WATER RESOURCES

IMPACT

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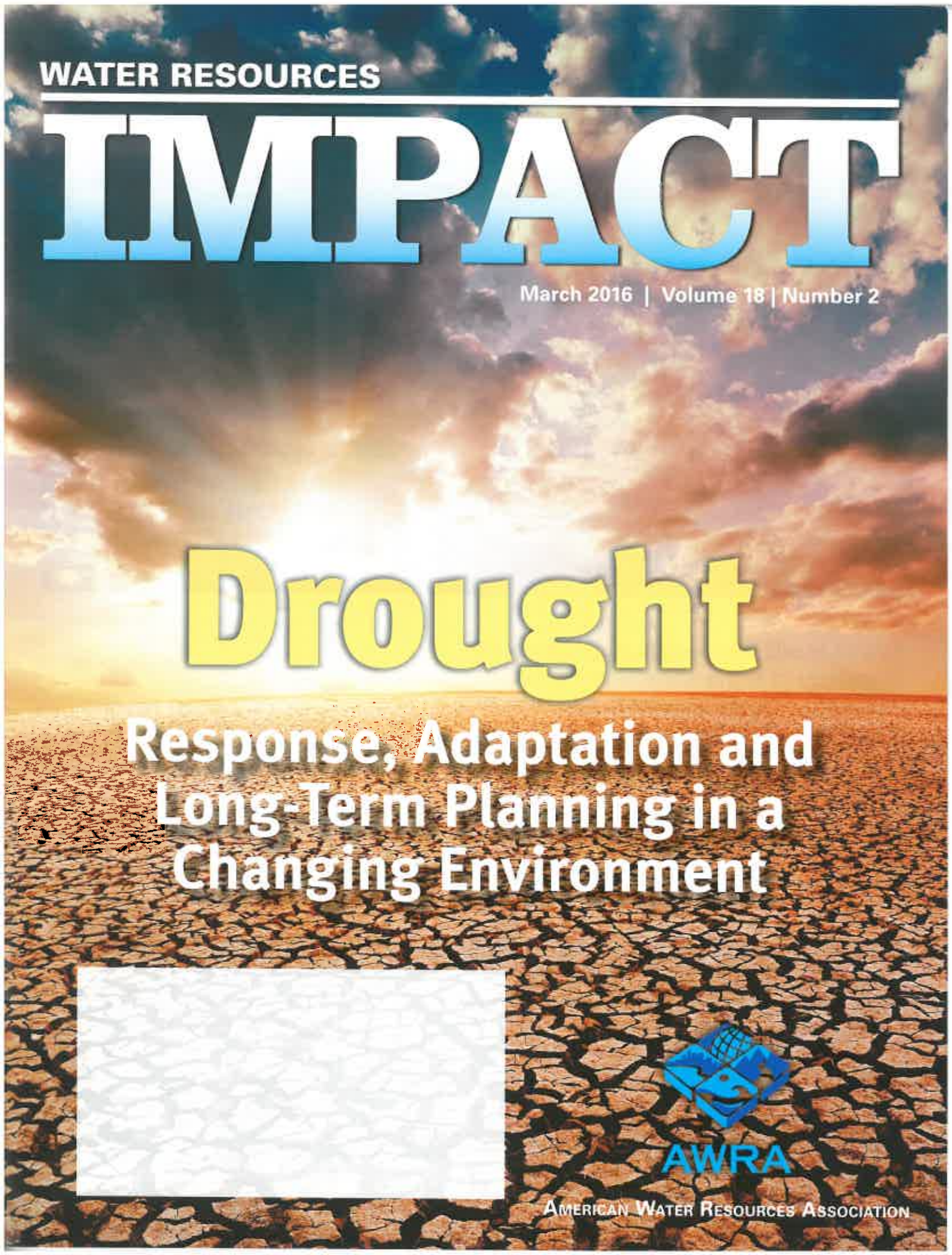


Drought

Response, Adaptation and Long-Term Planning in a Changing Environment

AWRA
American Water Resources Association

Smoky Hill River Restoration and Other Kansas Drought Planning Measures

Martha Tasker

Figure 1. Smoky Hill River Watershed in Kansas.

