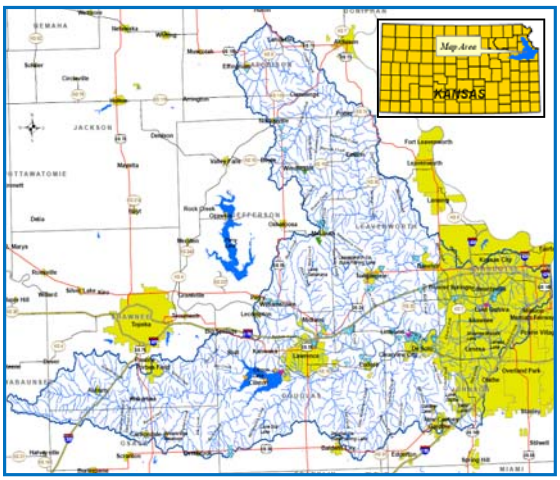


Lower Kansas Watershed

Lower Kansas WRAPS 9 Element Plan Overview

The overall goal of the Lower Kansas WRAPS 9 Element Plan is to provide a blueprint of protection and restoration strategies and activities to protect and restore surface waters in the Lower Kansas WRAPS Project Area.

The **Lower Kansas Watershed** includes parts of six counties including Atchison, Douglas, Jefferson, Johnson, Leavenworth,

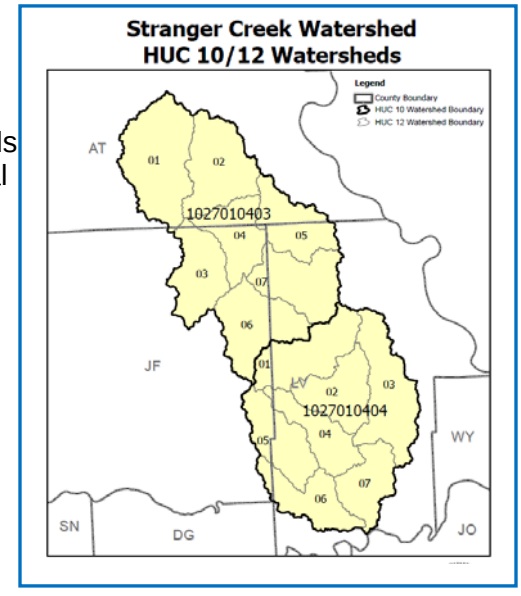
The **Lower Kansas WRAPS Project Area** covers the Lower Kansas HUC 8 watershed with the exception of the Wakarusa River drainage which feeds Clinton Lake.

The primary pollutant concern of this watershed's streams and rivers is bacteria, which is present in human and animal waste. Approximately 77% of the impaired stream/river segments within the Lower Kansas WRAPS do not meet their designated uses.

Lower Kansas WRAPS Project Area

Bacteria are naturally occurring single celled microorganisms. There are numerous types of bacteria; some are good, while others are bad. Water supplies contaminated with manure contain (E-coli) and may have other disease–causing microorganisms such as *Crytosporidium* and *Giardia*.

The Stranger Creek priority area includes HUC 10s 1027010403 and 1027010404. The watershed is 22% cropland and 52% pasture/hay/grassland with 18% in woodland. Grazing density of livestock is high, with a number of subwatersheds with more than 50 animal units per square mile.



Stream TMDLs within Lower Kansas WRAPS Project Area		
Water Segment	**TMDL Pollutant**	**Priority**
Cedar Creek	Fecal Coliform Bacteria	High
Cedar Creek	Nitrates	High
Crooked Creek	Biology	Low
Stranger Creek near Linwood	Fecal Coliform Bacteria	High
Stranger Creek near Easton	Fecal Coliform Bacteria	High
Washington Creek	Dissolve Oxygen	High
Kansas River near Lawrence	Biology	Medium
Nine Mile Creek near Linwood	***E. coli* bacteria**	**High**
Kill Creek	Fecal Coliform Bacteria	High
Lower Kansas River	Biology	Medium
Lower Kansas River	Nutrients and oxygen demand on aquatic life	Medium
Lower Kansas River	*E. coli* bacteria	High
Lower Wakarusa River	Fecal coliform bacteria	Medium
Mill Creek	Chloride	Low
Mill Creek	Fecal coliform bacteria	High
Mill Creek JO. CO.	Biology	High

Impairments to be Addressed

- Bacteria on Nine Mile Creek

Priority Areas for Stranger Creek

- The priority area for the Stranger Creek Watershed is Nine Mile Creek

Best Management Practices and Load Reduction Goals

Best Management Practices (BMPs) to address bacteria in the watershed was chosen by the Lower Kansas Stakeholder Leadership Team (SLT) based on local acceptance/adoption rate and amount of load reduction gained per dollar spent.

<u>Bacteria /Phosphorus Reducing BMPs for the Nine Mile Creek Watershed</u>:

- Vegetative filter strip

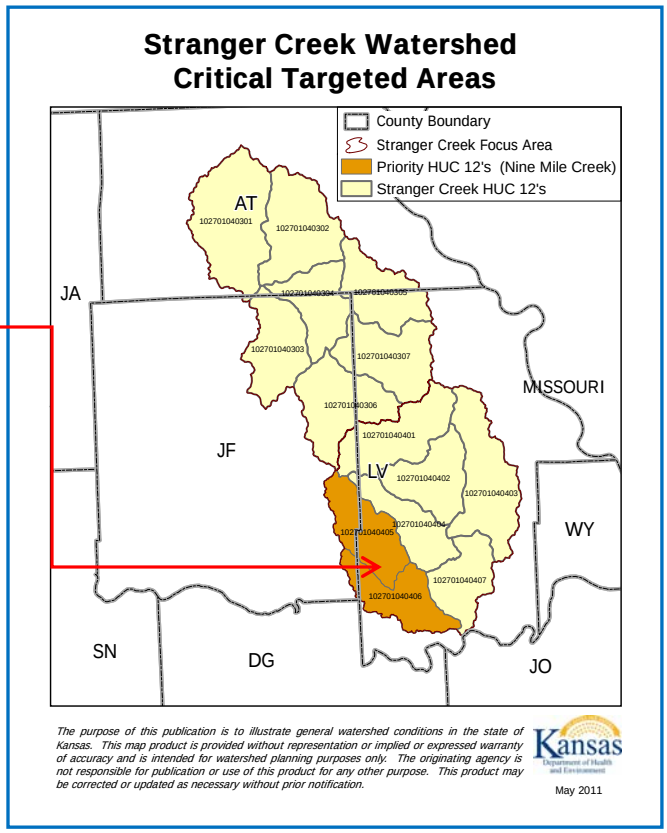
- Relocate feeding sites

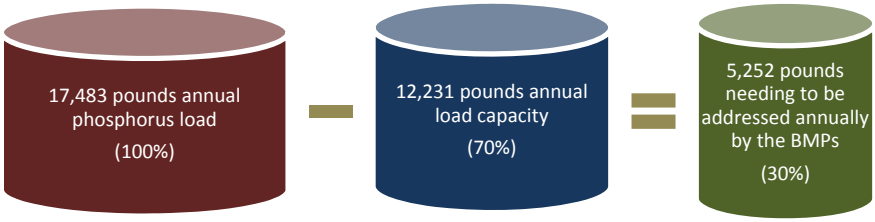
- Alternative (Off-Stream) watering system

- Relocate pasture feeding site

- Current Targeted HUC 12 Watershed:
  Nine Mile Creek Watershed

There is no bacteria load reduction calculation at this time. The SLT decided to use phosphorous load reduction instead. The assumption is that if you are reducing phosphorous, lowered bacteria counts should be evident in water quality samples. The annual reduction goal for phosphorous is 5, 2527 lbs. and will be implemented over a five year time frame.





The current estimated phosphorus load from nonpoint sources in the Nine Mile Creek watershed is 17,483 pounds per year according to the TMDL section of KDHE. This has been determined by KDHE as a result of sampling data obtained in the watershed. After subtracting the annual load capacity, the total annual load reduction allocated to the Lower Kansas Watershed needed to meet the phosphorus reduction goal of 30 percent with implemented BMPs is 5,252 pounds of phosphorus. This is the amount of phosphorus that needs to be removed from the watershed and is the target of the BMP installations that will be placed in the watershed.

The SLT has laid out specific BMPs that they have determined will be acceptable to watershed residents as listed below. These BMPs will be implemented in the Livestock Targeted Area (Stranger Creek Watershed). All these BMPs will simultaneously have a positive effect on reduction of phosphorus and nitrogen (nutrient) impairments.

Watershed Restoration and Protection Strategy

Lower Kansas Watershed

June 24, 2011

Stakeholder Leadership Team

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1.0 Executive Summary

Watershed restoration and protection efforts are needed to address a variety of water resource concerns statewide in Kansas. These concerns include issues such as water quality, public water supply protection, flooding, wetland and riparian habitat protection, unplanned urban development, and others. The State of Kansas committed to implementing a collaborative strategy to address watershed restoration and protection issues when the Governor's Natural Resources Sub-cabinet adopted the Kansas Watershed Restoration and Protection Strategy (KS-WRAPS) in May, 2004. The KS-WRAPS effort established a new way of approaching watershed issues for Kansas. The effort places emphasis on engaging watershed stakeholders in implementing a stakeholder developed action plan that achieves watershed goals established by the stakeholders themselves. This allows for an individualized approach to watershed issues across the state, with input, guidance, and action to achieve watershed improvements coming from the people who live and work in the watershed. Funding for the development of Watershed Restoration and Protection Strategy (WRAPS) plans for individual watersheds is made available to sponsoring groups, using Kansas Water Plan funds and EPA Section 319 Nonpoint Source Pollution Control Grant funds through the Kansas Department of Health & Environment (KDHE).

The Lower Kansas WRAPS Project Area is composed of the Lower Kansas watershed. The goal of the Lower Kansas Watershed Restoration and Protection Strategy is to provide a plan of restoration and protection goals and actions for the surface waters of the Kansas River and its tributaries. Watershed goals are characterized as "restoration" or "protection". Watershed restoration is for surface waters that do not meet water quality standards, and for areas of the watershed that need improvement in habitat, land management, or other attributes. Watershed protection is needed for surface waters that currently meet water quality standards, but are in need of protection from future degradation.

The Lower Kansas WRAPS project began when the Kansas Alliance for Wetlands and Streams (KAWS) was awarded a grant from the KDHE in 2007. A Coordinator for the Lower Kansas WRAPS project was hired in August of 2007 to guide the development of the WRAPS planning effort in the basin, and to work with stakeholders. Individuals with an interest in water resources in the Lower Kansas watershed met and began the process of identifying water-related issues in the basin in October, 2007. A diverse group of stakeholders became involved in the Lower Kansas WRAPS planning process. Farmers, landowners, representatives of natural resource agencies and organizations, city and county government representatives, public water suppliers and others participated. The Lower Kansas WRAPS Stakeholder Leadership Team (SLT) evolved from a core group of meeting attendees. Stakeholders discussed methods for devising a leadership team that would encompass the broad constituent base of the watershed, given the rural and urban components. The function of the team, how

it is governed, what its make-up should be and why it was needed were discussed. The SLT serves as a board to make decisions and provide guidance to the WRAPS Coordinator. They will also determine priorities and provide direction to the project. The SLT is comprised of ten members, including the following representatives: public water supply, watershed district, conservation district, outreach/education, tribal, environmental at large/local health, (fish, forestry, wildlife,) local government, livestock production, crop production.

The Lower Kansas WRAPS has completed three of the four basic stages in the WRAPS process. The Development Stage included stakeholder recruitment, affirming an interest in continuing the project, and documenting stakeholder decisions. The Assessment Stage reviewed watershed conditions and identified watershed restoration and protection needs. The Planning Phase established goals, actions needed to achieve goals, develop cost estimates, and identify stakeholder implementation strategies. The Lower Kansas WRAPS is ready to begin the Implementation Stage, which includes securing the resources needed to execute the plan, monitor and document progress, and revise the plan as needed.

In consultation with the KDHE – Watershed Management Section and the KDHE – TMDL Planning Section, the High Priority fecal coliform bacteria (FCB) TMDL for Stranger Creek and Nine Mile Creek, as well as the High Priority Phosphorous 303d impairment on Nine Mile Creek will be the focus of this plan. Elevated Phosphorous and FCB are associated with livestock manure deposited adjacent or directly into streams.

Additional existing stream and lake TMDLs in the watershed are recognized and will be addressed in the future in the following watersheds.

1. Lower Wakarusa including Washington Creek
2. Urban area including Mill Cr., Kill Cr. , Cedar Cr., Gardner City Lake and Lake Olathe
3. Lower Kansas River

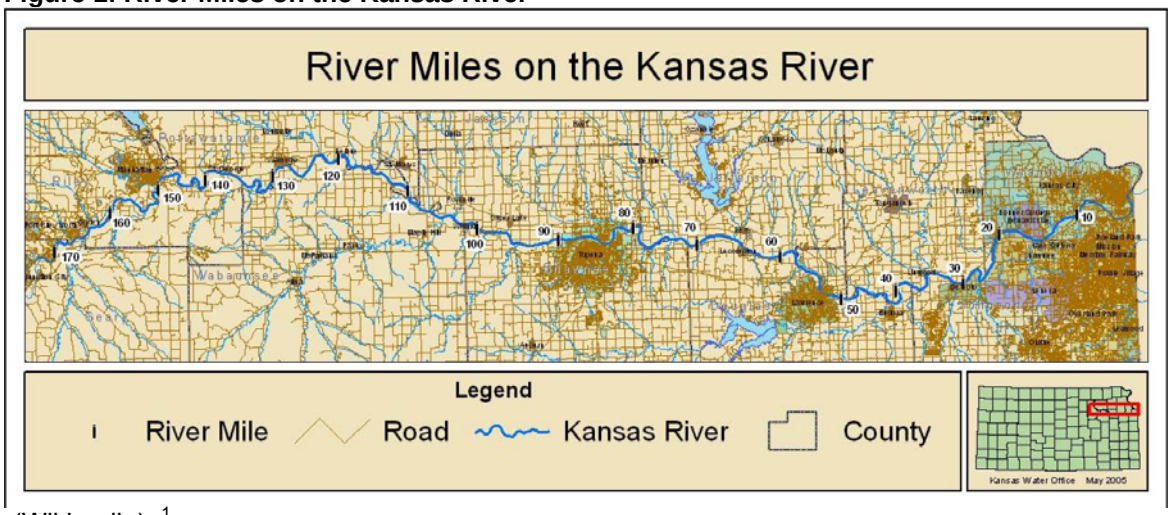
The overall goal of the Lower Kansas WRAPS 9 Element Plan is to provide a blueprint of protection and restoration strategies and activities to protect and restore surface waters in the Lower Kansas WRAPS project area. An additional goal is to address watershed issues identified by the Lower Kansas Stakeholder Leadership Team as resources allow. These issues, by priority, include: bacteria, sediment and biology, nutrient management, pesticides, source water protection, identify/preserve green space, water conservation, groundwater protection/water wells, and flooding.

2.0 Kansas River Description

One of the most outstanding physical features in Northeast Kansas is the Kansas River. Beginning at the confluence of the Republican and Smoky Hill rivers, just east of the aptly-named Junction City (1030 ft.), the Kansas flows some 170 miles generally eastward to join the Missouri River at Kaw Point (730 ft.) in Kansas City (Figure 1). The Kansas River valley is 138 miles long; the surplus length of the river is due to its meandering across the floodplain. This course roughly follows the maximum extent of the Kansan glaciation, and the river likely began as a path of glacial meltwater drain.

Recreation along the Kansas River includes fishing, canoeing and kayaking, and rowing. There are 18 public access points along the river. The Friends of the Kaw organizes many float trips down the river each year (as well as cleanup efforts), and the Lawrence KOA rents canoes for self-guided trips. At least two rowing teams regularly use the river: The University of Kansas rowing team uses the pool above the Bowersock dam for their exercises, and the Kansas City Rowing Club rows in the final stretches of the river, near its mouth.

Figure 1: River Miles on the Kansas River



(Wikipedia). [1]

3.0 Watershed Description

3.1 Lower Kansas Watershed

The Lower Kansas (HUC 10270104) watershed is comprised of an area of land approximately 1,064,551 acres in size that drains a portion of northeast Kansas. HUCs (Hydrologic Unit Codes) are an identification system for watersheds. Each watershed has a defined HUC number in addition to a common name. HUC 8s can further be split into smaller watersheds and are given HUC 10 numbers. HUC 10s can be further divided into smaller HUC 12 watersheds. Figure 2 shows the Lower Kansas HUC 8s, 10s, and 12s.

The Lower Kansas Watershed includes parts of six counties including Atchison, Douglas, Jefferson, Johnson, Leavenworth, and Wyandotte Counties. Figure 3 shows the stream network of the Lower Kansas watershed. The Lower Kansas WRAPS Project area is shown in Figure 4.

The Lower Kansas WRAPS Project Area covers the Lower Kansas HUC 8 watershed with the exception of the Wakarusa River drainage which feeds Clinton Lake.

