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Increased Use of Cheney Reservoir for Wichita Area Water Supply Benefits *Equus* Beds Aquifer

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

During the past decade, the city of Wichita in south-central Kansas has examined the future of their principal sources of public water supply— the *Equus* Beds aquifer and Cheney Reservoir (fig. 1). City planners found that the water-use appropriations in place for these two sources during the 1980's, if continued, would result in insufficient water to meet the expected needs of the city beyond 2010. Changes in water-management practices, which resulted from a 1992 study of the area's water resources and water use by the city of Wichita (Warren and others, 1995), have already shown promising results in extending the longevity of the local sources of water. Sustainability of the resources is important for the entire area, including agricultural and municipal water needs.

Background

For more than 50 years, Wichita's primary source of supply has been ground water pumped from the city's well field completed in the *Equus* Beds aquifer (fig. 1). The *Equus* Beds aquifer (a part of the regional High Plains aquifer) consists of unconsolidated silt, sand, and gravel deposits that store water infiltrating primarily from the land surface. In the Wichita well field, the aquifer consists of about 80 percent solid materials and about 20 percent open pore space where ground water is stored (Stramel, 1956). After pumping began in the well field on September 1, 1940, water levels and storage volumes in the aquifer began declining, and the decline generally has continued over the years.

When water is removed from an aquifer, water levels decline around each pumping well and may combine to form a larger area of decline. The area of decline in the *Equus* Beds aquifer is represented by the lines of equal change in water levels shown in figure 2. Water-level decline occurs when water is removed from the aquifer faster than it is recharged. Natural recharge of the aquifer occurs when precipitation and surface water infiltrate to the aquifer. Recharge depends primarily on precipitation (fig. 3*A*); if there is a drought, recharge to the aquifer slows in response to the lack of precipitation.

In 1965, surface water from Cheney Reservoir was first used to supplement Wichita's public supply. As a result, water use from the *Equus* Beds aquifer was not as great as it would have been without the availability of water from the reservoir. Ground-water levels did not resume their general decline until the late 1970's to early 1980's (fig. 3*B*) when pumpage from the aquifer for agricultural irrigation and city of Wichita use increased (fig. 3*C*).

Existing Conditions

Until 1993, the *Equus* Beds aquifer was used as the primary source of water for Wichita because of the excellent quality of the water. Surface water from Cheney Reservoir has high turbidity (reduced clarity due to the presence of suspended matter) and, therefore, requires more water treatment. In addition to high turbidity, quality issues concerning herbicides, bacteria, and dissolved organic carbon are important considerations. Until 1993, water from the reservoir was mixed with ground water from the Wichita well field at a ratio of about 40 percent surface water to 60 percent ground water because the better quality of the ground water helped reduce the amount and cost of treatment required for acceptable public water supplies.

In addition to effecting a decrease in the quantity of water in storage, intensive pumpage can affect the quality of water in the aquifer. If water levels in the aquifer reach sufficiently low levels, it is possible that water of poorer quality from an adjacent source could be drawn into and degrade the quality of water in the Wichita well field area. Saline water from the Arkansas River and from oil activity near Burrton (fig. 1) is migrating toward the Wichita well field area (Myers and others, 1996). If water levels in the aquifer continue to decline, the availability of water from this source could be in jeopardy due to quality and quantity concerns.

