State of the Resource & Regional Goal Action Plan Implementation Report

August 2018

Smoky Hill-Saline Regional Planning Area

Kansas Water Office

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Executive Summary

The Smoky Hill-Saline State of the Resource & Regional Goal Action Plan Implementation Report is intended to provide a background of the regional issues and record activities and progress toward regional goals and the *Long-Term Vision for the Future of Water Supply in Kansas (The Vision)* objectives utilizing the most up to date data available at the time of report development.

The primary concern within the Smoky Hill-Saline Region is future water quality and supply to fully meet the needs of the region. More specifically, it is the ability to maintain present usage while allowing for expanded use to support economic development and growth in the region, even in times of drought.

Surface and groundwater resources within the Smoky Hill-Saline Region suffered from lower than normal precipitation from 2009 to 2016. Due to very low precipitation in 2012, water use spiked at just over 50,000 acre-feet for the region, with irrigation use from groundwater sources over 25,000 acre-feet in 2012.

The region utilizes a mix of surface and groundwater to meet area needs, but often finds supply low in one area or another during periods of drought or low precipitation. Of the three federal reservoirs in the region, only Kanopolis Lake provides water supply on a consistent basis. Cedar Bluff reservoir is generally not full due to low inflows, but storage does include a small quantity for municipal use. Wilson Lake salinity has limited its development as a water supplier due to treatment costs.

Maintaining or increasing storage in the region is a key component to ensure water supply into the future, along with efficient use and developing additional supplies. As a primary source of supply serving many residents in the region with domestic water, as well as providing water for industry livestock, and irrigation, Kanopolis Lake's ability to store sufficient water is important to the regional supply. Both reducing sedimentation in Kanopolis and securing additional water storage are seen as components to allow for future water supply.

Increasing public water supply efficiency is recognized as an important contributor to regional water conservation and the ability to meet the demands of the future. Educating those who manage the water systems and their water users is an important component in achieving regional efficiency. Initial steps have been made with the first annual Public Water Supply Conservation Day to share the successes and failures in local conservation program components. Resources are needed to aid public water suppliers to reduce usage to quantities.

Conservation practice implementation now and into the future continues to be necessary to reduce nutrient and sediment runoff impacting the surface waters of the Smoky Hill-Saline Region. Annual implementation progress made on the Watershed Restoration and Protection Strategy (WRAPS) watershed plans within the region can be compared to the remaining needs identified within these same plans to quantify the overall financial need to fully implement watershed plans covering these areas. Overall, the total remaining need to fully implement WRAPS watershed plans for the region is almost $49 million.

Water Use Trends

Groundwater is the primary source of water used in the region (Figure 1), accounting for approximately 78% of the total use over the last 10 years. Irrigation water use is the primary use of groundwater within the region while municipal water use is the primary use for surface water. Annual reported water use for the region fluctuates based on climate conditions. Higher water use naturally occurs during periods of hot and dry weather in the growing season and lower water use during periods of cooler and/or wetter weather (Figure 2).

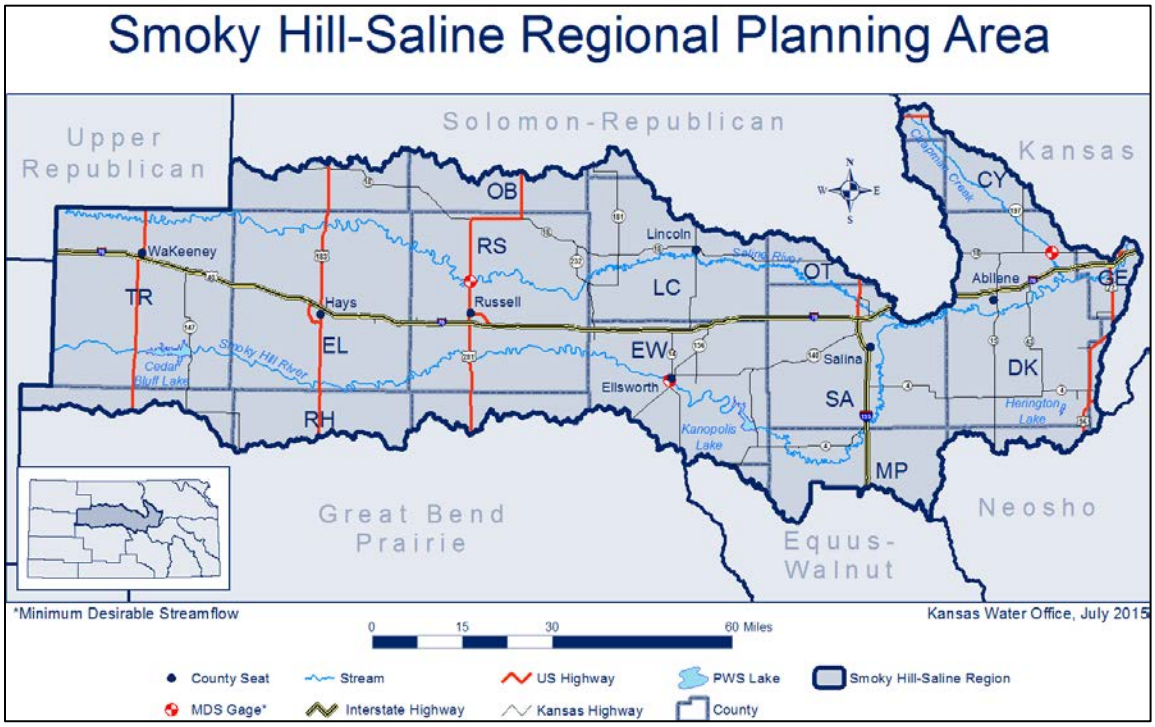
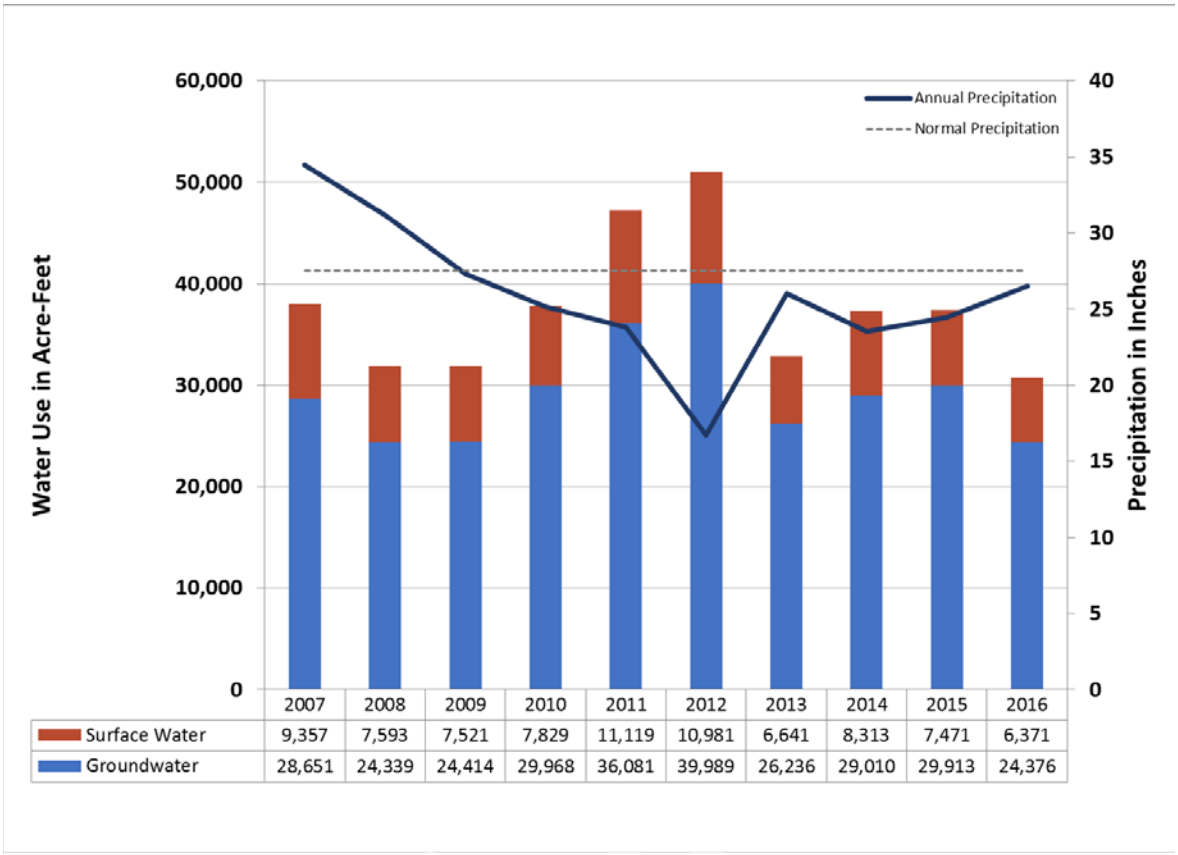