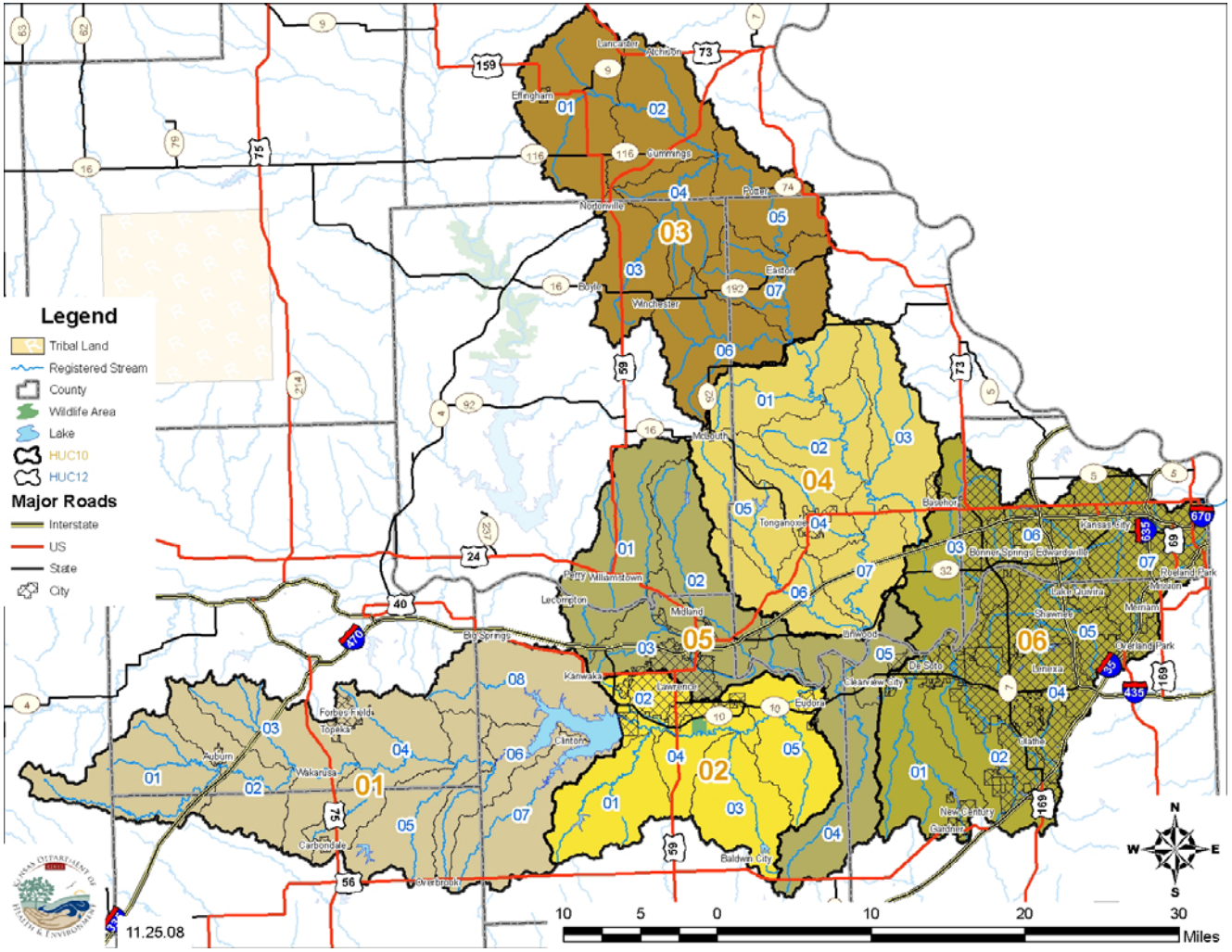


Figure 2: Lower Kansas HUC 8, 10, and 12 Watershed

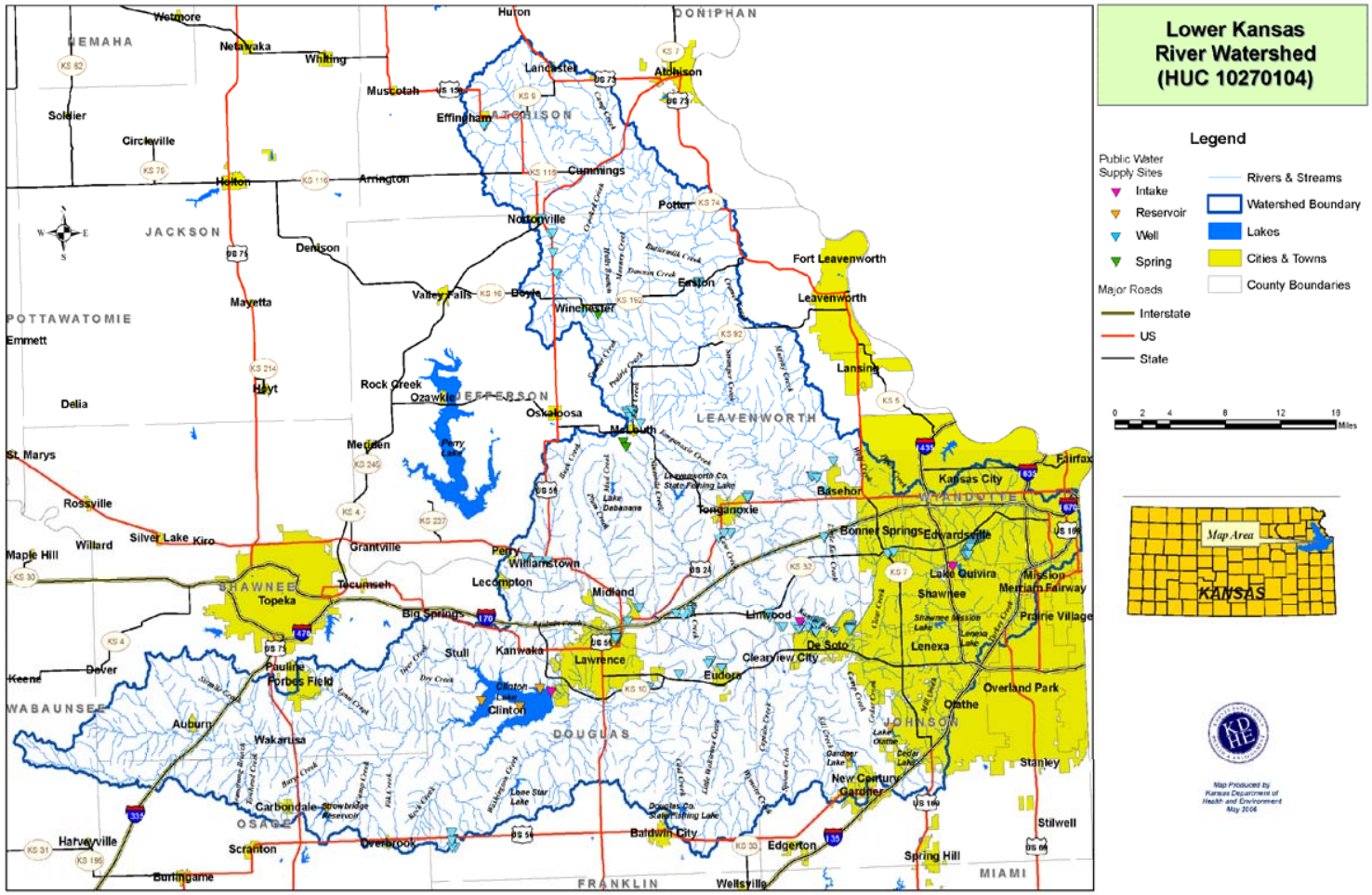


Figure 3: Stream Network Map of the Lower Kansas Watershed

Figure 4: Lower Kansas WRAPS Project Area

3.2 Land Area

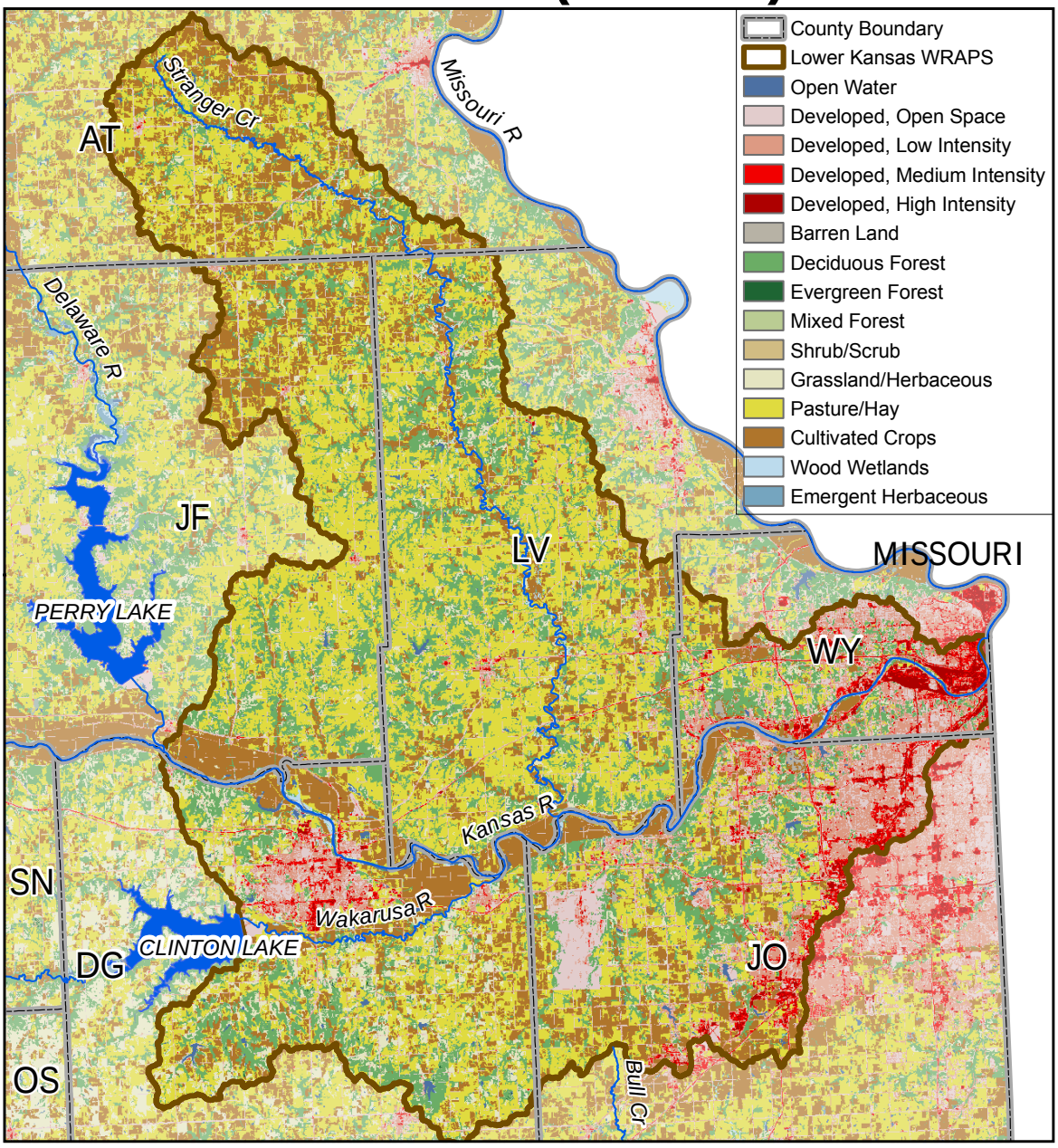
The Lower Kansas WRAPS Project Area comprises an area of land approximately 827,850 acres in size that drains a portion of northeast Kansas. The project area includes portions of six counties that include: Atchison, Douglas, Jefferson, Johnson, Leavenworth, and Wyandotte.

Table 1: Land Cover of the Lower Kansas WRAPS [2]

Land Cover	Acres	Percent
Pasture/hay	304,654	36.8
Cultivated Crops	164,185	19.8
Deciduous Forest	141,582	17.1
Developed, Open Space	67,452	8.1
Developed, Low Intensity	56,795	6.9
Grassland/Herbaceous	40,794	4.9
Developed, Medium Intensity	18,366	2.2
Open Water	12,398	1.5
Developed, High Intensity	8,320	1.0
Wood Wetlands	6,275	0.8
Shrub/Scrub	2,313	0.3
Mixed Forest	2,085	0.3
Barren Land	1,961	0.2
Emergent Herbaceous	484	0.1
Evergreen Forest	185	0.0
Total	**827,850**	**100.0**

Agriculture is the dominant land use in the Lower Kansas watershed, with nearly 57% of the land being cropped, hayed, and pastured followed by deciduous forest at 17% cover. The remaining land uses have covers of less than 10%.

Lower Kansas WRAPS
Land Cover (NLCD01)



The purpose of this publication is to illustrate general watershed conditions in the state of Kansas. This map product is provided without representation or implied or expressed warranty of accuracy and is intended for watershed planning purposes only. The originating agency is not responsible for publication or use of this product for any other purpose. This product may be corrected or updated as necessary without prior notification.

Kansas Department of Health and Environment

May 2011

Figure 5: Land Cover Map of the Lower Kansas WRAPS Project Area

3.3 Agricultural Crops, Hayland, and Livestock

The most common crops planted in the Lower Kansas watershed are soybeans, corn, wheat, and grain sorghum. In 2006, over 350,000 acres of soybeans were reported planted in this eight-county watershed. Corn planted was reported at 215,500 acres, wheat on 51,900 acres, and grain sorghum on 19,500 acres. In 2006, acreage that was hayed in the eight-county region came to 315,900, which topped individual cropping activities. In the Lower Kansas watershed, livestock operations handled more than 300,000 cattle, calves, and hogs in 2006.

Table 2 Acres of Crops, Hayland, and Livestock in the Lower Kansas WRAPS Project Area[3]

County	Soybeans	Corn	Wheat	Sorghum	Hayland	Cattle and Calves	Hogs
Atchison	62,300	53,100	8,300	1,800	26,600	31,400	10,700
Douglas	40,300	25,000	5,300	600	34,600	33,500	4,300
Leavenworth	31,900	16,800	3,900	1,200	39,600	23,600	6,200
Jefferson	46,600	33,900	5,200	3,800	41,800	43,300	3,400
Johnson	28,200	11,800	4,200	500	23,800	28,100	500
Wyandotte	4,200	1,700	400	500	4,000	2,000	500
Total	213,500	142,300	27,300	8,400	170,400	161,900	25,600

3.4 Agricultural Chemical Use

Agricultural chemical use is widespread in the six counties, in which the Lower Kansas watershed is located. According to the 2002 Census of Agriculture, 69% of the total land area in these counties received commercial fertilizer, lime, and soil conditioner applications in 2002 (Table 3). Only 27% of the cropland in the Lower Kansas watershed received manure applications. Insecticides and herbicides were used on 7% and 62% of the total land area in the watershed, respectively.

Table 3: Acres of Fertilizer, Manure, and Pesticide Application in the Lower Kansas WRAPS Project Area[4]

County	Total Commercial Fertilizer Use	Manure Application	Insecticide Application	Herbicide Application
Atchison	123,518	2,795	21,043	110,325
Douglas	78,904	2,252	2,574	80,054
Leavenworth	76,670	3,972	11,436	54,565
Jefferson	127,764	8,019	4,696	89,526
Johnson	60,417	4,433	12,063	62,649
Wyandotte	11,653	3	678	4,756
Total	**478,296**	**21,174**	**52,490**	**401,875**

3.5 Demographics

The total population of the eight counties in the Lower Kansas watershed has grown approximately 9% from 2000 to 2006. Three of the five most populous counties in the watershed, Johnson County (14.5%), followed by Douglas (12.2%) and Leavenworth (7.2%), counties were the primary counties contributing to that increase as each county grew by more than 7%. The remaining counties had either minimal increases (gains of 0.1 to 2.3%) or limited losses (declines of 0.2 to 1.5%). Wyandotte County had the largest population decline (1.5%).

3.6. Public Water Supplies

There are 144 active Public Water Supply (PWS) sites within the Lower Kansas WRAPS Project Area (HUC10270104). While some of the PWSs intake water from surface water sources, groundwater is the predominant PWS source of water within the watershed. Portions of the Glacial Drift and Douglas Aquifers exist in the northwest and southwestern portions of the Lower Kansas (respectively). Water from these aquifers is often used for rural domestic water supply. Historically, the water is very hard with nitrates being one of the primary pollutant concerns. Alluvial aquifers of the Kansas River and its tributaries exist throughout the watershed and provide the primary water source for many PWS. Water quality in alluvial aquifers is generally good, although nitrates, minerals, pesticides, and bacteria can be pollutant concerns. Figure 6 illustrates the number and geographical distribution of public water supplies in the Lower Kansas WRAPS Project Area.

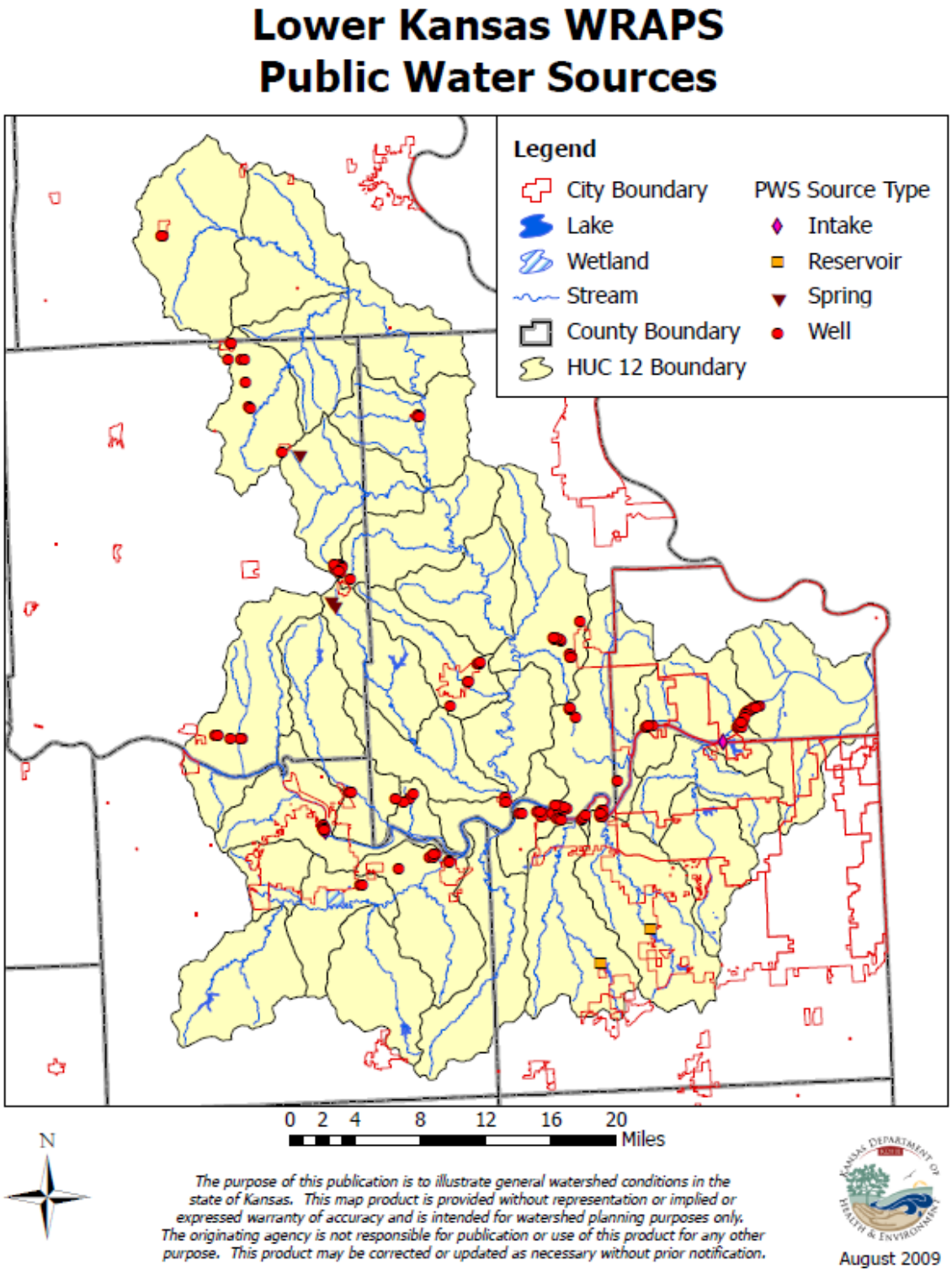


Figure 6: Lower Kansas WRAPS Project Area Public Water Resources

3.7 Designated Uses

According to the Kansas Surface Water Register, the rivers and streams in this area of Kansas are generally used to support aquatic life, recreation, food procurement, groundwater recharge, industrial water supply, irrigation water supply, livestock water supply, and domestic water supply.

The designated uses of a stream have associated water quality standards. A copy of the current Kansas Water Quality Standards and Supporting Documents can be downloaded at http://www.kdheks.gov/water/download/kwqs_plus_supporting.pdf

Table 4: Designated Uses for Lower Kansas WRAPS Rivers and Streams [5]

STREAMS	Class	AL	CR	DS	FP	GR	IW	IR	LW
Baldwin Cr	GP	E	b	X	O	X	X	X	X
Barber Cr	GP	E	b	X	X	X	X	X	X
Brenner Heights Cr	GP	E	B	X	O	X	X	X	X
Brush Cr	GP	E	B	X	O	X	X	X	X
West Buck Cr	GP	E	b	O	O	O	O	X	X
Bucks Cr	GP	S	b	X	X	X	X	X	X
Buttermilk Cr	GP	E	b	O	O	X	O	X	X
Camp Cr	GP	E	b	X	O	X	X	X	X
Camp Cr	GP	E	C	X	O	X	X	X	X
Camp Cr	GP	E	b	O	O	O	O	X	X
Captain Cr	GP	E	C	X	X	X	X	X	X
Cedar Cr	GP	E	B	X	X	X	X	X	X
Chicken Cr	GP	E	b	O	O	X	O	X	X
Clear Cr	GP	E	B	O	X	X	O	X	X
Coal Cr	GP	E	C	O	X	X	X	X	X
Cow Cr	GP	E	b	O	O	X	O	X	X
Crooked Cr	GP	E	C	X	X	X	X	X	X
Crooked Cr	GP	E	C	X	X	X	X	X	X
Dawson Cr	GP	E	b	X	O	X	X	X	X
Fall Cr	GP	E	b	O	O	O	O	X	X
Hanson Cr	GP	E	b	X	O	X	X	X	X
Hays Cr	GP	E	b	O	O	O	O	X	X
Hog Cr	GP	E	b	X	O	X	X	X	X
Howard Cr	GP	E	b	O	X	X	O	O	X
Hulls Branch	GP	E	b	O	X	O	O	O	O
Indian Cr	GP	E	b	O	O	O	O	X	X

Jarbalo Cr	GP	E	b	O	O	O	O	X	X
Kansas R	GP	S	B	X	X	X	X	X	X
Kansas R	GP	S	B	X	X	X	X	X	X
Kansas R	GP	S	B	X	X	X	X	X	X
Kansas R	GP	S	B	X	X	X	X	X	X
Kansas R	GP	S	B	X	X	X	X	X	X
Kansas R	GP	S	B	X	X	X	X	X	X
Kansas R	GP	S	B	X	X	X	X	X	X
Kansas R	GP	S	B	X	X	X	X	X	X
Kent Cr	GP	E	b	X	X	X	X	X	X
Kill Cr	GP	E	B	X	X	X	X	X	X
Little Cedar Cr	GP	E	B	O	X	X	O	X	X
Little Kaw Cr	GP	E	C	X	O	X	X	X	X
Little Mill Cr	GP	E	B	O	X	X	X	X	X
Little Sandy Cr	GP	E	b	O	O	O	O	X	X
Little Stranger Cr	GP	E	b	x	x	x	x	x	x
Little Stranger Cr	GP	E	C	x	x	x	x	x	x
Little Turkey Cr	GP	E	C	x	o	x	x	x	x
Little Wakarusa Cr	GP	E	C	x	x	x	x	x	x
Mill Cr	GP	E	B	X	X	X	X	X	X
Mission Cr	GP	E	b	O	O	O	O	X	X
East Mission Cr	GP	E	b	O	O	O	O	X	X
Mooney Cr	GP	E	b	X	X	X	X	X	X
Mud Cr	GP	E	C	X	X	X	X	X	X
Muncie Cr	GP	E	b	X	O	X	X	X	X
Nine Mile Cr	GP	E	b	X	X	X	X	X	X
Nine Mile Cr	GP	E	b	X	X	X	X	X	X
Oakley Cr	GP	E	b	X	O	X	X	X	X
Piper Cr	GP	E	B	O	O	O	O	X	X
Plum Cr	GP	E	b	X	O	X	X	X	X
Prairie Cr	GP	E	b	X	X	X	X	X	X
Rock Cr	GP	E	b	X	O	X	X	X	X
Scatter Cr	GP	E	b	O	O	O	O	X	X
Spoon Cr	GP	E	b	O	O	X	O	X	X
Stone House Cr,	GP	E	b	X	O	X	X	X	X
East Stone House Cr	GP	E	b	X	O	X	X	X	X
West stone House Cr	GP	E	b	X	O	X	X	X	X
Stranger Cr	GP	E	C	X	X	X	X	X	X
Stranger Cr	GP	E	C	X	X	X	X	X	X
Stranger Cr	GP	E	C	X	X	X	X	X	X
Stranger Cr	GP	E	B	X	X	X	X	X	X

Stranger Cr	GP	E	b	X	X	X	X	X	X
Tonganoxie Cr	GP	E	B	X	O	X	X	X	X
Tooley Cr	GP	E	b	X	X	X	X	X	X
Turkey Cr	GP	E	B	X	X	X	X	X	X
Unnamed Stream	GP	E	b	O	O	O	O	X	X
Unnamed Stream	GP	E	b	X	O	O	O	X	X
Unnamed Stream	GP	E	b	O	X	X	X	X	X
Unnamed Stream	GP	E	b	O	O	O	O	X	X
Unnamed Stream	GP	E	b	X	O	O	O	X	X
Wakarusa R	GP	E	B	X	X	X	X	X	X
Walnut Cr	GP	E	b	O	O	X	X	X	X
Washington Cr	GP	E	b	X	O	X	X	X	X
Wolf Cr	GP	E	C	X	X	X	X	X	X
Yankee Tank Cr	GP	E	B	X	O	X	X	X	X

DS = designated for domestic water supply use
FP = designated for food procurement use
GR = designated for ground water recharge
IW = designated for industrial water supply use
IR = designated for irrigation use
LW = designated for livestock watering use
X = referenced stream segment is assigned the indicated designated use
O = referenced stream segment does not support the indicated designated use
blank = capacity of the referenced stream segment to support the indicated designated use has not been determined by use attainability analysis

Table 5: Designated Uses for Lower Kansas WRAPS Lakes

LAKES	Class	AL	CR	DS	FP	GR	IW	IR	LW
Antioch Park Lake	GP	E	A	X	X	O	X	X	X
Baker Wetlands	GP	E	B	X	X	X	X	X	X
Cedar Lake	GP	E	B	X		O	X	X	X
Douglas Co. SFL	GP	E	B	X	X	O	X	X	X
Frisco Lake	GP	E	B	X	X	O	X	X	X
Gardner City Lake	GP	E	A	X	X	O	X	X	X
Lake Dabanawa	GP	E	A	X	X	O	X	X	X
Lake Quivera	GP	E	A		X				
Leavenworth Co.SFL	GP	E	B	X	X	O	X	X	X
Lone Star Lake	GP	E	A	X	X	O	X	X	X
Mahaffie Farmstead L	GP	E	B	x	X	O	X	X	X
Mary's Lake	GP	E	B	X	X	X	X	X	X
New Olathe Lake	GP	E	A	X	X	O	X	X	X

