Upper Neosho – 9 Element Watershed Plan Summary

Impairments to be addressed:

Since there are no TMDL's for Grand Lake, the number one goal of the Upper Neosho Watershed 9 Element Plan is a 30% load reduction of nutrients at watershed line as stated in the Kansas Nutrient Management Plan.

Turkey Creek near LeRoy (DO, Bacteria)

Chanute Sante Fe Lake (DO, EU, pH)

Big Creek near Le Roy (Bacteria)

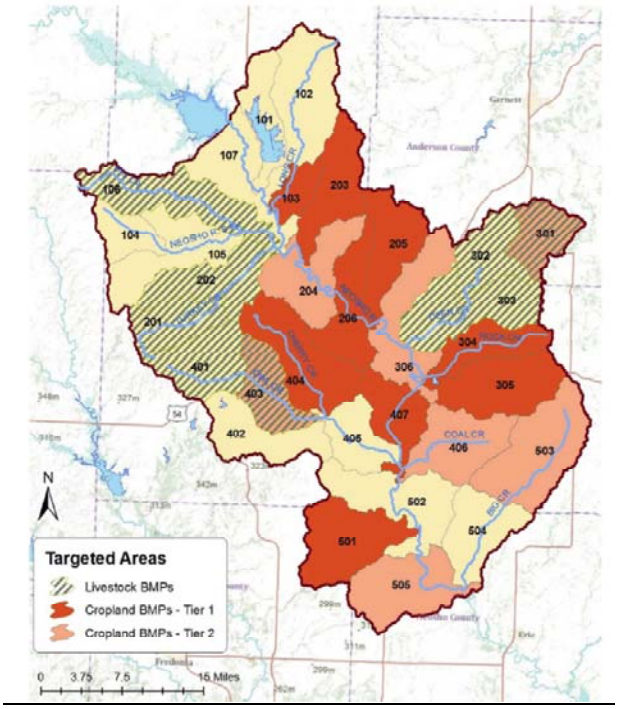
Deer Creek near Iola (Bacteria)

Owl Creek near Humboldt (Bacteria)

Big Creek near Chanute (DO)

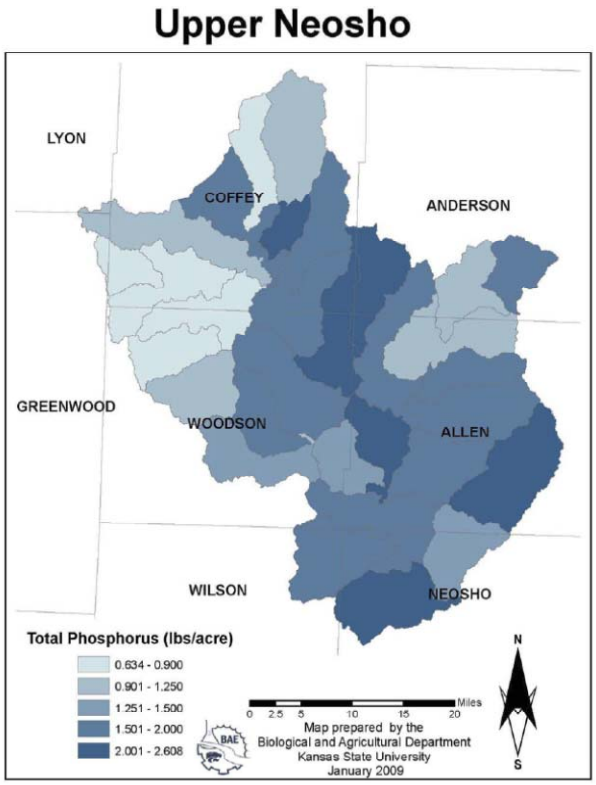
Long Creek near Le Roy (DO)

Prioritized Critical Areas for Targeting BMPs

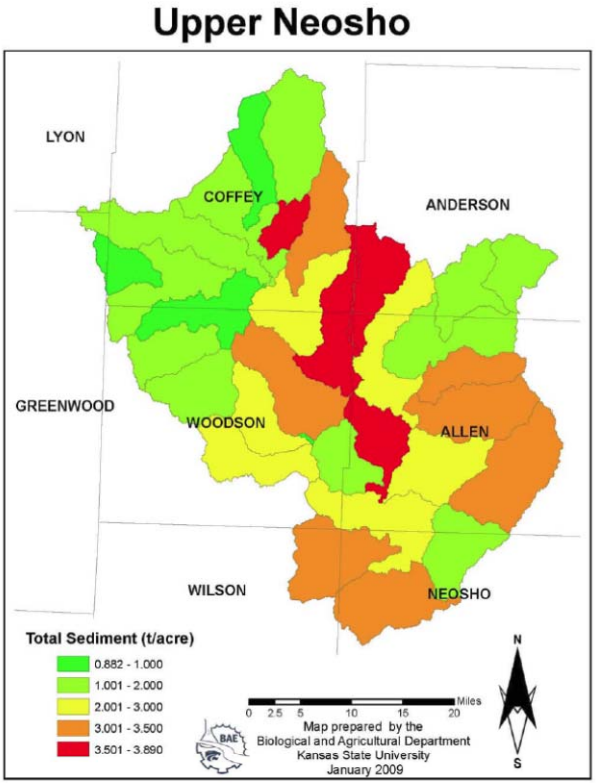


Targeting considerations:

- Livestock targeted areas were chosen by examining monitoring site information for elevated nutrient concentrations along with SLT input and were approved by the SLT.
- Cropland BMP Targeted areas were identified through SWAT (Soil and Water Assessment Tool) modeling to determine where high levels of phosphorous and sediment where coming from within the Upper Neosho watershed.



Upper Neosho – 9 Element Watershed Plan Summary



Best Management Practices and Load Reduction Goals

Best Management Practices (BMPs) to address phosphorus and sediment in the watershed where chosen by the SLT based on local acceptance/adoptability and the amount of load reduction gained per dollar spent.

Phosphorus/Sediment Reducing Cropland BMPs

- Conservation Crop Rotation
- Permanent vegetation in cropland
- No-Till cropping practices
- Vegetative buffers
- Terraces
- Subsurface fertilization

Phosphorus/Sediment Reducing Livestock BMPs

- Vegetative filter strips
- Relocate psture feeding sites
- Off strem watering sites
- Relocate feedlots

Sediment Reduction:

Required load reduction for Upper Neosho from Nonpoint Sources (30% load reduction of nutrients at watershed line as stated in the Kansas Nutrient Management)

Phosphorus Reducation:

Required load reduction for Upper Neosho from nonpoint sources (30% load reduction of nutrients at watershed line as stated in the Kansas Nutrient Management)

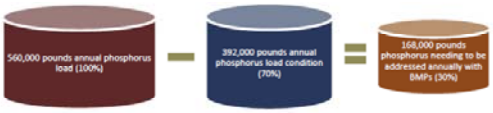


Photo courtesy of Kansas Forest Service

UPPER NEOSHO WATERSHED

Watershed Restoration and Protection Strategy

Final Draft Plan July 19, 2011

Funding for the development of this plan was provided through an EPA 319 grant 2004-0044 from the Kansas Department of Health and Environment.

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Glossary of Terms

Best Management Practices (BMP): Environmental protection practices used to control pollutants, such as sediment or nutrients, from common agricultural or urban land use activities.

Biological Oxygen Demand (BOD): Measure of the amount of oxygen removed from aquatic environments by aerobic microorganisms for their metabolic requirements.

Biota: Plant and animal life of a particular region.

Chlorophyll a: Common pigment found in algae and other aquatic plants that is used in photosynthesis

Dissolved Oxygen (DO): Amount of oxygen dissolved in water.

***E. coli* bacteria:** Bacteria normally found in gastrointestinal tracts of animals. Some strains cause diarrheal diseases.

Eutrophication (E): Excess of mineral and organic nutrients that promote a proliferation of plant life in lakes and ponds.

Fecal coliform bacteria (FCB): Bacteria that originate in the intestines of all warmblooded animals.

Municipal Water System: Water system that serves at least 25 people or has more than 15 service connections.

National Pollutant Discharge Elimination System (NPDES) Permit: Required by Federal law for all point source discharges into waters.

Nitrates: Final product of ammonia's biochemical oxidation. Primary source of nitrogen for plants. Originates from manure and fertilizers.

Nitrogen(N or TN): Element that is essential for plants and animals. TN or total nitrogen is a chemical measurement of all nitrogen forms in a water sample.

Nonpoint Sources (NPS): Sources of pollutants from a disperse area, such as urban areas or agricultural areas

Nutrients: Nitrogen and phosphorus in water source.

Phosphorus (P or TP): Element in water that, in excess, can lead to increased biological activity in water. TP or total phosphorus is a chemical measurement of all phosphorus forms in a water sample.

Point Sources (PS): Pollutants originating from a single localized source, such as industrial sites, sewerage systems, and confined animal facilities

Riparian Zone: Margin of vegetation within approximately 100 feet of waterway.

Sedimentation: Deposition of slit, clay or sand in slow moving waters.

Secchi Disk: Circular plate 10-12" in diameter with alternating black and white quarters used to measure water clarity by measuring the depth at which it can be seen.

Stakeholder Leadership Team (SLT): Organization of watershed residents, landowners, farmers, ranchers, agency personnel and all persons with an interest in water quality.

Total Maximum Daily Load (TMDL); Maximum amount of pollutant that a specific body of water can receive without violating the surface water-quality standards, resulting in failure to support their designated uses

Total Suspended Solids (TSS): Measure of the suspended organic and inorganic solids in water. Used as an indicator of sediment or silt.

Water Quality Standard (WQS): Mandated in the Clean Water Act. Defines goals for a waterbody by designating its uses, setting criteria to protect those uses and establishing provisions to protect waterbodies from pollutants.