Figure 1: Smoky Hill-Saline Regional Planning Area



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Surface Water	9,357	7,593	7,521	7,829	11,119	10,981	6,641	8,313	7,471	6,371
Groundwater	28,651	24,339	24,414	29,968	36,081	39,989	26,236	29,010	29,913	24,376

Figure 2: Surface water and groundwater use for years 2007- 2016 within the Smoky Hill-Saline Region

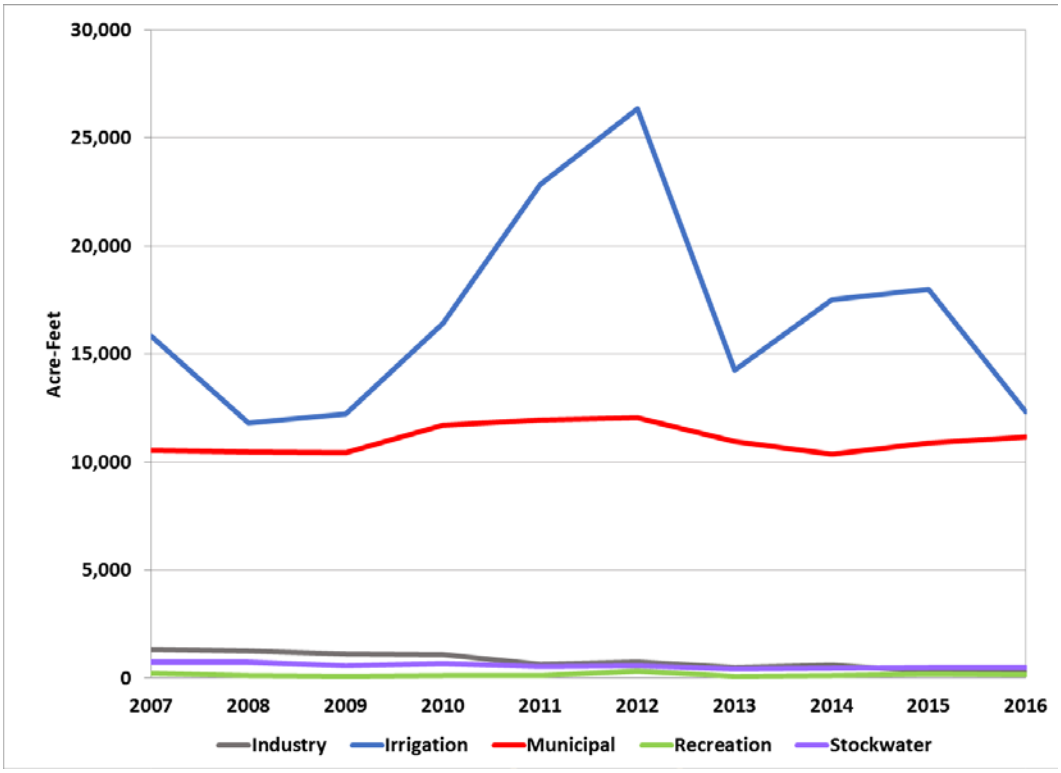


Figure 3: Annual reported water use by type from groundwater sources, Smoky Hill-Saline Region

Water Resources Conditions

Groundwater

Groundwater sources utilized within the Smoky Hill-Saline Region include the Ogallala-High Plains Aquifer in the far western portion of the region, Flint Hills Aquifer in the east, and alluvial deposits along major streams (Figure 4). The alluvial deposits (terrace and valley fill) become thicker and wider to the east. The alluvial water sources are closed or restricted to new appropriations in Ellis, Trego, and western Russell Counties.

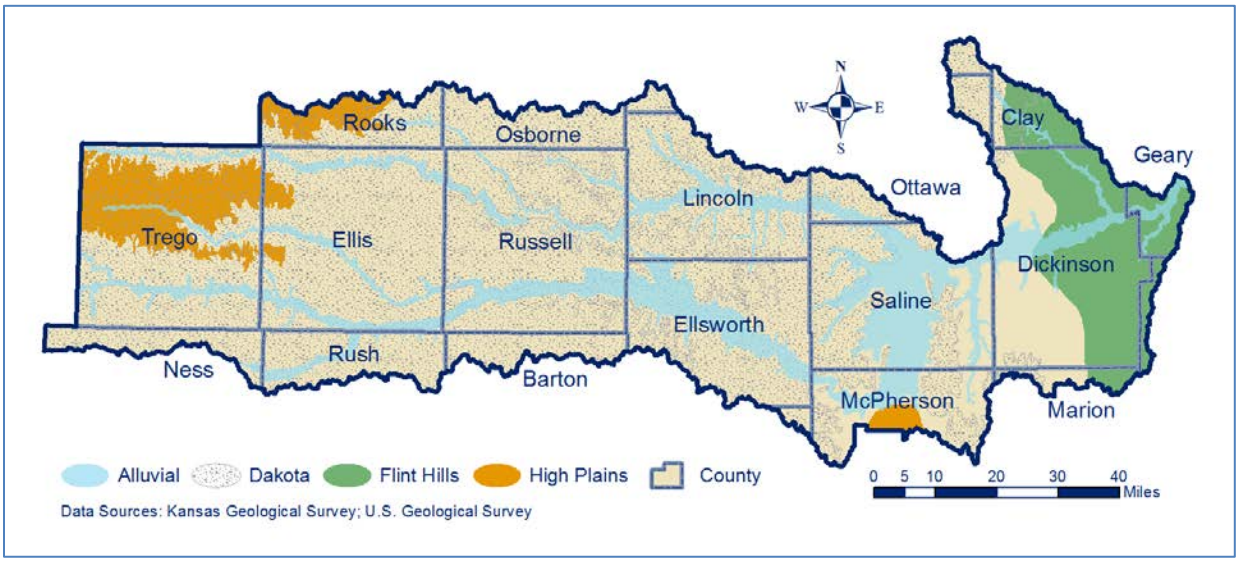


Figure 4: Aquifers in the Smoky Hill-Saline Region

Figure 5 is an example of annual water level changes in the region, in the High Plains Aquifer in Trego County and the alluvium of Ellis County. Water levels may also be obtained from monitoring wells within a municipal wellfield in the Smoky Hill River alluvium giving some trends on recharge events. More information can be found through the United States Geological Survey (USGS) website.

