Kansas-Lower Republican Basin High Priority Issue
Kansas River Bed Degradation
January 2009

Issue

The Kansas River, often referred to as the Kaw, stretches 171 miles from its origin in Junction City to its confluence with the Missouri River, and is the primary source of drinking water for many communities in northeast Kansas. Bed degradation on the Kansas River threatens water intakes, bridges and other manmade "hard points" along the river channel. Aquatic habitats in the river have been negatively impacted by bed degradation. As the channel has become deeper, river banks have sloughed, impacting farm land and riparian habitats.

Initial emphasis was placed on the impact of sand and gravel dredging on Kansas River bed degradation. Other causes are also considered to contribute to bed degradation.

Kansas River. Photo by Kansas Water Office

Description

Streams and rivers are dynamic systems that continually respond to natural and manmade factors to achieve overall stability. Five major stream stability responses are possible: bed aggradation (build up), bed degradation, channel widening or narrowing and channel migration. These natural processes are impacted by controlled flows from reservoirs, weir construction, aggregate dredging and land use practices in the watershed and along the river.

The Kansas River has generally aggraded over time. The depths of alluvial sediment deposits along the Kansas River near Lawrence are estimated to be approximately 100 feet deep.[7] The Kansas River has exhibited down cutting over the last 1,000–1,500 years.[3] Degradation becomes a problem when the decrease in stream elevation significantly alters the river ecosystem or threatens the integrity of structures both on and near the river.

Causes of Degradation

The Kansas River has been a source of sand and gravel for building projects and road construction from the Kansas City metropolitan area to Topeka for more than 100 years.[2] Sand and gravel (aggregate) are primary ingredients in concrete and asphalt. Aggregate has typically been removed from the river by hydraulic dredging. Sand and gravel is then sorted and processed for transport at plants located on the river bank. Water used in the dredging process is returned to the river.

Since the 1950s, Kansas River flows have been regulated by releases from reservoirs constructed on tributary streams. Federal reservoirs controlling flows on the Kansas River include Milford, Tuttle Creek, Perry and Clinton along with Kanopolis Reservoir upstream on the Smoky Hill River. Sediment loads from tributary watersheds are largely deposited in the reservoirs. The relatively clear water released from these reservoirs has an increased sediment carrying capacity compared to pre-impoundment conditions. This "hungry water" from reservoir releases may be contributing to the rate of bed degradation.

In accomplishing their primary purpose of flood control, reservoirs prevent the Kansas River from extending into the floodplain under normal conditions. One measure of a healthy stream or riparian system is periodic inundation of the floodplain. Rather than dissipating energy across the larger stream valley in periodic floods, this energy is concentrated on the river channel through extended reservoir releases.

The bed of the Missouri River, of which the Kansas River is a major tributary, is also degrading. The tributaries of

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a river which is exhibiting bed degradation will ultimately adjust to this downcut. The Missouri River bed degradation appears to have caused lowering of the bed elevation in some areas of the lower 15 miles of the Kansas River where both the Board of Public Utilities (BPU) of Kansas City, Kansas, and Water District No. 1 of Johnson County (WaterOne), have water supply intakes.

Missouri River bed degradation, as much as 12 feet since 1930,[5] and much of that since 1993, is believed to be a major factor in lowering of the stream bed below the WaterOne weir on the Kansas River and the resulting destabilization of the weir. The current streambed elevation above the weir is 732 feet above mean sea level (msl), but drops to 720 feet above msl below the weir.

Extent of Degradation

The degree and magnitude of Kansas River channel changes generally increases as one moves downstream. Localized streambed degradation on the Kansas River ranges from approximately two feet to greater than 12 feet in some locations.[5] It is important to note that some reaches of the Kansas River have aggraded, particularly above weirs.