1.0 Preface

The purpose of this Watershed Restoration and Protection Strategy (WRAPS) report for the Upper Neosho Watershed is to outline a plan of restoration and protection goals and actions for the surface waters of the watershed. 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 WRAPS development process involves local communities and governmental agencies working together toward the common goal of a healthy environment. Local participants or stakeholders provide valuable grass roots leadership, responsibility and management of resources in the process. They have the most “at stake” in ensuring the water quality existing on their land is protected. Agencies bring science-based information, communication, and technical and financial assistance to the table. Together, several steps can be taken towards watershed restoration and protection. These steps involve building awareness and education, engaging local leadership, monitoring and evaluation of watershed conditions, in addition to assessment, planning, and implementation of the WRAPS process at the local level. Final goals for the watershed at the end of the WRAPS process are to provide a sustainable water source for drinking and domestic use while preserving food, fiber, and timber production. Other crucial objectives are to maintain recreational opportunities and biodiversity while protecting the environment from flooding, and negative effects of urbanization and industrial production. The ultimate goal is watershed restoration and protection that will be “locally led and driven” in conjunction with government agencies in order to better the environment for everyone.

This report is intended to serve as an overall strategy to guide watershed restoration and protection efforts by individuals, local, state, and federal agencies and organizations. At the end of the WRAPS process, the Stakeholder Leadership Team (SLT) will have the capability, capacity and confidence to make decisions that will restore and protect the water quality and watershed conditions of the Upper Neosho Watershed.

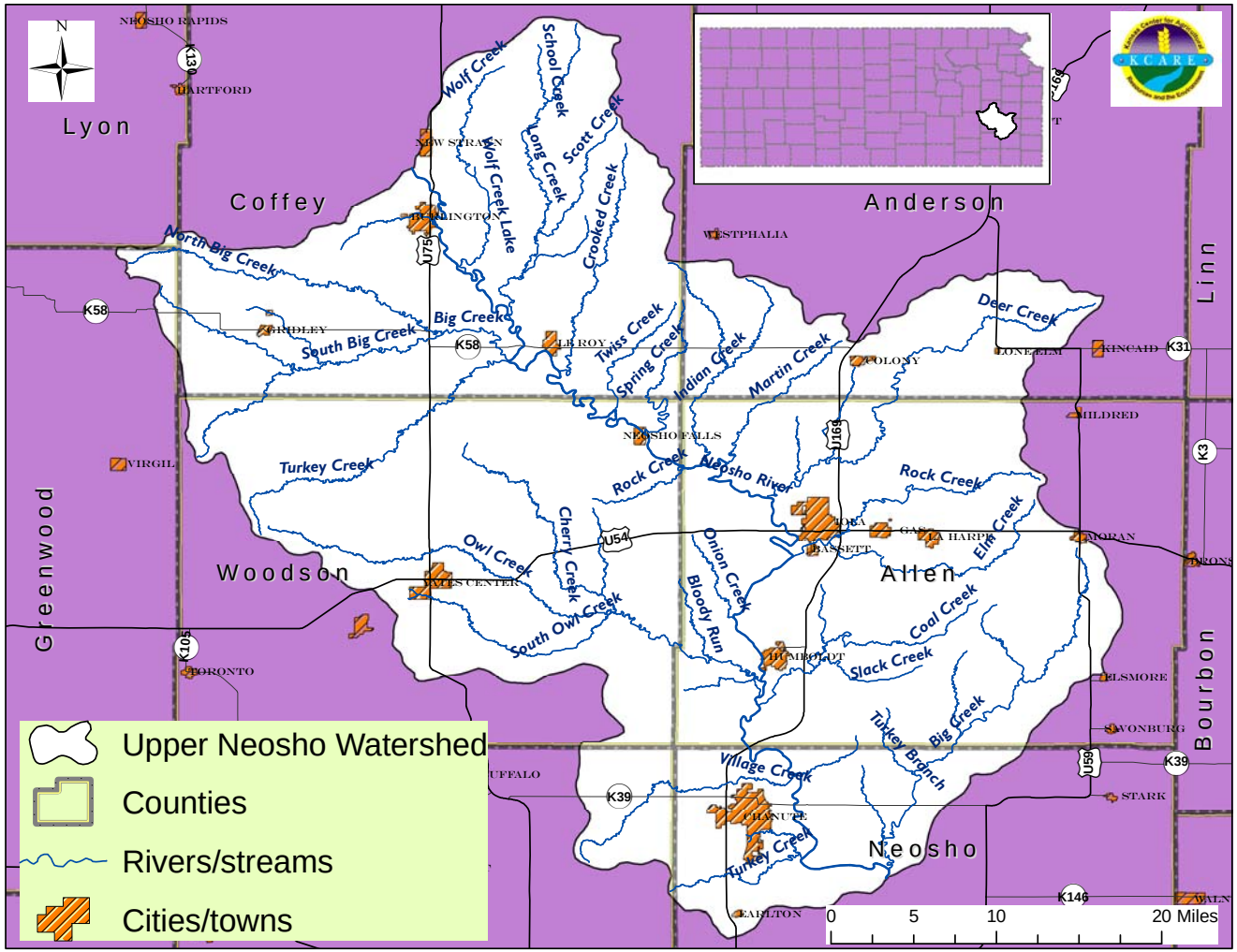


Figure 1. Map of Upper Neosho Watershed.

2.0 Watershed Goals

A group of concerned citizens in the watershed began meeting in 2006. They formed a Stakeholder Leadership Team (SLT) under the guidance of Kansas State Research and Extension personnel. Their charge has been to create a plan of restoration and protection measures for the watershed. During the time period that they have been meeting, technical experts in the watershed have participated and led discussions to review and study the watershed issues and concerns. The SLT set **priority watershed issues and concerns.** The priority issues that the SLT felt are most important to the health of the watershed are (in no particular order):

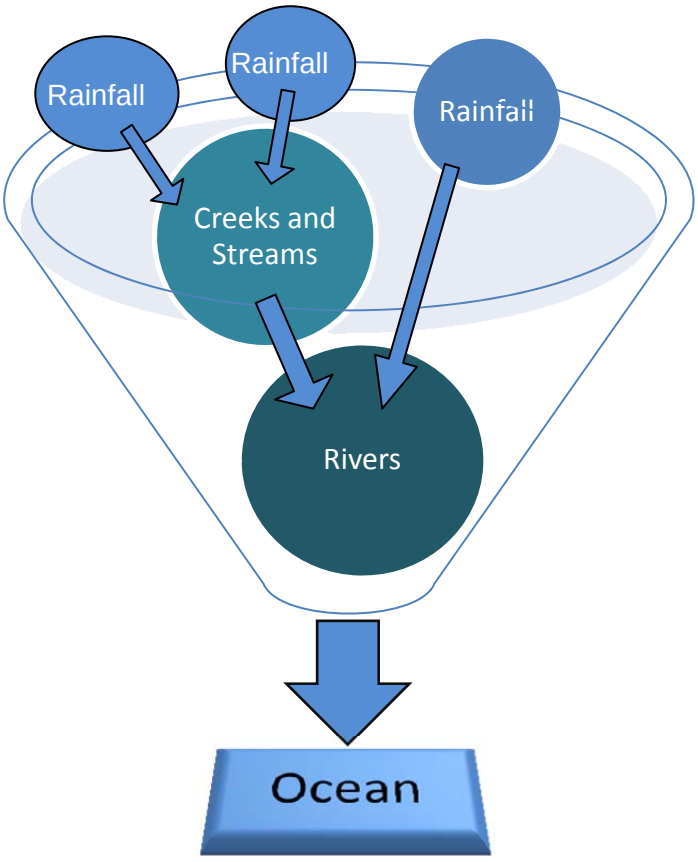
1. Sedimentation,
2. Fertilizer and nutrient runoff,
3. Fecal coliform bacteria,
4. Water supply development, and
5. Erosion of grassland and rangelands.

In order to address the watershed issues, the SLT has set certain **watershed restoration and protection goals.** They are:

1. To protect and restore water quality in the Neosho River and its tributaries,
2. To protect public water supply sources,
3. To protect productivity of agricultural lands, and
4. To protect the water quality and storage capacity of Grand Lake in Oklahoma.

The purpose of this WRAPS plan is to address the issues and concerns of the SLT, to address and mitigate current TMDLs in the watershed and to proactively improve conditions so that the impairments on the current 303d list will not reach the stage of TMDL development.

A watershed is an area of land that catches precipitation and funnels it to a particular creek, stream, and river and so on, until the water drains into an ocean. A watershed has distinct elevation boundaries that do not follow political "lines" such as county, state and international borders. Watersheds come in all shapes and sizes, with some only covering an area of a few acres while others are thousands of square miles across.



Elevation determines the watershed boundaries. The upper boundary of the Upper Neosho Watershed has an elevation of 677 meters (2,221 feet) and the lowest point of the watershed has an elevation of 200 meters (656 feet) above sea level.