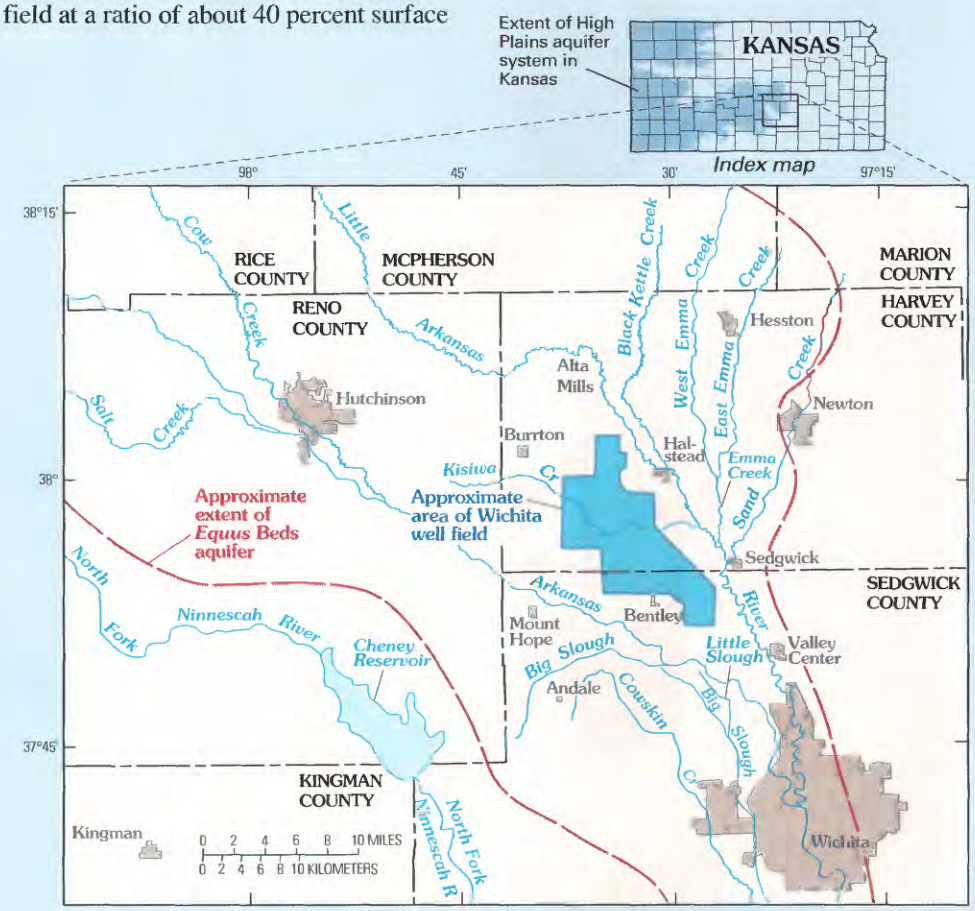

Figure 1. Location of Wichita well field, Cheney Reservoir, and extent of *Equus* Beds (Stramel, 1967) and High Plains aquifers.

Benefits of Reappropriated Water Use

The city of Wichita recognizes that surface water from Cheney Reservoir needs to be used in higher percentages to extend the usefulness of ground water in the *Equus* Beds aquifer and to meet future water-supply needs (Warren and others, 1995). In 1993, the city of Wichita reversed the ratio of surface water to ground water used in its public supply, to about 60:40, and consequently reduced the amount of water pumped from the aquifer (fig. 3*C*). The change has already been reflected in ground-water levels. Water levels in observation well M11B, located in the area which has experienced the greatest water-level decline (fig. 2), have risen almost 8 feet since 1993 (fig. 3*B*). Aquifer storage in the well-field area increased by almost 60,000 acre-feet since 1993 (fig. 3*B*). The response in water levels and aquifer-storage change in the well-field area enhance the outlook for the longevity of the *Equus* Beds aquifer. The higher water levels also will serve to deter the migration of the saline water that is threatening the quality of the ground water.

An additional remedy to declining ground-water levels is being examined. The *Equus* Beds Recharge Demonstration Project was begun during the summer of 1997 by the city of Wichita, in conjunction with the U.S. Geological Survey, Bureau of Reclamation (U.S. Department of the Interior), and the *Equus* Beds Groundwater Management District No. 2, to evaluate the feasibility of recharging the *Equus* Beds aquifer by capturing excess flow of the Little Arkansas River when it is available and storing it in the aquifer.

Early indications are that the conversion of Wichita's primary source of water to Cheney Reservoir, as well as the potential to increase storage in the *Equus* Beds aquifer with the Recharge Demonstration Project, provide a brighter future for water supply for the city of Wichita, area residents, and agricultural water users.