Four manmade structures serve as major degradation controls on the Kansas River. These are Bowersock Dam (Lawrence), the WaterOne weir and the City of Topeka and Westar Energy (Topeka) weirs. While locally important, the effect on overall river morphology is considered to be minor. Natural rock deposits exist at several locations along the river and may control the lateral or vertical movement of the channel. Prominent rock control points exist at river mile 12.2 at the site of the historic Grinter's Ferry and mile 101.1 above the Willard Bridge west of Topeka.[3]

Impacts of Degradation

Water Intakes

Kaw Generating Station is an inactive Kansas City, Kansas BPU power plant located on the Kansas River at river mile 8. The plant was constructed in the early 1950s. The generating station has not operated since 2003 because the river surface elevation has not been adequate to allow water to flow into the cooling water intakes. Both Missouri River degradation (causing downcutting and a lack of backwater conditions) and Kansas River degradation have been partially responsible for reducing the surface water level at the intakes. Movement of the primary river channel has also been a contributing factor to losing use of this intake. The inability of the plant to use the river for coolant led to the closure of the plant 15 years earlier than anticipated.

Kansas River at Bowersock Dam, Lawrence, Kansas
Photo by Kansas Water Office

Johnson County Rural Water District 1 (later WaterOne) began diverting water from the Kansas River in 1964 at river mile 15. Low flow conditions and bed degradation led to the construction of a weir at this location in 1967.

Bed degradation on the Missouri River is thought to be a contributing factor in the failure of the WaterOne rock weir in 1977 and more recently in March 2004. It is being replaced with a new steel and concrete structure scheduled to be completed in late 2008.

A weir located at river mile 87 controls water to the intake of the City of Topeka water treatment plant. Approximately two feet of bed degradation has been recorded at this location.

Bowersock Dam is the oldest manmade structure on the Kansas River. It was constructed in 1872 at river mile 52 in Lawrence and originally provided mechanical power for a milling company and other manufacturing plants. The dam is privately owned and currently generates electricity. The location of the dam benefits operation of a Lawrence public water supply intake, which is upstream in the pool behind the dam.

The City of Lawrence and Bowersock Mills and Power Company signed an agreement in the early 1990s, which formalized a long-standing working relationship. The City of Lawrence has spent approximately $1 million in recent years maintaining and upgrading the structure.

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One of the considerations was to stabilize the foundation of the dam from erosion, caused at least in part by downstream degradation.

Bowersock Dam, Lawrence, Kansas
Photo by Kansas Water Office

Well Fields

A consequence of bed degradation and corresponding reduction in surface water elevation is lowering of the water table along the river floodplain. Lower surface water elevations in the river channel and lower water table elevations in the floodplain have a high potential to adversely impact well yields, especially during low flows. When well field operations are impacted by riverbed degradation, a water supplier may need to modify or construct additional wells. In addition, lower ground water elevations result in higher costs due to increased power usage by lift pumps.

The City of Olathe well field, located near river mile 21, includes four horizontal collector wells and 11 vertical wells. During 1999 and 2000, the city reported that the elevation of the river channel in the vicinity of the well field had declined and they were also seeing a decline in the water levels and the capacity of their wells. Due to the loss of suction and low yield resulting from the decline in ground water elevation, the city is phasing-out some of the vertical wells.

The Junction City well field in the alluvial aquifer of the Republican River (a tributary of the Kansas River) has experienced a loss of pumping capacity. According to an engineering study requested by the city, there has been a 50% dewatering of the well field since 1991. Concurrently, bed degradation has occurred on the Republican River below Milford Lake and adjacent to Junction City.

WaterOne has also reported a loss in their Kansas River alluvial well field productivity, which is thought to be due to the lowering of the adjacent streambed and river elevation.

Bridges and Other Structures

Five of the seven railroad bridges crossing the Kansas River are located within two miles of the mouth in Kansas City. Thirty bridges carry roads and highways across the Kansas River between Junction City and the Missouri River confluence.

Riverbed degradation can undermine bridge piers and abutments, resulting in increased maintenance needs and compromising public safety. Unstable bridge pilings and piers must be stabilized in order to prevent failure of the structure. However, most bridges built since 1970 were constructed on bedrock and will not be affected by channel degradation.

Bed degradation also undermines bank protection structures such as dikes, jetties, revetments and other hard points. Boat ramps, pipelines and levees may also be affected.

