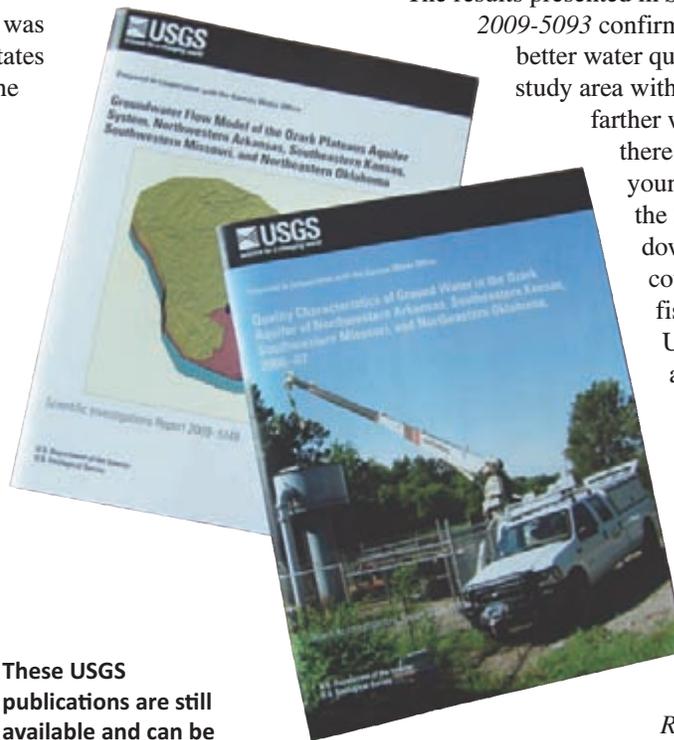
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conducted over the area of the Ozark Plateaus Aquifer. Because multiple states share the resource, and because of the complexity of the aquifers, it was appropriate that the United States Geological Survey perform the studies. One report is titled *Quality Characteristics of Ground Water in the Ozark Aquifer of Northwestern Arkansas, Southwestern Missouri, Southeastern Kansas and Northeastern Oklahoma, 2006-2007*; *Scientific Investigations Report 2009-5093*. The other report is titled *Groundwater Flow Model of the Ozark Plateaus Aquifer System, Northwestern Arkansas, Southwestern Missouri, Southeastern Kansas and Northeastern Oklahoma, Scientific Investigations Report 2009-5148*. These reports will likely maintain their importance for a long

period of time as difficult water management decisions are made in the future.

The results presented in *Scientific Investigations Report 2009-5093* confirmed the general understanding of better water quality in the eastern part of the study area with decreasing quality in locations farther west. Analysis also suggests that there appears to be some leakage of younger, lower quality water from the Springfield Plateau Aquifer down into the Ozark Aquifer. This could occur because of cracks and fissures in the Ozark Confining Unit, poorly constructed and abandoned wells, or by past lead mining activities. Water sampling during pumping from one of the city of Pittsburg's wells did not show any upwelling of saline water from the deeper parts of the aquifer, but did not rule out its possibility in the future.

The conclusions presented in *Scientific Investigations Report 2009-5148* include confirmation of the presumed flow of groundwater, from the recharge areas in the southeastern parts of the study area to the west.



These USGS publications are still available and can be purchased from the USGS website at <http://www.usgs.gov/pubprod/> for \$16.00 a piece. Alternatively, they can be downloaded in portable document format (pdf) at no charge.



