

Solomon Basin High Priority Issue Subbasin Water Management January 2009

Issue

Solomon River water resources management by sub-basins to stabilize hydrologic systems and improve reliability of water availability to water users.

Description

The Solomon River drains an area of 6,835 square miles including all or parts of Decatur, Norton, Phillips, Smith, Jewel, Sherman, Thomas, Sheridan, Graham, Rooks, Osborne, Mitchell, Cloud, Lincoln, Dickinson and Saline counties. The basin includes subbasins with hydrologic unit codes 10260011-upper North Fork Solomon River, 10260012-lower North Fork Solomon River, 10260013-upper South Fork Solomon River, 10260014-lower South Fork Solomon River and 10260015-mainstem Solomon River (Figure 1).

The present allocations and operation of water resources and the associated problems varies by watershed within the Solomon basin. Three U.S. Bureau of Reclamation dam/reservoir projects regulate streamflow in the Solomon basin. These are; Kirwin along the North Fork Solomon, Webster along the South Fork Solomon, and Glen Elder/Waconda at the confluence of North and South Forks of the Solomon River. Streamflow is dependent on runoff and climatic factors that cannot be regulated and vary widely year to year.

Ground water depletion due to pumping occurs in the Solomon River basin in the Ogallala-High Plains and the alluvial aquifers. Low stream flows have occurred in recent years as well. Stream flow has a direct effect on ground water recharge, especially in the alluvial aquifer.

The Ogallala-High Plains aquifer occurs in the western

third of the basin. The alluvial/stream systems interact with the Ogallala-High Plains in the upper North and South Forks of the Solomon River. Alluvial ground water supplies depend on recharge from runoff and stream flow from water released from the reservoir storage.

Three irrigation districts; Kirwin Irrigation District No. 1, Webster Irrigation District No. 4 and Glen Elder Irrigation District No. 8 operate using releases from the three reservoirs. These reservoirs are Kirwin, Webster and Waconda respectively. When water is available from storage in the lakes, the irrigation districts are authorized to irrigate up to 25,394 acres. Water storage in the reservoirs has often been well below levels needed to meet water allocations in recent years.

Water appropriations by sub-basin are shown in Table 1. Almost 425,000 acres are authorized for irrigation in the Solomon basin from surface and ground water sources. (1)

The major water use in the basin is irrigation. Ground water is the source for the upper North and South Forks and the lower North Fork, while surface water is the main source for the lower South Fork and the Solomon River subbasins.

Upper Solomon subbasins (above Kirwin and Webster reservoirs) annual water use average ranged from 66,461 acre-feet in 1993 to

246,868 acre-feet in 1998. The average water use for the subbasins from 1987-2006 was 147,004 acre-feet. (2)

The average annual water use in the lower Solomon subbasins (Kirwin and Webster reservoirs to the confluence of the North and South Forks) ranged from 5,384 acre-feet in 1993 to 30,821 acre-feet in 2000. Average water use for the subbasins from 1987-2006 was 19,911 acre-feet. (3)

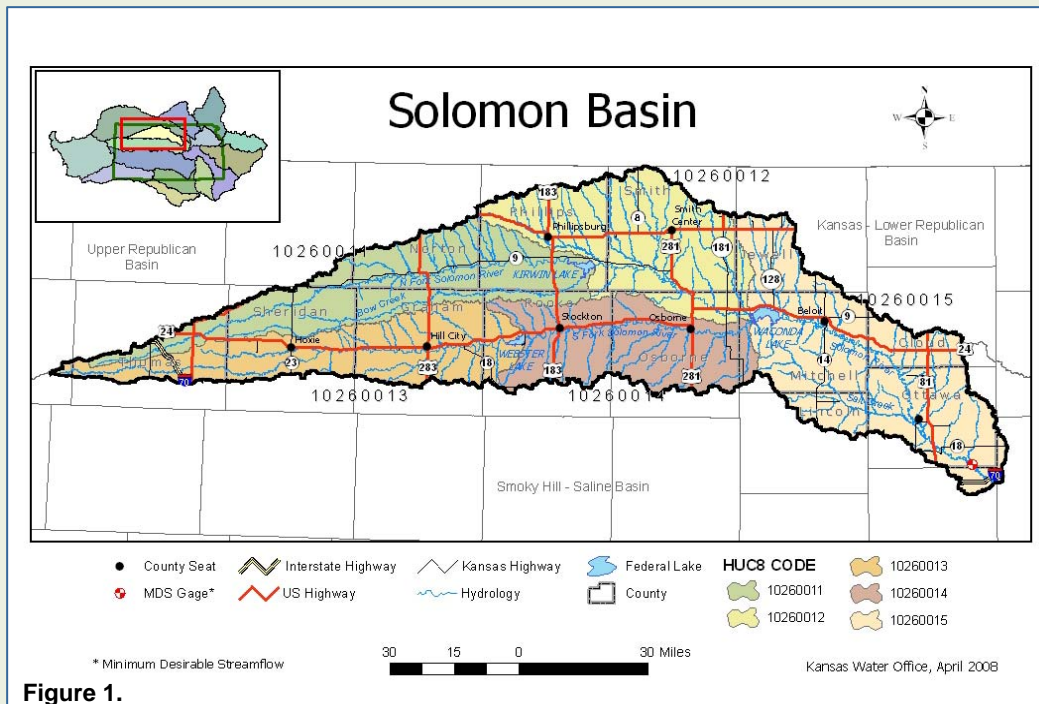


Figure 1.