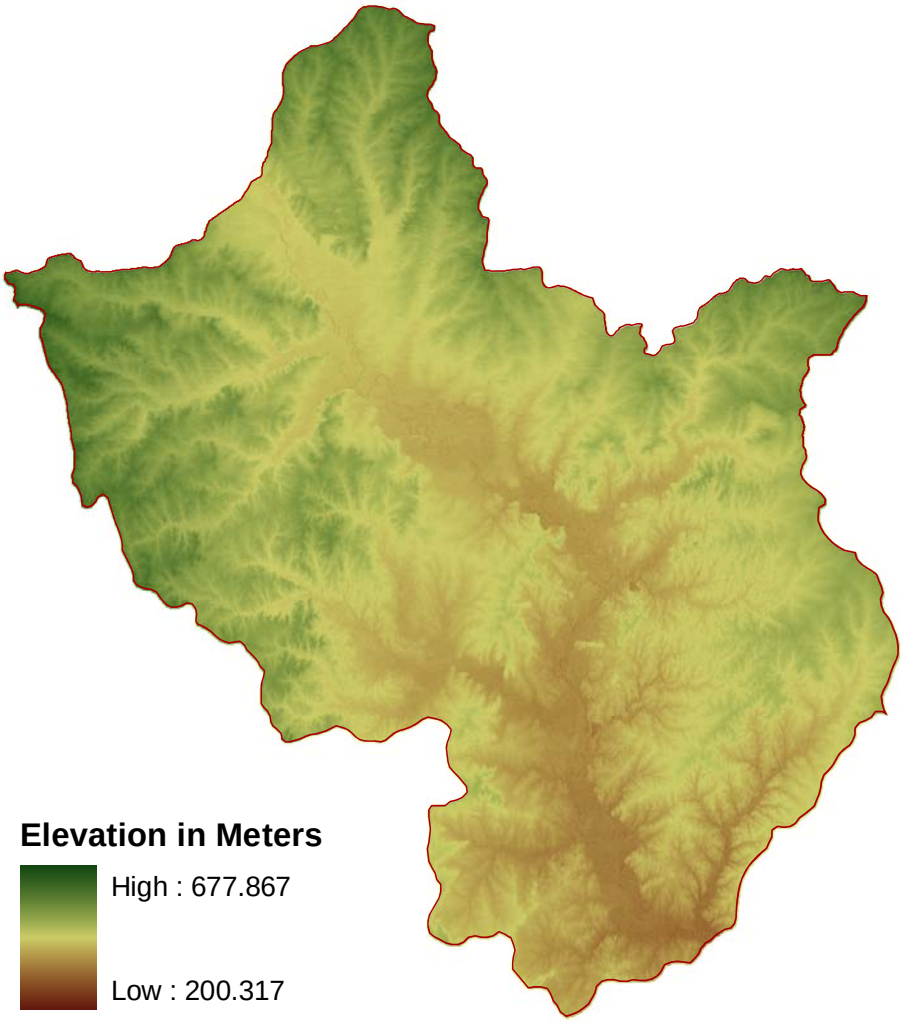


Figure 2. Relief Map of the Upper Neosho Watershed. [1]

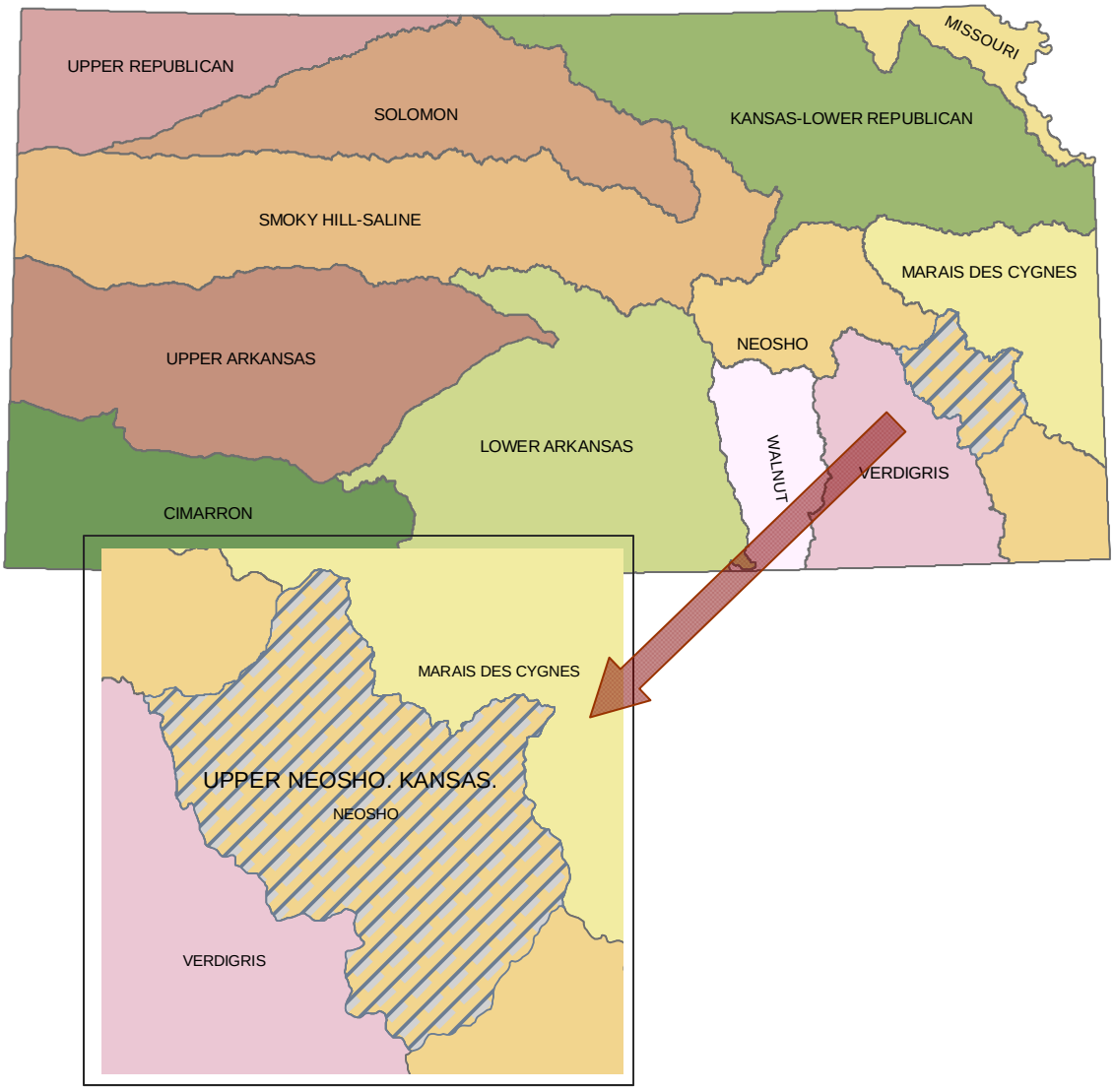
The Upper Neosho Watershed is designated as Category I watershed indicating that it is in need of restoration as defined by the Kansas Unified Watershed Assessment 1999 submitted by the Kansas Department of Health and Environment (KDHE) and the United States Department of Agriculture (USDA)[2]. A Category I watershed does not meet state water quality standards or fails to achieve aquatic system goals related to habitat and ecosystem health. Category I watersheds are also assigned a priority for restoration. The Upper Neosho is ranked twentieth in priority out of ninety-two watersheds in the state.

The Upper Neosho Watershed covers 862,080 acres with 668 stream miles. There are numerous towns and cities in this watershed in addition to developed rural areas. There are no Corps of Engineers reservoirs in the watershed.

3.0 Watershed Review

3.1 Where is the Upper Neosho Watershed?

There are twelve river basins located in Kansas. The scope of this WRAPS project is a portion of the Neosho Basin in southern Kansas. The entire basin drains the Neosho River and its tributaries into Oklahoma and eventually empties into the Gulf of Mexico. The extent of the WRAPS area is the portion of the Neosho River between John Redmond Lake and immediately downstream of the confluence of the Neosho River and Big Creek south of Chanute.



HUC is an acronym for **H**ydrologic **U**nit **C**odes. HUCs are an identification system for watersheds. Each watershed has a unique HUC number in addition to a common name. The Upper Neosho Watershed is classified as a HUC 8, meaning it has an 8 digit identifying code. Its HUC number is 11070204. The first 2 numbers in the code refer to the drainage region, the second 2 digits refer to the drainage subregion, the third 2 digits refer to the accounting unit and the fourth set of digits is the cataloging unit. For example, the Upper Neosho Watershed categories are as follows:
11070204 = Drainage of the Arkansas, White and Red River basins
11**07**0204= Drainage of the Neosho and Verdigris River basins
1107**02**04 = Drainage of the Neosho River basin
110702**04**= Drainage of the section of the Neosho River named the Upper Neosho
As watersheds become smaller, the HUC number will become larger. HUC 8s are further divided into smaller watersheds with HUC 10 and HUC 12 delineations.

The Upper Neosho Watershed is divided into 31 HUC 12 delineations.

