

# Smoky Hill-Saline Basin High Priority Issue

## Water Supply

### January 2009

Page 1

#### Issue

Meeting central Kansas Smoky Hill-Saline regional public water supply (municipal and industrial) needs.

Providing for the changing uses, demands and distribution of water use in the central part of the [Smoky Hill-Saline basin](#) to meet public water supply is a recognized need in the basin. Resource management to maintain economic stability and provide for economic growth is part of any considerations in management decisions.

#### Description

The provision of adequate quantities of good quality water for municipal and industrial purposes is of major concern. Increasing industrial, agribusiness and municipal needs for water supply all exist in various portions of this diverse basin. Communities in the relatively dry western part of the basin seek to expand and diversify their economic base. The Smoky-Hill-Saline basin relies on water from [surface](#) storage in the eastern portion and/or ground water available from local aquifers. Much of the central portion of the basin receives water from Kanopolis Lake through rural water district distribution to supplement any ground water appropriation held by the [public water supplier](#) or individual. Many communities seek to provide for industry as well as meet needs for population growth. The eastern portion of the basin receives greater precipitation, however demand in this area is also increasing with economic and population growth.

Recent climatic conditions, the decline of ground water levels and reduced reservoir yields contribute to water supply concerns. This issue is directly related to the Lower Smoky Hill River Management issue also found in this basin section.

#### Water Resources

Water sources in basin include: Cedar Bluff, Kanopolis, and Wilson Dams and associated reservoirs; the Smoky Hill and Saline rivers and tributaries and associated alluvium; as well as the Ogallala-High Plains [aquifer](#) in western portions of the basin.

Cedar Bluff Reservoir provides flood protection and storage of water for fish and wildlife, along with municipal use by the City of Russell and recharge of the Smoky Hill River alluvium. Cedar Bluff Reservoir was originally authorized for irrigation, flood control, and water supply, with incidental benefits for recreation, fish and wildlife, and water quality. In 1992, Congress reformulated the

project to create an operating pool for fish, wildlife, and recreation. Irrigation was abandoned as a project purpose and the irrigation district was dissolved. Results of an analysis by Kansas Water Office (KWO) to determine the water supply yield that can be expected during a 2 percent chance drought (required for the state Water Marketing Program) indicated Cedar Bluff is not suitable for storage of water under the Marketing Program. Therefore, Cedar Bluff Reservoir is not a potential source of additional municipal and industrial water supply.

Kanopolis dam and lake provides flood protection and storage of water for municipal and industrial use, along with fish, wildlife and recreation. The state Water Marketing Program purchase of storage of 12,500 acre feet in



Wilson Reservoir Dam on Saline River.  
Photo courtesy Kansas Geological Survey.

the multipurpose pool for municipal and industrial use was 46% of the pool based adjustments for 40 years of sedimentation. Storage capacity is presently estimated at 22,607 acre feet.. Kanopolis Lake was also analyzed by the KWO to determine water supply yield expected during a two percent chance drought. The available yield was revised in

2008 to an estimated 6.5 million gallons per day (MGD), reduced from earlier estimates.<sup>(5)</sup> The yield was originally estimated as 15.4 MGD, with 12.9 MGD yield estimated after 40 years due to sedimentation. The reduced 2008 yield is related to loss of inflow into the lake. Since 1950 there has been a significant reduction to the flow volume gain between the Bunker Hill and Ellsworth gages. This loss has reduced the volume of inflow to Kanopolis Lake.

# Smoky Hill-Saline Basin High Priority Issue Water Supply January 2009

Wilson dam and lake was originally authorized for construction by the U.S. Department of Interior, Bureau of Reclamation (Bureau) for the purposes of irrigation, navigation enhancement, flood control, recreation, fish and wildlife habitat, and water quality assurance. The multi-purpose (conservation) pool has an estimated current capacity of 227,701 acre feet. Due to the high salinity of waters in Wilson Lake; irrigation, municipal and industrial water use from the lake were determined impracticable and the construction and operation of the lake were transferred to the U.S. Army Corps of Engineers (Corps). While an authorized purpose of the project, navigation is no longer a specific consideration for the daily operations due to Wilson Lake's distance from the Missouri River.

Wilson Lake lies in the vicinity of the cities of Russell, Hays and others with anticipated water needs in the future. The possibility exists for reallocation of storage at Wilson Lake to supply water for municipal and industrial needs. Treatment techniques to address the salinity are available now at more reasonable costs, making water supply potentially practical. This water could prove crucial to assuring the long-term economic viability of the area.