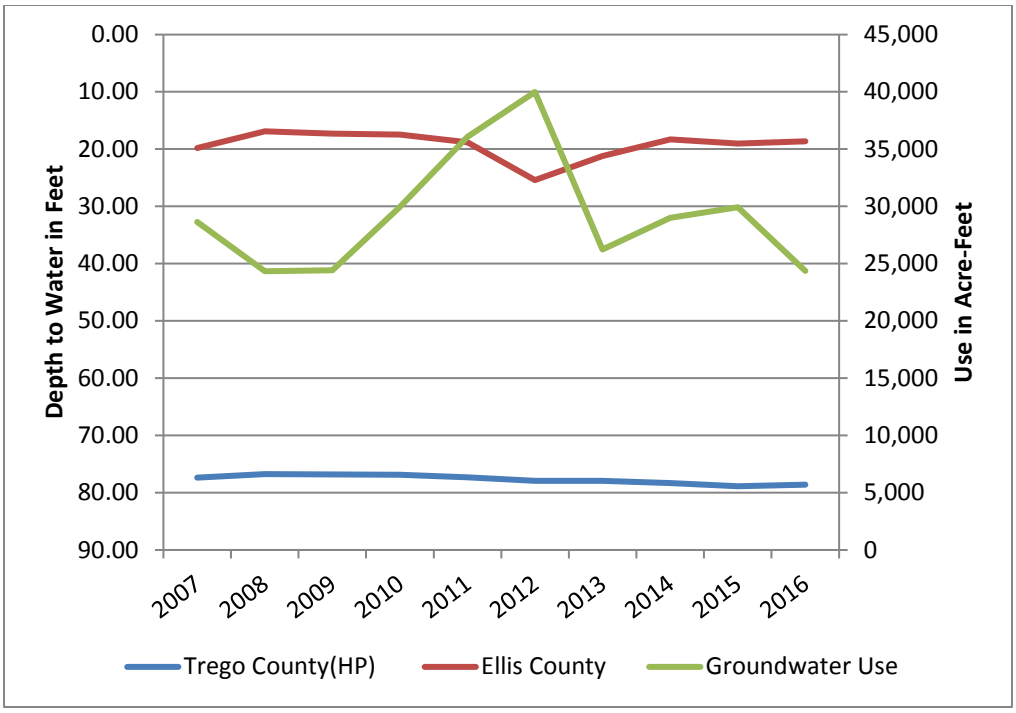


Figure 5: Groundwater use and groundwater depth for High Plains Aquifer (Trego County) and alluvium (Ellis County), Smoky Hill-Saline Region

Low quality waters, both ground and surface, are potential sources for additional water supply. Aquifers for additional water supply in the region include the Dakota, Arbuckle and Cedar Hills, although sources of poorer quality underlie the region. The water quality of the Dakota Aquifer is known to vary with location, depth, and rate of freshwater entering from above and saltwater intrusion from strata below.

Surface Water

The principal rivers in the Smoky Hill-Saline Region are the Smoky Hill River and the Saline River. Three federal reservoirs are located within the region: Cedar Bluff Reservoir and Kanopolis Lake on the Smoky Hill River, and Wilson Lake on the Saline River. Herington Reservoir in Dickinson County, a municipal owned lake, is a source of supply water for four communities.

Reservoirs within the Smoky Hill-Saline Region serve as an important source of water supply and provide flood protection benefits. Storage capacity for reservoirs within the region is being diminished over time due to soil erosion from upland and stream channel sources eventually being deposited in the nearest downstream reservoir. For long-term water supply planning purposes, it is important to know how much capacity has been lost due to reservoir sedimentation, as well as the estimated rate at which sedimentation is taking place. Estimated capacity loss, as well as sedimentation rate, as determined from the most recent bathymetric surveys has been calculated for Cedar Bluff Reservoir, Kanopolis Lake, and Wilson Lake within the Smoky Hill-Saline Region (Table 1). Bathymetric survey reports can be downloaded for each of these reservoirs through the reservoir interactive map at KWO.

Table 1: Smoky Hill-Saline Region reservoir sedimentation information

Reservoir	Year Built	Original Capacity (AF)	Estimated Current Capacity (AF)	Estimated Capacity Loss	Estimated Sedimentation Rate (AF/yr)
Cedar Bluff Reservoir	1950	185,090	168,537	9%	256
Kanopolis Lake	1948	73,200	48,378	34%	422
Wilson Lake	1964	235,256	229,619	2%	128

Kanopolis Lake serves as a primary water source for many in the Smoky Hill-Saline Region. From the beginning of 2016 through early 2017, Kanopolis Lake was at or above Conservation Pool (elevation 1463). Kanopolis Lake has remained at or above Conservation Pool for almost all of 2016 and 2017 (Figure 6).

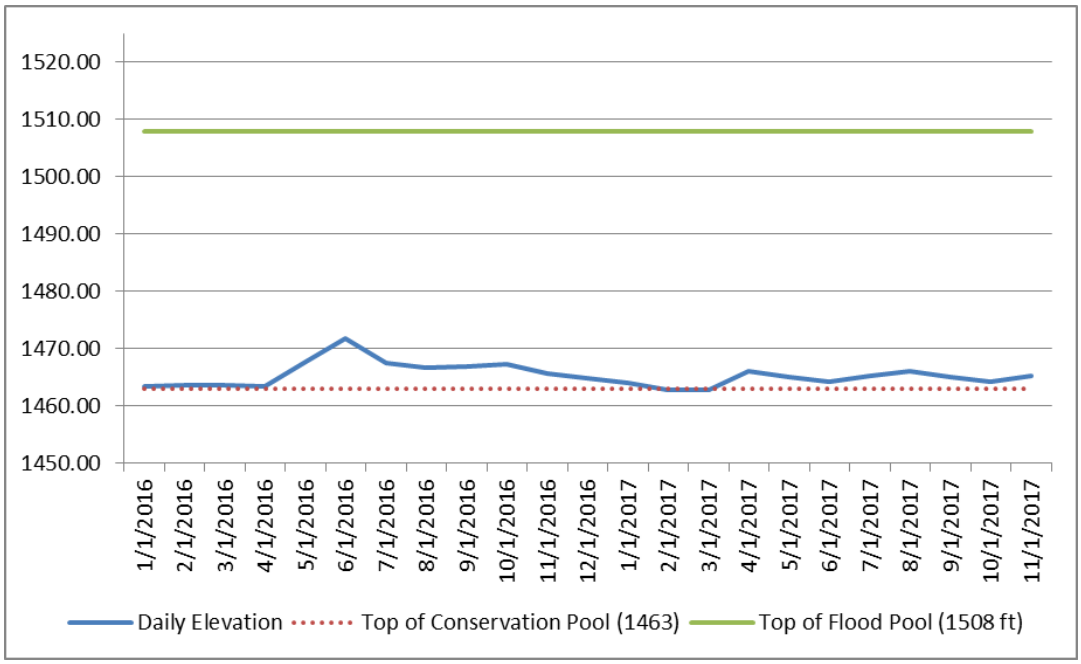


Figure 6: Kanopolis Lake elevations 2016 and 2017

Cedar Bluff Reservoir supports recreation, a fish hatchery, and a small municipal water right. When full, the conservation pool could contain 143,878 AF, however Cedar Bluff has not had a full Conservation Pool for many years.