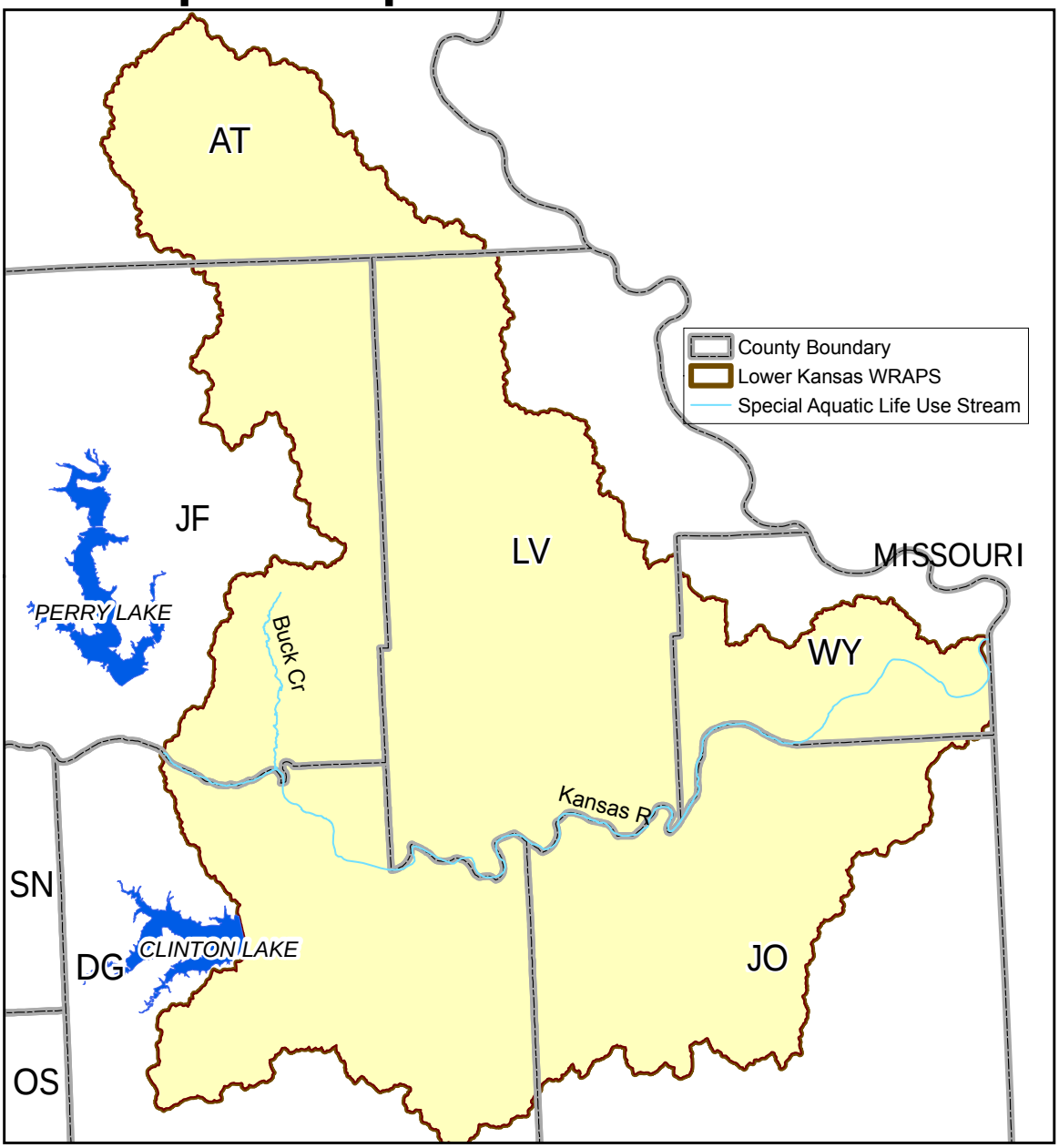
North Park Lake	GP	E	B	X	X	X	X	X	X
Olathe Waterworks	GP	E	B	X	X	O	X	X	X
Pierson Park Lake	GP	E	B	X	X	X	X	X	X
Potter's Lake	GP	E	B	X	X	O	X	X	X
Rose's Lake	GP	E	B	X	X	O	X	X	X
Shawnee Mission Lake	GP	E	A	X	X	O	X	X	X
Sunflower State Park	GP	E	B	X	X	O	X	X	X

AL = designated for aquatic life use
DS = designated for domestic water supply use
FP = designated for food procurement use
GR = designated for ground water recharge
IW = designated for industrial water supply use
IR = designated for irrigation use
LW = designated for livestock watering use
X = referenced lake is assigned the indicated designated use
O = referenced lake does not support the indicated designated use
blank = capacity of the referenced lake to support the indicated designated use has not been
S = special aquatic life use water
E = expected aquatic life use water

3.8 Special Aquatic Life Streams and Exceptional Waters

Special aquatic life use waters are defined as “surface waters that contain combinations of habitat types and indigenous biota not found commonly in the state, or surface waters that contain representative populations of threatened or endangered species. Special aquatic life use waters in the Lower Kansas WRAPS Project Area includes Buck Creek and the Kansas River. Potential pollutant sources impacting special aquatic use along the Kansas River include row crop production, and municipal/industrial effluent. Streambank erosion is often associated with poor cultivation practices or a lack of permanent vegetation adjacent a stream. Pollutants originating from grassland and pasture sources, are often associated with livestock production. Manure deposited in or adjacent stream can result in fecal coliform bacteria. Currently, there are no exceptional state waters in the Lower Kansas WRAPS Project Area.

Lower Kansas WRAPS
Special Aquatic Life Use Waters



The purpose of this publication is to illustrate general watershed conditions in the state of Kansas. This map product is provided without representation or implied or expressed warranty of accuracy and is intended for watershed planning purposes only. The originating agency is not responsible for publication or use of this product for any other purpose. This product may be corrected or updated as necessary without prior notification.

Kansas Department of Health and Environment

May 2011

Figure 7: Lower Kansas WRAPS Project Area Special Aquatic Streams

4.0 Identifying Watershed Issues in the Lower Kansas WRAPS

One of the first steps in the development of a Watershed Restoration and Protection Strategy plan is to identify major watershed issues within the watershed. Through a combination of research, local knowledge, and local interests, the Lower Kansas WRAPS was able to develop a list of priority watershed issues. Research includes reviewing Total Maximum Daily Loads (TMDLs) developed by the Kansas Department of Health and Environment. A TMDL is a quantitative series of objectives and strategies needed to achieve water quality standards. Those water quality standards represent the goals of water quality adequate to fully support designated uses of streams, lakes, and wetlands.

The process of identifying water quality issues through local knowledge and interest began in September 2007 with the first of many public meetings. Over the course of several months, local stakeholders engaged in a series of discussions that along with other water quality research efforts resulted in an extensive list of watershed issues. The following watershed issues were identified:

4.1 Bacteria

Bacteria is used as an indicator of contamination. Although bacteria may not be harmful, their presence in water indicates that fecal material is present, and that disease organisms such as *E. Coli,* giardia, or others may also be found in the water. Generally speaking, the higher the level of bacteria, the greater the level of fecal contamination of the water, and the greater the likelihood of pathogenic organisms being present.

Bacterial contamination of surface water in the Lower Kansas WRAPS is widespread. TMDLs designated “High Priority for Implementation” include Stranger Creek, Cedar Creek, Mill Creek, Kill Creek and the Lower Kansas River.

Bacterial contamination of water in the Lower Kansas WRAPS comes from a variety of sources including livestock wastes, failing on-site wastewater systems (such as septic tanks and lagoons), and wildlife. Discharges from public wastewater treatment plants may contribute to bacteria levels as well.

4.1.1 Livestock Wastes

A portion of farm income in the Lower Kansas WRAPS comes from the livestock industry. Some of these animals are contained within confined animal feeding operations (CAFO’s). More livestock can be found in unregistered, smaller

livestock operations that often over winter in riparian areas. These smaller operations may be a significant source of bacteria and nutrients to streams and lakes. Whether or not these smaller operations pose a water quality threat depends on waste management practices and their proximity to water resources.

4.1.2 Human Wastes

For rural populations, wastewater is usually disposed of by on-site wastewater systems. Properly designed, constructed and maintained systems are an effective and safe means of wastewater treatment. However, many of these systems are old, may not be properly maintained, and may consist of nothing more than a pipe from the house to a ditch or stream. Such systems do not provide sufficient treatment of wastes prior to release to the environment, and are considered to be failing. They can be a significant source of bacteria and other potentially disease-causing organisms, nutrients, and chemicals that are used in the household. Human wastes from public sewer systems may at times also be a source of fecal bacterial contamination. Public wastewater treatment plants are regulated under the National Pollutant Discharge Elimination System (NPDES) and must have pollution controls in place to avoid contaminating receiving waters with polluted discharges.

4.1.3 Wildlife Wastes

Wildlife can contribute to bacteria levels in water when their numbers are large. Migrating waterfowl congregating in large numbers on area ponds and lakes are an example of a situation where wildlife may be a significant source of bacterial contamination in water. However, it is not believed that wildlife are a consistent source of contamination in the watershed.

4.2 Sediment and Biology

Mill Creek in Johnson County has a TMDL for biology. The Kansas River at Lawrence and the Lower Kansas also have biology TMDLs. Washington Creek is listed in the 2010 303(d) list for dissolved oxygen. The natural process of succession (the progression of an aquatic ecosystem to a terrestrial ecosystem) occurs as sediment is deposited in streams, lakes and ponds over time. Lakes eventually fill with sediment to the point that they become marshes and finally dry land. This process usually takes many years to run its course. However, the rate at which this occurs is dependent on various characteristics of the watershed itself and land uses within the watershed. Human activity in the watershed tends to greatly accelerate this process, causing rapid aging of lakes. Cultivation of cropland, poor grazing practices, construction activity, and removal of trees or other vegetation along stream banks all increase the amount of sediment that is sent downstream into lakes and ponds. Once in the lake, sediment settles to the bottom, reducing the water storage of the lake, causing it to become more

shallow. In many cases, sediment has other materials attached to it such as pesticides and phosphorus that also pollute the water of lakes and ponds.

Soils in the Lower Kansas WRAPS are agriculturally very productive. Crop production exposes soils to erosion because the soil surface is not protected by permanent growing vegetation at all times, and is frequently disturbed for planting, cultivation and weed control. Overgrazing pastures, home and road construction and other activities also have the same effect. Runoff transports sediment and other pollutants to lakes and ponds. As the water slows it drops its load, filling ponds and lakes with the sediment that has been transported from fields, pastures and streambanks.

4.3 Nutrient Management

Nutrients including phosphorus and nitrogen are one of the greatest impediments to achieving improved quality of surface waters in Kansas. Additionally, nutrients exported beyond Kansas contribute to water quality problems elsewhere, such as development of a “dead zone” within the Gulf of Mexico where many bottom-dwelling organisms have been killed or forced to move.

The U.S. Environmental Protection Agency has requested that all states develop plans to establish water quality criteria for nutrients in surface waters. Kansas has focused on nutrient reduction rather than nutrient criteria as proposed in the Kansas Surface Water Nutrient Reduction Plan. The plan has a goal of 30% reduction in nutrients in waters crossing state lines.

Specific actions necessary to meet the 30% reduction target are expected to be developed through Watershed Restoration and Protection Strategies and establishment of high priority Total Maximum Daily Loads. The policy infrastructure for both approaches is in place. (Kansas Water Plan, Water Quality Policy and Institutional Framework, Working Draft Released for Public Review by the Kansas Water Authority, June 2, 2006)

Nutrient sources within the Lower Kansas WRAPS Project Area include both point and non-point sources. The major point sources in the basin include large wastewater treatment plants, which are regulated under the NPDES Program. The primary nonpoint sources of pollution include both agricultural and urban areas. Crooked Creek, the Kansas River at Lawrence, the Lower Kansas River, and Mill Creek have biology TMDLs. Stranger Creek near Easton, Stranger Creek near Linwood, Crooked Creek near Winchester, the Kansas River at Desoto, the Kansas River at Eudora, the Kansas River at Kansas City, Kansas, the Kansas River at Lecompton, and Mill Creek near Shawnee are listed on the 2010 303(d) list for biology.

4.4 Pesticides

To maximize production, modern agriculture employs the use of insecticides, herbicides, fungicides and other chemicals to control pests. Urban and suburban use of pesticides to control weeds and insects in lawns, on golf courses, in mosquito control programs and other uses is also prevalent. In many cases, the concentration of pesticides used for urban/suburban pest control is much higher than those used in agriculture. Urban, suburban and agricultural uses of pesticides are all potentially significant sources of water contamination in the Lower Kansas watershed.

4.5 Source Water Protection

The Safe Drinking Water Act, 1996 Amendments - Sec 1453 directs state drinking water agencies complete a source water assessment for all public water supplies that produce drinking water from a raw source, including rivers, reservoirs and lakes, and wells. Source water assessments are designed to delineate the source water assessment area, inventory potential contaminant sources, conduct a susceptibility analysis, and inform the public. The Kansas Rural Water Association provides technical assistance for Water Systems with Source Water Protection planning. Often in conjunction with Wellhead Protection assistance, water systems using surface water and/or groundwater are encouraged and assisted to work with other nearby water systems and local agencies.

The Kansas Source Water Assessment delineates Zones A, B, and C for groundwater and surface water.

Groundwater
Zone A
- 100 feet radius of well
- Kansas Public Water Supply Design Standards recommends public water supply own or control through easement

Zone B
- 2,000 feet radius of well
- Area eligible for Continuous Conservation Reserve Program

Zone C
- 2 mile radius of well or 10 year time of travel capture zone

Surface Water –River intake
Zone A
- 1,000 feet upstream radius of intake, 16 miles upstream of intake, ½ mile wide riparian buffer and six hour water travel distance.

Zone B
●16 to 65 miles upstream of intake, ½ mile wide riparian buffer, and hour water travel distance

Zone C
● Balance of watershed

4.7 Identify/Protect Open Space

4.6 Identify/ Protect Open Spaces

The Lower Kansas Watershed historically was the gateway to the Great Plains. To this day high quality natural resources and vegetative species reminiscent of those seen by early settlers exist. In the 150 years since settlement, communities in the region have grown and changed the environment of these natural resources, and these once abundant resources have diminished greatly. Identification and protection of open space can be used to plan for the future growth of the region and preserve valuable natural assets which benefit the people who live here.

The goal of the Lower Kansas WRAPS is to identify and protect open space to preserve concomitant benefits: improve air and water quality, reduce flood damage, and promote ecosystem and biodiversity conservation, habitat and wildlife protection, stream course stabilization, the creation of neighborhood and development amenities, better opportunities for outdoor recreation, and models of sustainable development.

The objective of the Lower Kansas WRAPS is to:
Promote preservation and ecological restoration work including stream water quality, fish habitat, wildlife habitat in forests, savannas, and grasslands, preservation of green space, recreational opportunities, and aesthetic character.

Promote and support community planning processes, zoning and ordinances which focus on the identification and stewardship of open space to benefit long term public and environmental interests.

4.7 Water Conservation

Water conservation is essential for the effective management of water resources to assure that a sufficient, long-term supply of water is available for beneficial uses. The goal of the Lower Kansas WRAPS is to promote water conservation in rural and urban areas. The objectives of the Lower Kansas WRAPS are to

promote the development, use, and monitoring of drought management plans in the watershed and promote water conservation practices, education, efficient irrigation technologies, and encourage the development and use of reclaimed water.

4.8 Groundwater Protection/ Water Wells

There are approximately 2,000 groundwater wells located within the Lower Kansas WRAPS Project Area. Water from these wells is used for domestic use, groundwater monitoring, irrigation and industrial use. Ground water is the primary source for water use in the Lower Kansas WRAPS Project Area. The most commonly identified problems with ground water were inorganic compounds, pesticides and nitrates.

The goal of the Lower Kansas WRAPS is to protect groundwater and private drinking wells in the watershed from contamination. The objective of the Lower Kansas WRAPS is to ensure all wells (water, testing or monitoring, etc.) are adequately protected.

5.0. Water Quality Issues

5.1. 303d List

The Lower Kansas WRAPS Project Area has numerous waterbodies listed on the 303d list. The 303d list of impaired waters is developed every two years and simply represents a list of impaired waters. Water bodies included on this list have shown that water quality standards are not being met therefore the designated uses are not being met. KDHE has an extensive water monitoring program with monitoring stations throughout Kansas and in the Lower Kansas WRAPS. Water quality data gathered through this water quality monitoring is used to determine whether or not an impairment is present. Impairments being addressed in this plan appear in bold.

Table 6: 2010 303(d) List of All Impaired/Potentially Impaired Waters Lower Kansas[6]

Waterbody Name	Station Number	Designated Use	Impairment	Priority
Coal Creek near Sibleyville	SC 679	Recreation Aquatic Life	Fecal Coliform Dissolved Oxygen	Medium Low
Wakarusa River near Eudora	SC 500	Aquatic Life	TSS	Low
Captain Creek near Eudora	SC 638	Aquatic Life	Atrazine Copper	Low Low
Kansas River at Eudora	SC 255	Aquatic Life Recreation	Phosphorous Copper Lead Food Procurement TSS *E. coli*	Medium Low Low Low Low High
Cedar Creek Near Cedar Junction	SC 252	Aquatic Life Recreation Water Supply	Phosphorous Nitrate	Low High
Kill Creek at De Soto	SC 253	Aquatic Life	Atrazine	Low
Kansas River at De Soto	SC 254	Aquatic Life Recreation	Phosphorous TSS	Medium Low

Stranger Creek near Linwood	SC 501	Aquatic Life	Atrazine Biology Lead	Low Low Low
Mill Creek near Shawnee	SC 251	Aquatic Life	Phosphorous Diazinon	Low Low
Nine Mile Creek near Linwood	**SC 680**	**Aquatic Life** Recreation	**Phosphorous** Lead	**Low** Low
Kansas River at Lecompton	SC 257	Aquatic Life Recreation	Phosphorous TSS	Medium Low
Buck Creek near Williamstown	SC 677	Recreation	Fecal Coliform	Medium
Kansas River at Kansas City, KS	SC 203	Aquatic Life	Phosphorous Lead TSS	Medium Low Low
Stranger Creek near Easton	SC 602	Aquatic Life	Atrazine Biology Copper Lead Phosphorous TSS	Low Low Low Low Low Low
Crooked Creek near Winchester	SC 683	Aquatic Life	Atrazine Phosphorous	Low Low
Baker Wetlands	LM 014401	Aquatic Life	Eutrophication	Low
Baker Wetlands	LM 014401	Aquatic Life	ph	Low

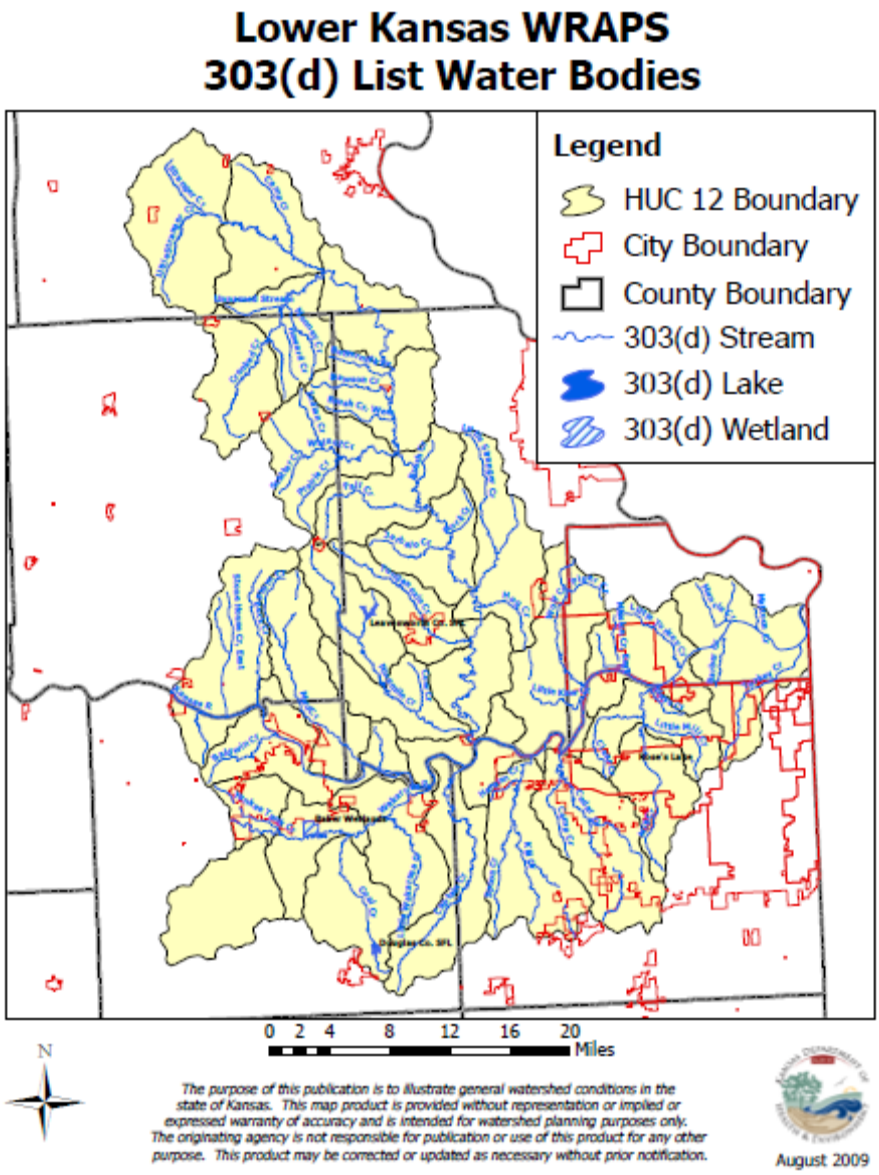


Figure 8: 2010 303(D) List for Lower Kansas Wraps Project Area

5.2 TMDLs

5.2.1. Stream TMDL/Contaminate Concerns

A TMDL designation sets the maximum amount of pollutant that a specific stream, river or lake can receive without violating surface water quality standards. Surface waters that do not meet their designated uses require total maximum daily loads. TMDLs established by Kansas state an objective for meeting the water quality standards of the impaired water body. TMDLs are a great resource for targeting and reducing nonpoint source pollution and are

typically classified as high, medium and low priority. Ideally, the goal of a WRAPS project would be to address all TMDLs. Impairments being addressed in this plan appear in bold.

Table 7: Stream TMDLs within Lower Kansas WRAPS Project Area[7]

Water Segment	TMDL Pollutant	Endgoal of TMDL	Priority	Sampling Station
Cedar Creek	FCB	2000 colonies per 100 ml for Secondary Recreation; 900 colonies per 100 ml for Primary Recreation	High	SC 252
Cedar Creek	N023	10,000 ug/l = 10 mg/l	High	SC 252
Crooked Creek	Bio	Endpoint is average MBI values of 4.5 or less	Low	SB 683
Stranger Creek near Linwood	**FCB**	**2000 colonies per 100 ml for Secondary; 900 colonies per 100 ml for Primary**	**High**	**SC 501**
Stranger Creek near Easton	FCB	2000 colonies per 100 ml for Secondary; 900 colonies per 100 ml for Primary	High	SC602
Washington Creek	DO	Dissolved Oxygen: > 5 mg/l	High	SC 678
Kansas River at Lawrence	Bio	Average MBI vales of 4.5 or less	Medium	SB 257, SC 256

Nine Mile Creek near Linwood	***E. coli***	**Geometric Means of at least five samples of *Escherichia coli (E. coli)* collected in separate 24-hour periods within a 30-day period shall not exceed the following criteria beyond the mixing zone: Primary Contact Recreation – Class B: 262 CFU/100 ml from April 1 to October 31; 2358 CFU/100 ml from November 1 to March 31 Primary Contact Recreation – Class C: 427 CFU/100 ml from April 1 to October 31; 3843 CFU/100 ml from November 1 to March 31 Secondary Contact Recreation – Class b: 3843 CFU/100 ml from January 1 to December 31**	**High**	**SC 680**

Kill Creek	FCB	2000 colonies per 100 ml for Secondary; 900 colonies per 100 ml for Primary	High	SC253
Lower Kansas River	Bio	Average percent composition of EPT taxa of 25% or more	Medium	SC127, SC203, SC 250, SB254, SC255
Lower Kansas River	Nutrients and Oxygen Demand Impact on Aquatic Life	Nutrients--Narrative: The introduction of plant nutrients into streams, lakes, or wetlands from artificial sources shall be controlled to prevent the accelerated succession or replacement of aquatic biota or the production of undesirable quantities or kinds of aquatic life.	Medium	SC127, SC203, SC250, SB254, SC255

Lower Kansas River	*E.coli*	Geometric Means of at least five samples of *Escherichia coli (E. coli)* collected in separate 24-hour periods within a 30-day period shall not exceed the following criteria beyond the mixing zone: Primary Contact Recreation – Class B: 262 CFU/100 ml from April 1 to October 31; 2358 CFU/100 ml from November 1 to March 31 Primary Contact Recreation – Class C: 427 CFU/100 ml from April 1 to October 31; 3843 CFU/100 ml from November 1 to March 31 Secondary Contact Recreation – Class b: 3843 CFU/100 ml from January 1 to December 31	High	SC203, SC254, SC255, SC257

Lower Wakarusa River	FCB	2000 colonies per 100 ml for Secondary; 900 colonies per 100 ml for Primary	Medium	SC236, SC500
Mill Creek	CI	Less than 10% of the sampled over criteria	Low	SC251
Mill Creek	FCB-high	2000 colonies per 100 ml for Secondary; 900 colonies per 100 ml for Primary	High	SC251
Mill Creek JO. CO.	Bio	Average MBI values of 4.5 or less	High	SC251, SB251

The Lower Kansas WRAPS 9 Element Plan will address the 303(d) impairment for Phosphorous near Linwood. The *E.coli* TMDLs at Stranger Creek near Linwood and Nine Mile Creek will also be addressed.