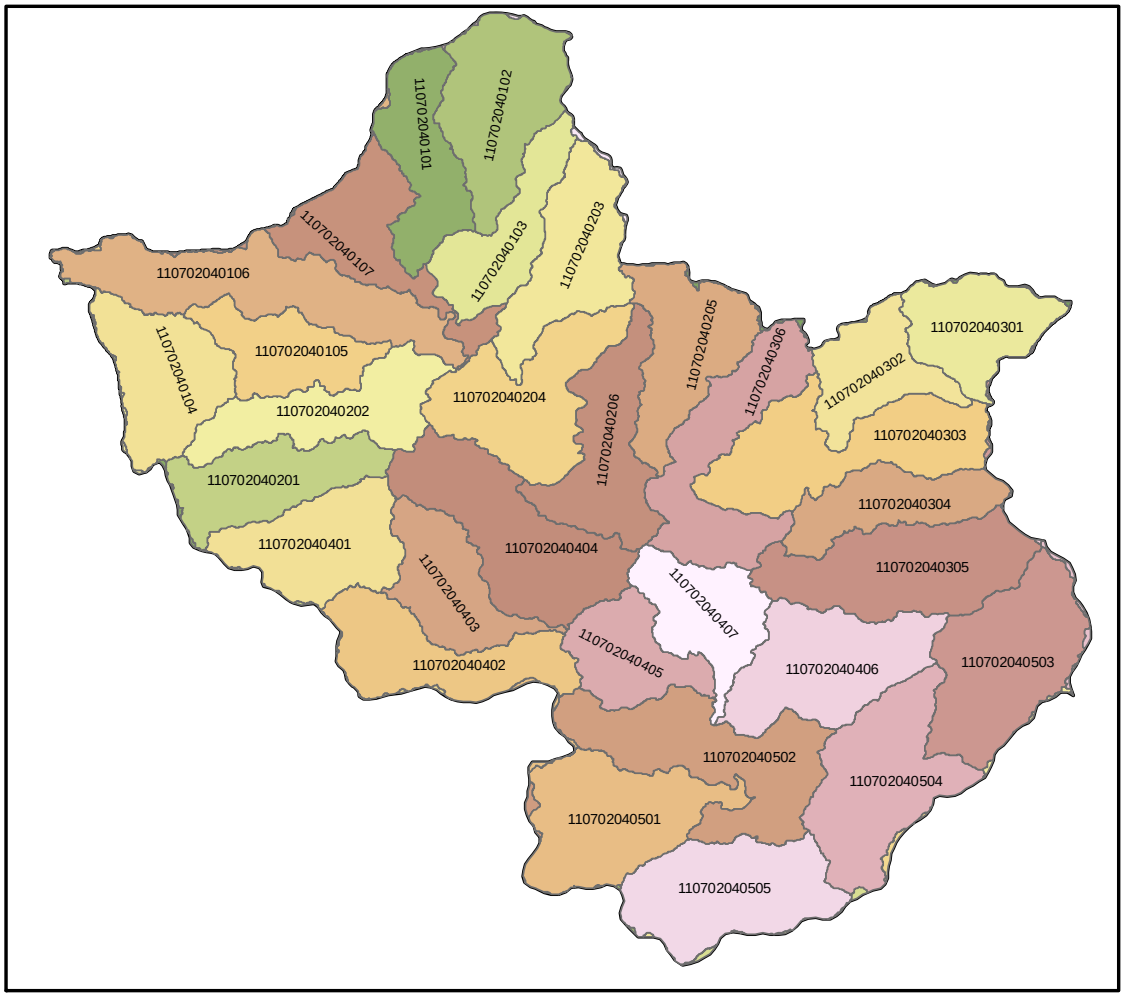


Figure 3. HUC 12 Delineations of the Upper Neosho Watershed.

3.2 Why is the Upper Neosho Watershed Important to Grand Lake?

Grand Lake was impounded in 1940. It is located in northeast Oklahoma. It contains 46,500 surface acres and is a major recreational reservoir. Three major rivers flow into Grand Lake:

- the Neosho River from Kansas,
- the Spring River from Missouri, and
- the Elk River from Missouri.

Grand Lake is a surface water supply to many communities in the area. It is also a major recreational economic resource for Oklahoma. The Neosho Basin comprises 57 percent of the total Grand Lake Watershed; therefore, it is of key importance to the overall environmental health of Grand Lake.

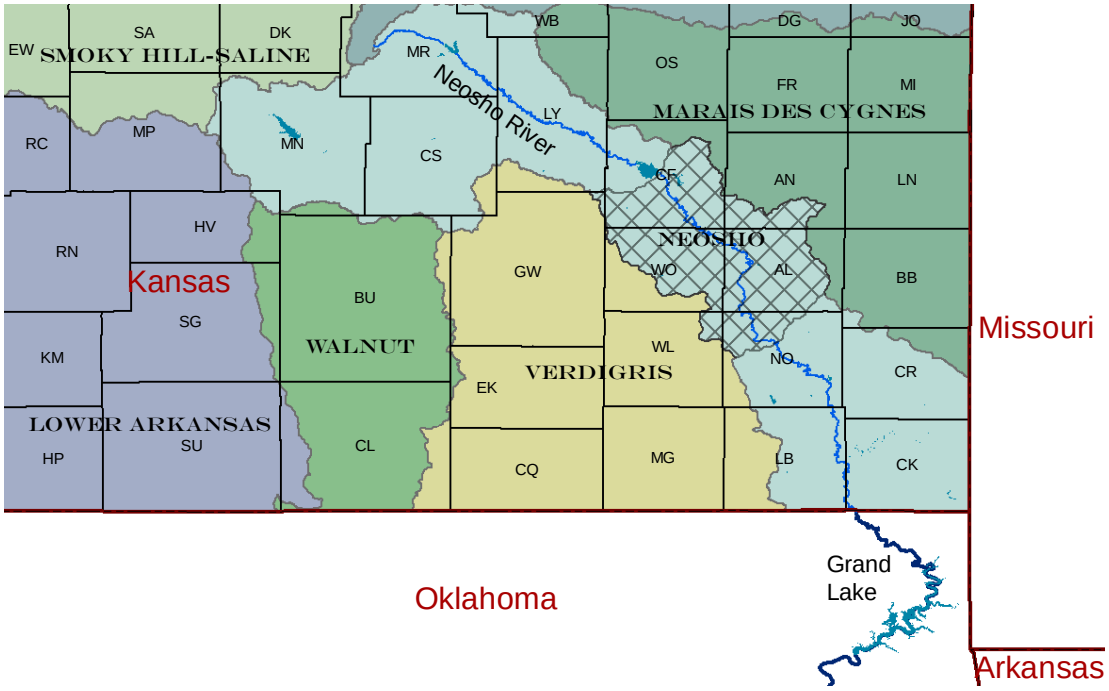


Figure 4. Neosho Basin and its Geographic Relationship to Grand Lake.

Grand Lake has elevated levels of phosphorus and nitrogen. This can cause algal blooms in the lake and low levels of dissolved oxygen which will be discussed later in this report. Both of these incidents will negatively impact aquatic life. According to the Grand Lake Watershed Alliance Foundation (GLWAF), the Neosho River basin can contribute phosphorus, nitrogen, sediment and bacteria into Grand Lake. Spring River may contribute to the phosphorus, nitrogen and bacteria levels, but also carries heavy metals from abandoned mining areas. Elk River is similar to the Neosho River in that it can contribute phosphorus, nitrogen, bacteria and sediment. Therefore, the water quality of Grand Lake depends on the water quality of the rivers entering it. Since the bulk of the watershed of Grand Lake lies in Kansas, it is important for Upper Neosho and the other Neosho Basin watersheds to reduce pollutants exiting their watersheds. A 30 percent reduction target has been assigned by KDHE to the outflow of Upper Neosho Watershed for sediment and phosphorus.

Grand Lake is expected to receive TMDLs in 2012. At this time, responsibilities for pollutants in the lake will be distributed to the incoming rivers. Therefore, the Neosho River could receive a significant portion of the pollutant load. At that time, the SLT for the Upper Neosho Watershed will need to reevaluate the BMPs (definition below) and load reductions that are outlined later in this plan for needed corrections and alterations.

NOTE:

In this report, the term BMP (Best Management Practice) will be used frequently. A BMP is defined as an environmental protection practice used to control pollutants, such as sediment or nutrients, from common agricultural or urban land use activities. Common agricultural BMPs are buffer strips, terraces, grassed waterways, utilizing no-till or minimum tillage, conservation crop rotation and nutrient management plans. Definitions of each of these BMPs are found in the appendix of this report.

3.3 Land Cover/Land Uses

Land use activities have a significant impact on the types and quantity of pollutants in the watershed. The major land use is grassland (52 percent) which can contribute nutrients to the watershed. Nutrients can originate from grasslands through overgrazing and allowing livestock access to streams and creeks. Livestock can also contribute bacteria to the water source through contaminated fecal matter. The second major land use is cropland (35 percent) which can also contribute nutrients into the watershed. Cropland nutrients can originate from application of fertilizers prior to a rainfall event or over application of fertilizers and manure when used as fertilizer. Cropland can also contribute sediment into the water streams from overland flow across conventional tilled crop fields and ephemeral gullies that are plowed through each year. All of these land uses and their implications will be discussed later in this report. The remaining land uses in the watershed are woodlands (7 percent), CRP (2 percent), water (2 percent) and other (2 percent).