Fish and Wildlife

Surveys conducted by the Kansas Department of Wildlife and Parks (KDWP), the University of Kansas, Ft. Hays State University and the interagency Kansas Cooperative Fish and Wildlife Research Unit based at Kansas State University all indicate the decline of several fish species in the Kansas River.[6] The pallid sturgeon is considered to no longer occur in the Kansas River and the once abundant plains minnow is absent in the lower reaches. In general, species adapted to shallow, turbid river conditions have declined while those with less specialized habitat needs have predominated. Studies have indicated a shift to lake-like aquatic species below river mile 22.

The Kansas Cooperative Fish and Wildlife Research Unit has maintained a study of Kansas River fishes since March 2005. Sampling has been conducted at 36 stations, five times per year within six reaches of the Kansas River including sample sites near Kansas City, Law-

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rence above and below Bowersock Dam, Topeka, Wamego, and Manhattan.

The Kansas River is designated critical habitat for the piping plover and interior least tern. These bird species require sandbars free from vegetation for nesting habitat. Periodic high flows are necessary to scour sandbars of vegetation providing the necessary habitat conditions. Riverbed degradation may also lower the water table in the adjacent floodplain, adversely impacting wetlands and riparian habitat.

State and Federal Activities

The U.S. Army Corps of Engineers (Corps) developed a regulatory plan with permits for aggregate dredging on the Kansas River in 1990.(2) The Corps initially issued 12 dredging permits on the Kansas River for a 10 year period that expired on December 31, 2001. These permits were extended until August 2003 when the Corps invited public comment on reauthorization of 10-year permits for the 12 dredging operations. The Corps received more than 350 communications during the comment period.

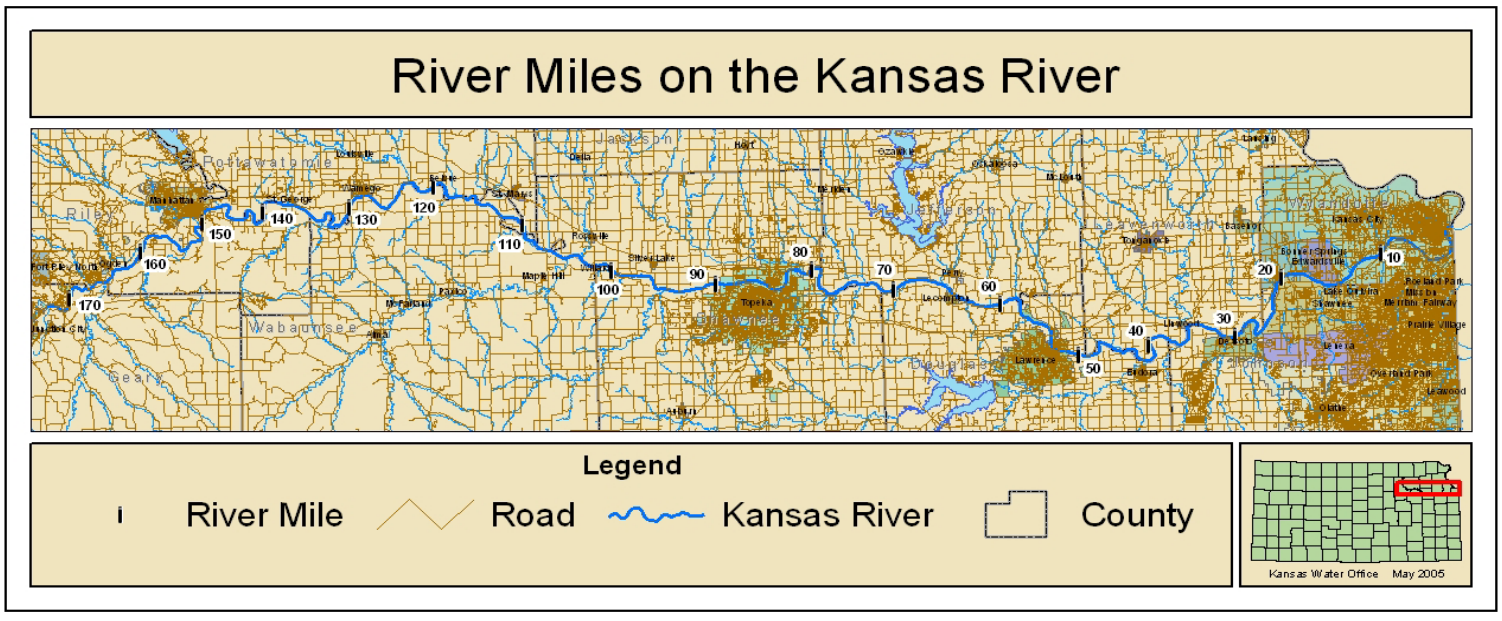
The Governor's Kansas Natural Resources Subcabinet (Subcabinet) sent a letter dated September 11, 2003 to the Corps in response to the public notice on the renewal of Kansas River dredging permits. The Subcabinet letter requested a public hearing be held and that a task force review the range of issues related to protection of the Kansas River. In February 2004, the Corps responded to the Subcabinet that there would be value in a process that would publicly review issues related to the dredging permits.