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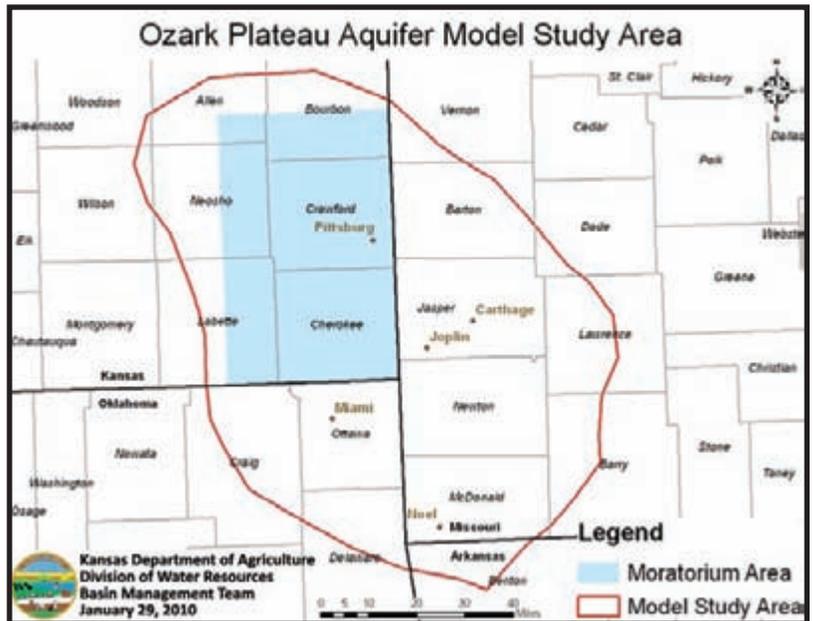
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Localized flow occurs toward the rivers and five pumping centers near the cities of Joplin, Carthage and Noel in Missouri, Miami, Oklahoma, and Pittsburg, Kansas. The model that was created and calibrated was also used to predict water levels in the year 2057 at the five pumping centers under five different scenarios. The first scenario conducted was to analyze the predicted water levels if pumping remained constant at 2006 levels. At this level, continued water level declines were predicted, but water would remain available at all five pumping centers. Another scenario was a one percent annual increase of water diversions in Missouri and Oklahoma with no increase in Kansas. The results of this test returned by the model predict that the aquifer will be dewatered at two of the pumping centers (Carthage and Noel, Missouri). This could occur as early as 2037 for Carthage. The most extreme scenario, an increase of pumping of four percent annually from the levels of 2006 water use in Kansas, Missouri, and Oklahoma predicts dewatering of the aquifer at four of the five pumping centers – Pittsburg, Kansas, being the only location with water remaining.

The Division of Water Resources announced in a December 28, 2010, press release and in their weekly electronic newsletter *DWR Currents*, dated December 29, 2010, that the Chief Engineer has rescinded the moratorium in place since 2004. It is likely that K.A.R. 5-3-29 will be rewritten to state the criteria for new appropriations to be approved. In the announcement, the Chief Engineer stated that this would likely be completed in 2011, and *DWR Currents* would be used to keep the public informed of the progress in its adoption process. Persons interested in subscribing to DWR's weekly newsletter (and in knowing of invitations to participate in the regulation adoption process) can do so by accessing http://www.ksda.gov/dwr/mailling_list/id/88 with their internet browser. DWR has determined that three times more water is available under safe-yield criteria than is currently appropriated, so the applications approved as term permits under K.A.R. 5-3-29 (after the declaration of the moratorium) can be converted into permanent appropriations. It is likely that well spacing for new wells in the Ozark



Map showing Moratorium Area and Study Area. – Ozark Plateau Aquifer Hydrologic Report, Division of Water Resources, December 17, 2010.

A compact would not be taken lightly by Kansas' eastern neighbor.

Plateaus Aquifer system may be greater than the spacing requirements for unconsolidated aquifers in other parts of Kansas. It's also a possibility that a graduated spacing requirement based on instantaneous rate of diversion and total quantity of water authorized could be imposed.



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For more information:

Kansas Department of Agriculture Ozark Plateaus Aquifer System
<http://www.ksda.gov/subbasin/content/297>
http://www.ksda.gov/includes/document_center/subbasin/Ozark/Ozark_Model_Final_Report_1.pdf

Kansas Water Office
www.kwo.org/Reports%20%26%20Publications/Fact%20Sheets/Rpt_Ozark%20aquifermanagement_factsheet_111407_mf_kf.pdf

Kansas Geological Survey, Bulletin 258, part 3:
<http://www.kgs.ku.edu/Current/2010/Macfarlane/index.html>

United States Geological Survey Ozark Aquifer Study:
<http://ks.water.usgs.gov/studies/OzarkAquifer/index.html>
<http://pubs.usgs.gov/sir/2009/5093/> • <http://pubs.usgs.gov/sir/2009/5148/>

Somewhat surprisingly, the USGS reports, and DWR's evaluation of the model, indicate that the increasing water demand in Missouri will not significantly affect the quality or the quantity of the water resources of the Ozark Plateaus Aquifer system in Kansas. Before the release of the studies, questions were being asked regarding the necessity for Missouri and Kansas to talk to each other and possibly formulate an agreement - a compact. This idea would not be taken lightly by Kansas' eastern neighbor, as Kansas has squabbled with a majority of the states with which they have a compact or two. Colorado and Nebraska are upstream states, for the most part, and Missouri would be too with the Ozark Plateaus Aquifer system. Fortunately, it appears

Kansas will be able to manage its Ozark Aquifer resources without formal cooperation with Missouri. But now that the smoke is clearing, it might be a great time to initiate discussion on working cooperatively to meet everyone's water needs in the next fifty years.

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