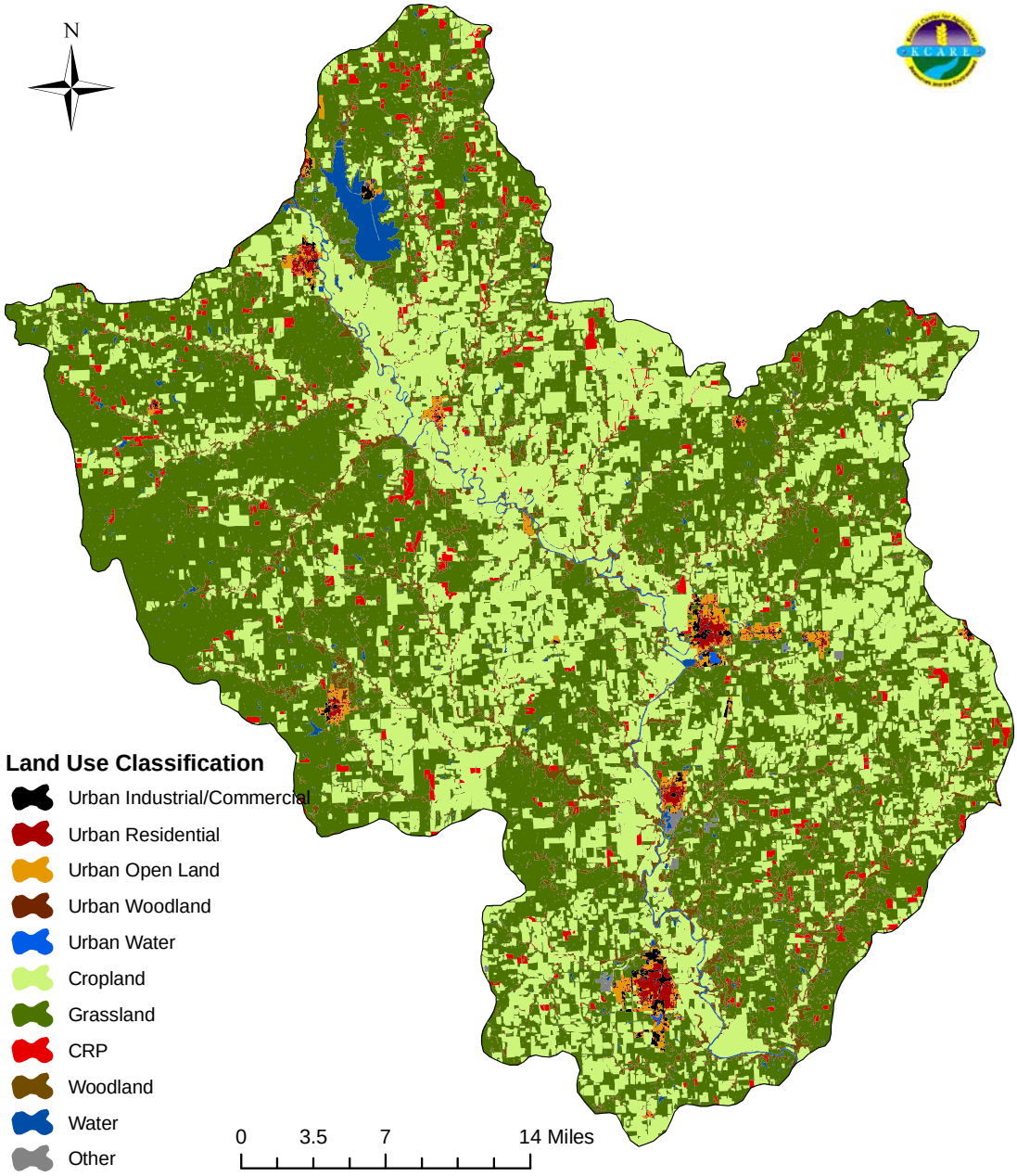


Figure 5. Land Cover of the Watershed, 2005 [3]. Kansas Applied Remote Sensing Program, Kansas Geospatial Community Commons.

Table 1. Land Use Calculations, 2005. [4]

Land Use	*Acres*	*Percentage*
Commercial/Industrial	3,703	0.42
Residential	5,156	0.59
Urban Openland	7,259	0.83
Urban Woodland	826	0.09
Urban Water	305	0.03
Cropland	309,147	35.41
Grassland	453,899	51.99

Land Use, cont.		
Land Use	***Acres***	***Percentage***
CRP	18,824	2.16
Woodland	57,861	6.63
Water	14,648	1.68
Other	1,349	0.15
Total	**872,978**	**100.00**

3.4 Designated Uses

All surface waters in this watershed are generally used for aquatic life support (fish), food procurement, domestic water supply, recreation (fishing, boating, and swimming), groundwater recharge, industrial water supply, irrigation or livestock watering. These are commonly referred to as "designated uses" as stated in the Kansas Surface Water Register, 2009, issued by KDHE. If the designated uses of a water body are not being met, the Water Quality Standard for that water body is not being met and therefore, it is impaired.

Table 2. Designated Water Uses for the Upper Neosho River Watershed. [5]

Designated Uses Table								
Stream Name	**AL**	**CR**	**DS**	**FP**	**GR**	**IW**	**IR**	**LW**
Rock Cr seg 15	E	A		X				
Gridley City Lake	E	A	X	X	O	X	X	X
John Redmond Wildlife Area	E	A	X	X	X	X	X	X
Yates Center Reservoir	E	A	X	X	O	X	X	X
Badger Cr,	E	b	O	O	X	O	O	X
Bloody Run, Carlyle Cr, Cottonwood Cr	E	b	O	X	O	O	O	X
Charles Br	E	b	O	O	O	O	O	X
Cherry Cr, Coal Cr, Crooked Cr, Rock Cr seg 7, Rock Cr seg 23, Village Cr	E	b		X				
Draw Cr, Goose Cr, Mud Cr seg 31, Owl Cr seg 19, Plum Cr, School Cr, Scott Cr, Sutton Cr, Turkey Br, Turkey Cr seg 28, Twiss Cr, Varvel Cr	E	b						
Little Turkey Cr, Spring Cr	E	b	X	X	X	X	X	X
Elm Cr	E	B						
Mud Cr seg 26	E	B	O	O	X	O	O	O
Chanute Santa Fe Lake, Neosho Falls City L, New Strawn Park L, Wolf Creek L	E	B	X	X	X	X	X	X
Iola City Lake	E	B		X				
Big Cr, N, Indian Cr, Slack Cr	E	C						
Deer Cr, Long Cr	E	C	X	X	X	X	X	X
Big Cr Seg 14	E	C	X	X				
Big Cr Seg 2, Big Cr, S, Dinner Cr, Martin Cr, Turkey Cr seg 32	E	C		X				

Designated Uses Table, cont.								
Little Indian Cr, Onion Cr, Owl Cr seg 24, owl Cr S, Wolf Cr	S	b						
Neosho R, Circle L, Leonard's L	S	B	X	X	X	X	X	X

AL = Aquatic Life Support
CR = Contact Recreation Use
DS = Domestic Water Supply
FP = Food Procurement
GR = Groundwater Recharge
IW = Industrial Water Supply
IR = Irrigation Water Supply
LW = Livestock Water Supply

A=Primary contact recreation lakes that have a posted public swimming area
B=Primary contact recreation stream segment is by law or written permission of the landowner open to and accessible by the public
b=Secondary contact recreation stream segment is not open to and accessible by the public under Kansas law
C=Primary contact recreation lakes that are not open to and accessible by the public under Kansas law
S=Special aquatic life use water
E = Expected aquatic life use water
X = Referenced stream segment is assigned the indicated designated use
O = Referenced stream segment does not support the indicated beneficial use
Blank=Capacity of the referenced stream segment to support the indicated designated use has not been determined by use attainability analysis

3.5 Special Aquatic Life Use Waters and Exceptional State 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". The Upper Neosho Watershed has a special aquatic life use designation in the Neosho River in addition to Wolf Creek, Little Indian Creek, Owl Creek South, Bloody Run and Onion Creek. **Exceptional state waters** are waters that are defined as "any of the surface waters or surface water segments that are of remarkable quality or of significant recreational or ecological value". There are no exceptional state waters in this watershed.

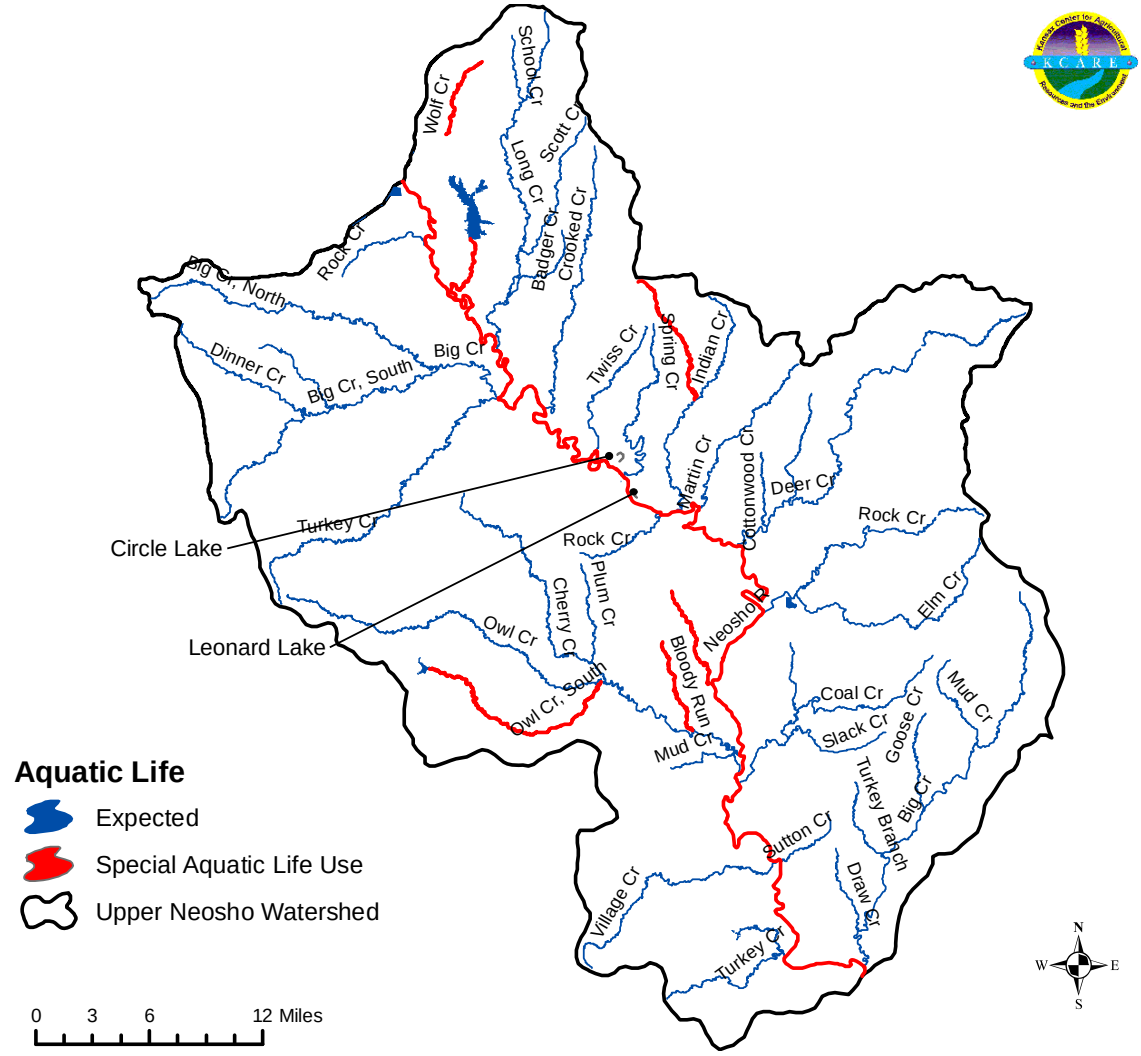


Figure 6. Special Aquatic Life Use Waters and Exceptional State Waters. [6]

The special aquatic life use waters are located in an area that is primarily cropland, as can be seen by the figure below. Pollutants that might threaten the health of these waters would be sediment or nutrient related. Sediment in the Neosho River would destroy habitat for mussels and fish. Fertilizer or manure in the streams would concentrate nutrients and alter dissolved oxygen concentrations, pH, and phosphorus concentrations.