In November 2004, the Kansas Water Office (KWO) recommended to the Subcabinet that a basin issue of Kansas River channel degradation be taken to the Kansas Water Authority (KWA) for consideration in the state water planning process.(5) The Subcabinet approved this request and the KWA approved a concept paper on channel degradation and formation of a technical advisory committee in 2005.(5)

The technical advisory committee was comprised of representatives of state agencies and the Corps (Kansas City District). Representatives of the aggregate production industry and environmental groups also participated. The committee met several times during 2005 and 2006. In April 2006, the committee decided not to recommend that in-river dredging permits be phased out because not enough technical information had been collected on the historical and current condition of the Kansas River. In 2007, the Corps approved reauthorization of nine dredging permits for five years, to be reviewed in 2012.

As a result of the technical advisory committee recommendations, two actions were initiated by the KWO. The Kansas Biological Survey completed an Index of Biological Integrity in 2007 consisting of a list of Kansas River fishes and their trophic level. KWO has contracted with an engineering company to install new cross section markers between river miles 50 to 77 and 96.5 to 170.4. These survey points will supplement similar cross section measurements required as a condition of the dredging permits issued by the Corps.

On August 20, 2007, the Corps (Kansas City District) issued a decision stating that due to increasing bed deg-



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radation on the Missouri River below Rulo, Nebraska, there would be no authorizations for dredging on the Missouri after December 31, 2009 without completion of an Environmental Impact Statement (EIS). The Corps has also received funding to conduct a reconnaissance study to determine federal interest in Missouri River bed degradation.

Recommended Actions

1. Complete installation of cross section survey points in the non-dredged portions of the Kansas River.
2. Analyze historic cross section data from dredged locations to determine the potential correlation between high and low flows, reservoir operations and climatic conditions and bed degradation trends.
3. As cross section data from non-dredged areas is available, compare this information to dredged area as in action 2.
4. Compile an inventory of bridges constructed prior to 1970 which may be susceptible to bed degradation.
5. Monitor progress on study of Missouri River bed degradation for implications on the Lower Kansas River.
6. Compare cross section analysis information with data from the ongoing study of Kansas fish communities.
7. Develop a plan to stabilize the channel of the Kansas River.
8. Evaluate the state's regulatory framework as it applies to channel degradation.

Resources

1. Kansas Water Office. 2005. *Report to the Kansas Water Authority - Kansas River Channel Degradation.*
2. U.S. Army Corps of Engineers, Kansas City District. 1990. *Commercial Dredging Activities on the Kansas River, Kansas.*
3. Kansas Geological Survey, 1998. *The Kansas River Corridor-Its Geologic Setting, Land Use, Economic Geology, and Hydrology.*
4. Kansas River Channel Degradation Technical Advisory Committee, 2005, 2006. Meeting notes
5. Kansas Water Office. January 2005. Kansas Water Plan. *Concept Paper - Channel Degradation in the Kansas River.*
6. Transactions of the Kansas Academy of Science, 2005. *Current Status of Native Fish Species in Kansas.*
7. Dort, Wakefield Jr.. 2008. Draft - *Historical Channel Changes of the Kansas River and its Major Tributaries*, Bulletin 252, Kansas Geological Survey.

Dredge, Mile 13. Friends of the Kaw Photo