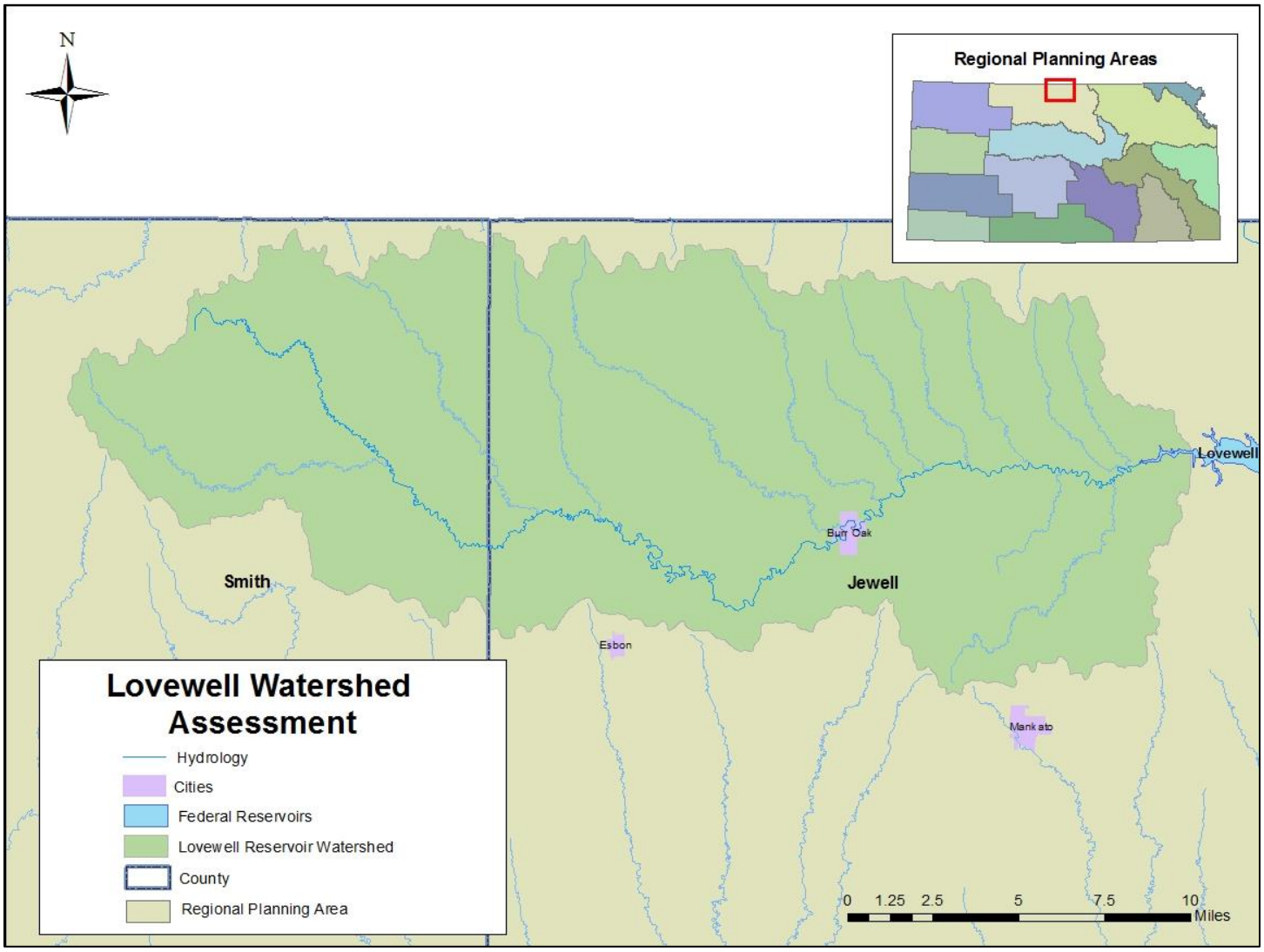
**WHITE ROCK CREEK WATERSHED**
**STREAMBANK EROSION ASSESSMENT**

ArcGIS® Comparison Study: 1991 vs. 2012, 2015 Aerial Photography

**UPDATED DRAFT: February 2017**

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## Executive Summary

Federal reservoirs are an important source of water supply in Kansas for approximately two-thirds of Kansas' citizens. The ability of a reservoir to store water over time is diminished as the capacity is reduced through sedimentation. In some cases reservoirs are filling with sediment faster than anticipated. Whether sediment is filling the reservoir on or ahead of schedule, it is beneficial to take efforts to reduce sedimentation to extend the life of the reservoir.

The Kansas Water Authority has established a *Reservoir Sustainability Initiative* that seeks to integrate all aspects of reservoir input, operations and outputs into an operational plan for each reservoir to ensure water supply storage availability long into the future. Reduction of sediment input is part of this initiative.