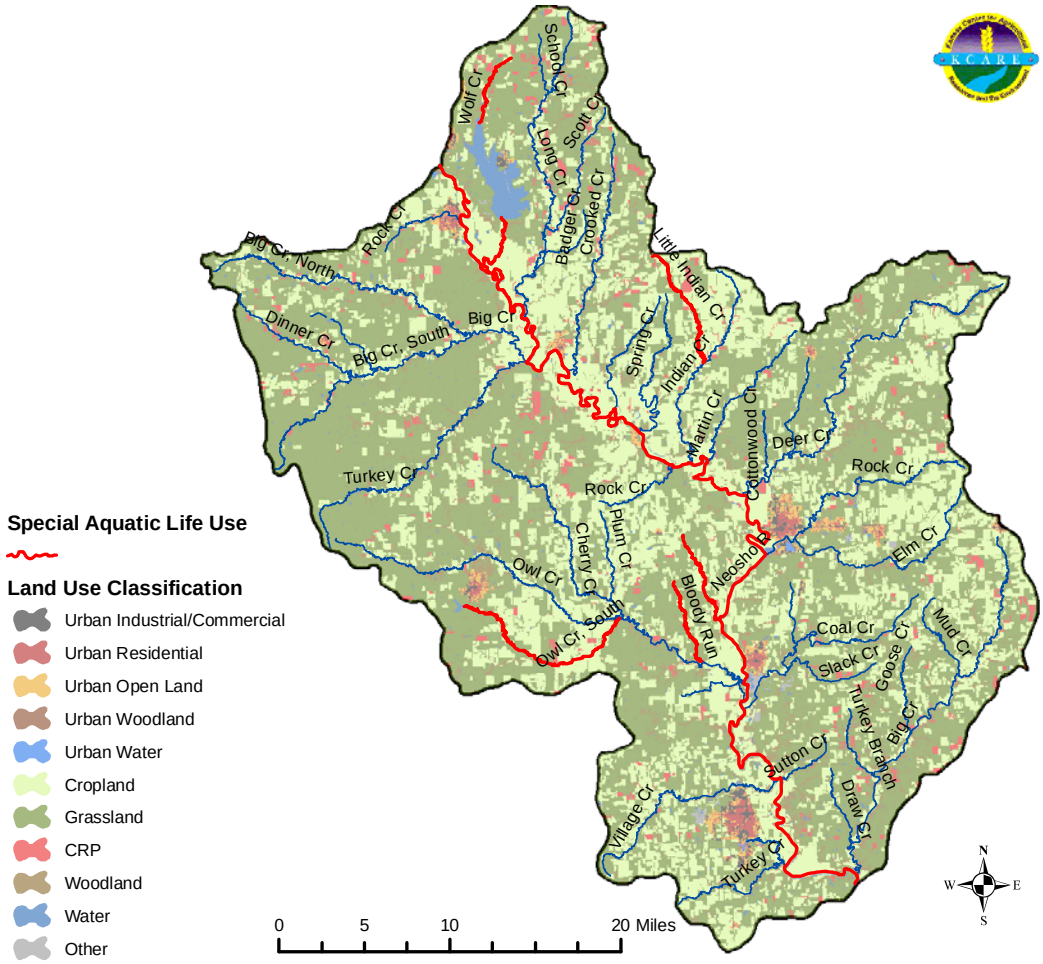


Figure 7. Special Aquatic Life Use Waters in the Watershed with Land Use. [6 and 3]

3.6 Public Water Supply and NPDES

3.6.1 Public Water Supplies (PWS)

A PWS that derives its water from a surface water supply can be affected by sediment – either in difficulty at the intake in accessing the water or in treatment of the water prior to consumption. Nutrients and fecal coliform bacteria will affect surface PWSs causing excess cost in treatment prior to public consumption. The City of New Strawn is the only groundwater PWS in the watershed. All other water supply points are surface water intakes. The table below lists the PWSs in the Upper Neosho Watershed. Refer to Figure 8 for PWS intakes and Rural Water Districts.

Table 3. Public Water Suppliers Serving the Upper Neosho Watershed. [7] Municipalities are in bold print.

Municipality	Source	Serves (Secondary Users)	County	Population Served
Burlington	Neosho	Coffey County RWD No. 2	Coffey	2,852
	Neosho	Coffey County RWD No. 3		
	Neosho	**Gridley**		
	Neosho (pond)	**Leroy**		
	Neosho (pond)	**New Strawn**		
Chanute	Neosho	Allen County RWD No. 13	Neosho	9,500
	Neosho	Neosho County RWD No. 1 Cons.		
	Neosho	Neosho County RWD No. 6		
	Neosho	Neosho County RWD No. 7		
		Neosho County RWD No. 9		
		Neosho County RWD No. 12		
Humboldt	Neosho River	Allen County RWD No. 9		1,906
	Neosho River	Allen County RWD No. 10	Allen	
Iola	Neosho River	Allen County RWD No. 2	Allen	6,033
	Neosho River	Allen County RWD No. 3		
	Neosho River	Allen County RWD No. 7		
		Allen County RWD No. 8		
		Allen County RWD No. 9		
		Allen County RWD No. 11		
		Allen County RWD No. 15		
		Gas		
		Water Sales		
New Strawn	Groundwater		Coffey	430
PWWSD 05	Neosho River	Allen County RWD No. 4		
	Neosho River	Allen County RWD No. 6		
		Allen County RWD No. 8		
		Allen County RWD No. 16		
		Anderson County RWD No. 5		

Public Water Suppliers, cont.				
Municipality	**Source**	**Serves (Secondary Users)**	**County**	**Population Served**
		Bourbon County RWD 2 Cons.		
		Colony		
		LaHarpe		
		Moran		
		Neosho-(Allen) RWD No. 2		
		Walnut		
		Neosho RWD No. 8		
Yates Center	Neosho River	Wilson County RWD No. 9	Woodson	1,470
	Verdigris River	Woodson County RWD No. 1		

3.6.2 National Pollutant Discharge Elimination System (NPDES)

Wastewater treatment facilities are permitted and regulated through KDHE. They are considered point sources of pollutants. NPDES permits specify the maximum amount of pollutants allowed to be discharged to surface waters. Having theses point sources located on streams or rivers may impact water quality in the waterways. For example, municipal waste water can contain suspended solids, biological pollutants that reduce oxygen in the water column, inorganic compounds or bacteria. Waste water will be treated to remove solids and organic materials, disinfected to kill bacteria and viruses, and discharged to surface water. Treatment of municipal waste water is similar across the country. Industrial point sources can contribute toxic chemicals or heavy metals. Treatment of industrial waste water is specific to the industry and pollutant discharged. [8] Any pollutant discharge from point sources that is allowed by the state is considered to be Wasteload Allocation.

In this watershed, there are numerous municipalities that have NPDES sites in close proximity with PWS sites. There could be a possible threat of nitrates and bacteria in the PWS from the NPDES site. Industrial NPDES sites can contribute specific pollutants that could threaten the water supply. The cities that have both a sewerage NPDES site and public water supply diversion point are highlighted in the table below in tan.

Table 4. Permitted Point Source Facilities. [9] Municipalities that have both NPDES and PWS sites are highlighted in tan.

NPDES	Facility Name	Ownership	Description	Industrial Classification	City	County
KS0022632	Humboldt Wwtf	Public	Sewerage Systems	Municipal	Humboldt	Allen
KS0032123	Iola City Of Stp	Public	Sewerage Systems	Municipal	Iola	Allen
KS0078905	Iola City Of Munic Power Plant	Pub Pri	Electrical Services	Primary O	Iola	Allen
KS0085201	Allen County Sewer Dist 1 Wwtp	Public	Sewerage Systems	Municipal	Iola	Allen
KS0082686	Nelson Quarry-stokes Quarry	Private	Crushed And Broken Limestone	On Elg	La Harpe	Allen
KS0115991	Laharpe Mwwtf	Public	Sewerage Systems	Municipal	La Harpe	Allen
KS0116122	Colony Mun Wwtf	Public	Sewerage Systems	Municipal	Colony	Anderson
KS0079057	Wolf Creek Generating Station	Pub Pri	Electrical Services	Primary O	Burlington	Coffey
KS0090417	Burlington - Municipal Plt	Pub Pri			Burlington	Coffey
KS0045993	Gridley City Of Stp	Public	Sewerage Systems	Municipal	Gridley	Coffey
KS0030813	Leroy City Of Stp	Public	Sewerage Systems	Municipal	Le Roy	Coffey
KS0001201	Ash Grove Cement Co Chanute P	Private	Cement, Hydraulic	On Elg	Chanute	Neosho
KS0080837	Chanute Wwtp (New Plant)	Public	Sewerage Systems	Municipal	Chanute	Neosho
KS0082597	Chanute, City Of Power Plnt 3	Public	Electrical Services	On Elg	Chanute	Neosho
KS0024732	Yates Center City Of Stp	Public	Sewerage Systems	Municipal	Yates Center	Woodson

Numerous onsite wastewater systems exist in the watershed. There is no accurate accounting number of these systems and their functional condition is

generally unknown. It is estimated that ten percent of onsite wastewater systems are either failing or inadequately constructed. [10] All counties in the watershed have sanitary codes.