> The Smoky Hill River Renewal Master Plan was accepted by the Salina City Commission in August 2010, and is utilized as a planning document for projects along the Old River Channel.

River restoration projects require a sound engineering analysis of a wide range of issues, such as physical and legal water supply, water quality, channel design, regulatory requirements and public safety—to name a few. The Smoky Hill River restoration project in Salina, Kansas, addressed major technical issues such as physical and legal water supply, drought period operations and sediment management in conjunction with the proposed planning improvements to ensure compatibility and to align with the goals and objectives identified by public input. The Smoky Hill River Renewal Master Plan (Master Plan) identifies appropriate planning, design and preliminary engineering responses to the restoration and redevelopment of the existing river channel within the city of Salina, Kansas.

Smoky Hill River Watershed

The Smoky Hill River is a 560-mile river in the central Great Plains of North America, running through the states of Colorado and Kansas (see Figure 1).

The Smoky Hill River originates in the High Plains of eastern Colorado and flows eastward into Kansas through the Smoky Hill region. The Saline and Solomon Rivers are tributaries of the Smoky Hill River, which then joins the Republican River at Junction City to form the Kansas River. The Smoky Hill River has a tributary of 8,810 square miles and feeds two reservoirs, Cedar Bluff Reservoir, (far west/ upstream of Salina) and Kanopolis Reservoir (approximately 65 miles west/upstream of Salina).

Salina, Kansas - Smoky Hill River

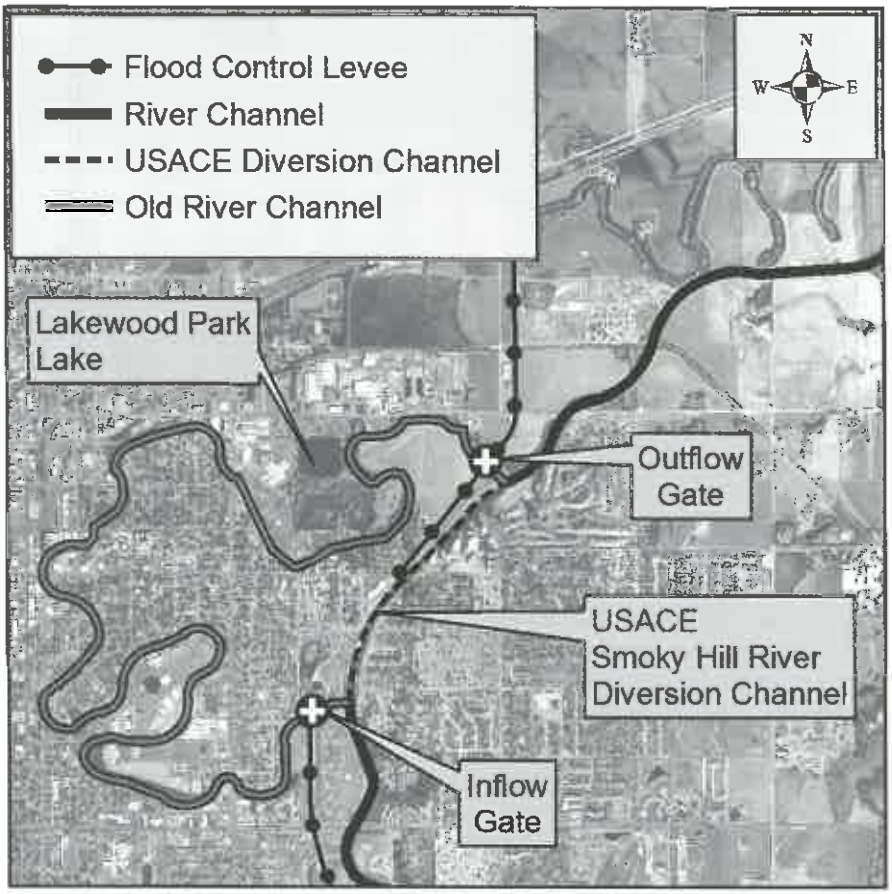
Prior to 1957, the Smoky Hill River flowed through Salina along the course of the Old Smoky Hill River Channel (Figure 2), subjecting downtown and much of the city to seasonal flooding. Major floods devastated Salina in 1903, 1927, 1938 and 1951.