The White Rock Creek Watershed Assessment, an ArcGIS® Comparison Study, was initiated to partially implement the *Reservoir Sustainability Initiative*. This assessment identifies areas of streambank erosion to provide a better understanding of the White Rock Creek Watershed for streambank restoration purposes and to increase understanding of streambank erosion to reduce excessive sedimentation in reservoirs across Kansas. The comparison study was designed to guide prioritization of streambank restoration by identifying reaches of streams where erosion is most severe in the watershed above Lovewell Reservoir.

The Kansas Water Office (KWO) 2017 assessment quantifies annual tons of sediment eroded from the White Rock Creek Watershed between 1991 and 2003 or 2015 above Lovewell Reservoir in Kansas. During this assessment, no streambank erosion sites were identified. It should be noted that streambank erosion is often a symptom of a larger, more complex problem requiring solutions that may involve more than just streambank stabilization.

**Introduction**

Riparian areas are vital components of proper watershed function that, when wisely managed in context of a watershed system, can moderate and reduce sediment input. There is growing evidence that a substantial source of sediment in streams in many areas of the country is generated from stream channels and edge of field gullies (Balch, 2007).

Streambank erosion is a natural process that contributes a large portion of annual sediment yield, but acceleration of this natural process leads to a disproportionate sediment supply, stream channel instability, land loss, habitat loss and other adverse effects. Many land use activities can affect and lead to accelerated bank erosion (EPA, 2008). In most Kansas watersheds, this natural process has been accelerated due to changes in land cover and the modification of stream channels to accommodate agricultural, urban and other land uses.

A naturally stable stream has the ability, over time, to transport the water and sediment of its watershed in such a manner that the stream maintains its dimension, pattern and profile without significant aggregation or degradation (Rosgen, 1997). Streams significantly impacted by land use changes in their watersheds or by modifications to streambeds and banks go through an evolutionary process to regain a more stable condition. This process generally involves a sequence of incision (downcutting), widening and re-stabilizing of the stream. Many streams in Kansas are incised (SCC, 1999).

Streambank erosion is often a symptom of a larger, more complex problem requiring solutions that may involve more than just streambank stabilization (EPA, 2008). It is important to analyze watershed conditions and understand the evolutionary tendencies of a stream when considering stream stabilization measures. Efforts to restore and re-stabilize streams should allow the stream to speed up the process of regaining natural stability along the evolutionary sequence (Rosgen, 1997). A watershed-based approach to developing stream stabilization plans can accommodate the comprehensive review and implementation.

Additional research in Kansas documents the effectiveness of forested riparian areas on bank stabilization and sediment trapping (Geyer, 2003; Brinson, 1981; Freeman, 1996; Huggins, 1994). Vegetative cover based on rooting characteristics can mitigate erosion by protecting banks from fluvial entrainment and collapse by providing internal bank strength. Riparian vegetative type is an important tool that provides indicators of erosion occurrence from land use practices. Forested riparian areas are superior to grassland in holding banks during high flows, when most sediment is transported. When riparian vegetation is changed from woody species to annual grasses and/or forbs, sub-surface internal strength is

weakened, causing acceleration of mass wasting processes (extensive sedimentation due to sub-surface instability) (EPA, 2008). The primary threats to forested riparian areas are agricultural production and suburban/urban development.

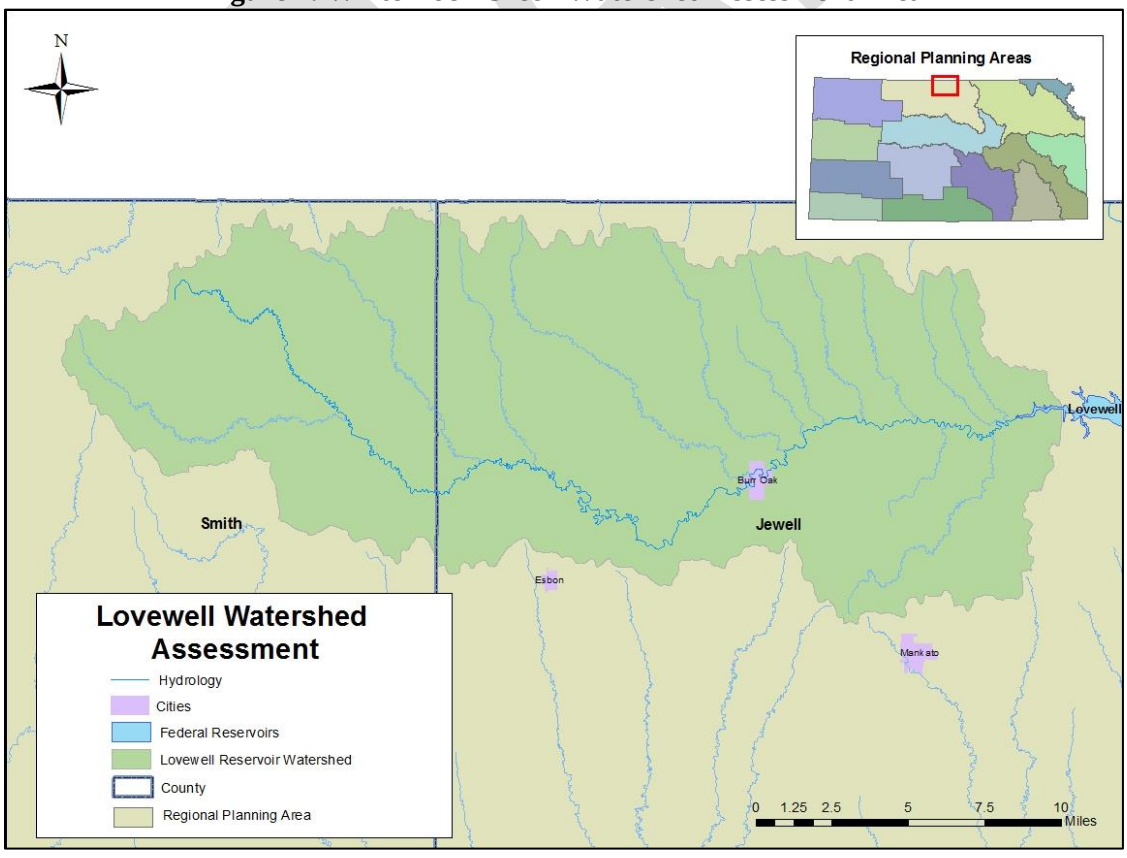
In Kansas, monitoring the extent of erosion losses is difficult, and current up-to-date inventories are needed. This assessment identifies areas with erosion concerns and estimates erosion losses to provide a better understanding of this watershed for mitigation purposes and for application of understanding to watersheds across Kansas.