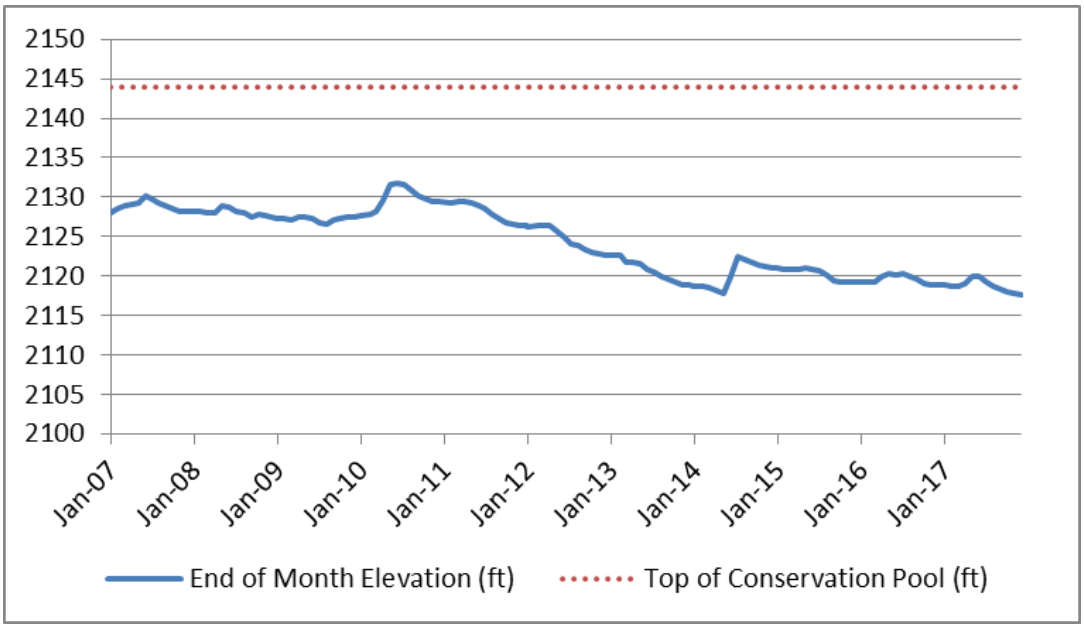


Figure 7: Cedar Bluff Reservoir Elevations 2007-2017

Wilson Lake primarily provides recreational opportunities for the region, as costs for treatment for salinity and transportation have prohibited its development as a water supply source.

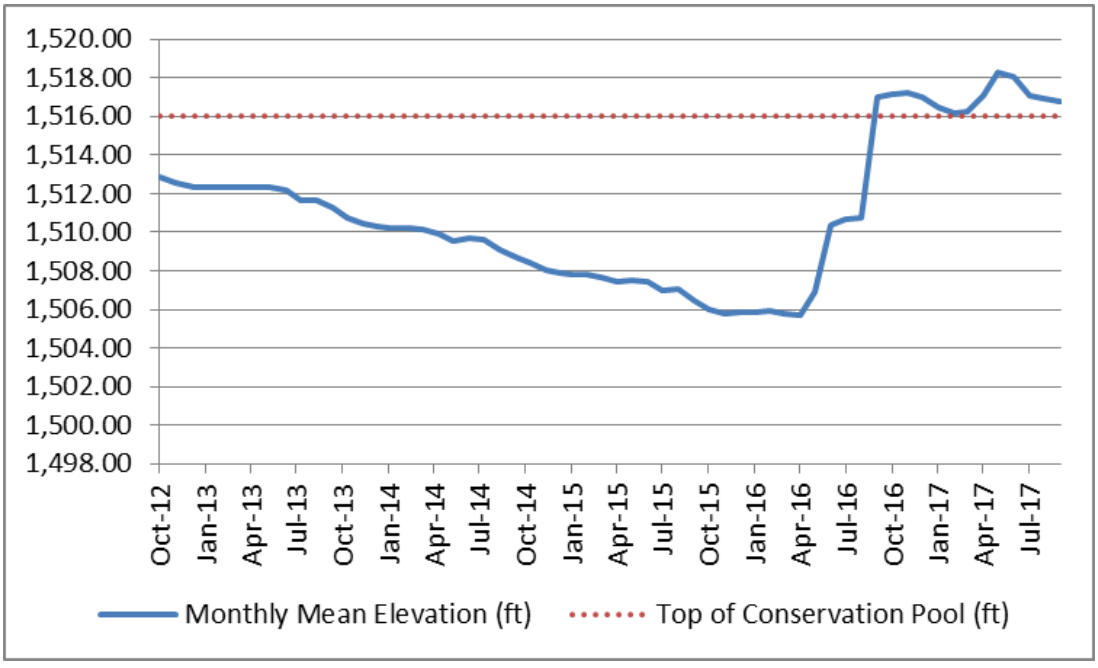


Figure 8: Wilson Lake water level information (USGS water data, 1/31/2018)

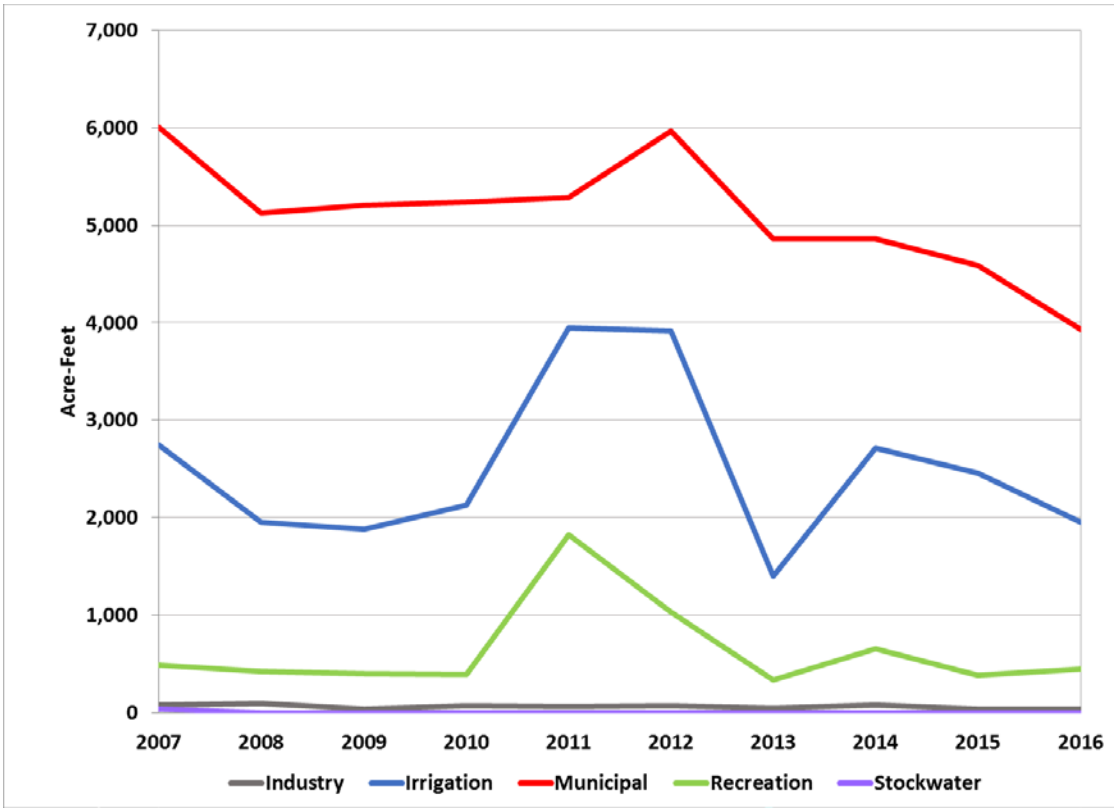


Figure 9: Annual surface water use by type of use

Operations of the Kanopolis Lake, primarily releases, have been revised in recent years, improving overall water availability by keeping more water in storage much of the time. This results in more water availability for downstream water users under dryer conditions, contributing to a major regional goal to increase available water supply.