Stranger Creek is composed of fourteen HUC 12s. The two HUC 12 watersheds that comprise Nine Mile Creek will be addressed first through BMP implementation. If the Stranger Creek *E. coli* TMDL is not met by addressing Nine Mile Creek, additional HUC 12 watersheds will receive water quality monitoring and assessment to determine targeted watersheds for BMP implementation.

Additional existing stream TMDLs in the watershed are recognized and will be addressed in the future. Targeting the TMDLs listed above will primarily benefit the Kansas River which has several designated uses.

However, limited financial and technical resources require targeting BMPs toward high priority TMDLs. Unfortunately, the Lower Kansas WRAPS will not have the resources initially to address all high priority TMDLs. The primary pollutant concern of this watershed's streams and rivers is fecal coliform bacteria (FCB), which is present in human and animal waste. Approximately 59% of the stream and river segments are impaired by FCB, 12% nutrients, 8% silt, 7% chlordane, 5% by ammonia, 5% by zinc, and 2% by dissolved oxygen and chloride.

5.2.2 Future Priority Areas and Water Quality Impairments to be Addressed by the Lower Kansas WRAPS

In consultation with the KDHE – Watershed Management Section and the KDHE – TMDL Planning Section, the following is a schedule of priority areas for BMP implementation:

Priority Area Implementation Schedule

2010 – 2020: Stranger Creek (10270104 – 03,04) – Bacteria
2020 – 2025: Lower Wakarusa including Washington Creek (1027010402)
2025 – 2035:Urban areas including Mill Creek, Kill Creek, Cedar Creek, Gardner City Lake and Lake Olathe (1027010406)
2035 – 2045: Lower Kansas River (10270104 – 05,06)

Targeting TMDLs in the above future priority areas listed above will primarily benefit the Kansas River which has several designated uses. Additional existing stream TMDLs in the watershed are recognized and will be addressed per the schedule listed above. These streams include:

Cedar Creek – FCB and NO23.
Crooked Creek – Biology
Kansas River at Lawrence – Biology
Turkey Creek – NH3

The table below shows when the KDHE – TMDL and Watershed Planning Section will review TMDLs. TMDLs meeting the end goal will be candidates for delisting. New TMDLs may also be listed.

Table 8: TMDL Review Schedule for the Kansas Lower Republican Basin

Year Ending in September	Implementation Period	Possible TMDLs to Revise	TMDLs to Evaluate
2010	2011 -2020	1999	1999
2015	2016-2025	1999, 2007	1999, 2007
2020	2021 – 2030	1999, 2007, 2010	1999, 2007, 2010

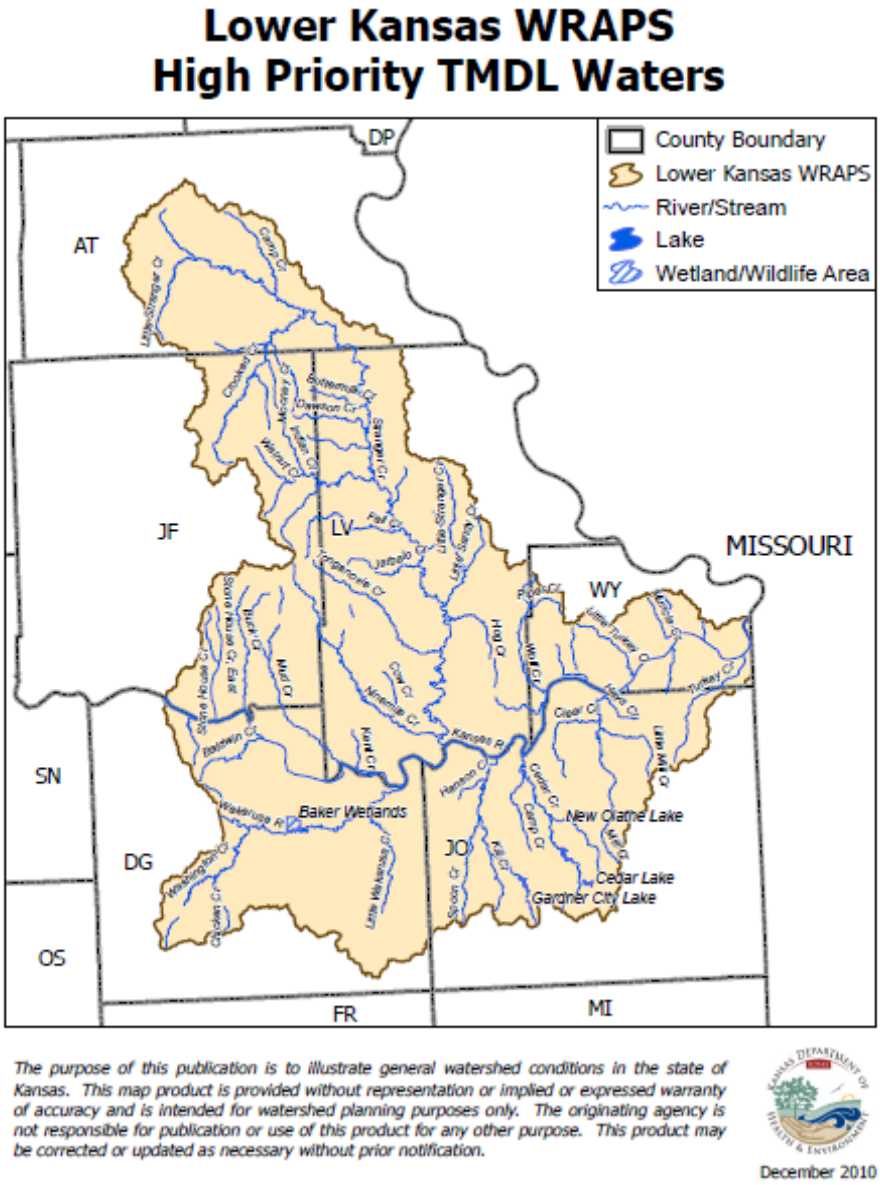


Figure 9: Lower Kansas WRAPS Project Area High Priority Stream TMDLS

5.2.3 Lake TMDL/Contaminant Concerns

A TMDL designation sets the maximum amount of pollutant that a specific stream, river or lake can receive without violating surface water quality standards. Surface waters that do not meet their designated uses require Total Maximum Daily Loads. TMDLs established by Kansas state an objective for meeting the water quality standards of the impaired water body. TMDLs are a great resource for targeting and reducing nonpoint source pollution and are typically classified as high, medium and low priority. Ideally, the goal of a WRAPS project would be to address all TMDLs. However, limited financial and technical resources require targeting BMPs toward high priority TMDLs.

Unfortunately, the Lower Kansas WRAPS will not have the resources initially to address all high priority TMDLS.

Some of the smaller lakes in the watershed include Shawnee Mission Lake, Oskaloosa Lake, Lakeview Estates Lake, Lone Star Lake, and the Baker Wetlands. Surface waters not meeting their designated uses will require total maximum daily loads (TMDLs). Approximately 100% of this watershed's lakes/wetlands sampled need TMDLs. Primary pollutants for this watershed's lakes and wetlands are eutrophication, dissolved oxygen levels, pH, and excess biomass (AP).

Approximately 56% of the lakes/wetlands in this watershed are eutrophic, 25% have low dissolved oxygen levels, 13% have either high or low pH, and 6% have excessive biomass. Eutrophication is caused by excess nutrients from a variety of nitrogen and phosphorous sources including row crop agriculture, feedlots, septic systems, and urban/suburban runoff. Low DO levels typically coincide with an abundance of algae, which cause the population of decomposers to increase which in turn use up the oxygen in the stream or river. Excessive biomass is an abundance of vascular plants that tend to be a nuisance and interfere with designated water uses. pH determines the alkalinity or acidity of water in the lake. If the water is too basic or too acidic it can potentially stress or kill the aquatic life and vegetation.

Additional existing lake TMDLs in the watershed are recognized and will be addressed per the schedule listed above. These lakes include:

Frisco Lake/Johnson County – Eutrophication
Cedar Lake – Eutrophication
Lakeview Estates – Eutrophication and AP
Lone Star Lake – Eutrophication
Mary's Lake – pH, Eutrophication, and DO
Pierson Park Lake – Eutrophication
Potter's lake – Eutrophication and pH
Sunflower State Park – Eutrophication and DO
Waterworks Lakes – Eutrophication

Table 9: Lake TMDLs within Lower Kansas WRAPS Project Area[8]

Water Segment	TMDL Pollutant	Endgoal of TMDL	Priority	Sampling Station
Baker Wetlands	DO	>5 mg/l	High	LM014401
Frisco Lake/Johnson Co.	EU	summer chlorophyll a concentrations at or below 20 ug/l,	Low	LM065201

Gardner Lake	EU	summer chlorophyll a concentrations at or below 20 ug/l,	High	LM040401
Gardner Lake	DO	>5 mg/l	High	LM040401
Lake Olathe & Cedar Lake	EU	summer chlorophyll a concentrations at or below 20 ug/l,	High	LM061301 LM061601
Lone Star Lake	EU	summer chlorophyll a concentrations at or below 20 ug/l,	Low	LM011401
Mary's Lake	pH	pH > 6.5 □ 8.5	Medium	LM061401
Mary's Lake	EU	summer chlorophyll a concentrations at or below 20 ug/l,	Medium	LM061401
Mary's Lake	DO	>5 mg/l	Medium	LM061401
Pierson Park	EU	summer chlorophyll a concentrations at or below 20 ug/l,	Low	LM061801
Potter's Lake	pH	pH > 6.5 □ 8.5	Low	LM073401
Potter's Lake	EU	summer chlorophyll a concentrations at or below 20 ug/l,	Low	LM073401
Sunflower Park Lake	EU	summer chlorophyll a concentrations at or below 20 ug/l,	Medium	LM073601
Sunflower Park Lake	DO	> 5 mg/l	Medium	LM073601
Olathe Waterworks Lakes	EU	summer chlorophyll a concentrations at or below 20 ug/l,	Low	LM062201

Figure 10: Lower Kansas WRAPS Project Area Lake TMDLS

5.2.4 Potential Nonpoint Pollution Sources Impacting Streams

Potential sources of bacteria contamination include feedlots, septic systems, and wildlife. Potential sources of sediments include construction sites, stream bank erosion, and row crop agriculture. Potential sources of nutrients include row crop agriculture, urban/suburban runoff, registered feedlots, unregistered feedlots, wastewater treatment facilities, septic systems, and wildlife. Sources of ammonia include livestock, septic tanks, fertilizer, municipal and industrial waste.

5.2.4.A. Septic Systems

There are currently thousands of septic systems within the watershed and this number is increasing. When properly designed, installed, and maintained, septic systems can act as an effective means of wastewater treatment. However, poorly maintained or “failing” septic systems can leach pollutants into nearby surface waters and groundwater. The exact number of failing septic systems within the watershed is unknown; however the number may be increasing due to the current trends in suburban development. Local Environmental Protection Programs and County health departments may provide excellent sources of information regarding the proper design, installation, and maintenance for septic systems.

5.2.4.B. Wildlife

Wildlife located throughout the watershed are not usually considered a significant source of nonpoint source pollutants. However, during seasonal migrations, concentrations of waterfowl can add significant amounts of fecal coliform bacteria and nutrients into surface water resources.

5.2.4.C. Row Crop Agriculture

As stated above, approximately 26% of the watershed’s land is used for row crop agriculture. Row crop agriculture can be a significant source of nonpoint source pollution. Common pollutants from row crop agriculture include sediment, nutrients, pesticides, and fecal coliform bacteria. Many producers within the watershed regularly implement and maintain BMPs to limit the amount of nonpoint source pollutants leaving their farm. Some common BMPs include: the use of contour plowing; use of cover crops; maintaining buffer strips along field edges; and proper timing of fertilizer application.

5.2.4.D. Urban/Suburban Runoff

Many urban landscapes are covered by paved surfaces including roads, driveways, parking lots, and sidewalks. These surfaces are impermeable and tend to divert water into storm drains at high velocities. This increased flow velocity from urban areas can cause severe stream bank erosion in receiving water bodies. Additionally, urban and suburban runoff may carry other pollutants like petroleum hydrocarbons and heavy metals. Currently, the watershed is only about 6% urban. Limiting paved surfaces is the key to slowing urban nonpoint source pollution. The use of grass swales, open spaces, and storm water retention ponds are recommended to slow runoff in urban areas. The watershed has an increasing population living in suburban areas. Residential landscapes are often designed with large turf areas which require high amounts of water and chemicals to maintain. The use of excessive amounts of fertilizers and lawn care chemicals in residential areas can contribute a significant amount of pollution to nearby water resources. Suburban nonpoint source pollution can be limited by:

using less lawn fertilizers and chemicals; control of construction sites; proper disposal of pet waste; establishing large areas of native vegetation; and conserving the amount of water use for plant maintenance.

5.2.5 Point Pollution Sources Impacting Streams

Lower Kansas NPDES

Stranger/Nine Mile

The Nine Mile Creek watershed has a High Priority TMDL for bacteria and according to KDHE water quality monitoring data has exceeded the water quality standard for bacteria on several occasions. The frequency and magnitude of bacteria exceedances must be reduced on Nine Mile Creek in order for the bacteria impairment to be reduced (see Bacteria Load Reductions for Rock Creek section on page 48 for details). In addition, Nine Mile Creek has a 303d listed impairment for Total Phosphorus and according to the KDHE TMDL section (February 2011) there is currently 17,483 lbs/yr of phosphorus entering the stream. Water quality data interpretation determined that in order for the stream to meet designated uses the annual load should be reduced by 5,252 lbs/year reduction to 12,231 lbs/year of phosphorus. There are permitted facilities on Nine Mile Creek that are contributing a bacteria or phosphorus load to the stream. The reduction of bacteria concentrations and phosphorus load reductions needed to remove the Bacteria TMDL and Total Phosphorus impairment for Nine Mile Creek will have to come from nonpoint sources of pollution.

5.2.5.A Wastewater Treatment Facilities

There are approximately 105 municipal and industrial wastewater treatment facilities within the watershed (this number may be dated and subject to change). These facilities are currently regulated by KDHE under National Pollutant Discharge Elimination System (NPDES) permits. These permits specify the maximum amount of pollutants allowed to be discharged to the “waters of the State”. Due to the chlorination processes involved in municipal waste treatment, these facilities are not considered to be a significant source of fecal coliform bacteria; however they may be a significant source of nutrients. Nutrient Reduction Plans may provide further protection from nitrogen and phosphorus with upgrades to treatment plants when permits are renewed.

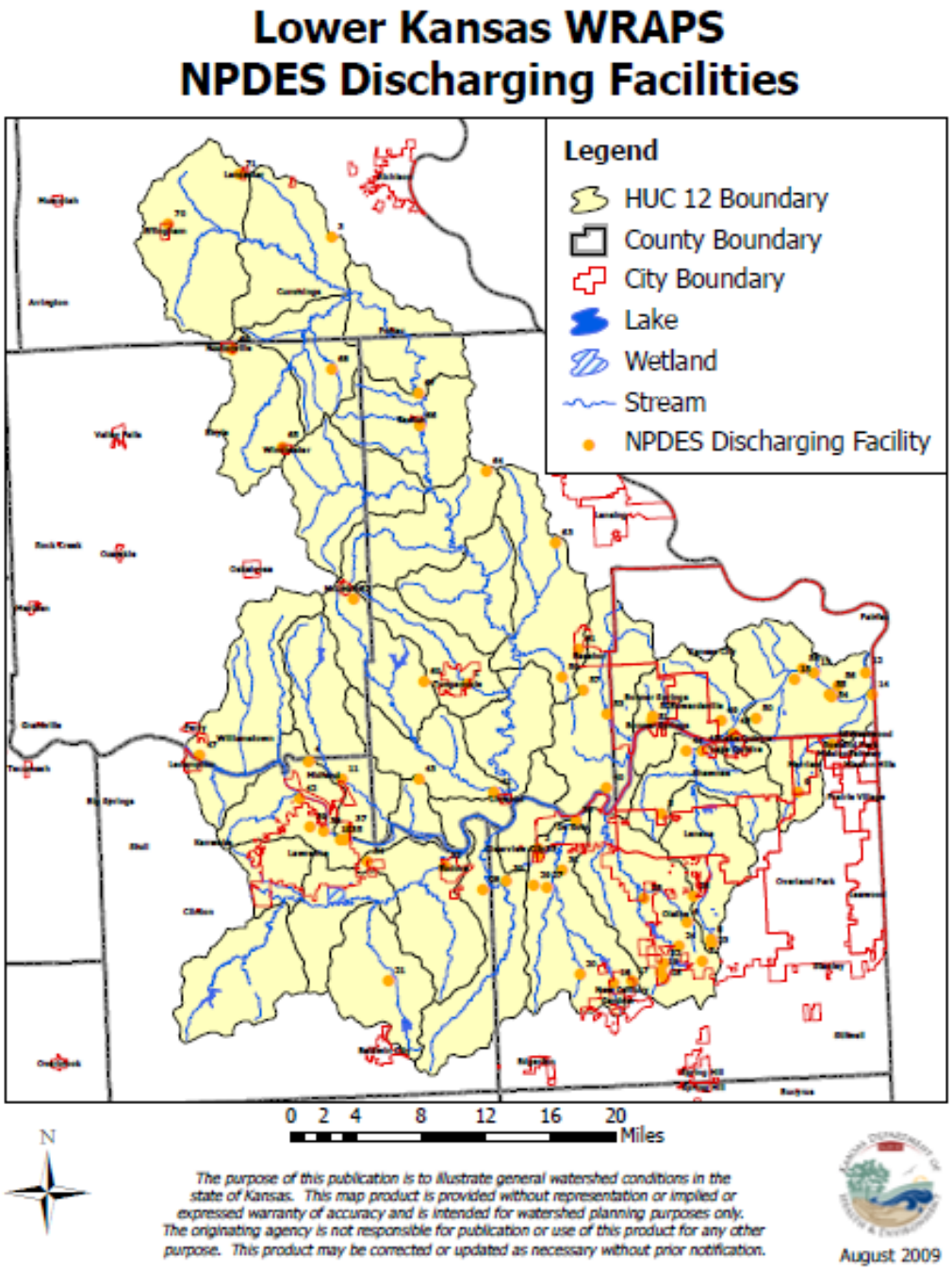


Figure11: Lower Kansas WRAPS Project Area NPDES Permitted Facilities

5.2.6 Potential Point Pollution Sources Impacting Streams

5.2.6.A. Feedlots

In Kansas, confined animal feeding operations (CAFOs) with greater than 300 animal units must register with KDHE. There are approximately 46 registered CAFOs located within the Lower Kansas WRAPS Project Area (this number, which is based on best available information, may be dated and subject to change). Waste disposal practices and waste water effluent quality are closely monitored by KDHE for these registered CAFOs to determine the need for runoff control practices or structure. Because of this monitoring, registered CAFOs are not considered a significant threat to water resources within the watershed. A portion of the State's livestock population exists on small unregistered farms. These small unregistered livestock operations may contribute a significant source of fecal coliform bacteria and nutrients, depending on the presence and condition of waste management systems and proximity to water resources.

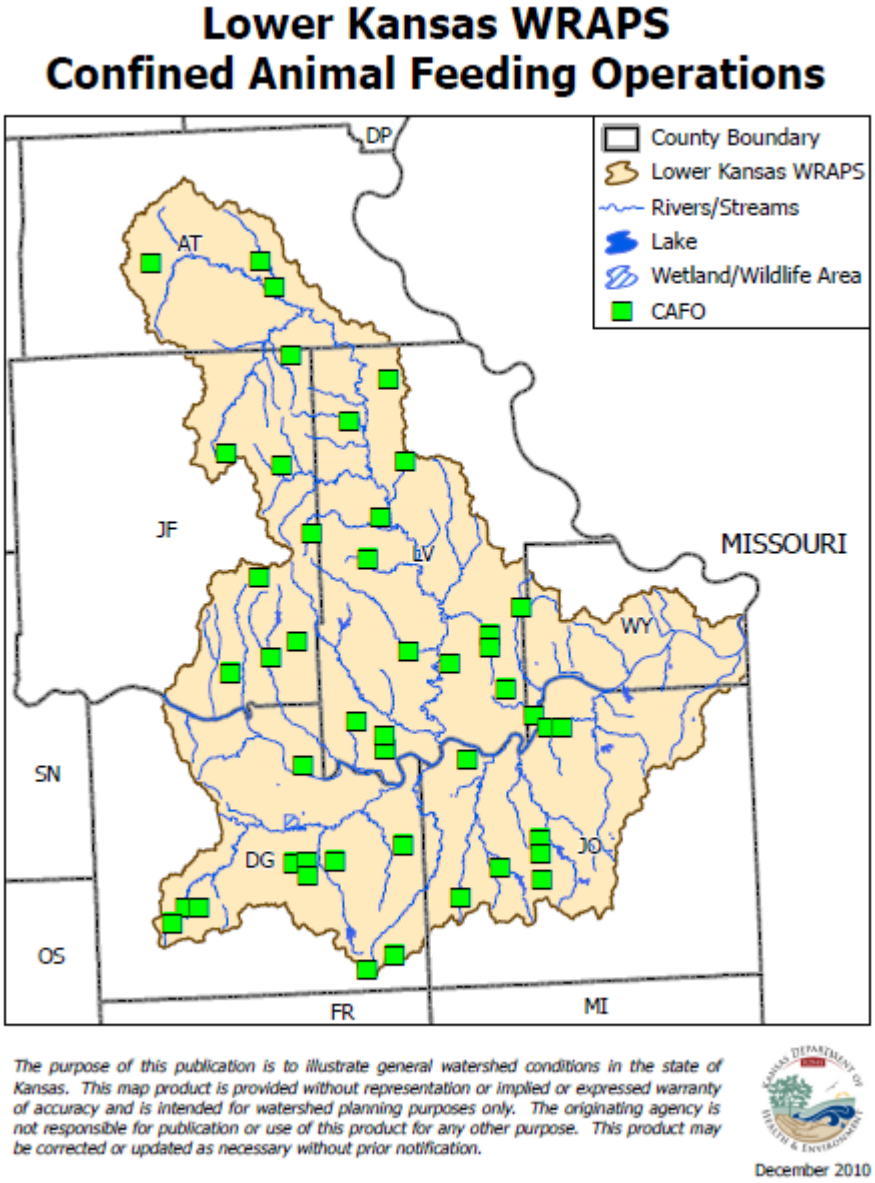


Figure 12: CAFOs in the Lower Kansas WRAPS Project Area

6.0 Prioritization of Watershed Issues

Resources necessary for addressing watershed issues include funding to implement best management practices, technical assistance, community leadership, educational, informational and data resources. These resources are frequently in limited supply, and must be allocated in the most efficient manner possible to have the greatest impact. To do this, it becomes necessary to prioritize where resources will be used. This is not intended to diminish the importance of issues that may receive lower priority, but is a necessary step in making sure that the most pressing needs receive the greatest attention first.