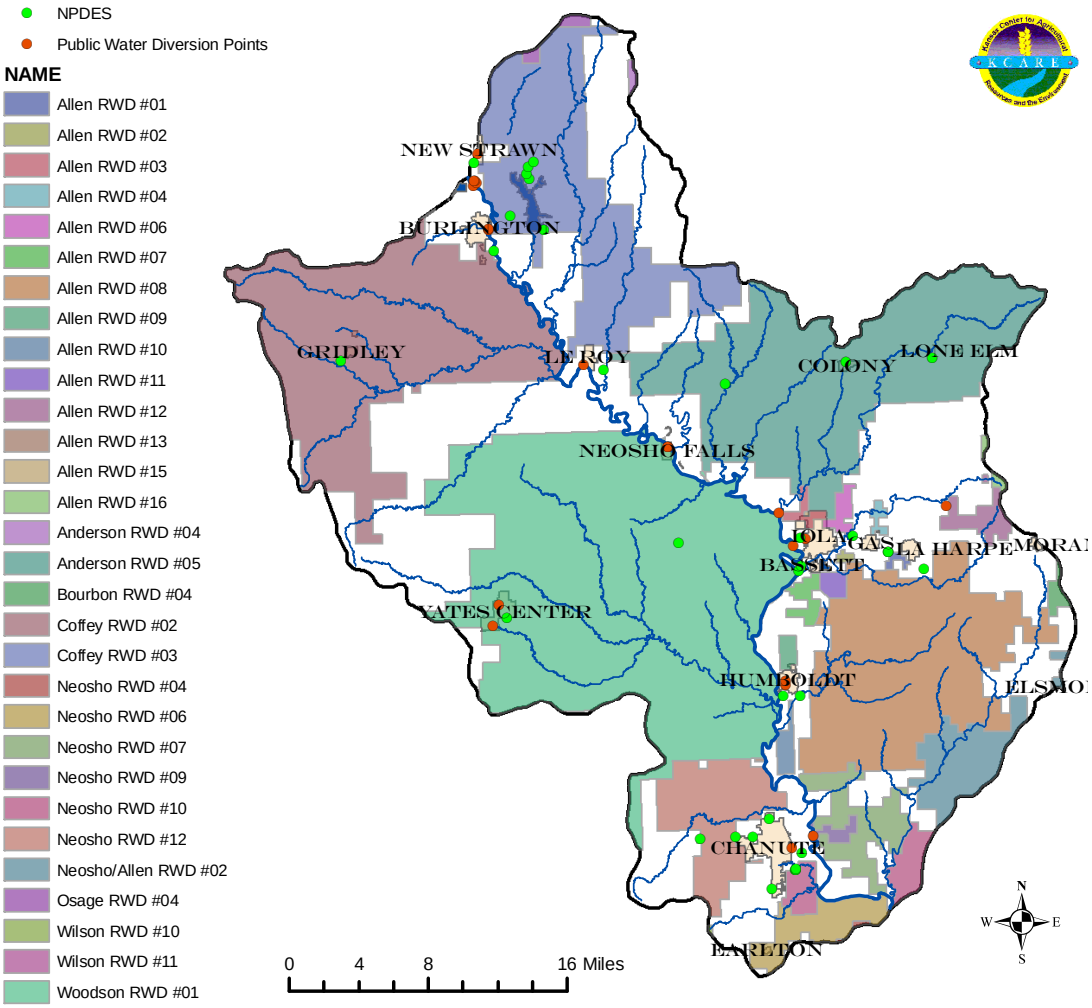


Figure 8. Rural Water Districts, Public Water Supply Diversion Points and NPDES sites in the Watershed. Kansas Department of Health and Environment. Rural Water Districts, 2006 and Public Water Supply source water wells and surface water intakes, 1994. These sites include those that are currently in use and those that have been functional in the past. NPDES Treatment Facilities, Kansas Department of Health and Environment, 1994.
11

3.7 Aquifers

Type of aquifer that underlies the watershed:

- Alluvial Aquifer - The alluvial aquifer is a part of and connected to a river system and consists of sediments deposited by rivers in the stream valleys. The Neosho River has an alluvial aquifer that lies along and below the river and some of its tributaries. Wolf Creek Lake also overlies an alluvial aquifer.

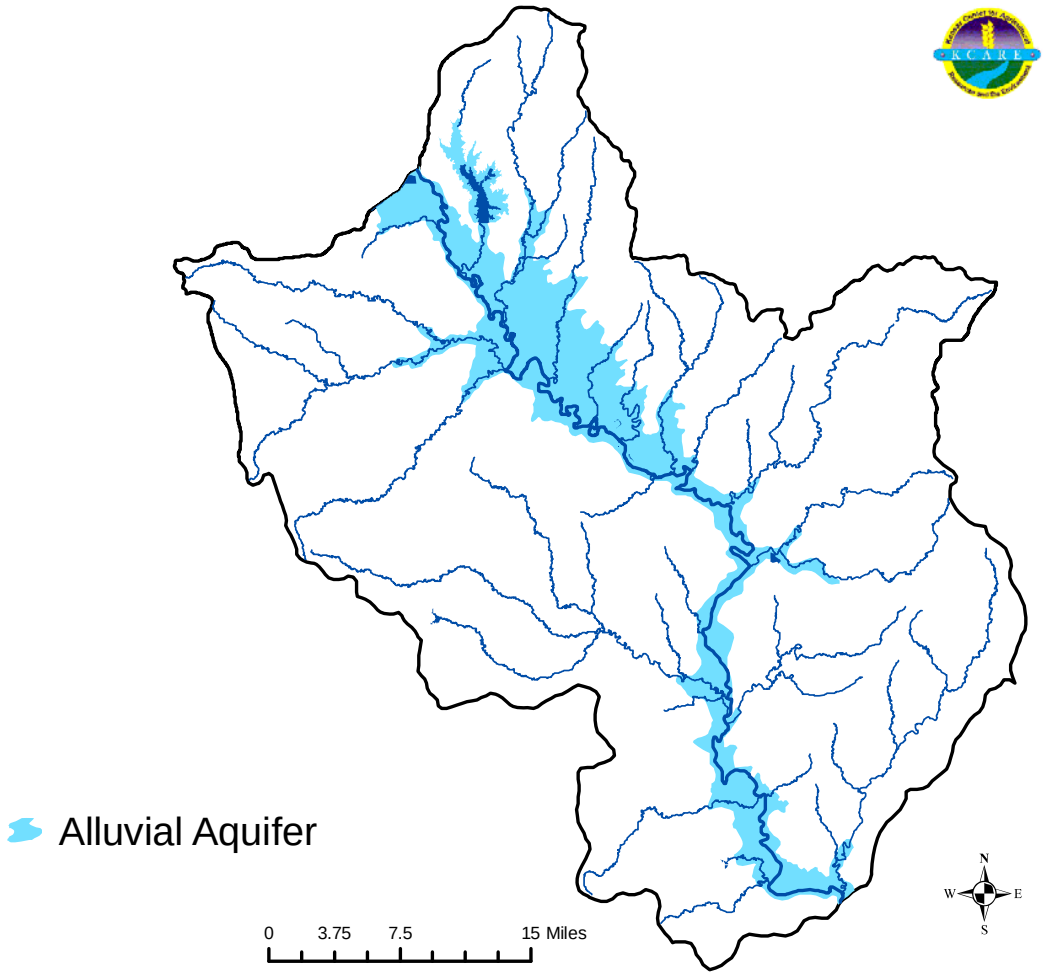


Figure 9. Aquifers in the Watershed. Kansas Geospatial Community Commons.
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3.8 TMDLs in the Watershed

A TMDL designation sets the maximum amount of pollutant that a specific body of water can receive without violating the surface water-quality standards, resulting in failure to support their designated uses. TMDLs provide a tool to target and reduce point and nonpoint pollution sources. TMDLs established by Kansas may be done on a watershed basis and may use a pollutant-by-pollutant approach or a biomonitoring approach or both as appropriate. TMDL establishment means a draft TMDL has been completed, there has been public notice and comment on the TMDL, there has been consideration of the public comment, any necessary revisions to the TMDL have been made, and the TMDL has been submitted to EPA for approval. The desired outcome of the TMDL process is indicated, using the current situation as the baseline. Deviations from the water quality standards will be documented. The TMDL will state its objective in meeting the appropriate water quality standard by quantifying the degree of

pollution reduction expected over time. Interim objectives will also be defined for midpoints in the implementation process. [13] In summary, TMDLs provide a tool to target and reduce point and nonpoint pollution sources. The goal of the WRAPS process is to address high priority TMDLs.

KDHE reviews TMDLs assigned in each of the twelve basins of Kansas every five years on a rotational schedule. The table below includes the review schedule for the Neosho Basin.

Table 5. TMDLs Review Schedule for the Neosho Basin. [14]

Year Ending in September	Implementation Period	Possible TMDLs to Revise	TMDLs to Evaluate
2013	2014-2023	2002, 2004, 2005	2002, 2004, 2005
2018	2019-2028	2000, 2004, 2005, 2008	2000, 2004, 2005, 2008

TMDLs in the watershed are listed in the table below.

Table 6. TMDLs in the Upper Neosho Watershed. [15] The shaded lines indicate high, medium or low priority priorities. The TMDLs in bold print indicate ones that will be targeted by this WRAPS plan.