To prevent future flooding, the U.S. Army Corps of Engineers constructed flood control measures consisting of a levee system and river diversion channel, bypassing the majority of the flow around the downtown area. This construction occurred from 1957 to 1961. The Old River Channel was the source of water for the city's water treatment plant; therefore, inflow and outflow gates were provided through the levee to allow water flow to the city's water treatment plant. Sediment restricted flow in the Old River Channel and a pump station and pipeline was constructed in the 1980s to connect the Main Channel of the river to the Water Treatment Plant.

Old River channel deterioration

The diversion of water from the Main Channel to the Old River Channel is controlled by the inflow gate/piping and is limited to 100 cubic feet per second (cfs), which results in shallower, slower flows and deposits sediment in the bottom of the Old River Channel (six feet deep over half of the seven mile channel). In addition, trash, debris and dead trees restrict flow and are unsightly. The Old River Channel receives urban stormwater run-off, city street debris, oils and other accumulated material from approximately five square miles of the city, including downtown. Over the past 50 years, the Old River Channel has slipped from a featured focus of the community to a drainage ditch that is not recognized as a river.

Figure 2. Old Smoky Hill River Channel.



Technical issues

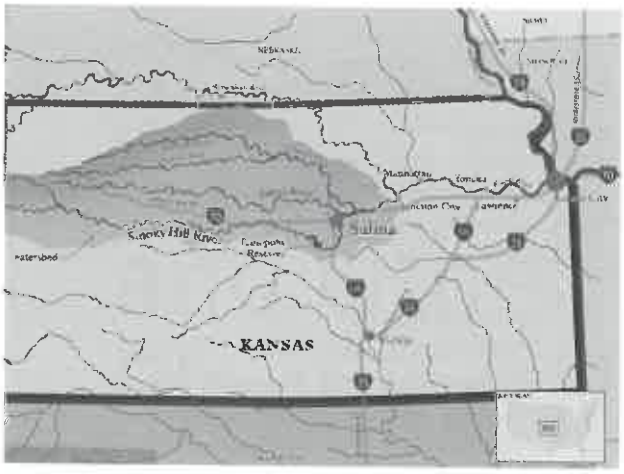
1. PHYSICAL WATER SUPPLY—The Smoky Hill River has historically been subject to periods of extended drought at approximately 10-year intervals, and has experienced low-flow or no flow. To address these times, the following alternatives were evaluated:
   - Dams that raise and lower
   - Line selected channel reaches
   - Narrow, low-flow channel and design techniques
   - Pumped recirculation of channel water with supplements from the Lakewood Park Lake
2. LEGAL WATER SUPPLY—One of the major areas of concern is securing the legal right to divert flows from the Main Channel into the Old River Channel. Approval of Application and Permit to Proceed were received from the Kansas Department of Agriculture–Division of Water Resources in May 2011.

Appropriation of Water File No. 47,509

- Priority date of April 5, 2010
- Recreational use
- Groundwater (Lakewood Park Lake)
- Maximum diversion rate of 4,500 gallons per minute (10 cfs)
- Quantity of 1,785 acre-feet
- Diversion works complete December 31, 2012– extended to December 31, 2017
- Perfect by December 31, 2016 – extended to December 31, 2021
- Cease diversion if lake drops below elevation 1,194
- Water diverted returns to lake

Appropriation of Water File No. 47,510

- Priority date of April 5, 2010
- Recreational use
- Surface water (Smoky Hill River)
- Maximum diversion rate of 44,800 gallons per minute (100 cfs)
- Quantity of 28,952 acre-feet
- Diversion works complete December 31, 2012
- Perfect by December 31, 2016



- October 1–June 30 verbal or written permission of Chief Engineer or authorized representative
- July 1–September 30, no diversion without written permission of Chief Engineer or authorized representative
- Smoky Hill River flow equal or greater than 40 cfs

The surface water diversion is directly into the Old River Channel with flow, less channel losses and seepage returning to the Main Channel. The proposed diversion rates are as follows:

- Maximum—100 cfs for filling and occasional channel cleaning/flushing
- Dominant—40 cfs is the typical project diversion rate
- Low stream flow—10 cfs or less

The pumpback pipeline from Lakewood Park Lake augments streamflow from the Main Channel. If water is not available from the Main Channel, the pumpback system provides limited water supply to maintain water levels in the Old River Channel. Water will not be pumped from the Lake during off-peak season (October 1 through June 30), except under unusual conditions.