The size of the Lower Kansas WRAPS and the number of water issues in the basin required stakeholders involved in the development of a watershed restoration and protection strategy to make decisions as to where available resources will be focused. The prioritization process involved three phases. First, the watershed issues were ranked according to their priority relative to each other. Next, priority areas and sub-watersheds within the larger watershed were identified, keeping in mind the highest priority issues identified in the first step. Finally, best management practices necessary to improve the water quality concerns identified were also prioritized within each issue.

Monthly public meetings were held in various locations throughout the watershed in 2008 and 2009 to gather input from local stakeholders and concerned citizens. Farmers, landowners, representatives of natural resource agencies and organizations, city and county government representatives, public water suppliers, business owners, and others participated. The group identified watershed priorities and issues, gathered information, planned how resource concerns would be addressed, and prioritized issues and actions that should be taken. The group used a prioritization technique to assign priority ranking for each of the ten major watershed issues. This was done using the Pairs Comparison Technique for Prioritization, which uses preference scores to prioritize a list of items. Each cell of this matrix represents a pairing of the thirteen watershed issues. The stakeholders looked at each pair and selected the one that they perceived as most important of the two, or their “preferred choice”. The choices were tallied and a ranking assigned to the issues in order of their priority.

The following list shows the ranking of the ten watershed issues that resulted from this prioritization exercise.

1. Bacteria
2. Sediment and Biology
3. Nutrients
4. Pesticides
5. Source Water
6. Identify/Protect Green Space
7. Water Conservation

8. Groundwater
9. Flooding
10. Water Wells

After the ten watershed issues were prioritized, stakeholders examined modeling data for the watershed. Maps of watershed pollutant loads developed using the Spreadsheet Tool for Estimating Pollutant Loads (STEPL) model were reviewed. These maps illustrate expected pollutant loads at the Hydrologic Unit Code 12 level. Maps showing sediment, nitrogen, phosphorus and biological oxygen demand (BOD) loads were used.

Watershed issues, other than those being directly addressed by the Lower Kansas WRAPS 9 Element Plan, will be addressed through outreach and public education/information efforts.

7.0 Critical Target Areas

Since bacteria is the leading TMDL and priority watershed issue in the Lower Kansas WRAPS Project Area, stakeholders decided to initially focus on the Stranger Creek watershed in Leavenworth County. Future prioritized watershed areas, primarily due to TMDLs, include the Lower Wakarusa (bacteria) and Washington Creek (dissolved oxygen), Cedar Creek (bacteria), Mill Creek (bacteria), Mill Creek (sediment), Kill Creek (bacteria), Gardener City Lake (eutrophication), and Lake Olathe (eutrophication) and the Lower Kansas River (bacteria).

Priority Area Implementation Schedule

2010-2020: Stranger Creek (10270104 – 03, 04)
2020-2025: Lower Wakarusa including Washington Creek (1027010402)
2020-2030: Urban area including Mill Cr., Kill Cr. , Cedar Cr., Gardner City Lake and Lake Olathe (1027010406)
2030-2035: Lower Kansas River (10270104 – 05, 06)

7.1 Stranger Creek

7.1.1 Water Quality Impairments

The Stranger Creek watershed has a high priority TMDL for bacteria and numerous 303d listed impairments, listed in the tables below. Highlighted impairments are those being addressed currently to reach the endpoint of the high priority TMDL.

Table 10: Stranger Creek Impairments – 303(d)

Stream	Impairment	Priority
Crooked Creek Near Winchester	Atrazine, Total Phosphorus	Low
Stranger Creek Near Easton	Atrazine, Biology, Copper, Lead, Total Phosphorus, Total Suspended Solids	Low
Stranger Creek Near Linwood	Atrazine, Biology, Lead	Low
Nine Mile Creek Near Linwood	Lead, **Total Phosphorus**	Low

Table 11: Stranger Creek Impairments -TMDLs

Stream/Lake	Impairment	Priority
Crooked Creek Near Winchester	Biology	Low
Stranger Creek Near Easton	Fecal Coliform Bacteria	High
Stranger Creek Near Linwood	***E. coli***	**High**
Nine Mile Creek Near Linwood	**Fecal Coliform Bacteria**	High

There is no longer a Water Quality Standard for FCB. Bacteria TMDLs will be evaluated using the new Bacteria indicator criteria, which is for *E. Coli* (ECB). The term "Bacteria" applies to both FCB and ECB and this term bridges the two indicators together easily. The standard changed in 2003 as a result of House Bill 2219 as research proved that FCB data did not support the risk of FCB concentrations being related to illness. ECB has a much better correlation between illness and concentration.

The overall endpoint of the high priority bacteria TMDL will be to reduce the percent of samples over the applicable criteria from 34% to less than 10% for samples taken at flows below the high flow exclusion over the monitoring period of 2004-2008. This TMDL endpoint meets water quality standards as measured and determined by Kansas Water Quality Assessment protocols. Monitoring data plotting below the applicable seasonal TMDL curves will indicate attainment of the water quality standards. As with the overall endpoint, the manner of evaluation of the seasonal endpoints is consistent with the assessment protocols used to establish the case for impairment in these streams.

1. Less than 10% of samples taken in Spring exceed primary criterion at flows under 785 cfs with no samples exceeding the criterion at flows under 125 cfs.

2. Less than 10% of samples taken in Summer or Fall exceed the primary criterion at flows under 785 cfs with no samples exceeding the criterion at flows under 18 cfs.

3. Less than 10% of samples taken in Winter exceed secondary criterion at flows under 785 cfs.

These endpoints will be reached as a result of improvements in tributary buffer strip conditions, remediation of small livestock operations near the streams, as well as fixing failing on-site waste systems, and monitoring municipal waste discharge into area waters.

7.1.2 The Stranger Creek Priority Area Boundary

The Stranger Creek priority area includes HUC 10s: 1027010403 and 1027010404.

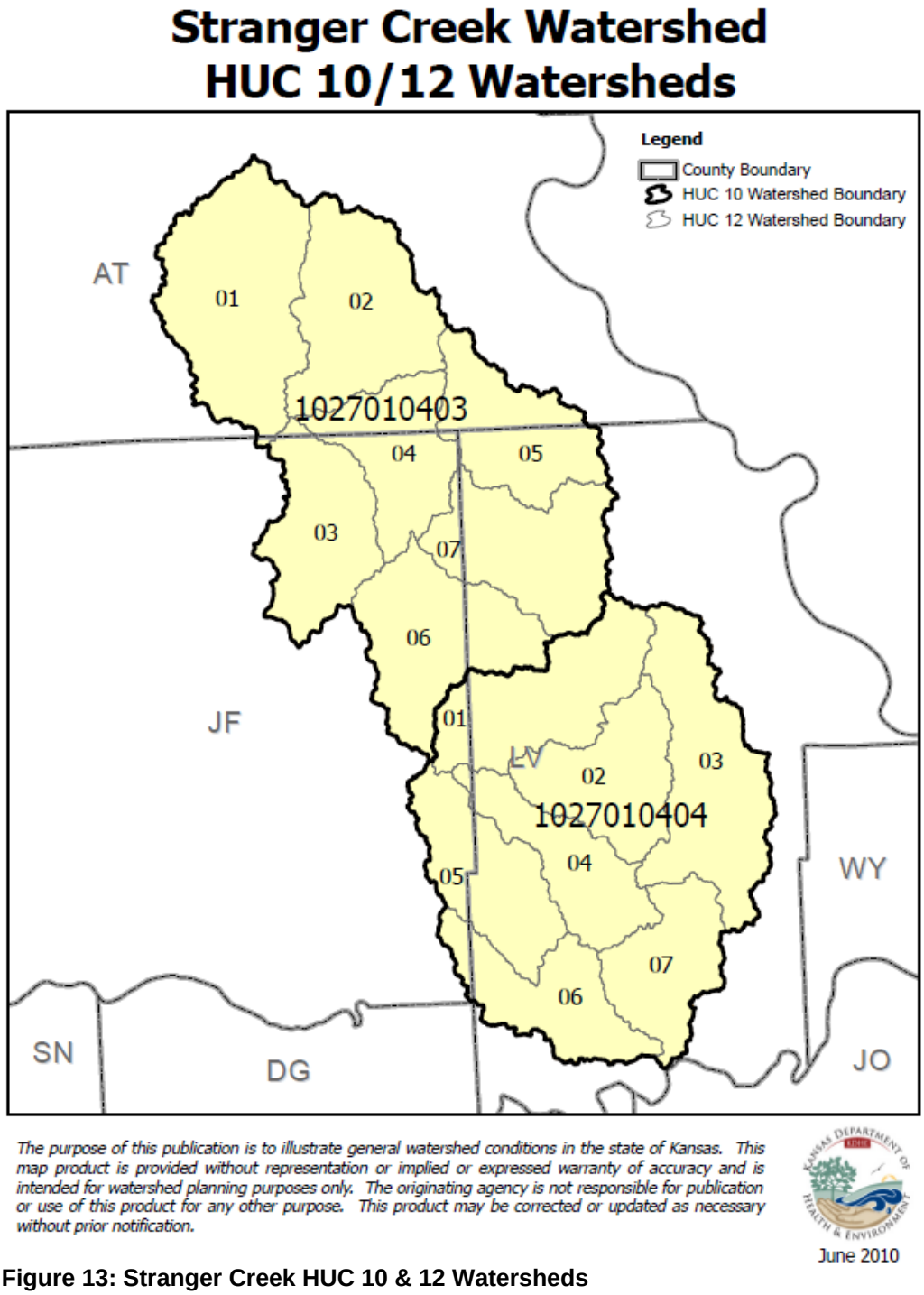


Figure 13: Stranger Creek HUC 10 & 12 Watersheds

7.1.3 Land Use

The watershed is 22% cropland and 52% pasture/hay/grassland with 18% in woodland. Grazing density of livestock is high, with a number of subwatersheds with more than 50 animal units per square mile.

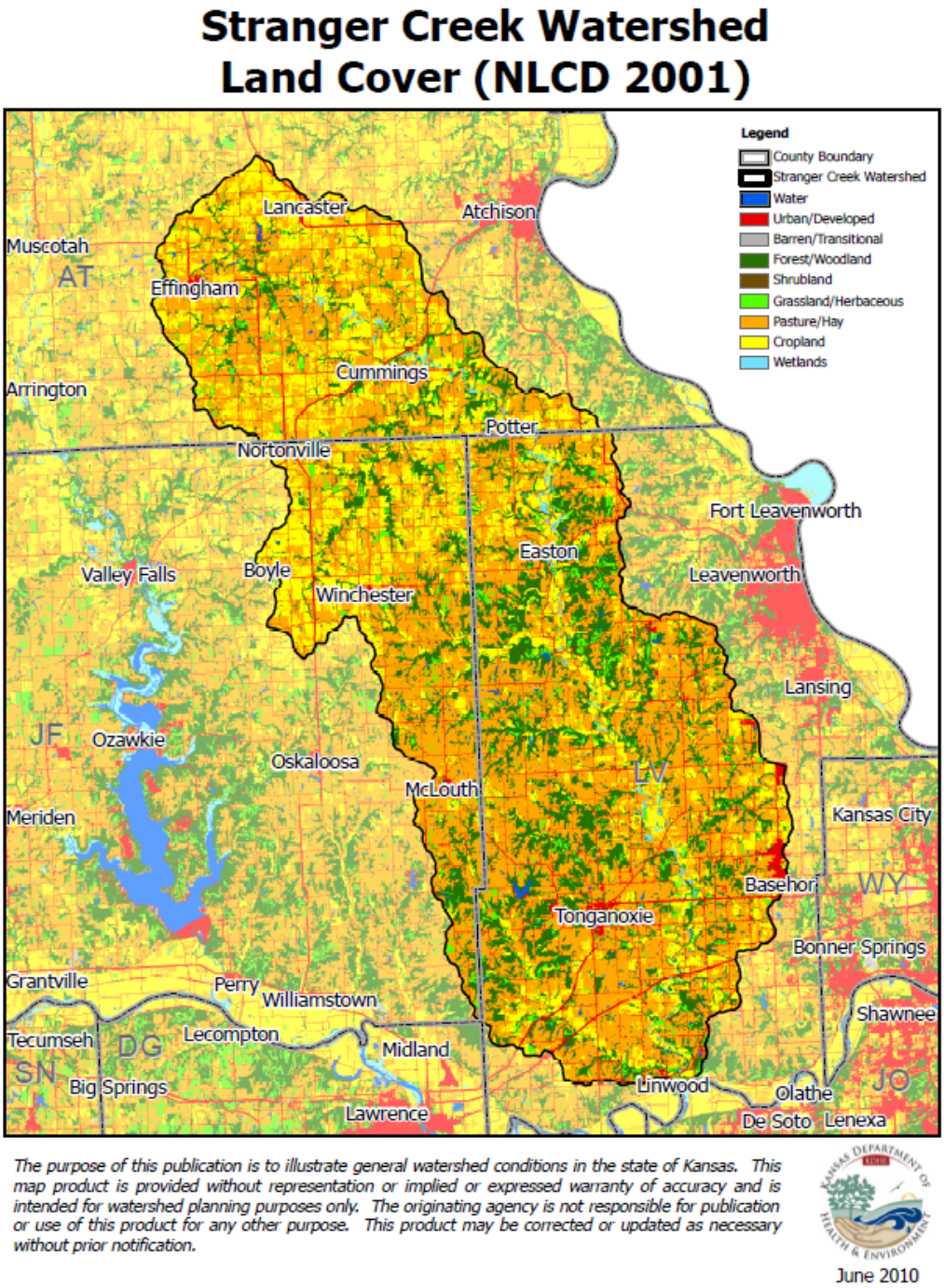


Figure 14: Stranger Creek Land Cover

7.1.4 Stranger Creek Public Water Suppliers

There are 38 public water supplies in the Stranger Creek watershed as depicted in Figure 15.

Figure 15: Stranger Creek Sub-Basins Public Water Suppliers

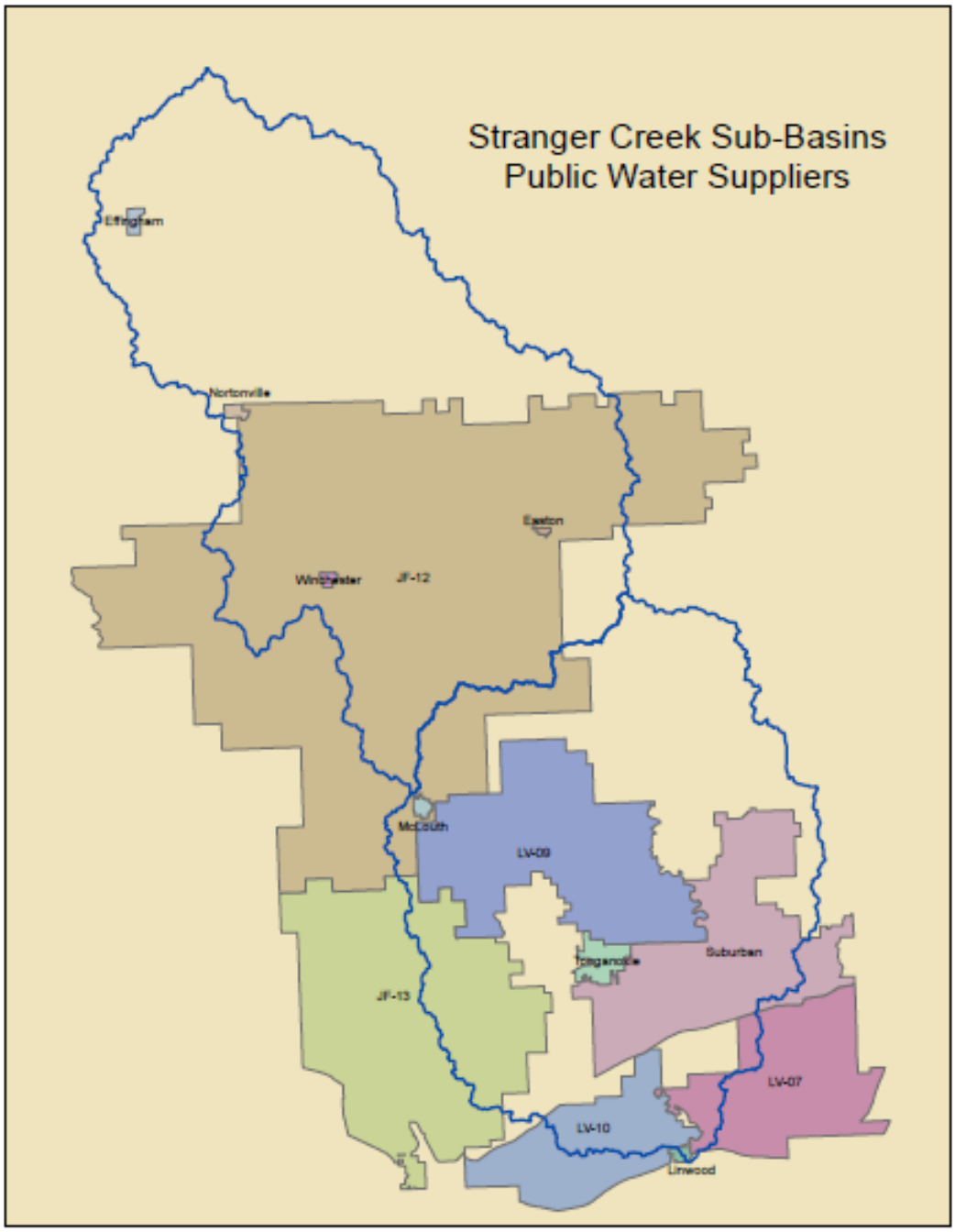


Table 12: Population Served by Stranger Creek Sub-Basin Public Water Suppliers

Municipality	Water Rights	Source	County	Population Served
Stranger Creek (WRAPS)				
Effingham	AT-001	Groundwater	Atchison	540
Effingham	33906	Groundwater	Atchison	
Nortonville	JF-002	Groundwater	Jefferson	590
Nortonville	24203	Groundwater	Jefferson	
Nortonville	34492	Groundwater	Jefferson	
Nortonville	46153	Groundwater	Jefferson	
Winchester	40622	Groundwater	Jefferson	619
Winchester	40623	Groundwater	Jefferson	
Winchester	40624	Groundwater	Jefferson	
Easton	39365	Groundwater	Jefferson	
Easton	39366	Groundwater	Jefferson	305
Jefferson County RWD No. 12	21577	Groundwater	Jefferson	3430
Jefferson County RWD No. 12	34545	Groundwater	Jefferson	
Jefferson County RWD No. 12	34546	Groundwater	Jefferson	
Jefferson County RWD No. 12	38138	Groundwater	Jefferson	
Jefferson County RWD No. 12	38139	Groundwater	Jefferson	
Jefferson County RWD No. 12	38985	Groundwater	Jefferson	
Jefferson County RWD No. 12	39896	Groundwater	Jefferson	
McLouth	JF-005	Groundwater	Jefferson	1000
McLouth	27715	Groundwater	Jefferson	
McLouth	39494	Groundwater	Jefferson	
Leavenworth County RWD No. 9	19460	Groundwater	Leavenworth	2000
Leavenworth County RWD No. 9	43487	Groundwater	Leavenworth	
Leavenworth County RWD No. 9	43488	Groundwater	Leavenworth	
Leavenworth County RWD No. 9	43489	Groundwater	Leavenworth	
Tonganoxie	LV-001	Groundwater	Leavenworth	4305
Tonganoxie	38597	Groundwater	Leavenworth	
Suburban	39287	Groundwater	Leavenworth	3892
Suburban	41844	Groundwater	Leavenworth	
Suburban	42733	Groundwater	Leavenworth	
Jefferson County RWD No. 13	24331	Groundwater	Douglas	2405
Jefferson County RWD No. 13	42722	Groundwater	Douglas	
Jefferson County RWD No. 13	42725	Groundwater	Douglas	
Leavenworth County RWD No. 7	43883	Groundwater	Leavenworth	2952
Leavenworth County RWD No. 7	43952	Groundwater	Leavenworth	
Linwood	15870	Groundwater	Leavenworth	368
Linwood	30014	Groundwater	Leavenworth	
			Total	**22406**
Leavenworth County RWD No. 10 is served by Suburban and Jefferson County RWD No. 13				

7.1.5 Possible Nonpoint Pollution Sources Contributing to Bacteria TMDL

7.1.5.A Bacteria

Activities in proximity to the stream may be contributing to the bacteria violations. These activities would include small livestock operations near the streams, as well as potentially failing on-site waste systems. Given the high percentage of hayland in the watershed and the high grazing density, these small livestock operations could be a significant source of bacteria contamination. An even distribution of cattle and swine counted in the 1997 Ag Survey shows the watershed having about 6,900 swine and 40,400 cattle. Permitted facilities account for nearly all swine, but only a small percentage of the cattle in the watershed. The remaining cattle (estimated 38,000 head) are likely dispersed throughout the watershed in small family operations (un-permitted) and on open range/grassland. The 1997 Ag survey data indicate a decline in the number of small farms with under 200 head of cattle in Atchison County, but Jefferson County has seen an increase in those small farms as well as the number of cattle in those small operations. Leavenworth County has seen a reduction in small farms, but an increase in the number of cattle in the remaining small operations. As of 1997, there remains a sizable number of these small, unregistered farms (over 1,000) in the three counties. Reflecting the high grazing density patterns in Stranger Creek, there is a high probability that a large number of these small operations are in the watershed. The fecal coliform TMDL on Stranger Creek near Linwood and the *E. coli* TMDL also on Stranger Creek near Linwood will be addressed with this plan.