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**Table 1.
SOLOMON BASIN APPROPRIATIONS BY SUB BASIN (HUC08)
Acre-Feet per Year**

	Domestic	Industrial	Irrigation	Municipal	Recreation	Stock	Other	Total
Upper North Fork Solomon River	16	16,288	163,751	2,039	320	1,424	586	184,424
Lower North Fork Solomon River	1,246	3	17,215	1,464	0	172	683	20,783
Upper South Fork Solomon River	4	734	111,939	2,077	204	369	0	115,327
Lower South Fork Solomon River	15	249	34,253	2,709	98	2,684	291	40,299
Solomon River	154	226	34,852	3,449	499	668	774	40,622
BASIN TOTAL	1,435	17,500	362,010	11,738	1,121	5,317	2,334	401,455

Mainstem Solomon subbasin (below Glen Elder) annual water use ranged from 2,990 acre-feet in 1993 to 30,326 acre feet in 2002. Average [water use](#) for the subbasin from 1987-2006 was 14,503 acre feet.⁽⁴⁾

In the upper North and South Fork Solomon, streamflow observations at U.S. Geological Survey (USGS) gages at Glade (North Fork), Bow Creek at Stockton and above Webster Reservoir on the upper South Fork have been in operation since at least 1952. The average streamflow for their periods of record were 25 cubic feet per second (cfs), 12 cfs and 49 cfs respectively. During the 1990s flow was higher, averaging 38 cfs, 17 cfs and 55 cfs. Reduced flows averaging 7 cfs, 6 cfs and 13 cfs have occurred in the 2000s.

On the lower North and South Fork of the Solomon, streamflow observations at USGS gages at Portis and Osborne indicate average flows have declined from the 1990s flows of 175 cfs and 168 cfs, respectively. Declines in flows since records began in the 1940s, averaging 115 cfs and 105 cfs, respectively, are also documented. Averages for the 2000s, so far, are 33 cfs and 20 cfs. Ground water in these subbasins displays seasonal fluctuations which are affected by the operations of surface water delivery systems through the Kirwin and Webster irrigation districts. Overall ground water levels were down throughout the subbasin in 2007.

In the mainstem Solomon subbasin, streamflow observations at USGS gages located below Glen Elder Reservoir, downstream from Niles and on Salt Creek at Ada, indicate average flows over their periods of record were 219 cfs, 539 cfs and 64 cfs, respectively. (The period of record varies for each gage, but includes at least 1965 through present.) During the 1990s streamflow levels were higher averaging 468 cfs below Glen Elder, 883 cfs at Niles and 108 cfs on Salt Creek. Reduced flows oc-

curred in the 2000s averaging 58 cfs, 154 cfs and 23 cfs respectively.

The Niles gage has minimum desirable streamflow (MDS) set in 1984. Most of the time MDS criteria is met at Niles, although in 2002 MDS was not met.

Ground water measurements indicate an average decline of 0.78 feet from 2006 to 2008. The five-year rolling average shows a cyclical pattern with a declining trend since 1998.

Recommended Actions

1. Complete the refinement of water balance of subbasins within the Solomon basin.
2. Continue modeling of upper North and South Fork with scenarios of possible future water use patterns.
3. Develop management operations to improve reliability of water available to water right holders.
4. Work with federal agencies to make appropriate reservoir storage and operation changes to meet sustainable yield management and other goals of *Kansas Water Plan*.

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Resources

1. Kansas Department of Agriculture-Division of Water Resources. 2008. Water Right Database-Water Resources Information System (WRIS). April 18, 2008.
2. Kansas Department of Agriculture-Division of Water Resources. 2008. *Upper Solomon Subbasin 2007 Field Analysis Summary*. Subbasin Water Resources Management Program.
3. Kansas Department of Agriculture-Division of Water Resources. 2008. *Lower Solomon Subbasin 2007 Field Analysis Summary*. Subbasin Water Resources Management Program.
4. Kansas Department of Agriculture-Division of Water Resources. 2008. *Mainstem Solomon Subbasin 2007 Field Analysis Summary*. Subbasin Water Resources Management Program.
5. USDA National Resource Conservation Service. 2008. http://www.ks.nrcs.usda.gov/technical/RWA/kansas_watersheds.html



Solomon and Smoky Hill Rivers. Photo courtesy KGS.