



In reservoir and downstream channel effects of a low-cost sediment bypass option at Tuttle Creek Lake

Description

NWK will assess the long-term effectiveness of sediment removal from Tuttle Creek Lake via hydrosuction and inlet extension and quantify sediment concentration increases and potential impacts to the downstream Kansas River.

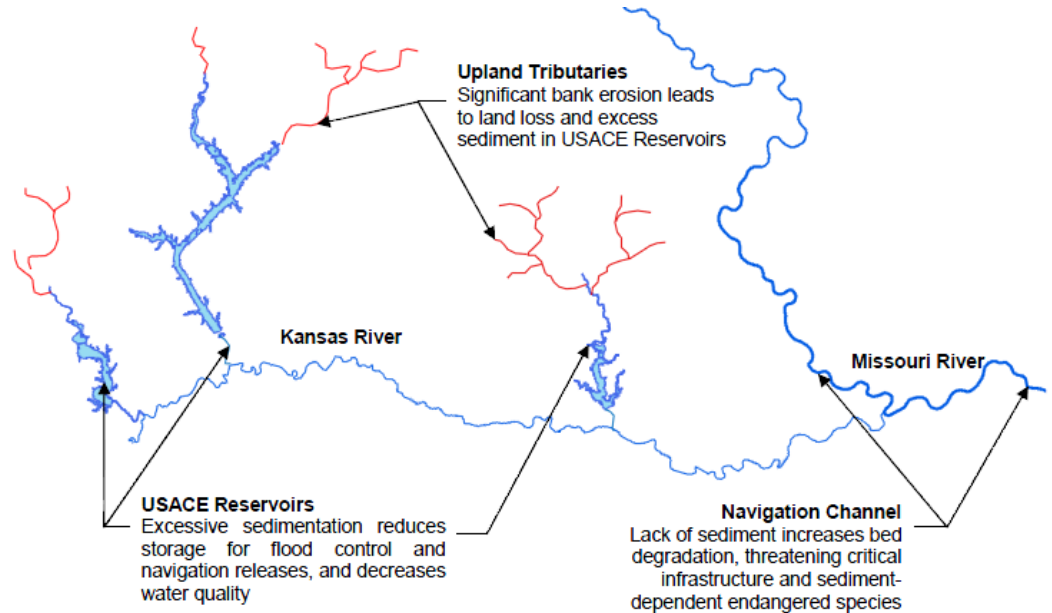


Figure 1. Tuttle Creek Lake and the Kansas River Basin

Issue/Challenge To Address

Tuttle Creek Lake is a large, multi-purpose reservoir that provides significant water supply, recreation, flood control, environmental, and navigation support benefits. The multi-purpose pool of this reservoir is accumulating sediment at a rate of 5.8 million cubic yards per year. As of 2009, the reservoir had lost 40% of its multi-purpose pool storage volume and is projected to lose 88% of the multi-purpose storage over the next 50 years. Traditional dredging with upland placement of sediment is cost prohibitive, starting at \$36M per year and increasing over time, just to keep pace with the incoming sediment load. Furthermore, erodibility testing has indicated that the sediment deposits are highly erodible, but the older, more consolidated deposits are up to 100 times less erodible. In other words, it is much less expensive to maintain storage now through intentional sediment management than to attempt to restore lost storage in the future.

One promising method for managing sediment is to pass it through the dam to the downstream channel via hydrosuction or inlet extension. A preliminary analysis by McFall and Welp (2015) indicates that at multi-purpose pool level, this sediment bypass scheme could pass between 40 and 80% of the total incoming sediment load. This idea garnered significant interest at the 2016 Governors' Water Conference. For this RSM



In reservoir and downstream channel effects of a low-cost sediment bypass option at Tuttle Creek Lake

project, NWK will address the following questions related to this bypass option: (1) How does the efficiency change using actual annual hydrographs instead of assuming a constant water level? (2) How does the efficiency change if a new conduit is opened through the embankment or spillway instead of connecting to the existing inlet? (3) What will the concentration of suspended sediment be in the downstream channel with and without this inlet extension bypass in the short term and at the end of 50 years? (4) At what discharges in the Kansas River will this sediment release fall into the “noise” of the data? (and thus not trigger permit rejection based on state “anti-degradation” laws) and (5) How significant would a discharge of sand be compared to the overall sand budget in the Kansas River?

Successes Lessons Learned

Lessons learned will be compiled during the duration of this study.

Expected Products

- A tech note documenting the answers to the above questions.
- A “how-to” document for performing a hydrosuction/inlet extension analysis.
- Final Report and Presentation

Stakeholders/Users

Stakeholders include the Kansas Water Office (planning agency), the Kansas Department of Health and Environment (regulator agency), and the Kansas Water Authority (funding agency).

Projected Benefits Value Added

The cost to maintain multi-purpose pool storage by dredging at Tuttle Creek Lake has been estimated at \$36 million annually—a cost that would need to be repeated year after year forever. The cost for constructing and operating the inlet extension bypass is likely much less. This technology and other low-power methods for sediment management could save billions of dollars over conventional dredging at the Corps’ nearly 500 reservoirs. The long-term benefits to Navigation, Flood Risk Management, Water Supply, and Ecosystem functions are tremendous.

Leveraging Opportunities

This effort leverages the previous work of the Section 204 program, previous RSM projects (2014 and 2016), the DOTS program, bathymetric data collected by the Kansas Water Office, and the Cross Section Viewer Tool developed at NWK for use on the Missouri River. The results of this project will inform an upcoming Watershed planning study.

Points of Contact

John Shelley, NWK-EDHR
River Engineering and Restoration
816-389-2310
john.shelley@usace.army.mil

Participating Partners

Kansas Water Office