—Heather C. Ross, Nathan C. Myers, and Walter R. Aucott

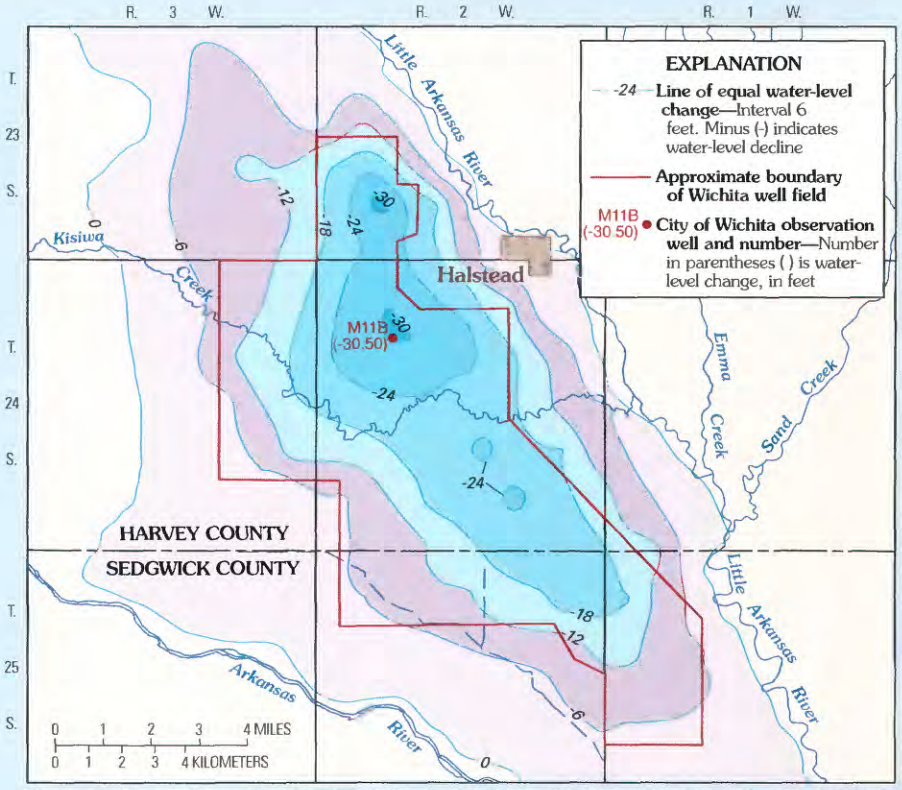

Figure 2. Lines of equal water-level change in *Equus* Beds aquifer from August 1940 to January 1997.

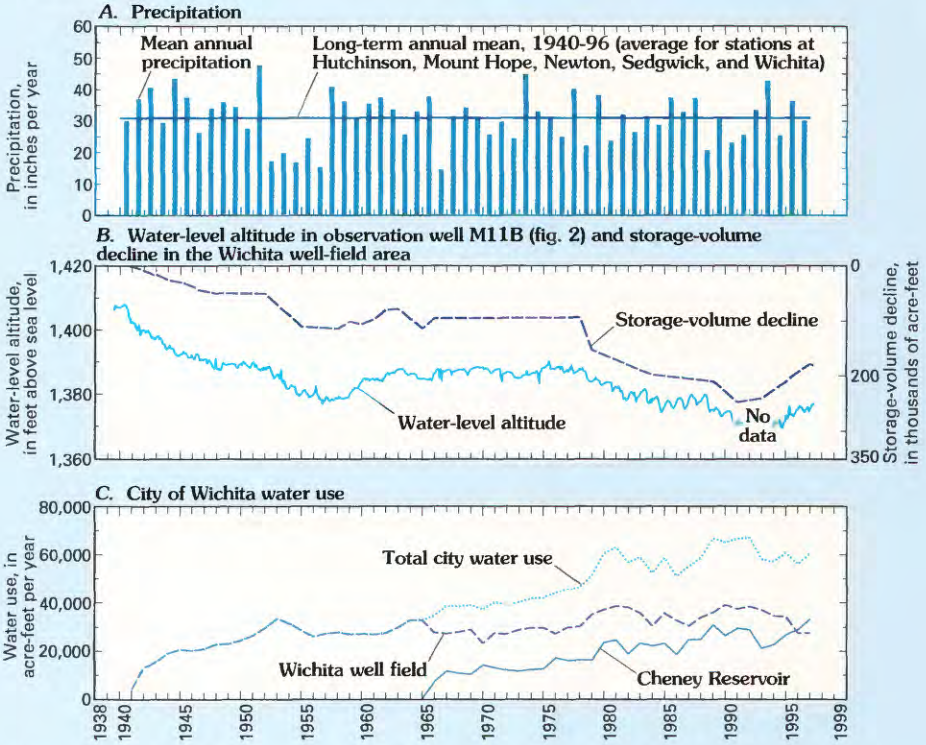

Figure 3. Relation of (*A*) precipitation, (*B*) water-level altitudes and *Equus* Beds storage-volume decline, and (*C*) city of Wichita water use. Source: (*A*) data from National Climate Data Center (1997); (*B*) data on file with U.S. Geological Survey, Lawrence, Kansas; (*C*) data from Stramel (1956, 1967) and Gerald T. Blain (city of Wichita, written commun., 1997).

References

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For more information, please contact:

District Chief
U.S. Geological Survey
4821 Quail Crest Place
Lawrence, Kansas 66049-3839
(785) 842-9909
email: waucott@usgs.gov