7.1.5.B On-Site Waste Systems

A number of residents within Leavenworth, Atchison and Jefferson Counties are in rural settings without sewer service, relying instead on septic systems or on-site waste lagoons. Failing on-site waste systems contribute bacteria loadings. The infrequent excursions from the water quality standards seem to indicate a lack of persistent loadings from such systems on any grand scale. It is likely that the contribution of high bacteria loads from on-site waste systems is restricted to local areas**.**

7.1.6 Possible Point Sources Contributing to Bacteria TMDL

7.1.6.A NPDES Permits

There are twenty-six NPDES permitted municipal wastewater dischargers located within the watershed, most with waste stabilization lagoons with 2-4 cells and 120 - 150 day detention. Most cities appear to have additional treatment capacity available. Since the excursions from the water quality standards appear to occur under flow conditions of less than 65% duration and given the magnitude of the design flows of each of these systems, point source impacts appear to be minimal to the watershed. Impacts from municipal lagoons appear to be local in nature and insignificant at the downstream monitoring site.

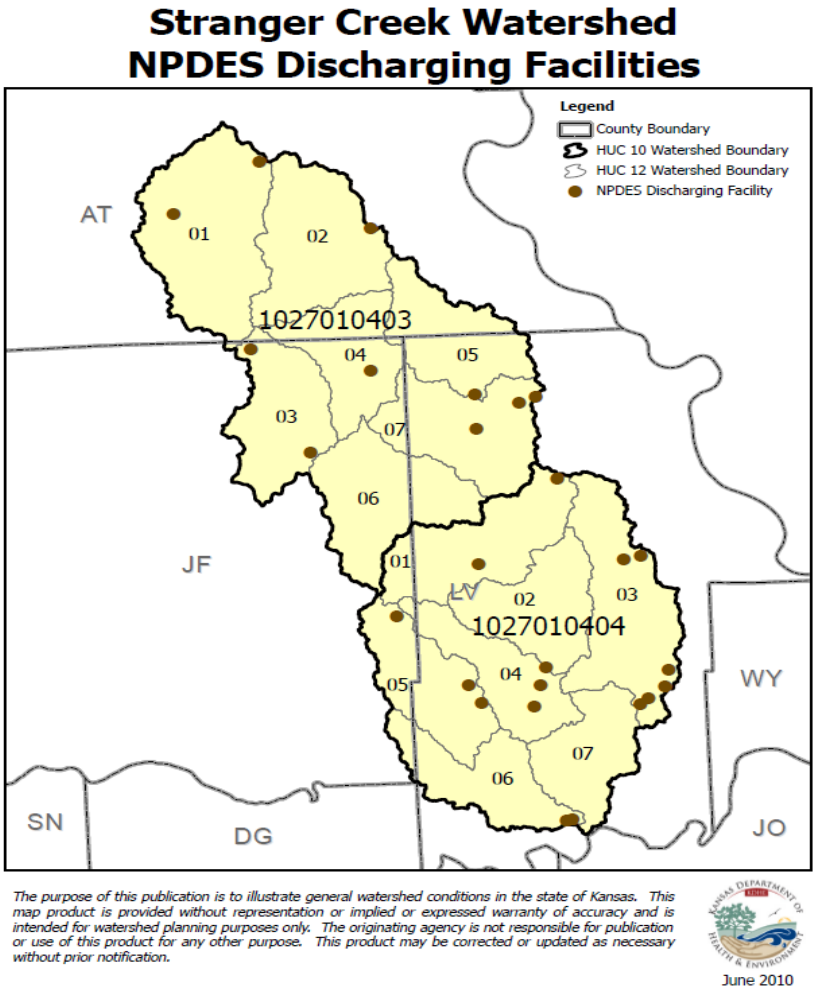


Figure 16: Stranger Creek NPDES Discharging Facilities

7.1.6.B Livestock Waste Management Systems:

Twenty seven operations are registered, certified or permitted within the watershed, accounting for a potential of up to 5,733 animal units. These operations are either swine (11) or dairy (16). All permitted livestock facilities have waste management systems designed to minimize runoff entering their operations or retaining runoff from their areas. Such systems are designed for the 25 year, 24 hour rainfall/runoff event, which would be indicative of flow durations well under 10 percent of the time. The actual number of animal units on site is variable, but typically less than permitted numbers.

7.1.7 Implementation Activities to Address Pollutants

7.1.7.A Bacteria

Grazing activities to reduce bacterial pollution should be directed toward the smaller, unpermitted livestock operations and rural homesteads and farmsteads in the watershed. The Load Allocation assigns responsibility for maintaining water quality below the TMDL curve over flow conditions bracketed by the 7Q10 low flow of 1 cfs and the high flow exclusion of 500 cfs. These flows are exceeded 17-94% of the time during the Spring, 9-60% of the time over the Summer and Fall and 8-87% of the time during the Winter. Best Management Practices will be directed toward those activities such that there will be minimal violation of the applicable bacteria criteria at higher flows. On-Site waste system integrity should be addressed, particularly in Leavenworth County, as well.

Primary participants for implementation will be small livestock producers operating without need of permits within the priority subwatershed. Implementing livestock management practices should be targeted at those areas with greatest potential to impact the stream. Nominally, this would be activities located within one mile of the streams. The following livestock Best Management Practices (BMPs) will include:

Definitions of Livestock Best Management Practices (BMPs)

Vegetative Filter Strip
-A vegetated area that receives runoff during rainfall from an animal feeding operation.
-Often require a land area equal to or greater than the drainage area (needs to be as large as the feedlot).
-10 year lifespan, requires periodic mowing or haying, average P reduction: 50%.
-$714 an acre

Relocate Feeding Sites

-Feeding Pens- Move feedlot or pens away from a stream, waterway, or body of water to increase filtration and waste removal of manure. Highly variable in price, average of $6,600 per unit.
-Pasture- Move feeding site that is in a pasture away from a stream, waterway, or body of water to increase the filtration and waste removal (eg. move bale feeders away from stream). Highly variable in price, average of $2,203 per unit.
-Average P reduction: 30-80%

Planned Grazing

-Grazing management plans that reduce overgrazing which leads to additional nutrient runoff and erosion.
-Can include rotational grazing.
-25% Phosphorous Reduction Efficiency
-The SLT estimated a cost of approximately $3,500 per plan

Alternative (Off-Stream) Watering System

-Watering system so that livestock do not enter stream or body of water.
-Studies show cattle will drink from tank over a stream or pond 80% of the time.
-10-25 year lifespan, average P reduction: 30-98% with greater efficiencies for limited stream access.
-$3,795 installed for solar system, including present value of maintenance costs.

Average Stocking Rates for Lower Kansas Watershed:
One pair on 6.75 acres of native grass.
Average grazing dates: April 20-October 15

7.1.7.B Phosphorus

Activities in proximity to the stream may be contributing to the increased in stream phosphorus levels. These activities would include small livestock operations near the streams, row crop agriculture, and failing on-site waste systems. Small livestock operations often depend on riparian areas, especially in the winter, as a source of water and shelter. Feed bunks are often located near streams as well. Manure deposited adjacent and in streams results in increased bacteria levels. Bacteria impairments and associated sampling are in the process to shifting from fecal coliform to *E. coli.* In addition to bacteria, manure contains phosphorus. Sampling for bacteria typically includes phosphorous as an additional way to determine trends of impairments. The 303(d) listing for phosphorous on Nine Mile Creek near Linwood will be addressed with this plan.

7.1.8 Possible Future Priority Watershed Ranking

BMP implementation in the Lower Kansas WRAPS Project Area will begin in Nine Mile Creek – HUC 1027 01040405 and HUC 102701040406. Nine Mile Creek is scheduled for implementation from 2011 to 2015. In the event the *E.coli* TMDL is not met, additional HUC 12 watersheds in Stranger Creek will be monitored and assessed. Because of their higher grazing density, number of registered livestock waste management systems and drainage area and proximity to the Primary Contact reaches of Stranger Creek and the Kansas River, the following subwatersheds are the priority focus for assessment and/or monitoring, and implementation. Table 13 and Figure 17 depict the Stranger Creek priority watersheds for monitoring, assessment and implementation.

Table 13: Stranger Creek Priority Watersheds for Implementation, Assessment and/or Monitoring

HUC 12	Watershed Implementation
102701040305 102701040307	Upper Stranger Creek
120701040401 102701040402	Middle Stranger Creek
102701040404	Tonganoxie Creek
102701040403 102701040407	Lower Stranger Creek

HUC 12	Watershed Assess/or Monitoring
102701040305 102701040307 102701040301	Upper Stranger Creek
120701040401 102701040402	Middle Stranger Creek
102701040404	Tonganoxie Creek
102701040403 102701040407	Lower Stranger Creek
102701040306	Adams Creek
102701040303 102701040304	Crooked Creek
10270104302	Camp Creek
102701040405	Ninemile Creek - Monitoring

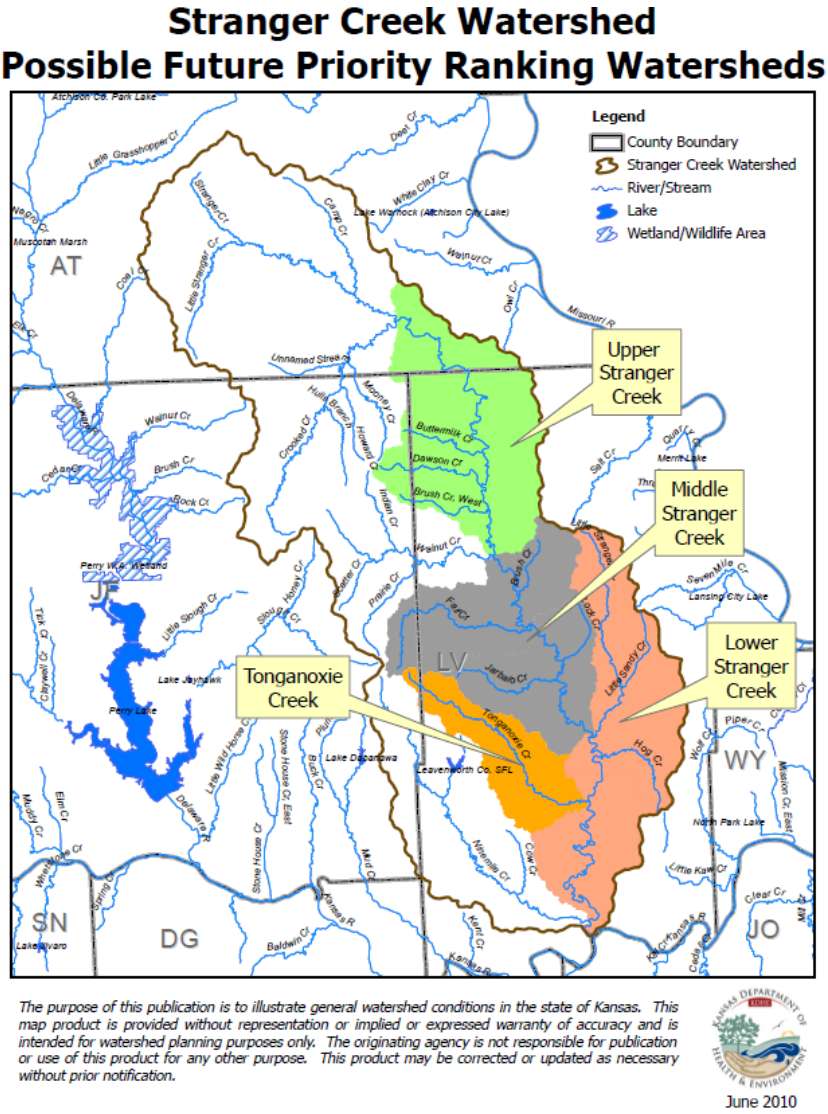


Figure 17: Stranger Creek Watershed Possible Future Priority Ranking Watersheds[9]

KDHE SFY 2012 funds will be used for water quality sampling on the watersheds listed in table 13, excluding the two HUC 12s that comprise Nine Mile Creek. Based on the results of the sampling, one watershed will be assessed annually beginning in KDHE SFY 2013 to determine the watershed(s) that are contributing the heaviest bacteria levels. Assessment results will direct further targeting of HUC 12 watersheds determined necessary to achieve the bacterial endpoints.

Table 14: Stranger Creek Assessment & Monitoring Needs[10]

Assessment and Monitoring Needs					
Watershed	**TMDL**	**Type of Assessment**	**Water Quality Sampling**	**Technical Assistance**	**Financial Assistance**
Upper Stranger Creek - 102701040305 102701040307 102701040301	Bacteria	Aerial Assessment/ Ground Truthing Combination @ $15,000 ea.	$400/sample x 2 samples = $800/site/yr.	KAWS	$2,400 WQS $45,000 Assessments
Middle Stranger Creek - 120701040401 102701040402	Bacteria	Aerial Assessment/ Ground Truthing Combination @ $15,000 ea.	$400/sample x 2 samples = $800/site/yr.	KAWS	$1,600 WQS $30,000 Assessments
Tonganoxie Creek - 102701040404	Bacteria	Aerial Assessment/ Ground Truthing Combination @ $15,000 ea.	$400/sample x 2 samples = $800/site/yr.	KAWS	$800 WQS $15,000 Assessment
Lower Stranger Creek - 102701040403 102701040407	Bacteria	Aerial Assessment/ Ground Truthing Combination @ $15,000 ea.	$400/sample x 2 samples = $800/site/y.r	KAWS	$1,600 WQS $30,000 Assessments
Crooked Creek 102701040303 102701040304	Bacteria	Aerial Assessment/ Ground Truthing Combination @ $15,000 ea.	$400/sample x 2 samples = $800/site/yr.	KAWS	$1,600 WQS $30,000 Assessments
Camp Creek 102701040302	Bacteria	Aerial Assessment/ Ground Truthing Combination @ $15,000 ea.	$400/sample x 2 samples = $800/site/yr.	KAWS	$800.00 WQS $15,000 Assessment
Ninemile Creek 102701040405 102701040406	Bacteria	Aerial Assessment completed.	$400/sample x 2 samples = $800/site/yr.	KAWS	$800/site/yr. WQS for HUC 1027010404005
Adams Creek 102701040306	Bacteria	Aerial Assessment/ Ground Truthing Combination	$400/sample x 2 samples = $800/site/yr.	KAWS	$800.00 WQS $15,000 Assessment

7.1.9 Watershed Assessments

The Stranger Creek watershed encompasses a very large drainage area. Three HUC 12 watersheds were initially chosen for an assessment based on guidance from the Lower Kansas WRAPS SLT and local residents familiar with the watersheds. The three HUC 12s are Fall Creek – HUC 102701040401, and Nine Mile Creek – HUC102701040405 and HUC 102701040406. The aerial

assessment paired with field verification identified potential sites impacted by livestock activities and/or streambank stabilization, which can occur together.

7.1.9.A Level 1 Watershed Assessment of Fall Creek-Stranger Creek Watershed Assessment, June, 2010

Focus of the Assessment

The focus of the assessment was to identify sites impacted by livestock activities and/or streambank erosion. Interpretation of aerial photographs and geographic informational system (GIS) data were used to complete the analysis. Field verification of sites identified in the assessment was completed by the assessor in cooperation with the WRAPS Coordinator, the Leavenworth County Water Quality Coordinator, and a Kansas Alliance for Wetlands and Stream representative.

Assessment Activities

The HUC 12 watershed level was used to evaluate:

1) Land use throughout the watershed.

2) Land use changes over two time periods (1992-2001 and 1990-2005), including estimates of acreages.

The riparian region is an ecosystem located between the upland and aquatic ecosystems. The riparian region was used to evaluate:

1) The identification of Animal Feed Operations (AFO's), Confined Animal Feeding Operations (CAFO's) and lagoons in close proximity to the stream network utilizing aerial photography assessment and ancillary GIS datasets.

2) Land use throughout the riparian region using several land cover datasets.

3) The identification of major stream bank erosion sites for rehabilitation and stabilization utilizing aerial photography and ancillary GIS datatsets.

Field verification of AFO's and major stream bank erosion sites identified in the analysis period utilizing aerial photography was undertaken on May 6th, 2010 with the WRAPS coordinator, the Leavenworth County Water Quality Coordinator, and a Kansas Alliance for Wetlands and Streams representative.

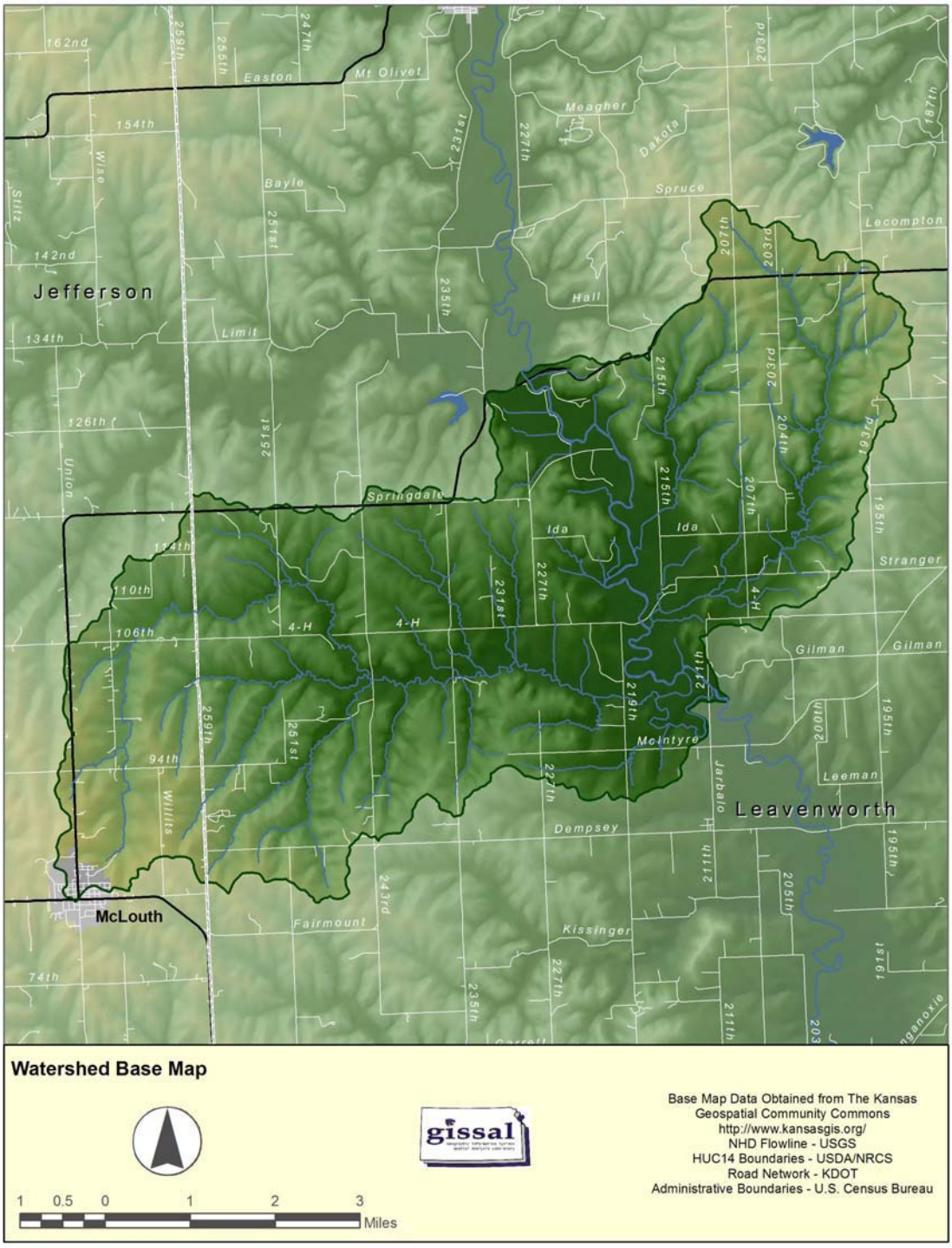


Figure 18: Fall Creek-Stranger Creek Watershed (HUC-12: 102701040401)

Results

Twenty-eight livestock operations and zero (0) waste water treatment lagoons were identified in close proximity to the riparian region of Fall Creek-Stranger Creek. Two (2) additional sites were identified just outside the Fall Creek-Stranger Creek watershed during field verification. Livestock feeding sites are often transitory and seasonal and may or may not have been active at the time of identification in the 2008 NAIP imagery and/or during field verification or results.

Indicators of recent or active livestock activity were used to confirm the presence or absence of an operation in close proximity to the stream network during field verification. Bale feeders, manure piles, fencing, shelters, denuded land or other signs of recent feeding activity were considered confirmation that animals have been or are active in an identified location.

Sites where livestock may gain access to riparian areas or where livestock have or are being fed in close proximity to streams are considered to be areas where Best Management Practices (BMPs) may be required to address water quality issues related to fecal coliform bacteria and bank erosion associated with hoof shear and grazing of riparian areas that reduces vegetative cover, especially shrub and tree sapling growth whose roots are important bank stabilizers, exposes topsoil, and weakens stream banks making them more susceptible to erosion.

Field verification results indicate while there are a few operations immediately adjacent to a stream, the majority of operations were located on hill tops. The discrepancy between the aerial photography and field verification indicate the need for both assessment components. The Fall Creek watershed is a good candidate for water quality protection. The watershed will not be included in the project implementation.

A copy of the assessment can be downloaded at
http://www.kaws.org/files/kaws/Fall%20Creek-Stranger%20Creek%20Level%20I%20Assessment.pdf

7.1.9.B Level 1 Watershed Assessment of Ninemile Creek-Stranger Creek Watershed Assessment

The Nine Mile Creek watershed, composed of HUC 102701040405 and HUC 102701040406, has numerous visible sources of impairment and has been chosen for targeted BMP implementation. Based on water quality monitoring knowledge identifying Nine Mile Creek as having a high priority bacteria impairment on the 303d list, this subwatershed was identified as a prime target area to begin to address the overall high priority bacteria TMDL on Stranger Creek. In addition, addressing the bacteria impairment in this subwatershed will also help to address a Total Phosphorus impairment in this subwatershed.

Focus of the Assessment

The focus of the assessment was to identify sites impacted by livestock activities and/or streambank erosion. Interpretation of aerial photographs was used to complete the analysis. Field verification of sites identified in the assessment was completed by the assessor in cooperation with the WRAPS Coordinator, the Leavenworth County Water Quality Coordinator, and a Kansas Alliance for Wetlands and Stream representative.

Assessment Activities

The riparian region is an ecosystem located between the upland and aquatic ecosystems. The riparian region was used to evaluate:

1) The identification of Animal Feed Operations (AFO's), Confined Animal Feeding Operations (CAFO's) in close proximity to the stream by interpreting aerial photography.

2) The identification of major stream bank erosion sites for stabilization utilizing aerial photography.

Field verification of AFO's and major stream bank erosion sites identified in the analysis period utilizing aerial photography was undertaken with the WRAPS coordinator, the Leavenworth County Water Quality Coordinator, and a Kansas Alliance for Wetlands and Streams representative.