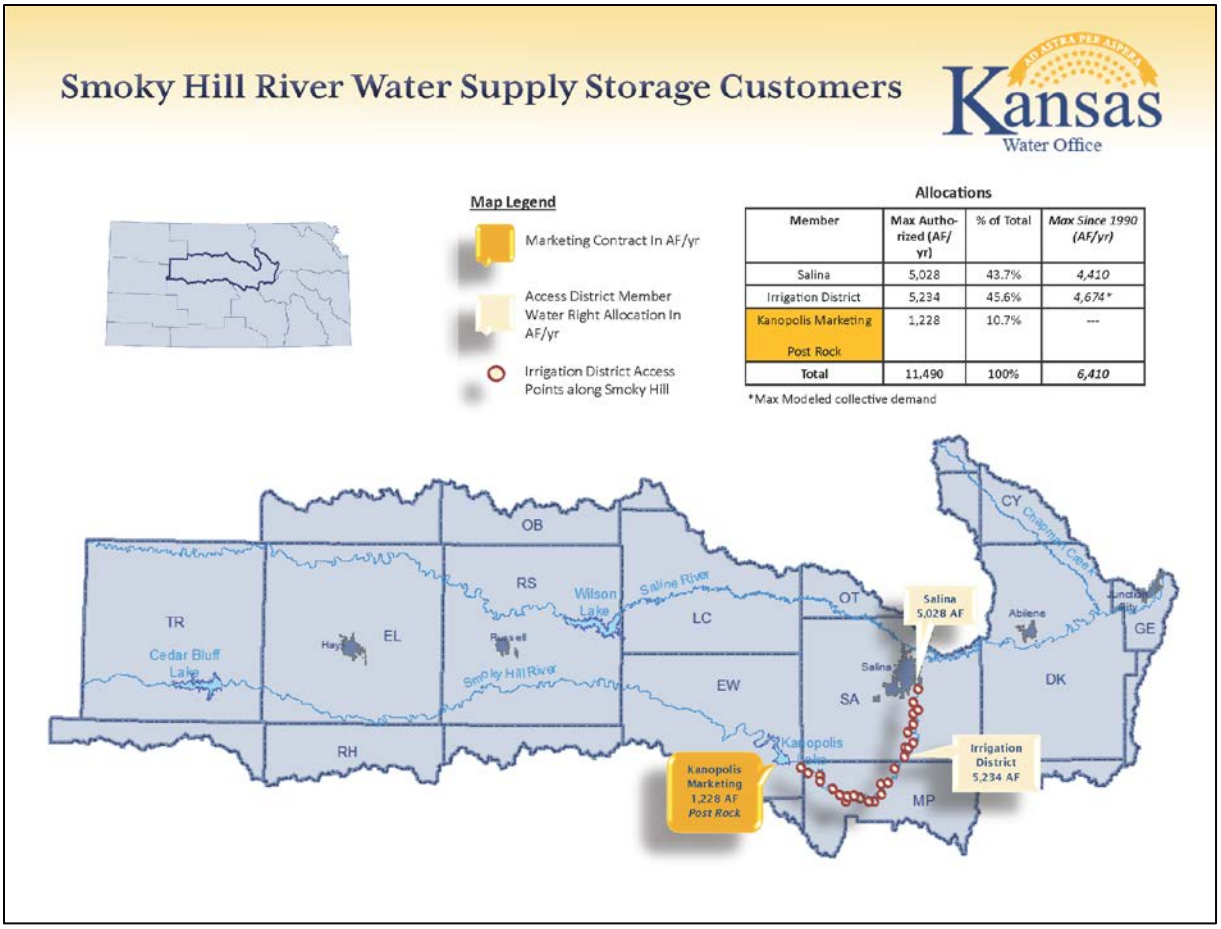


Figure 10: Smoky Hill River water supply storage customers

Water Quality

Surface Water

The Clean Water Act requires states to conduct Total Maximum Daily Load (TMDL) studies and develop TMDLs for surface water bodies identified on the state's List of Impaired Waters (Section 303(d) List). TMDLs are quantitative objectives and strategies needed to achieve the state's surface water quality standards. In the Smoky Hill-Saline Region, TMDLs have been developed to address dissolved oxygen, sulfate, chloride E. Coli bacteria, selenium, total suspended solids, eutrophic conditions and other parameters.

Four impairments were added to the 2016 Section 303(d) list that were not in place in 2014 including arsenic and gross alpha on the Smoky Hill River. Table 3 provides an overview of the impaired waters within the Smoky Hill-Saline Regional Planning Area. Additional information on TMDLs and the Section 303(d) list of impaired waters can be found through Kansas Department of Health and Environment (KDHE).

Table 3: KDHE 2016 303(d) list of impaired waters summary, Smoky Hill-Saline Regional Planning Area

Smoky Hill-Saline Region 2016 303(d) List Summary	
Total Number of Impairments	125
Lake Impairments	34
Most Common Impairments	
Sulfate	30
Eutrophication	19
Chloride	17
Selenium	9
E.Coli	6

Sedimentation

Sedimentation is a major issue in the eastern regions of the state and creates many challenges to managing reservoir water supplies. As reservoirs reach their design life they accumulate sediment, reducing the reservoir's capacity to hold water supply for municipal and industrial customers in the Water Marketing Programs and the Water Assurance Districts. The reservoirs in this region are all affected by sedimentation and loss of storage capacity is a concern.

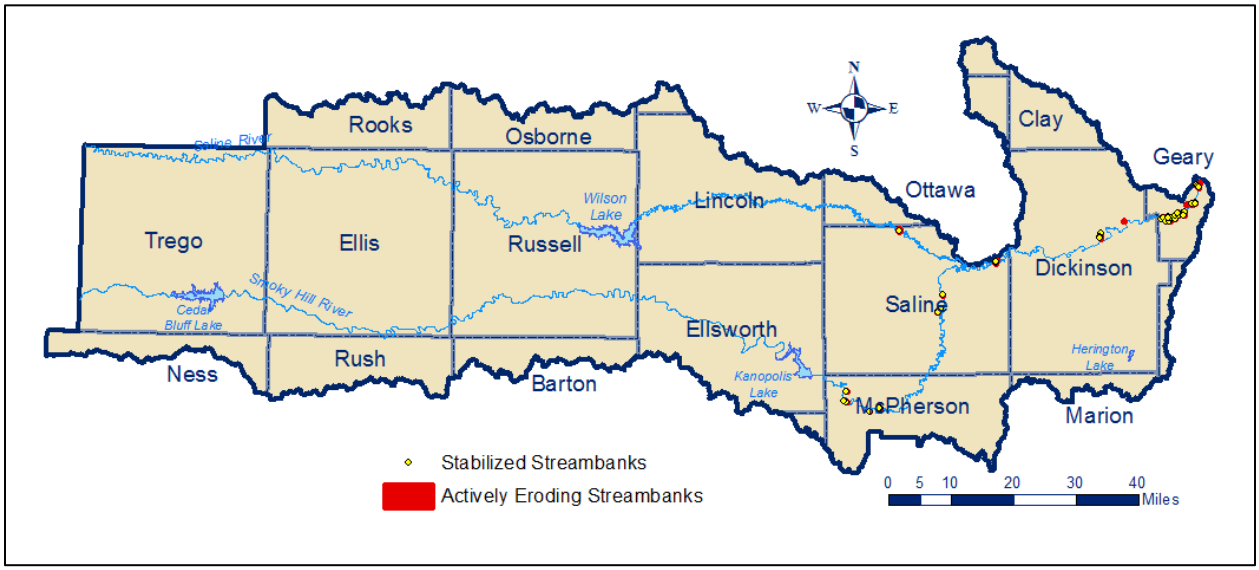


Figure 11: Smoky Hill-Saline Regional Planning Area streambank stabilization projects

Currently in the Smoky Hill-Saline Region there is no streambank erosion above the reservoirs. Below the three reservoirs in the region (Figure 11) there are 42 streambank hotspots and of these 42 sites, 38 have already been stabilized, reducing the sediment load by an estimated 60,194 tons per year. There are four sites that remain to be completed and if completed, will reduce the sediment load by an additional estimated 17,515 tons per year.