Streams in the basin include approximately 3,832 perennial stream miles.<sup>(4)</sup> Diversions totaling 241,950 acre feet are authorized from all surface water sources in the basin. Approximately 9,531 acre feet are authorized for public water supply from [surface](#) supplies.<sup>(3)</sup> Minimum Desirable Streamflow (MDS), an amount of flow for in-stream uses and downstream water rights, has been set for one U.S. Geological Survey (USGS) gage on the Smoky Hill River near Ellsworth. MDS sets monthly flow targets at a gage that may vary by month. On average, streamflow has been insufficient to meet the MDS.

Ground water is found in alluvial [aquifers](#) along the major rivers and tributaries, supplying some water for beneficial uses in the basin. Ground water appropriations total 78,828 acre-feet in the basin.<sup>(3)</sup> The High Plains aquifer provides water where the Ogallala Formation is present in the western part of the basin and from the Equus Beds aquifer in McPherson County. The USGS estimated water in storage in the High Plains aquifer to be about 3.25 billion acre-feet of drainable water in 1992, with ten percent of that in Kansas.<sup>(9)</sup> The Dakota aquifer underlies most of the basin, with outcrops in Russell, Lincoln, Ellsworth and eastern Saline counties. There is great variability in aquifer yield and quality from the Dakota. The salinity of Dakota aquifer waters is one of the most important factors limiting current exploration in the confined aquifer. Water availability and economics have caused the City of Hays to develop and utilize slightly saline waters in the Dakota in west central Ellis County. The Dakota-Cedar Hills aquifer underlies portions of Ellis, Russell, Rooks, Osborne, Rush and Barton counties in the basin.<sup>(8)</sup> The Flint Hills aquifer is found in the eastern end of the basin.

Availability of additional water appropriations is limited as all of the streams and alluvial corridors in the basin are either closed or restricted for new appropriations. The Ogallala-High Plains aquifer, in the western part of

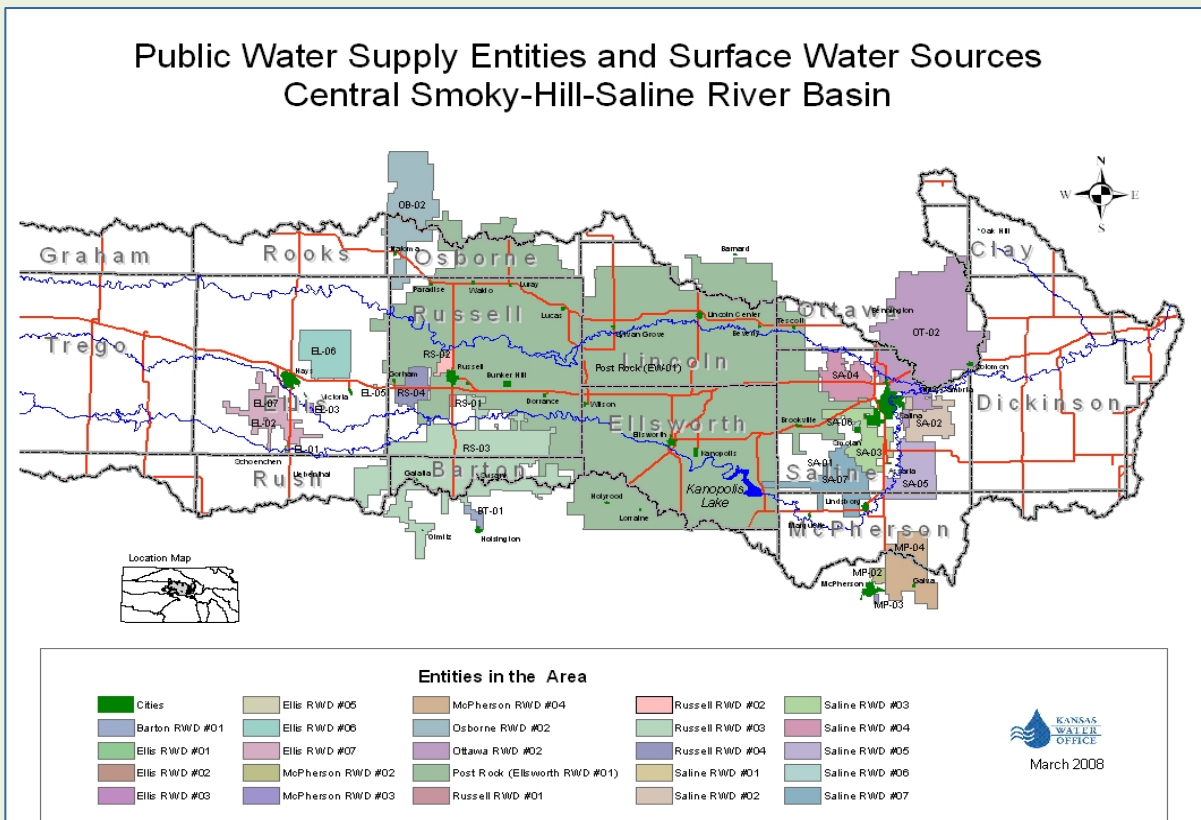


Figure 1.