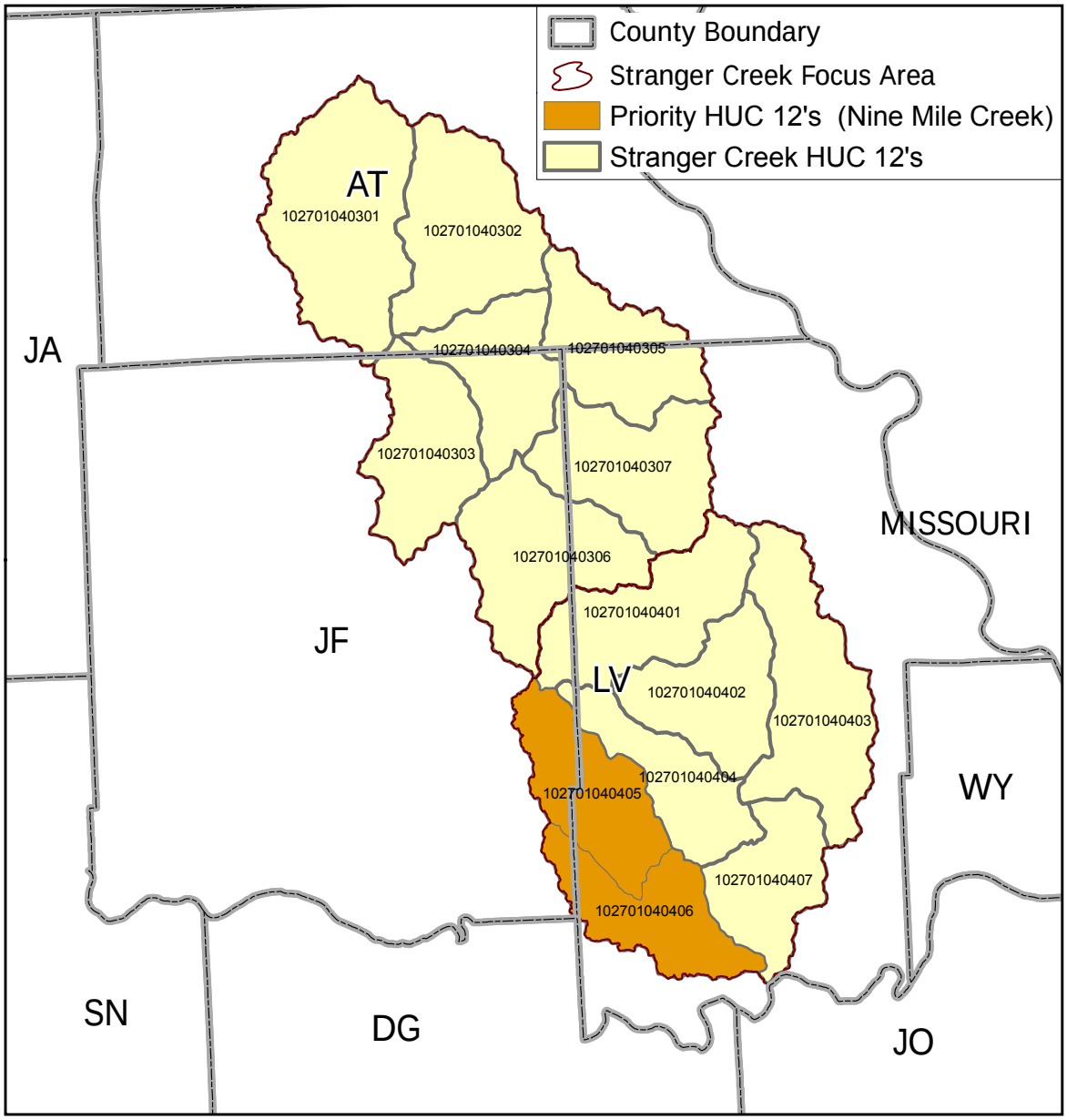
Results

Most of the interpretation of aerial photography is complete. Preliminary results show HUCs 102701040405 and 102701040406, both within the Nine Mile Creek sub-watershed of Stranger Creek, have a minimum of 26 animal feeding sites combined. Local knowledge strongly suggests there are additional livestock sites present in the watershed, due to the dynamic nature of moving feeding locations, access to water and shelter. Nine Livestock BMPs are proposed each year for Nine Mile Creek over a five year timeframe.

In June, 2011, a demonstration project was completed in the Nine Mile Creek watershed. BMPs installed included two alternate watering systems. In addition, over a mile of fencing was installed to isolate livestock from the creek. The project will serve as a valuable tool to reach other local producers.

For Nine Mile Creek, BMP implementation will be tightly focused on making improvements to small livestock operations. Practices chosen by the SLT include installing vegetative filter strips along creeks, relocating small feedlots away from streams, and promoting alternative watering away from streams.

Stranger Creek Watershed
Critical Targeted Areas



The purpose of this publication is to illustrate general watershed conditions in the state of Kansas. This map product is provided without representation or implied or expressed warranty of accuracy and is intended for watershed planning purposes only. The originating agency is not responsible for publication or use of this product for any other purpose. This product may be corrected or updated as necessary without prior notification.

Kansas Department of Health and Environment

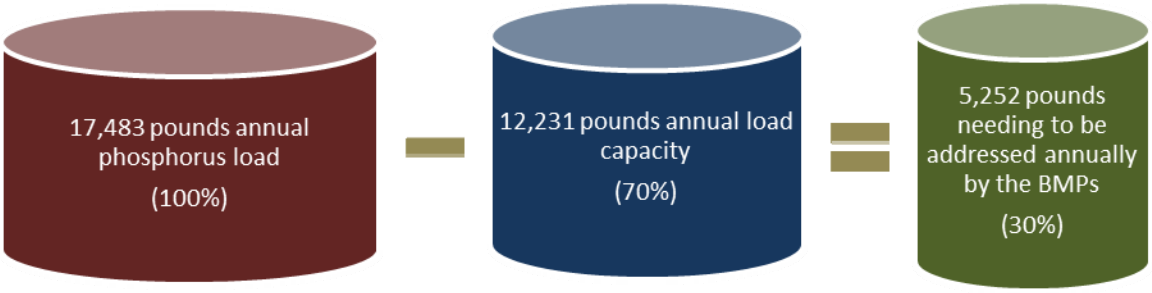
May 2011

Figure 19: Stranger Creek Priority Watersheds

8.0 Nine Mile Creek BMPs and Load Reductions BMP Definitions

There is a TMDL for FCB on Nine Mile Creek; however, FCB load reductions cannot be calculated. Therefore, this plan only provides livestock BMP scenarios without load reductions for FCB. KDHE has set load reductions for phosphorus based on delisting the Total Phosphorus 303d listed impairment. The goal for phosphorus reduction for the watershed is 30 percent. If the Total Phosphorus load reduction goal can be met, the FCB TMDL will be addressed.

The current estimated phosphorus load from nonpoint sources in the Nine Mile Creek watershed is 17,483 pounds per year according to the TMDL section of KDHE. This has been determined by KDHE as a result of sampling data obtained in the watershed. After subtracting the annual load capacity, t**he total annual load reduction allocated to the Lower Kansas Watershed needed to meet the phosphorus reduction goal of 30 percent with implemented BMPs is 5,252 pounds of phosphorus**. This is the amount of phosphorus that needs to be removed from the watershed and is the target of the BMP installations that will be placed in the watershed.



The SLT has laid out specific BMPs that they have determined will be acceptable to watershed residents as listed below. **These BMPs will be implemented in the Livestock Targeted Area (Stranger Creek Watershed). All these BMPs will simultaneously have a positive effect on reduction of phosphorus and nitrogen (nutrient) impairments.** Specific projects that need to be implemented per year have been determined and approved by the SLT.

Table 15: BMPs and Number of Projects to be Installed as Determined by the SLT Aimed at Meeting the FCB TMDL in Stranger Creek and 30% Phosphorus Reduction Goal.

Protection Measures	Best Management Practices and Other Actions	Total Projects Needed to be Implemented Annually
1. Prevention of FCB and nutrient contribution from **livestock**	1.1 Relocate Feedlot Pens	2
	1.2 Vegetative Filter Strip	2
	1.3 Relocate Pasture Feeding Site	2
	1.4 Alternative Watering System	2
	1.5 Planned Grazing	1

8.1 Load Reductions

Even though FCB load reductions cannot be calculated, phosphorus and nitrogen reductions can be calculated. They are included in this report to add to the body of work. This is another example of multiple benefits from BMPs that are being used to target a single pollutant. The table below lists the livestock BMPs installed with the associated phosphorus load reductions. In three years, if all BMPs have been installed, the phosphorus reduction goal will be met.

Table 16: Nine Mile Creek Estimated Phosphorous Load Reduction

Nine Mile Creek Estimated Phosphorous Load Reduction (lbs.)								
Year	Relocate Feeding Pens	Vegetative Filter Strip	Relocate Pasture Feeding Site	Alternative Watering System	Planned Grazing	Annual Total	Cumulative Load Reduction	% of Required Reduction
2011	1,914	1,276	228	152	76	3,646	3,646	69%
2012	1,914	1,276	228	152	76	3,646	7,292	139%
2013	1,914	1,276	228	152	76	3,646	10,938	208%
2014	1,914	1,276	228	152	76	3,646	14,584	278%
2015	1,914	1,276	228	152	76	3,646	18,230	347%
Phosphorous Load Reduction Required:				*5,252*	*Pounds*			

Table 17: Nine Mile Creek Implementation Estimated Nitrogen Load Reduction

Nine Mile Creek Estimated Nitrogen Load Reduction (lbs.)							
Year	Relocate Feeding Pens	Vegetative Filter Strip	Relocate Pasture Feeding Site	Alternative Watering System	Planned Grazing	Annual Total	Cumulative Load Reduction
2011	3,605	2,403	429	286	143	6,867	6,867
2012	3,605	2,403	429	286	143	6,867	13,734
2013	3,605	2,403	429	286	143	6,867	20,602
2014	3,605	2,403	429	286	143	6,867	27,469
2015	3,605	2,403	429	286	143	6,867	34,336

Table 18: Nine Mile Creek Number of Animal Units Treated Per Year

Nine Mile Creek Number of Animal Units Treated per Year						
Year	Relocate Feeding Pens	Vegetative Filter Strip	Relocate Pasture Feeding Site	Alternative Watering System	Planned Grazing	Annual Total
2011	200	200	80	80	40	600
2012	200	200	80	80	40	600
2013	200	200	80	80	40	600
2014	200	200	80	80	40	600
2015	200	200	80	80	40	600

8.1.2 Livestock Load Reduction Methodology

Baseline nutrient loadings per animal unit are calculated using the Livestock Waste Facilities Handbook.[27] Livestock management practice load reduction efficiencies are derived from numerous sources including K-State Research and Extension Publication MF-2737 and MF-2454.[28] Load reduction estimates are the product of baseline loading and the applicable BMP load reduction efficiencies.

MF-2737 Available at: http://www.oznet.ksu.edu/library/h20ql2/mf2737.pdf

MF-2454 Available at: http://www.oznet.ksu.edu/library/ageng2/mf2454.pdf

8.2 BMP Adoption Rates

Table 19: Nine Mile Creek Additional Adoption Rate

Nine Mile Creek Additional Adoption Rate						
Year	Relocate Feeding Pens	Vegetative Filter Strip	Relocate Pasture Feeding Site	Alternative Watering System	Planned Grazing	Total
2011	2	2	2	2	1	9
2012	2	2	2	2	1	9
2013	2	2	2	2	1	9
2014	2	2	2	2	1	9
2015	2	2	2	2	1	9

8.3 Costs for Implemented BMPs

Table 20: Nine Mile Creek Livestock BMPs, Costs, and Estimated Phosphorous Reduction

BMP	Approximate P Reduction Efficiency	Unit Cost	Estimated P Reduction (Pounds)	Additional Installations (Goal)	Total Estimated P Reduction
Vegetative Filter Strip	50%	$714	638	2	1,276
Relocate Feeding Pens	50-90%	$12,000	638	2	1,276
Relocated Pasture Feeding Site					
Native Grass	50-90%	$2,203	76	2	153
Off-Stream Watering System					
Native Grass	85%	$3,795	76	2	153
Planned Grazing	25%	$7,000	76	1	76
Total Cost	$44,424				
Year 1 Cost	$44,420				
Year 5 Cost	$49,995				
Annual Estimate of Phosphorous Reduction (lbs)	2,933				
Cost of P Reduction over Project Life (25 Years)					
Phosphorous Reduction ($/lb)	$1.07				

Table 21: Nine Mile Creek Implementation Cost Before Cost-Sharing

Nine Mile Creek Implementation Cost Before Cost-Share (3% Inflation)						
Year	Relocate Feeding Pens	Vegetative Filter Strip	Relocate Pasture Feeding Site	Alternative Watering System	Planned Grazing	Total
2011	$24,000	$1,430	$4,400	$7,590	$7,000	$44,420
2012	$24,720	$1,473	$4,532	$7,818	$7,210	$45,753
2013	$25,462	$1,517	$4,668	$8,052	$7,426	$47,125
2014	$26,225	$1,563	$4,808	$8,294	$7,649	$48,539
2015	$27,012	$1,609	$4,952	$8,543	$7,879	$49,995
Total	**$127,419**	**$7,592**	**$23,360**	**$40,296**	**$37,164**	**$235,832**

Table 22: Nine Mile Creek Implementation After Cost-Sharing

Nine Mile Creek Implementation Cost After Cost-Share (3% Inflation)						
Year	Relocate Feeding Pens	Vegetative Filter Strip	Relocate Pasture Feeding Site	Alternative Watering System	Planned Grazing	Total
2011	$12,000	$715	$2,200	$3,795	$3,500	$22,210
2012	$12,360	$736	$2,266	$3,909	$3,605	$22,876
2013	$12,731	$759	$2,334	$4,026	$3,713	$23,563
2014	$13,113	$781	$2,404	$4,147	$3,825	$24,269
2015	$13,506	$805	$2,476	$4,271	$3,939	$24,998
Total	**$63,710**	**$3,796**	**$11,680**	**$20,148**	**$18,582**	**$117,916**

9.0 Information and Education in Support of BMPs

The SLT has determined which information and education activities will be targeted toward the Nine Mile Creek watershed. These activities are important in providing the residents of the watershed with a higher awareness of watershed issues. This will lead to an increase in adoption rates of BMPs.

Table 23: Information and Education Activities for Livestock BMP Implementation

9.1 Information and Education Activities for Livestock BMP Implementation					
BMP	**Target Audience**	**Information/Education Activity/Event**	**Time Frame**	**Estimated Costs**	**Sponsor/Responsible Agency**
Relocate Pasture Feeding Sites	Livestock Producers/Landowners	Tour/Field Day	Annual-Summer	$5,000	Kansas Rural Center K-State Research and Extension Conservation Districts NRCS KAWS Stranger Creek Focus Group
	Livestock Producers/Landowners	Scholarships to Grazing Schools and Workshops	Annual-Winter	5 per year, $50 per scholarship	Kansas Rural Center K-State Research and Extension KAWS Stranger Creek Focus Group
	Livestock Producers/Landowners	One-on-one technical assistance for producers to implement BMPs in the targeted area.	Annual, Ongoing	$15,000	K-State Research and Extension Kansas Rural Center Conservation Districts NRCS KAWS Stranger Creek Focus Group

BMP	Target Audience	Information/Education Activity/Event	Time Frame	Estimated Costs	Sponsor/Responsible Agency
	Livestock Producers/Landowners	One-on-one technical assistance to remove livestock from riparian area.	Annual, Ongoing	$4,000	Kansas Forest Service K-State Research and Extension Kansas Rural Center Conservation districts NRCS Stranger Creek Focus Group
	Livestock Producers/Landowners	Tour/Field Day	Annual-Summer	Included above	Kansas Rural Center K-State Research and Extension Conservation Districts KAWS NRCS Stranger Creek Focus Group
	Livestock Producers/Landowners	Scholarships to Grazing Schools and Workshops	Annual-Winter	Included above	Kansas Rural Center K-State Research and Extension KAWS Stranger Creek Focus Group
Off-stream Watering Systems	Livestock Producers/Landowners	One-on-one technical assistance for producers to implement BMPs in the targeted area.	Annual, Ongoing	Included above	K-State Research and Extension Conservation districts NRCS KAWS Stranger Creek Focus Group Kansas Rural Center

	Small Livestock Producers/Landowners	Tour/Field Day	Annual-Summer	Included above	Kansas Rural Center K-State Research and Extension Conservation Districts NRCS KAWS Stranger Creek Focus Group
	Small Livestock Producers/Landowners	One-on-one technical assistance for producers to implement BMPs in the targeted area.	Annual, Ongoing	Included above	K-State Research and Extension Conservation districts NRCS KAWS Stranger Creek Focus Group Kansas Rural Center
	Small Livestock Producers/Landowners	Tour/Field Day	Annual-Summer	Included above	Kansas Rural Center K-State Research and Extension Conservation Districts NRCS KAWS Stranger Creek Focus Group
Relocate Feeding Pens	Livestock Producers/Landowners	One-on-one technical assistance for producers to implement BMPs in the targeted area.	Annual, Ongoing	Included above	K-State Research and Extension Conservation districts NRCS KAWS Stranger Creek Focus Group

	Livestock Producers/Landowners	Tour/Field Day	Annual-Summer	Included above	Kansas Rural Center K-State Research and Extension Conservation Districts NRCS KAWS Stranger Creek Focus Group
Vegetative Filter Strips **Planned Grazing**	Livestock Producers/Landowners	Scholarships to Grazing Schools and Workshops	Annual-Winter	Included above	Kansas Rural Center K-State Research and Extension KAWS Stranger Creek Focus Group
Nine Mile Creek – Stranger Creek Outreach	Nine Mile Creek	One-on-one technical assistance to remove livestock from riparian area. Tour/field Day	July 1, 2011 to June 30, 2012	$15,000	Leavenworth County Conservation District

Total annual cost for Livestock Information and Education if all events are implemented = $39,250.00

Table 24: General/Watershed Wide Information and Education

General / Watershed Wide Information and Education					
BMP	**Target Audience**	**Information/Education Activity/Event**	**Time Frame**	**Estimated Costs**	**Sponsor/Responsible Agency**
Educational Activities Targeting Youth	**Educators, K-12 Students**	Water Festivals/Water Rally	Annual- Spring or Summer	$500 per event	Conservation Districts
		Events/campaigns created by student environmental groups at high schools in the watershed	Annual - spring, summer or fall	$250 per event	Local School Districts/ K-State Research & Extension?/ Local environmental volunteer organizations?
		Poster, essay, speech contests	Annual - Spring	$200	Conservation Districts
		Day on the Farm	Annual - Spring	$500 per event	Conservation Districts, Kansas Farm Bureau, K-State extension
		Thank-You Farmer	Annual - Winter	$200	Conservation District

Total annual cost for General/Watershed Wide Information and Education if all events are implemented = $1,650.00

Table 25: Watershed Issues Information and Education

Watershed Issues Information and Education					
BMP	Target Audience	Information/Education Activity/Event	Time Frame	Estimated Costs	Sponsor/Responsible Agency
Bacteria	Watershed Landowners	Water Testing	Semi-Annually Four Locations	$2,000	Conservation District, KAWS, KDHE, MARC
Sediment/Biology	Watershed Landowners	Sampling	Annually	$500	Conservation District, KAWS, KDHE, MARC
Nutrients	Watershed Landowners	Onsite visits	Bi-Monthly	$300/Year	Conservation Districts
Pesticides	Watershed Landowners	Onsite visits	Quarterly	$1,000/Year	Conservation Districts, Kansas Rural Center
Source Water	County/Landowners	Scheduled meetings	Semi-Annually	$100	County Planning and Zoning/Conservation District
Identify/Protect Green Space	City/County Government Officials	Scheduled meetings	Annually	$100	County Planning and Zoning/Conservation Districts
Water Conservation	Watershed Landowners	Onsite visits	Quarterly	$500	KAWS/ Conservation Districts
Flooding	City/County, Watershed Landowners	Area visits	Semi-Annually	$200	City/County Officials/Conservation Districts
Water Wells	Watershed Landowners	Onsite visits	As needed	$250	Conservation Districts
Total annual cost for Watershed Issues Information and Education if all events are implemented = $4,950.00					
Total annual cost per year for Information and Education if all events are implemented = $45,850					

Table 26: Project Management

Project Management			
WRAPS Coordination	Annual	$37,390	KAWS
Grant Administration	Annual	$12,600	KAWS
TOTAL		$49,990	
Total annual cost per year for all Information and Education + Project Management = $95,840			

9.2 Evaluation of Information and Education Activities

All service providers conducting Information and Education (I&E) activities funded through the Lower Kansas WRAPS will be required to include an evaluation component in their project proposals and Project Implementation Plans. The evaluation methods will vary based on the activity. At a minimum, all I&E projects must include participant learning objectives as the basis for the overall evaluation. Depending on the scope of the project, development of a basic logic model identifying long-term, medium-term, and short-term behavior changes or other outcomes that are expected to result from the I&E activity may be required.

Specific evaluation tools or methods may include (but are not limited to):
* Feedback forms allowing participants to provide rankings of the content, presenters, useful of information, etc.
* Pre and post surveys to determine amount of knowledge gained, anticipated behavior changes, need for further learning, etc.
* Follow up interviews (one-on-one contacts, phone calls, e-mails) with selected participants to gather more in-depth input regarding the effectiveness of the I&E activity. All service providers will be required to submit a brief written evaluation of their I&E activity, summarizing how successful the activity was in achieving the learning objectives, and how the activity contributed to achieving the long-term WRAPS goals and/or objectives for pollutant load reduction

10.0 Costs of Implementing BMPs and Possible Funding Sources

The SLT has reviewed all the recommended BMPs listed in this report for each individual impairment. It has been determined by the SLT that specific BMPs will be the target of implementation funding for each category. Most of the BMPs that are targeted will be advantageous to more than one impairment, thus being more efficient.