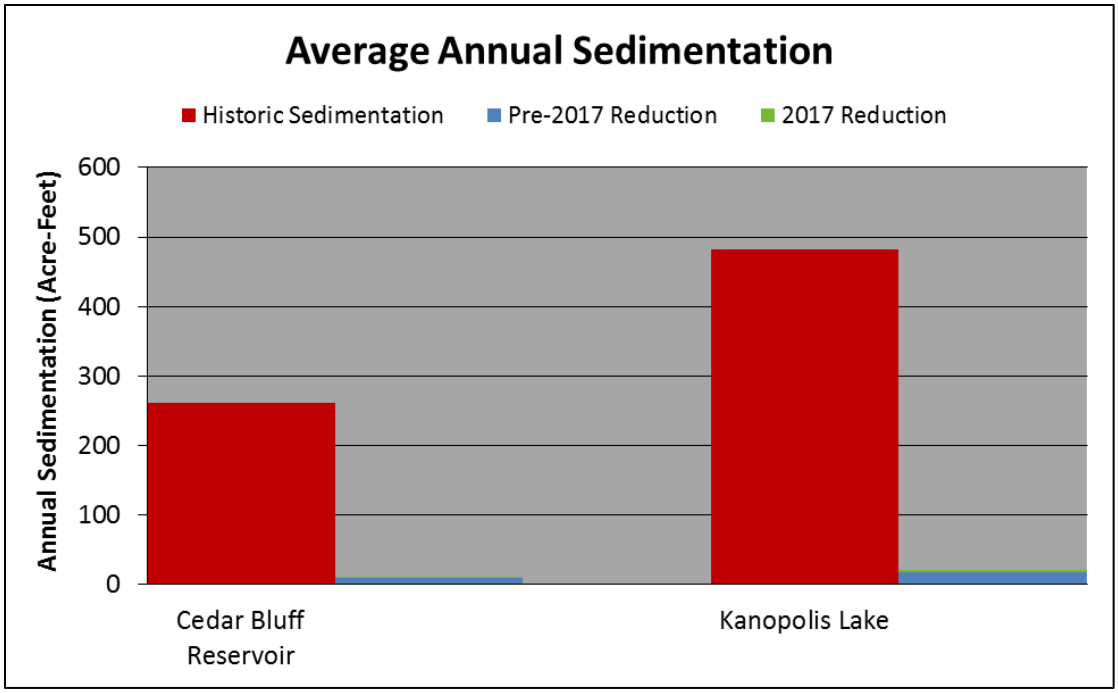


Figure 12: Average annual sedimentation in Smoky Hill-Saline Region reservoirs

Figure 12 shows the average annual sedimentation which is estimated using the change in conservation storage between bathymetric surveys, compared to the estimated sediment load reduction of Best Management Practices (BMPs) and stream stabilization project implemented in the watersheds above federal reservoirs in the Smoky Hill-Saline region, where data is available.

The estimated annual reductions compare total implementation prior to 2017 (beginning in 2012) to reductions in 2017. The results show Kanopolis Lake has the highest historical sedimentation rate of about 480 acre-feet per year but also has the highest estimated sediment reduction. All sediment reduction came from the implementation of BMPs as there were no stream stabilization projects upstream of the reservoirs.

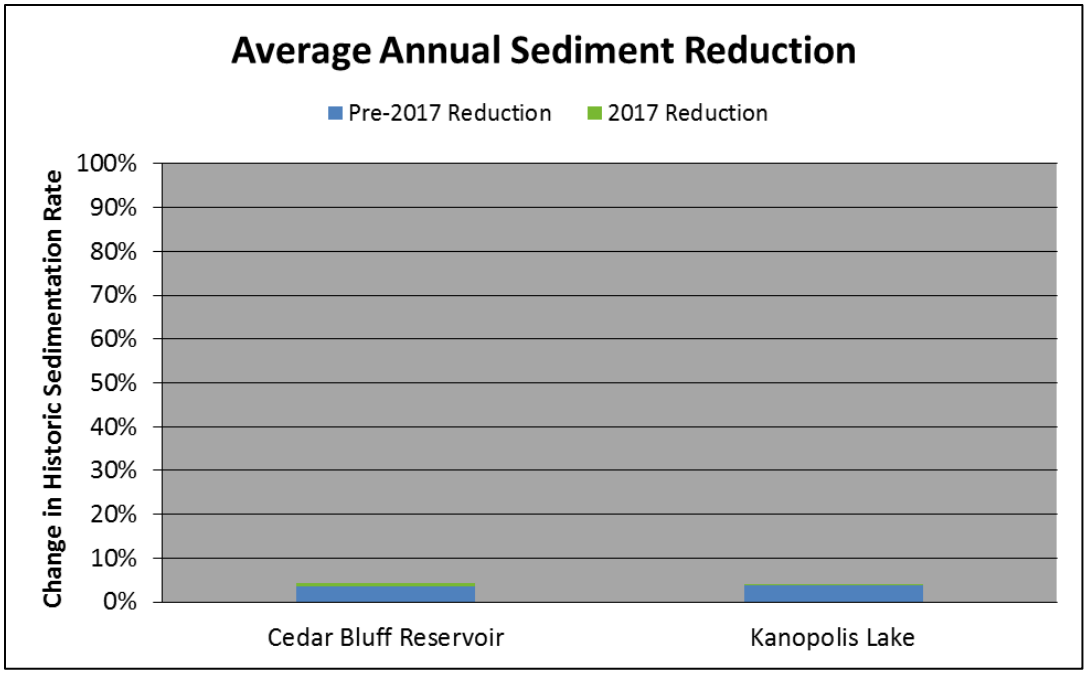


Figure 13: Average annual sediment reduction in Smoky Hill-Saline Region reservoirs

Figure 13 shows the change in reservoir sedimentation from the implementation of load reduction practices. Both lakes had similar percent reductions of about 4% of the total sedimentation rate.

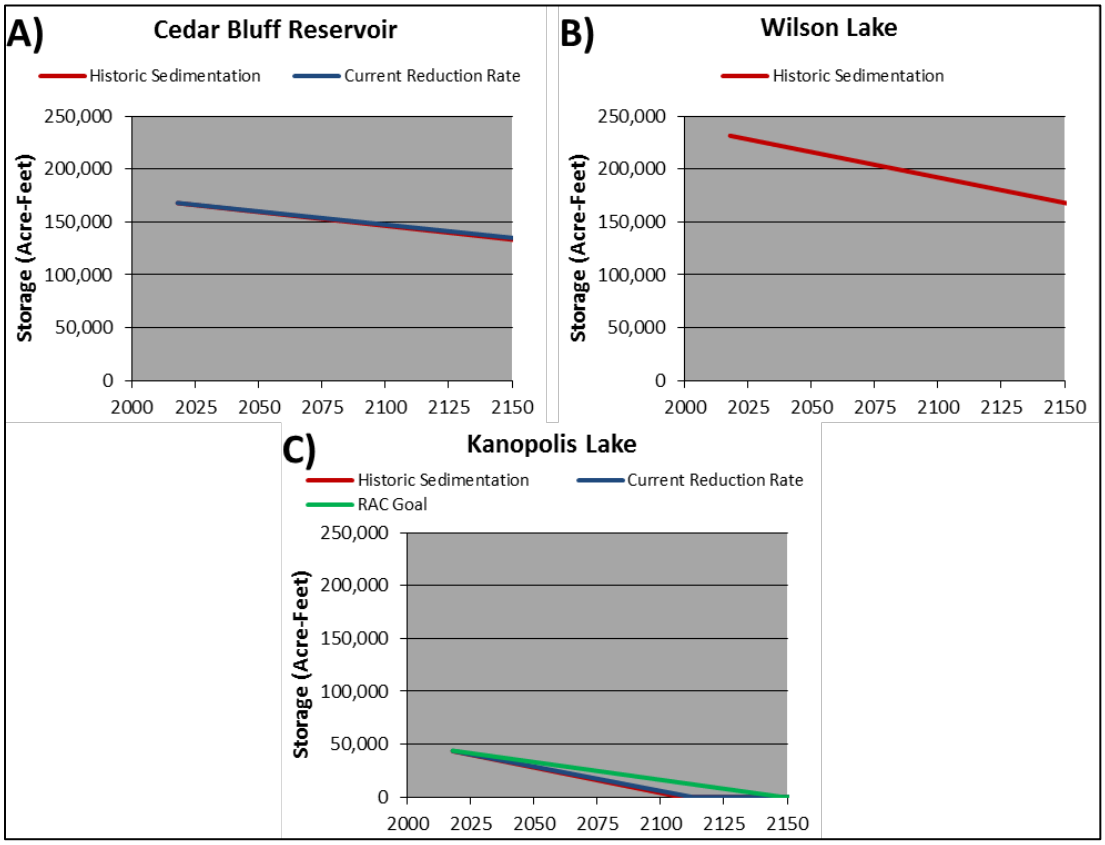


Figure 14: Reservoir capacity at conservation pool for Smoky Hill-Saline Region reservoirs