**Study Area**

Lovewell Reservoir is located on the White Rock Creek, 3 miles northwest of Lovewell, Kansas and 133 miles northwest of Topeka, Kansas. The White Rock Creek Watershed in the Solomon-Republican Regional Planning Area was assessed for streambank erosion with a primary focus on White Rock Creek from roughly Lovewell Reservoir to the edge of Smith County, Kansas. The White Rock Creek Watershed above Lovewell Reservoir travels through portions of Jewel and Smith counties. There are smaller tributaries including Montana Creek, which flows south into the reservoir's west end, and Johns Creek, which flows north into the reservoir's west end. Authorized purposes of Lovewell Reservoir are flood control, navigation, water supply, water quality, recreation and fish and wildlife. White Rock Creek is a major tributary to the lower portion Republican River in the Milford Reservoir Watershed.

The multipurpose pool of the reservoir was filled in 1957. The reservoir is impounded at its eastern end by Lovewell Dam and has a sedimentation rate of 227 acre-ft/year. The most current bathymetric survey was performed in 2011 by the Kansas Biological Survey. Texture analysis of sediment coring and sampling results from the survey indicated that sediment in the reservoir is predominately silt, with a secondary fraction of clay. The bathymetric survey also concluded that the current storage capacity of the reservoir is estimated at 92,150 acre-feet to date. It is estimated to take 137 years to fill the multipurpose pool completely with sediment, filling it by the year 2154.

**Figure 1: White Rock Creek Watershed Assessment Area**



**Data Collection Methodology**

The White Rock Creek Watershed streambank erosion assessment was performed using ArcGIS® software. The purpose of the assessment is to identify locations of streambank instability to prioritize restoration needs and slow sedimentation rates into Lovewell Reservoir. ArcMap®, an ArcGIS® geospatial processing program, was utilized to assess color aerial photography from 2015, provided by National Agriculture Imagery Program (NAIP), and compare it with 1991 Farm Service Agency (FSA) black and white aerial photography, provided by the State of Kansas GIS Data Access & Support Center (DASC). Aerial photography from 2012 photos was used in this assessment when river/stream stage was too high in more recent photos to accurately assess bank movements.

The streambank erosion assessment was performed by overlaying a more recent NAIP county aerial imagery onto 1991 FSA county aerial imagery. Using ArcMap® tools, "aggressive movement" of the streambank between 1991 FSA and 2003 or 2015 NAIP aerial photos were identified, at a 1:2,500 scale, as a site of streambank erosion. "Aggressive movement" represents areas of 2,000 sq. feet or more of streambank movement between 1991 FSA and the more recent NAIP aerial photos. If found, streambank erosion sites were denoted by geographic polygons features "drawn" into the ArcGIS® software program through the ArcMap® editor tool. The polygon features were created by sketching vertices following the 2015 streambank and closing the sketch by following the 1991 streambank at a 1:2,000 scale.

**Results**

The Kansas Water Office (KWO) 2017 assessment found no areas with streambank hotspots or specific erosion concerns between 1991 and 2012 or 2015 on the White Rock Creek Watershed.

**Conclusion**

The KWO created this 2017 assessment for the Solomon- Republic Regional Planning Area. Information contained in the assessment can be used by the KWO and the Solomon-Republic Regional Advisory Committee to target streambank stabilization and riparian restoration efforts within the White Rock Creek Watershed above Lovewell Reservoir.

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