Table 27: Costs Before Cost Share for Livestock BMPs in Nine Mile Creek

Nine Mile Creek Implementation Cost Before Cost-Share (3% Inflation)						
Year	Relocate Feeding Pens	Vegetative Filter Strip	Relocate Pasture Feeding Site	Alternative Watering System	Planned Grazing	Total
2011	$24,000	$1,430	$4,400	$7,590	$7,000	$44,420
2012	$24,720	$1,473	$4,532	$7,818	$7,210	$45,753
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2015	$27,012	$1,609	$4,952	$8,543	$7,879	$49,995
Total	**$127,419**	**$7,592**	**$23,360**	**$40,296**	**$37,164**	**$235,832**

Table 28: Costs After Cost Share for Livestock BMPs in Nine Mile Creek

Nine Mile Creek Implementation Cost After Cost-Share (3% Inflation)						
Year	Relocate Feeding Pens	Vegetative Filter Strip	Relocate Pasture Feeding Site	Alternative Watering System	Planned Grazing	Total
2011	$12,000	$715	$2,200	$3,795	$3,500	$22,210
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2014	$13,113	$781	$2,404	$4,147	$3,825	$24,269
2015	$13,506	$805	$2,476	$4,271	$3,939	$24,998
Total	**$63,710**	**$3,796**	**$11,680**	**$20,148**	**$18,582**	**$117,916**

Table 29: Potential BMP Funding Sources

Potential Funding Sources	Potential Funding Programs
Natural Resources Conservation Service	- Environmental Quality Incentives Program (EQIP) - Wetland Reserve Program (WRP) - Conservation Reserve Program (CRP) - Wildlife Habitat Incentive Program (WHIP) - Cooperative Conservation Partnership Initiative (CCPI) - State Acres for Wildlife Enhancement (SAFE) - Grassland Reserve Program (GRP) - Farmable Wetlands Program (FWP)
EPA/KDHE	- 319 Funding Grants
KS Dept. of Wildlife and Parks	- Partnering for Wildlife
Kansas Alliance for Wetlands &Streams	
KDA - Division of Conservation	
Conservation District	
Kansas Rural Center	- River Friendly Farms Program
Kansas Forest Service	- Forest Legacy Program (US Forest Service & Kansas Forest Service)
US Fish and Wildlife	

Table 30: Potential Service Providers for BMP Implementation

BMP	Services Needed to Implement BMP		
	Technical Assistance	***Information & Education***	***Service Provider***
1. Vegetative filter strips	Design, cost share and maintenance	BMP workshops, field days, tours	KAWS NRCS SCC FSA KFS KRC KSRE CD RC&D KDWP
2. Relocate small feedlots	Design, cost share and maintenance	BMP workshops, field days, tours	KAWS NRCS SCC FSA KFS KRC KSRE CD RC&D KDWP
3. Relocate pasture feeding sites	Design, cost share and maintenance	BMP workshops, field days, tours	KAWS NRCS SCC FSA KFS KRC KSRE CD RC&D KDWP
4. Establish off stream watering systems	Design, cost share and maintenance	BMP workshops, field days, tours	KAWS NRCS SCC FSA KFS KRC KSRE CD RC&D KDWP

11.0 Timeframe

The SLT will request an update of monitoring data from KDHE every four years to correspond with the frequency of monitoring data. The plan will be reviewed every five years starting in 2015. The timeframe of this document for BMP implementation to meet bacteria TMDLs in Stranger Creek – Nine Mile Creek is five years. The SLT will review bacteria sampling data and BMP placement annually. Targeting and BMP implementation may shift over time to achieve TMDLs.

Table 31: Review Schedule for Pollutants and BMPs.

Review Year	Bacteria	BMP Placement
2011		X
2012		X
2013		X
2014	X	X
2015	X	X

12.0 Interim Measurable Milestones

Milestones will be determined by number of acres treated, projects installed, contacts made to residents of the watershed and water quality parameters at the end of every year. The SLT will examine these criteria to determine if adequate progress has been made from the current BMP implementations. If they determine that adequate progress has not been made, they will readjust the implementation projects in order to achieve the TMDL.

Table 32: Adoption Rates for BMPs in Nine Mile Creek Watershed.

Nine Mile Creek Additional Adoption Rate for BMPs						
Year	Relocate Feeding Pens	Vegetative Filter Strip	Relocate Pasture Feeding Site	Alternative Watering System	Planned Grazing	Total
2011	2	2	2	2	1	9
2012	2	2	2	2	1	9
2013	2	2	2	2	1	9
2014	2	2	2	2	1	9
2015	2	2	2	2	1	9
Total	10	10	10	10	5	45

BMP Implementation Milestones

The SLT will review the number of livestock projects and contacts made in the watershed at the end of 2015. The SLT will then have the option to reassess the goals and alter BMP implementation. Below is the outline of BMP implementation from 2011-2015.

Table 33: Nine Mile Creek Livestock BMP Implementation Milestones

Nine Mile Creek Livestock BMP Implementation Milestones						
Year	Relocate Feeding Pens	Vegetative Filter Strip	Relocate Pasture Feeding Site	Alternative Watering System	Planned Grazing	Total
2011	2	2	2	2	1	9
2012	2	2	2	2	1	9
2013	2	2	2	2	1	9
2014	2	2	2	2	1	9
2015	2	2	2	2	1	9
Total	**10**	**10**	**10**	**10**	**5**	**45**

Water Quality Milestones to Determine Improvements

The goal of the Lower Kansas Ninemile Creek plan is to restore water quality for uses supportive of aquatic life and secondary contact recreation for Ninemile Creek. The plan will specifically address the high priority bacteria TMDL and 303d phosphorus listing for Ninemile Creek. The restoration plan includes a BMP implementation schedule spanning a period of five years.

Water Quality Milestones for Total Phosphorus

A timeframe of five years has been utilized for the water quality milestones, as listed in the table below. The table includes a milestone for average phosphorus that should be achieved through BMP implementation.

Figure 20: Water Quality Milestones for Nine Mile Creek[13]

Water Quality Milestones for Nine Mile Creek			
	Current Condition (2000 - 2010) Average TP	Improved Condition (2011 - 2016) Average TP	Reduction Needed
Sampling Site	Total Phosphorus (average of data collected during indicated period), ppb		
Ninemile Creek SC680	167	130	37

Water Quality Milestones for Bacteria

In addition to the milestones listed above, the plan is addressing the high priority bacteria TMDL for the Stranger Creek Watershed, which includes Ninemile Creek as a tributary segment. The water quality goal associated with the bacteria impairment can be tied to the E. Coli Bacteria (ECB) Index values. ECB index values for individual samples are computed as the ratio of the sample count to the contact recreation criterion. The calculated index is the natural logarithm of each sample value taken during the primary recreation season (April through October), divided by the natural logarithm of the bacteria criteria. Plotting the ECB ratio against the percentile rank for each individual sample within the data set for each sampling location illustrates the frequency and magnitude of the bacteria impairment for the sampling location. Higher bacteria frequencies are evident when the ECB ratio is over 1 for a large percentage of samples.

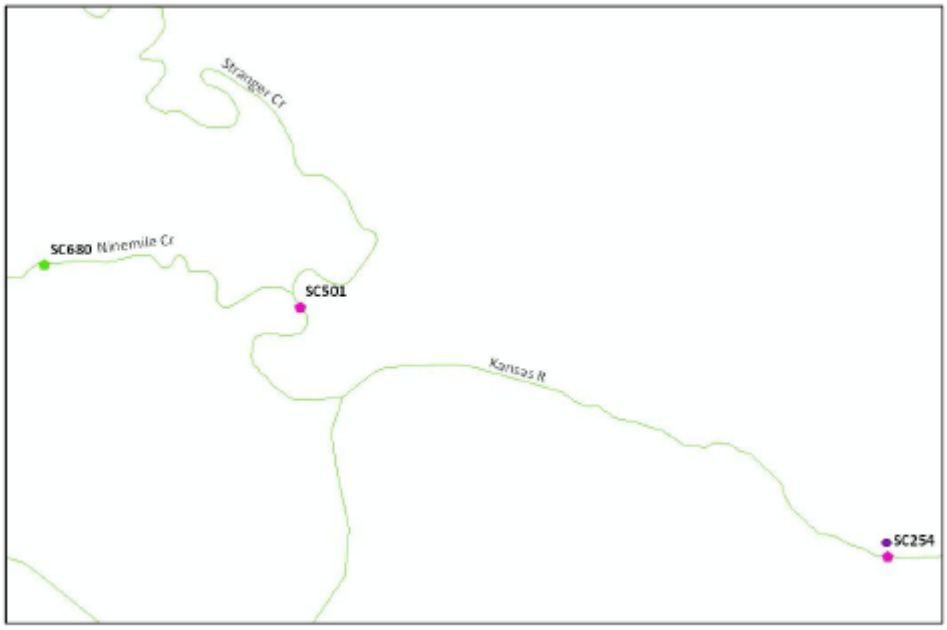
The water quality milestones associated with bacteria are based on the contact recreation designation of the impaired water body, as well as the proximity and designation of the downstream water body. Contact recreation is designated as either primary or secondary. Primary contact designation is assigned to water

bodies that have a high likelihood of ingestion based on the recreational use (i.e. swimming), while secondary contact recreation designation is assigned to waters that are not as likely to be ingested based on the recreational use (i.e. fishing, boating).

13.0 Monitoring Water Quality Progress

The map below illustrates the location of Nine Mile Creek, Stranger Creek, and the Kansas River, as well as the location of the referenced KDHE monitoring stations in relation to all three water bodies.

Figure 21: KDHE Monitoring Station Map



Monitoring Station Location Map

Monitoring Station Location Map

Monitoring station SC680 is located along Nin Mile Creek near the confluence of Stranger Creek. Station SC501 is located immediately downstream of the Nine Mile confluence with Stranger Creek, which joins the Kansas River immediately downstream of SC501. Station SC254 is located along the Kansas River, downstream of Stranger Creek. Both the Kansas River and the Stranger Creek Watershed, which includes Nine Mile Creek, have high priority TMDLs for bacteria. The water quality goals for the TMDLs are based on the designated uses for the specific water body. The contact recreation designations for the referenced water bodies are as follows:

Kansas River → Primary Contact Recreation B (open to public)
Stranger Creek → Primary Contact Recreation C (not open to public)
Nine Mile Creek → Secondary Contact Recreation b (not open to public)

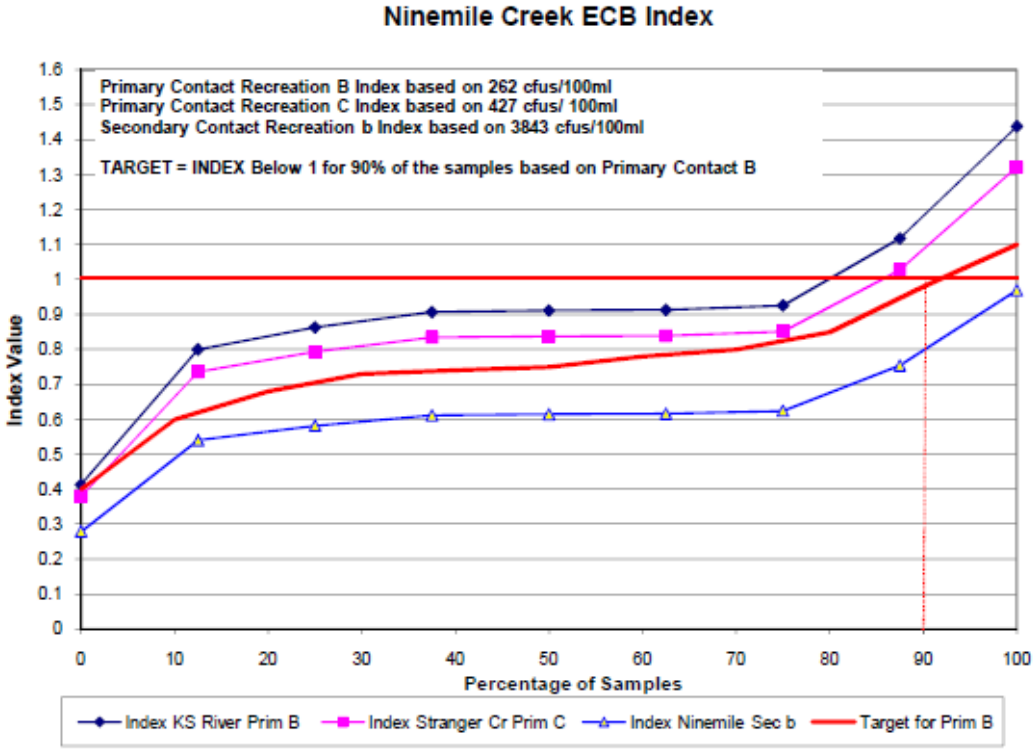
Due to the fact that both Nine Mile Creek and Stranger Creek flow to the Kansas River, KDHE has recommended that the water quality goal associated with the

bacteria impairment on Nine Mile Creek be the achievement of an ECB index below 1 for 90% of the samples based on the Primary Contact Water Quality Milestones and Monitoring for Lower Kansas Nine Mile Creek Recreation B Index, which is based on 262 cfus/100 ml. The chart below illustrates the referenced ECB Indexes based on past Nine Mile Creek bacteria sample data. The goal is to reduce both the magnitude and frequency of the bacteria impairment in order to meet the water quality standards for the Kansas River.

Monitoring Water Quality Progress

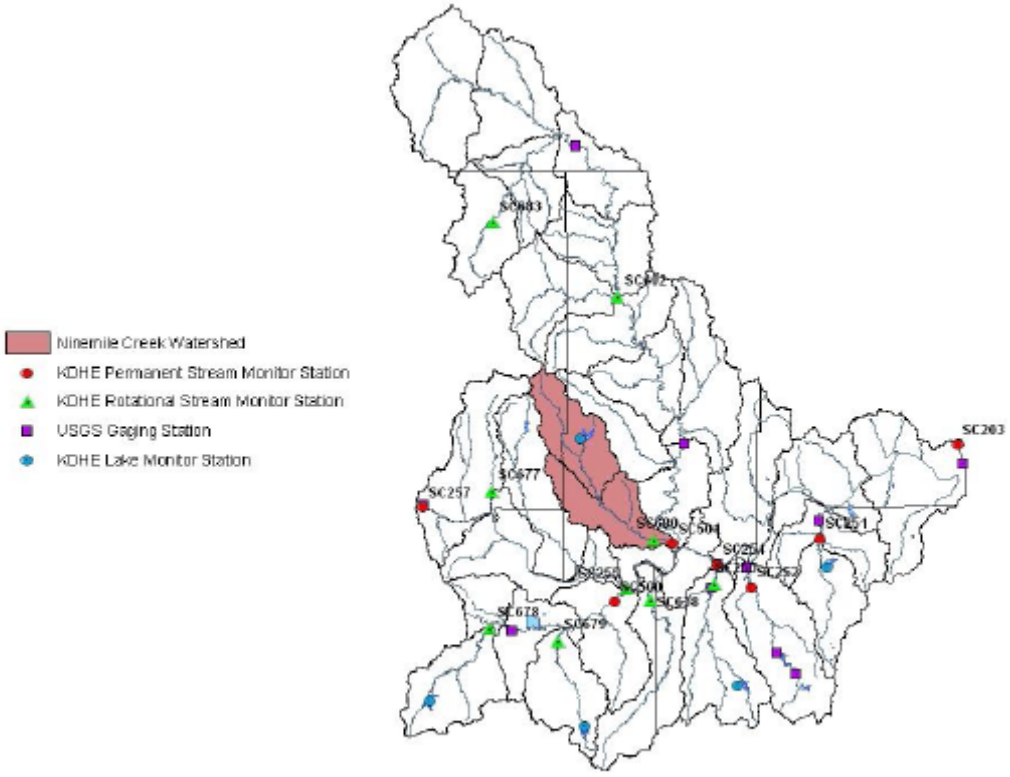
As shown on the map in the previous section, KDHE has two monitoring stations along and downstream of Nine Mile Creek. Station SC680, located along Nine Mile Creek, is a rotational KDHE monitoring site which provides sampling of Nine Mile Creek every four years. The next scheduled sampling at SC680 is 2013. Station SC501, located downstream of Nine Mile Creek along Stranger Creek near Linwood, is a permanent KDHE monitoring site that provides ongoing sampling of Stranger Creek. Another station (SC254) is located in the Kansas River downstream of SC501. The sites are sampled for nutrients, e. coli bacteria, chemicals, turbidity, alkalinity, dissolved oxygen, pH, ammonia and metals. The pollutant indicators tested for at each site may vary depending on the season at collection time and other factors.

Figure 22: Nine Mile Creek ECB Index



The map below shows the existing monitoring sites within the Lower Kansas Watershed, and those located specifically within the Nine Mile Creek watershed. A USGS stream flow data station (06892350) is located at Station SC254 in the Kansas River. This information, along with the information from the permanent and rotational KDHE monitoring sites (as shown in the above map), will be utilized by KDHE and the SLT to evaluate the water quality of the associated water bodies. Monitoring data will be used to determine water quality progress, track water quality milestones, and to determine the effectiveness of BMP implementation outlined in the plan. The BMP implementation schedule and water quality milestones associated with this plan extend through a five-year period to 2016. At that time, KDHE and the SLT can evaluate the water quality data and determine whether the water quality standards have been attained.

Figure 23: KDHE Monitoring Sites in the Lower Kansas Watershed



Monitoring Sites in Lower Kansas Watershed

14.0 Appendix

14.1 Service Providers

Table34: Potential Service Provider Listing.

Organization	Programs	Purpose	Technical or Financial Assistance	Website address
Environmental Protection Agency	Clean Water State Revolving Fund Program Watershed Protection	Provides low cost loans to communities for water pollution control activities. To conduct holistic strategies for restoring and protecting aquatic resources based on hydrology rather than political boundaries.	Financial	www.epa.gov
Kansas Alliance for Wetlands and Streams	Streambank Stabilization Wetland Restoration Cost share programs	The Kansas Alliance for Wetlands and Streams (KAWS) organized in 1996 to promote the protection, enhancement, restoration and establishment wetlands and streams in Kansas.	Technical	www.kaws.org
Kansas Dept. of Agriculture	Watershed structures permitting.	Available for watershed districts and multipurpose small lakes development.	Technical and Financial	www.accesskansas.org/kda

Organization	Programs and Technical Assistance	Purpose	Technical or Financial Assistance	Website address
Kansas Dept. of Health and Environment	**Nonpoint Source Pollution Program** Municipal and livestock waste Livestock waste Municipal waste State Revolving Loan Fund	Provide funds for projects that will reduce nonpoint source pollution. Compliance monitoring. Makes low interest loans for projects to improve and protect water quality.	Technical and Financial	www.kdheks.ks.us

Kansas Department of Wildlife and Parks	Land and Water Conservation Funds	Provides funds to preserve develop and assure access to outdoor recreation.	Technical and Financial	www.kdwp.state.ks.us/
	Conservation Easements for Riparian and Wetland Areas	To provide easements to secure and enhance quality areas in the state.		
	Wildlife Habitat Improvement Program	To provide limited assistance for development of wildlife habitat.		
	North American Waterfowl Conservation Act	To provide up to 50 percent cost share for the purchase and/or development of wetlands and wildlife habitat.		
	MARSH program in coordination with Ducks Unlimited	May provide up to 100 percent of funding for small wetland projects.		
	Chickadee Checkoff	Projects help with all nongame species. Funding is an optional donation line item on the KS Income Tax form.		
	Walk In Hunting Program	Landowners receive a payment incentive to allow public hunting on their property.		
	F.I.S.H. Program	Landowners receive a payment incentive to allow public fishing access to their ponds and streams.		

Organization	Programs and Technical Assistance	Purpose	Technical or Financial Assistance	Website address
Kansas Forest Service	Conservation Tree Planting Program Riparian and Wetland Protection Program	Provides low cost trees and shrubs for conservation plantings. Work closely with other agencies to promote and assist with establishment of riparian forestland and manage existing stands.	Technical	www.kansasforests.org
Kansas Rural Center	The Heartland Network Clean Water Farms-River Friendly Farms Sustainable Food Systems Project Cost share programs	The Center is committed to economically viable, environmentally sound and socially sustainable rural culture.	Technical and Financial	www.kansasruralcenter.org
Kansas Rural Water Association	Technical assistance for Water Systems with Source Water Protection Planning.	Provide education, technical assistance and leadership to public water and wastewater utilities to enhance the public health and to sustain Kansas' communities	Technical	www.krwa.net

Kansas State Research and Extension	Water Quality Programs, Waste Management Programs Kansas Center for Agricultural Resources and Environment (KCARE) Kansas Environmental Leadership Program (KELP) Kansas Local Government Water Quality Planning and Management Rangeland and Natural Area Services (RNAS) WaterLINK Kansas Pride: Healthy Ecosystems/Healthy Communities Citizen Science	Provide programs, expertise and educational materials that relate to minimizing the impact of rural and urban activities on water quality. Educational program to develop leadership for improved water quality. Provide guidance to local governments on water protection programs. Reduce non-point source pollution emanating from Kansas grasslands. Service-learning projects available to college and university faculty and community watersheds in Kansas. Help citizens appraise their local natural resources and develop short and long term plans and activities to protect, sustain and restore their resources for the future. Education combined with volunteer soil and water testing for enhanced natural resource stewardship.	Technical	www.ksre.ksu.edu

Organization	Programs and Technical Assistance	Purpose	Technical or Financial Assistance	Website address
Kansas Water Office	Public Information and Education	Provide information and education to the public on Kansas Water Resources	Technical and Financial	www.kwo.org
No-Till on the Plains	Field days, seasonal meetings, tours and technical consulting.	Provide information and assistance concerning continuous no-till farming practices.	Technical	www.notill.org

Organization	Programs and Technical Assistance	Purpose	Technical or Financial Assistance	Website address
KDA Division of Conservation and Conservation Districts	Water Resources Cost Share	Provide cost share assistance to landowners for establishment of water conservation practices.	Technical and Financial	www.accesskansas.org/kscc www.kacdnet.org
	Nonpoint Source Pollution Control Fund	Provides financial assistance for nonpoint pollution control projects which help restore water quality.		
	Riparian and Wetland Protection Program	Funds to assist with wetland and riparian development and enhancement.		
	Stream Rehabilitation Program	Assist with streams that have been adversely altered by channel modifications.		
	Kansas Water Quality Buffer Initiative	Compliments Conservation Reserve Program by offering additional financial incentives for grass filters and riparian forest buffers.		
	Watershed district and multipurpose lakes	Programs are available for watershed district and multipurpose small lakes.		

Organization	Programs and Technical Assistance	Purpose	Technical or Financial Assistance	Website address
US Army Corps of Engineers	Planning Assistance to States Environmental Restoration	Assistance in development of plans for development, utilization and conservation of water and related land resources of drainage Funding assistance for aquatic ecosystem restoration.	Technical	www.usace.army.mil
US Fish and Wildlife Service	Fish and Wildlife Enhancement Program Private Lands Program	Supports field operations which include technical assistance on wetland design. Contracts to restore, enhance, or create wetlands.	Technical	www.fws.gov
US Geological Survey	National Streamflow Information Program Water Cooperative Program	Provide streamflow data Provide cooperative studies and water-quality information	Technical	ks.water.usgs.gov Nrtwq.usgs.gov

Organization	Programs and Technical Assistance	Purpose	Technical or Financial Assistance	Website address
USDA-Natural Resources Conservation Service and Farm Service Agency	Conservation Compliance	Primarily for the technical assistance to develop conservation plans on cropland.	Technical and Financial	www.ks.nrcs.usda.gov
	Conservation Operations	To provide technical assistance on private land for development and application of Resource Management Plans.		
	Watershed Planning and Operations	Primarily focused on high priority areas where agricultural improvements will meet water quality objectives.		
	Wetland Reserve Program	Cost share and easements to restore wetlands.		
	Wildlife Habitat Incentives Program	Cost share to establish wildlife habitat which includes wetlands and riparian areas.		
	Grassland Reserve Program, EQIP, and Conservation Reserve Program	Improve and protect rangeland resources with cost-sharing practices, rental agreements, and easement purchases.		

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