There is a relativity small benefit of sediment reduction practices shown in Figure 14, extending the estimated lifetime of Kanopolis Lake from 2109 to 2113. Furthermore, with the high rate of sedimentation at Kanopolis Lake, long term loss of storage will still be an issue even with the implementation of the RAC goal to have a 26% reduction in total suspended solids on the Smoky Hill River at Ellsworth (shown as a 26% reduction the sediment load on top of the current reduction).

Implementation Progress

Surface Water

Conservation practice implementation is a key action to protect water supply storage and improve water quality in surface water within the Smoky Hill-Saline Region. These conservation practices can be individual practices or a combination that have been determined to be the most effective and practicable (including technological, economic, and institutional considerations) means of controlling non-point sources of pollution at levels compatible with resource and economic goals. A number of agencies partnered within the Smoky Hill-Saline Region to assist producers with conservation practice implementation, including the Natural Resource Conservation Service (NRCS), the Kansas Department of Agriculture–Division of Conservation (KDA-DOC), and the local county conservation districts, as well as KDHE and the active WRAPS projects within the region (Figure 15).

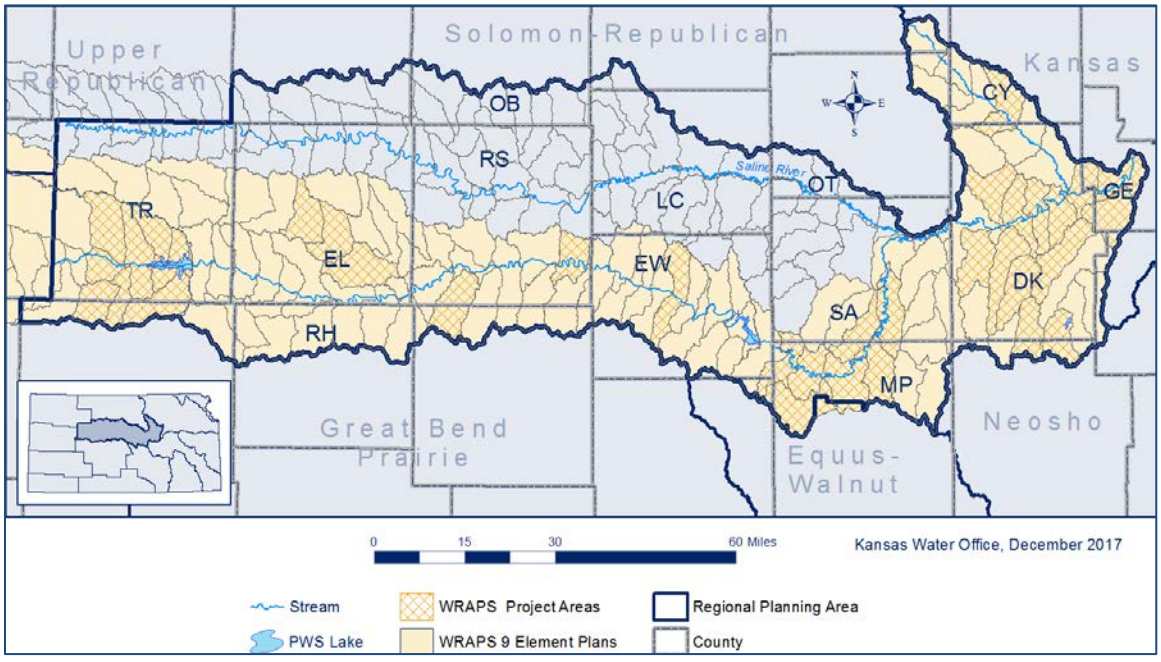


Figure 15: WRAPs project areas in Smoky Hill-Saline Region

The conservation practices implemented through the above mentioned partners are compiled on an annual basis by KDHE, with load reduction estimates from these efforts being calculated and reported to the Environmental Protection Agency (EPA) to show progress made within Kansas to reduce nutrient and sediment runoff from non-point sources of pollution. These annual load reduction estimates can then be compared to load reduction targets identified within WRAPS watershed plans to evaluate

annual watershed plan implementation progress in relation to overall watershed plan goal targets (Table 4). The highest 2017 load reductions from conservation practice implementation in this region have been in watersheds that are not above the federal reservoirs.

Table 4: KDHE data summary of effect of practices put in place in 2017 and WRAPs targets

Smoky Hill-Saline Region Watershed	Load Reduction Information	Nitrogen (lbs/yr)	Phosphorus (lbs/yr)	Sediment (tons/yr)
Not above a federal reservoir	2017 Reported Load Reductions	5,155	2,735	2,383
	WRAPs Plan Reduction Target	N/A	80,165	83,255
	% Target Achieved	N/A	3.4%	2.9%
Cedar Bluff Reservoir	2017 Reported Load Reductions	954	477	435
	WRAPs Plan Reduction Target	N/A	32,005	N/A
	% Target Achieved	N/A	1.5%	N/A
Kanopolis Lake	2017 Reported Load Reductions	2,093	1,084	749
	WRAPs Plan Reduction Target	288,780	37,735	15,734
	% Target Achieved	0.7%	2.9%	4.8%

For Federal FY2015 through FY2017, NRCS has compiled information summarizing conservation practice implementation efforts through their Environmental Quality Incentives Program (EQIP) and National Water Quality Initiative (NWQI) for surface water resources within the region. There were a total of 149 contracts with a total obligation of over $3.6 million benefiting over 21,000 acres within the region (Table 5). Over this time period, the top five conservation practices contracted acres included conservation crop rotation, residue and tillage management (no-till and reduced till), prescribed grazing, and terraces. Please note this data was not obtained through the Resource Economic Analysis and Planning Division (REAP) of the NRCS and as such is considered unofficial.

Table 5: NRCS contract program summary for Smoky Hill-Saline Region for surface water resources, FFY2015-17

FFY2015 thru FFY2017 EQIP and RCPP Contracts by Fund Code: Smoky Hill-Saline Region			
EQIP or RCPP Fund Code	**Number of Contracts**	**Contract Acres**	**Contract Obligation**
NWQI-Big Creek	22	3,169	$534,446
Sedimentation Above Federal Reservoirs	13	2,418	$306,136
Water Quality	114	16,261	$2,793,205
TOTAL	**149**	**21,848**	**$3,633,788**

The first public water supply field day was held October 13, 2017, showcasing conservation and efficiency efforts by the City of Hays to almost 50 attendees. The field day showcased various conservation practices and attendees toured sites demonstrating successful practices. The second field day is scheduled for October 19, 2018 in Salina.

Implementation Needs

Conservation practice implementation now and into the future continues to be necessary to reduce nutrient and sediment runoff impacting the surface waters of the Smoky Hill-Saline Region. Annual implementation progress made on the WRAPS watershed plans within the region can be compared to the remaining needs identified within these same plans to quantify the overall financial need to fully implement watershed plans covering these areas (Table 6). These figures include costs associated with conservation practice implementation, as well as technical assistance needs to help landowners implement conservation practices. Overall, the total remaining need to fully implement WRAPS watershed plans for the region is almost $49 million.