3. **POTENTIAL DROUGHT PERIOD OPERATIONS** enhance supplies during the dry years or times when flow is not sufficient in the Main Channel to allow diversion to the Old River Channel. A statistical analysis of river flows indicated that more than 80 percent of the time, on an annual basis, there will be flow to direct to the Old River Channel. During drought years, there will be times when diversion is not possible. To address these times, the following alternatives were evaluated:
   - Creating ponded water reaches in the restored channel, with permanent and movable (inflatable) dams
   - Lakewood Park Lake pumpback recirculation system
   - Utilizing golf course wells for short periods and limited volumes
   - Purchasing senior water rights
   - Utilizing existing or constructing new storage facilities

   Securing additional water rights and implementing stormwater quality approaches were also recommended.

4. **SEDIMENTATION MANAGEMENT** was analyzed in detail due to the extensive sediment deposits in the Old River Channel. These deposits have built up from 1961 (when the Diversion Channel became operational) to the present. The deposits are the result of the majority of the flow passing through the Diversion Channel and limited flow and low velocities through the Old River Channel, which allows the sediment to settle out. Prior to the Diversion, flood events flushed/cleaned the sediment from the river channel.

To address sediment deposits, the following alternatives were evaluated:

- Utilize no sediment control
- Utilize various controls and management practices, but no mechanical treatment removal
- Construct mechanical treatment removal facility (clarifier) near intake

The current plan includes a multifaceted sediment management program with no mechanical treatment removal. Multiple strategies will be utilized to reduce sediment inflow into the restored Channel: reduced or cease diversion when sediment concentrations are high, multiple gate intake structure to select river level with less sediment concentrations, concrete sediment settling basin that is cleaned annually by a front-end loader, and a storm drainage scour where high storm flows are utilized to transport the sediment. The overall philosophy of the restoration project has been to acknowledge that the water quality in the Main Channel will be the quality in the Old River Channel once the river has been restored and flow has returned on a regular basis.

5. **OPERATION AND MAINTENANCE ACTIVITIES AND COSTS** were defined in some detail in the Master Plan. Anticipating and budgeting for ongoing maintenance activities is a critical component of a successful river renewal project.

The Smoky Hill River Renewal Master Plan was accepted by the Salina City Commission in August 2010, and is utilized as a planning document for projects along the Old River Channel. The restoration project has not been funded to date; the project could be funded through a combination of local, state and federal funding. Local funding could be provided through a local sales tax.

Other drought planning measures

The Lower Smoky Hill Water Supply Access District (Access District) legislation was passed in 2011 (K.S.A. 82a-2301 through 82a – 2324). The Access District allows the Kansas Water Office to provide access to water storage owned by the state in Kanopolis Reservoir to surface water users below the reservoir. Membership in the Access District is voluntary and may include municipal, industrial, recreation and irrigation users in the reach of the Smoky Hill River below the reservoir to the confluence of the Smoky Hill and Solomon Rivers. Prior to creation of the Access District, irrigation and recreation did not have access, or the ability to purchase water stored in the reservoir. The creation of the Access District allows the state and the stakeholders to better manage the resources of the reservoir and the river. Simply put, membership in the Access District is an insurance policy to protect against drought and is not the purchase of water for continuous consumption.

The Access District is a feasible alternative for water supply during drought times for the Smoky Hill River Renewal Project. ■

Martha A. Tasker has served as the Director of Utilities for the City of Salina, Kansas for 12 years, and prior to that Wilson and Company Engineers and Architects. Ms. Tasker served as the project manager for The Smoky Hill River Renewal Master Plan.

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References

Design Studios West and Wright Water Engineers, Inc. Smoky Hill River Renewal Master Plan. Retrieved from http://salina-ks.gov/content/126/1559/2839/10853/default.aspx

Kansas State Legislature. Lower Smoky Hill Water Supply Access Program. K.S.A. 82a-2301 through 82a – 2324