# Smoky Hill-Saline Basin High Priority Issue

## Water Supply

### January 2009

Page 3

the basin, is closed in Western Kansas Groundwater Management District No. 1 (GMD1), but small ground water appropriations may be obtained in some locations in Northwest Kansas Groundwater Management District No. 4 (GMD4).

#### **Public Water Supply**

Appropriations for municipal use water rights from all sources in the Smoky Hill-Saline basin totaled 35,247 acre feet per year. Industrial water rights, not included as part of municipal water rights, totaled an additional 7,319 acre feet per year. Corresponding [water use reported](#) for 2006 was 18,901 and 1,687 acre feet per year for municipal and industrial uses respectively.<sup>(3)</sup>

Delivery of water supply in the central portion of the basin is interrelated and interconnected among suppliers. In 2006, there were 99 [public water suppliers](#) in the basin. In 2006, 721 acre-feet of water was marketed from Kanopolis Lake to Post Rock Rural Water District who in turn supplied 11 other suppliers as well as rural customers. Eleven other public water suppliers in the basin also sell water to 13 other public water suppliers.

Post Rock Rural Water District currently has a [contract](#) for a maximum quantity of 400 million gallons per year (MGY) or 1,227.555 acre feet from Kanopolis Lake. Post Rock currently serves retail customers and the cities of Brookville, Ellsworth, Dorrance, Gorham, Luray, Waldo, Paradise; the Wilson Lake Estates of Lincoln County Development; and the rural water districts #5 of Ellis County, #7 of Saline County and #2 of Osborne County. In 2006, the City of Russell was added as a place of use in order to meet a shortage at that time. Post Rock is currently providing water to an ethanol plant in Russell.

#### **Future Needs**

The basin had an estimated [population](#) of 156,161 in 2000. The population of the 32 counties that are entirely or partially in the Smoky Hill-Saline basin was 330,631 in the year 2000 and is projected to be 288,939 in the year 2040. There are no population projections for the basin itself for 2040. Rural counties have lost population, sometimes more than 10 percent every decade. However the populations are expected to increase from 19,726 in 2006 to 35,455 in 2050 for Hays and 4,280 in 2006 to 6,631 for Russell in 2050, respectively.<sup>(2)</sup> Additional water demands are occurring presently as energy and other industrial users are requesting water through public water suppliers or directly.<sup>(10)</sup>

Water supply demand projections for the central area of the basin have been estimated numerous times over the past decades. The most recent study completed in 2005, estimated a need for 7.0 million gallons maximum day net water need for the regional area including the cities of Hays and Russell and other public water suppliers. The average day net water need was estimated at 3.0 million gallons per day (MGD) for the year 2050.<sup>(1)</sup> This estimated need did not include McPherson, located outside the basin, and the additional water to meet energy industry demands that increased in 2006.

More recent estimates indicate total maximum demand of 18.4 MGD will be needed to provide Post Rock Rural Water District, Wilson, and the cities of Hays, Russell, Victoria, Sylvan Grove and Bunker Hill in the north central part of the basin by 2050.<sup>(2)</sup> This is 7.5 MGD of maximum daily water demands above estimated available supplies in the central portion of the basin. This does not include the City of McPherson's request for 3.65 million gallons per year (MGY) (11,201 acre feet) from Kanopolis, or the needs of the cities of Salina and Lindsborg in the future. The City of Lindsborg filed an application in 1997 for 606.735 MGY (1,862 acre feet) from Kanopolis but has not pursued negotiations. The City of Salina's population in 2008 was 45,956, according to the Chamber of Commerce. KWO has projected Salina's population to be 58,790 by 2040, a 28% increase. Salina has not submitted an application for water from Kanopolis but is investigating options to meet future needs..



Smoky Hill River. Photo courtesy KGS.

In 2006, KWO projected demand from 2010 to 2040 for potential additional customers of Post Rock Rural Water District as shown in Table 1.<sup>(7)</sup>

# Smoky Hill-Saline Basin High Priority Issue

## Water Supply

### January 2009

Although the estimated future water needs for public water supply (municipal and industrial uses) vary, all indicate a need for water in addition to that presently available through appropriation or water marketing. Not only does the quantity of water need to be addressed, but the distribution/transportation must be considered. Many [public water suppliers](#) in the basin are interconnected, either as a supplier or purchaser. These cooperative relationships are needed to provide water through out the basin. Planning to most effectively meet projected needs throughout the basin is the present challenge.