Table 6: WRAPS watershed plan remaining funding needs

Watershed	Rangeland/Livestock Practice Needs	Cropland Practice Needs	Technical Assistance and Information Needs	Streambank Needs	Total
Cedar Bluff	$ 216,360	$ 5,956,033	$ 5,497,683		$ 11,670,076
Kanopolis	$ 8,846,140	$ 9,578,995	$ 1,556,979		$ 19,982,114
Upper Lower Smoky Hill	$ 397,904	$ 6,407,754.0		$ 1,811,408	$ 8,617,066
Lower Lower Smoky Hill	$ 550,952	$ 5,388,888	$ 2,300,000	$ 233,505	$ 8,473,345
Total	$ 10,011,356	$ 27,331,670	$ 9,354,662	$ 2,044,913	$ 48,742,601

Regional Goals & Action Plan Progress

While *The Vision* provides a framework for the management of the State's water supply overall, Regional Goals identify and address issues at the local level. In 2015, Regional Goal Leadership Teams were developed for each of the 14 regional planning areas which were comprised of local water users along with input from area stakeholders to help develop regional water supply goals. These goals were adopted by the KWA in August of 2015 and at that same time members for the 14 RAC were appointed. The first task for the newly formed RACs was to develop action plans to correspond with the regional goals. The Smoky Hill-Saline RAC completed action plans for their regional goals in fall of 2016. Information included within this section highlights recent progress made on regional goal action plan implementation.

Regional Goal #1	Goal Theme	Annual Progress			
		2017	2018	2019	2020
Increase available water supply, water supply storage, and interconnectivity among public water supplies within the Smoky Hill – Saline Planning Region. Methods of attaining goal can include: temporary or permanent conservation pool rise at Cedar Bluff Reservoir; utilize Wilson Reservoir as a	Water Supply and Storage			--	--

water supply source for the region; permanent conservation pool rise at Kanopolis Reservoir; evaluate Kanopolis Reservoir to determine the feasibility of dredging and initiate project if deemed viable; construction of new water supply reservoirs within region; and phreatophyte control within riparian areas. Timeframe of implementation: Complete by 2060. Result of efforts: Ensure water supply available from reservoir storage exceeds demand by at least 10% through the year 2060.					
Progress Legend	Not Started	In Progress	Delayed	Cannot Complete	Complete

2018 Update:

- Official request to the USACE for a 2-foot pool rise at Kanopolis was made in 2010
- An inventory of watershed districts structures in the region has been mapped by KWO
- Low quality water summit, a step to additional water supply
- KDHE completed the Technical, Financial and Managerial (TFM) Survey of water suppliers statewide

Next Step(s):

- Complete Smoky Hill-Saline section of Reservoir Roadmap
- Review results of pilot produced water treatment project in Red Hills to determine viability as additional supply
- Review KDHE-TFM survey to evaluate needs for interconnections among systems

Regional Goal #2	Goal Theme	Annual Progress			
		2017	2018	2019	2020
Develop a statewide conservation education program/model which is applicable to all public water supplies which quantifies water conservation efforts on customer usage. Develop a youth-based water conservation education program which is tied to school curriculum. Provide producers with tools and resources needed to make informed management decisions which improve water use efficiency. Educate all Planning Region stakeholders on the benefits of water conservation, thus working towards sustainable use of the region's water surface and groundwater	Education			--	--

resources.						
Progress Legend	Not Started	In Progress	Delayed	Cannot Complete		Complete

2018 Update:

- Low Quality Water Summit was held July 18, 2017 in Hutchinson as a joint meeting for the Equus-Walnut, Great Bend Prairie, Red Hills and Smoky Hill-Saline Regional Advisory Committees (RACs). The summit provide opportunity for the four RACs to open dialogue with local, state and federal agencies and experts on the characteristics of low quality waters and the potential to utilize them to meet future needs. In addition to the educational benefits of the meeting, this is a step in determining the viability of produced and low quality waters as a part of increasing available water supply in the region
- First annual field day for public water supply conservation held October 2017, coordinated with 50-Year Vision Education efforts
- Second field day scheduled for October 2018
- Education coordinator position has been established and the KDA is looking to fill the position
- A marketing firm has delivered a marketing campaign, Kansas Runs on Water

Next Step(s): Work with statewide vision education and outreach to educate region's stakeholders.

Regional Goal #3	Goal Theme	Annual Progress			
		2017	2018	2019	2020
Reduce sediment and total suspended solids (TSS) concentrations within the lakes and streams within the Smoky Hill – Saline Planning Region. Method of attaining goal can include the continued support of best management practice (BMP) implementation for practices which reduce sediment runoff. Focus BMP implementation within priority areas identified in Big Creek Middle Smoky Hill River Watersheds 9 Element Watershed Protection Plan. Timeframe of implementation: Complete by 2040 - Final year of 9 Element Watershed Protection Plan is 2034. Result of efforts: 26% reduction of TSS concentrations on the Smoky Hill River at Ellsworth as noted within the 9 Element Watershed Protection Plan. Remove sediment-impaired waters from the KDHE TMDL list.	Sedimentation			--	--
Progress Legend	Not Started	In Progress	Delayed	Cannot Complete	Complete	

2018 Update:

- WRAPs 9 element plans are in place for all of the Smoky Hill River including Big Creek within the region through four projects; Cedar Bluff, Kanopolis Lake, Upper Lower Smoky Hill and Lower-Lower Smoky Hill

- Conservation practice implementation through existing local, state and federal programs produced estimated nutrient and sediment load reductions across the Region
- Reservoir Protection Initiative to put BMPs in Kanopolis Lake watershed

Next Step(s): Continue support of placement of BMPs to reduce sediment in lakes and streams.

Regional Goal #4	Goal Theme	Annual Progress			
		2017	2018	2019	2020
Increase public water supply water use efficiency for suppliers within the region. Method of attaining goal can include the promotion of development of new or updated water conservation program plans for public water supplies within the Smoky Hill – Saline Planning Region. Implementation of conservation measures which lead to all public water supplies in the Smoky Hill – Saline Planning Region operating in the bottom 1/3rd of Gallons per Capita Per Day (GPCD) when compared to other public water supplies within respective Regions used for GPCD comparison. Timeframe of implementation: Complete by 2040. The results of the efforts will be obtaining the same or increased outputs within participating municipalities while utilizing the same or less amounts of water.	Water Supply Conservation			--	--

Progress Legend	Not Started	In Progress	Delayed	Cannot Complete	Complete

2018 Update:

- Completed data evaluation of GPCD use for public water suppliers in region revealed a range of 35 to 189 gallons GPCD
- A review of regional averages for the 2007-2011 and 2009-2013 periods had 22 systems reporting use above their regional average both periods
- First public water supply field day held October 13, 2017, showcasing conservation and efficiency efforts by the City of Hays to almost 50 attendees. Included presentations on relative success of various conservation practices and a tour to sites in the city demonstrating successful practices
- List of PWS and priority for water conservation plan assistance developed

Next Step(s):

- Develop outreach program to public water suppliers
- Develop toolbox for public water suppliers' education of customers

References

"Map of Real-Time Streamflow Compared to Historical Streamflow for the Day of the Year (Kansas)." *USGS WaterWatch – Streamflow Conditions*, waterwatch.usgs.gov/?m=real&r=ks.

"Regional Water-Quality Patterns." *Dakota Aquifer Program* , www.kgs.ku.edu/Dakota/vol1/water/water03.htm.

"Surplus Water Available in Water Marketing Program Lakes Calendar Year 2018", December 2017, *Kansas Water Office*, http://www.kwo.ks.gov/docs/default-source/reservoirs/rpt_2018_surplus_water_120117.pdf?sfvrsn=4.

"Watershed Planning, Monitoring, and Assessment Section." *Kansas Department of Health and Environment* , www.kdheks.gov/tmdl/.