Potential Customers	Year				
	2000*	2010	2020	2030	2040
Bunker Hill	4.401	5.095	4.735	4.323	3.911
Kanopolis	20.700	29.635	29.337	29.039	28.692
Lincoln	75.148	53.505	48.150	43.320	38.969
Lorraine	6.643	7.190	7.190	7.190	7.190
Natoma	12.372	12.187	10.961	9.850	8.853
Russell	373.757	218.224	215.852	213.434	211.061
Russell Co. RWD #1	1.576	2.626	2.626	2.626	2.626
Russell Co. RWD #2	1.199	1.737	1.737	1.737	1.737
Russell Co. RWD #3**	59.691	58.192	60.999	63.806	66.669
Russell Co. RWD #4**	6.124	3.830	3.785	3.785	3.741
Saline Co. RWD #2	20.449	20.860	20.028	19.252	18.475
Saline Co. RWD #3**	28.229	31.787	36.835	41.884	46.933
Saline Co. RWD #4	34.205	28.732	31.934	35.218	38.421
Saline Co. RWD #8	9.388	13.389	16.831	20.327	23.768
Saline Co. RWD #6	4.233	6.833	8.655	10.477	12.261
<b>TOTAL</b>	<b>658.115</b>	<b>493.822</b>	<b>499.655</b>	<b>506.268</b>	<b>513.307</b>

\* Actual water use. \*\* Purchases from another source.

#### Recommended Actions

1. Evaluate (quantity) water resources in the basin and compare with appropriations (supply and demand analysis).
2. Evaluate management of various hydrologic systems and resources in the basin that may provide opportunities for additional water uses.
3. Develop strategy for additional supplies. Options include:
  - a. Request federal reallocation of storage in Wilson Lake.
  - b. Purchase Wilson Lake storage for Water Marketing Program, if determined feasible.
  - c. Consider additional storage in Kanopolis Lake.
  - d. Explore opportunities for long-term reconfiguring of connections if storage in Wilson Lake is purchased.
4. Negotiate water marketing contracts based on available water.
5. Explore methods to reduce need for additional water supplies such as:
  - a. Evaluate opportunities to improve efficiency and conservation of existing municipal supplies to provide additional users with the savings.
  - b. Explore options for reuse/recycling of water to allow for additional water users without increasing consumptive use.
6. Continue to support local conservation efforts and programs such as in the City of Hays and WaterOne district in Johnson County.
7. Continue to promote water quality measures to protect sources of public water supply.

# Smoky Hill-Saline Basin High Priority Issue

## Water Supply

### January 2009

Page 5

#### Resources

1. Burns & McDonnell. 2005. *Wilson Lake Water Treatment Facilities Concept Design Report*.
2. Burns & McDonnell. 2007. Preliminary data for Wilson Lake Public Assistance to States evaluation report.
3. Kansas Department of Agriculture-Division of Water Resources. 2008. Water Right Data.
4. Kansas Geological Survey. 2007. *KGS OFR 2003-55E: Assessment of Riparian Areas Inventory, State of Kansas*. [http://hercules.kgs.ku.edu/geohydro/ofr/2003\\_55/riparian/ofr\\_2003\\_55e.htm](http://hercules.kgs.ku.edu/geohydro/ofr/2003_55/riparian/ofr_2003_55e.htm).
5. Kansas Water Office. April 2008. *DRAFT Kanopolis Water Supply Yield Analyses and Review of Reservoir Inflow Depletions*.
6. Kansas Water Office. 2008. *Surplus Water Available in Water Marketing Program Lakes Calendar Year 2008*.
7. Kansas Water Office. 2006. *Preliminary Findings Request by Rural Water District No. 1, Ellsworth County dba Post Rock Rural Water District to Purchase Water from Kanopolis Lake for Water Supply Purposes*. November 16, 2006.
8. McFarlane, Alan. 1998. *Dakota Aquifer Program*. Kansas Geological Survey. [HTTP://www.kgs.ku.edu/Dakota/vol1/hydro/hydro1.htm](http://www.kgs.ku.edu/Dakota/vol1/hydro/hydro1.htm).
9. Miller, James A. 1997. *Groundwater Atlas of the United States Kansas, Missouri and Nebraska, HA-730-D*. United States Geological Survey.
10. United States Census Data. 2000.