Water Segment	TMDL Pollutant	Water Quality Standard	Endgoal of TMDL	Priority	Sampling Station
High Priority TMDLs					
Turkey Creek near LeRoy	**Dissolved Oxygen**	• **DO >5mg/l**	**Average BOD <3.9mg/l and no excursions <5mg/l**	**High**	**SC614**
Turkey Creek near LeRoy	**Fecal Coliform Bacteria**	• **Secondary Contact < 2,000 colonies per 100 ml water**	**Not to exceed criterion of 2,000 colonies per 100 ml**	**High**	**SC614**
Medium Priority TMDLs					
Chanute Sante Fe Lake	**Dissolved Oxygen, Eutrophication, pH**	• **DO > 5mg/L** • **pH > 6.5 and < 8.5**	• **Summer Chlorophyll a </= 20 ug/L** • **pH > 6.5 and < 8.5** • **Total Nitrogen < 0.79mg/L**	**Medium**	**LM 044401**
Gridley City Lake	Dissolved Oxygen, Eutrophication	• DO >5mg/l	• Summer Chlorophyll a </= 12 ug/L • DO >5.0mg/l Total Nitrogen < 0.62mg/L	Medium	LM045601

TMDLs, cont.					
Water Segment	**TMDL Pollutant**	**Water Quality Standard**	**Endgoal of TMDL**	**Priority**	**Sampling Station**
Medium Priority TMDLs					
Big Creek near Le Roy	**Fecal Coliform Bacteria**	• **Primary Contact < 200 colonies per 100 ml water** • **Secondary Contact < 2,000 colonies per 100 ml water**	• **Primary Contact <200 colonies/100ml from 5 samples within a 30 day period** • **Secondary Contact by single "not to exceed"criterion of <2,000 colonies/100 ml**	**Medium**	**SC615**
Deer Creek near Iola	**Fecal Coliform Bacteria**	• **Primary Contact < 200 colonies per 100 ml water**	• **Primary Contact <200 colonies/100ml from 5 samples within a 30 day period** • **Secondary Contact by single "not to exceed"criterion of <2,000 colonies/100 ml**	**Medium**	**SC609**
Owl Creek near Humboldt	**Fecal Coliform Bacteria**	• **Secondary Contact < 2,000 colonies per 100 ml water**	• **Secondary Contact by single "not to exceed"criterion of <2,000 colonies/100 ml**	**Medium**	**SC610**
Low Priority TMDLs					
Gridley City Lake	Berylium	• Be < 0.13ug/L	• Be </= 0.13 g/L	Low	LM045601
Big Creek near Le Roy	Copper	• Acute Criterion (WQS) = Water Effects Ratio {EXP{(0.9422*(ln(hardness in mg/L)))-1.700}}	• Copper Concentration < WQS	Low	SC615
Neosho River near Chanute	Copper	• Acute Criterion (WQS) = Water Effects Ratio {EXP{(0.9422*(ln(hardness in mg/L)))-1.700}}	• Copper Concentration < WQS	Low	SC560 and SC271

TMDLs, cont.					
Water Segment	**TMDL Pollutant**	**Water Quality Standard**	**Endgoal of TMDL**	**Priority**	**Sampling Station**
Low Priority TMDLs					
Owl Creek near Humboldt	Copper	• Acute Criterion (WQS) = Water Effects Ratio {EXP{(0.9422*(ln(hardness in mg/L)))-1.700}}	• Copper Concentration < WQS	Low	SC610

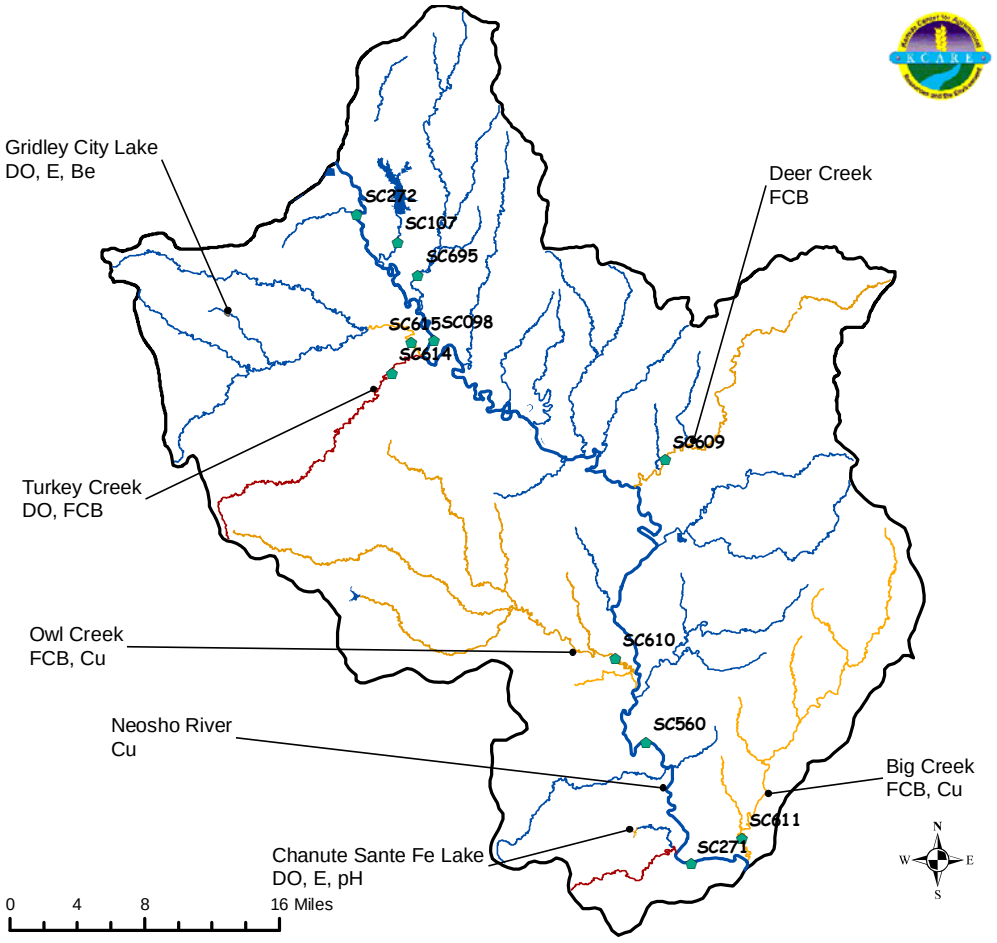


Figure 10. TMDLs in the Upper Neosho Watershed [16] Red color on the map indicates high priority, orange color indicates medium priority or a combination of medium and low priority. Refer to table listing TMDLs above.

3.9 303d Listings in the Watershed

The Upper Neosho Watershed has numerous new listings on the 2010 "303d list". A 303d list of impaired waters is developed biennially and submitted by KDHE to EPA. To be included on the 303d list, samples taken during the KDHE

monitoring program must show that water quality standards are not being met. This in turn means that designated uses are not met. TMDL development and revision for waters of the Upper Neosho Watershed is scheduled for 2013. TMDLs will be developed over the subsequent two years for "high" priority impairments. Priorities are set by work schedule and TMDL development timeframe rather than severity of pollutant. If it will be greater than two years until the pollutant can be assessed, the priority will be listed as "low". Water bodies are assigned "categories" based on impairment status:

- Category 5 – Waters needing TMDLs
- Category 4a – Waters that have TMDLs developed for them and remain impaired
- Category 4b – NPDES permits addressed impairment or watershed planning is addressing atrazine problem
- Category 4c – Pollution (typically insufficient hydrology) is causing impairment
- Category 3 – Waters that are indeterminate and need more data or information
- Category 2 – Waters that are now compliant with certain WQSs
- Category 1 – All designated uses are supported, no use is threatened

Note: Implemented strategies for addressing current TMDLs as determined by the SLT and outlined in this report will have an additional benefit by proactively addressing the impairments on the 303d list. The ultimate goal will be to eliminate the need for TMDL development of these impairments. This will be achieved by targeting the sub watersheds of the 303d listed water bodies for priority of implementation resources.

Table 7. 2010 303d List of Impaired Waters in the Upper Neosho Watershed. [17] The bold impairments indicate ones that will be targeted by this WRAPS plan.

Category	Water Segment	Impairment	Priority	Sampling Station
Low Priority				
5 –needing TMDL	Turkey Creek near LeRoy	Copper	Low	SC614
5 –needing TMDL	**Big Creek near Chanute**	**Dissolved Oxygen**	**Low**	**SC611**
5 –needing TMDL	**Long Creek near Le Roy**	**Dissolved Oxygen**	**Low**	**SC695**
5 –needing TMDL	Neosho River near Chanute	Lead	Low	SC560
5 –needing TMDL	Owl Creek near Humboldt	Lead	Low	SC610
5 –needing TMDL	Deer Creek near Iola	Zinc	Low	SC609
5 –needing TMDL	Neosho River near Chanute	Zinc	Low	SC560
5 –needing TMDL	Owl Creek near Humboldt	Zinc	Low	SC610

303d Listing, cont.				
Category	**Water Segment**	**Impairment**	**Priority**	**Sampling Station**
3 – need more information	Little Turkey Creek	Ammonia	Evaluate for 2012 303d list	NPDES80837
3 – need more information	Owl Creek	Ammonia	Evaluate for 2012 303d list	NPDES97446
3 – need more information	Big Creek near Chanute	Copper		SC611
3 – need more information	Little Turkey Creek	Fecal Coliform Bacteria	Evaluate for 2012 303d list	NPDES80837

As of the 2010 303d listing, some water segments have been removed from the list.

Table 8. 2010 303d List of Formerly Impaired Waters. [18]

Category	Water Segment	Impairment	Comments	Sampling Station
2 – no longer needing TMDL	Turkey Creek near Le Roy	Lead, Zinc	No longer impaired	SC614
2 – no longer needing TMDL	Neosho River near Chanute	pH	No longer impaired	SC271 and SC560

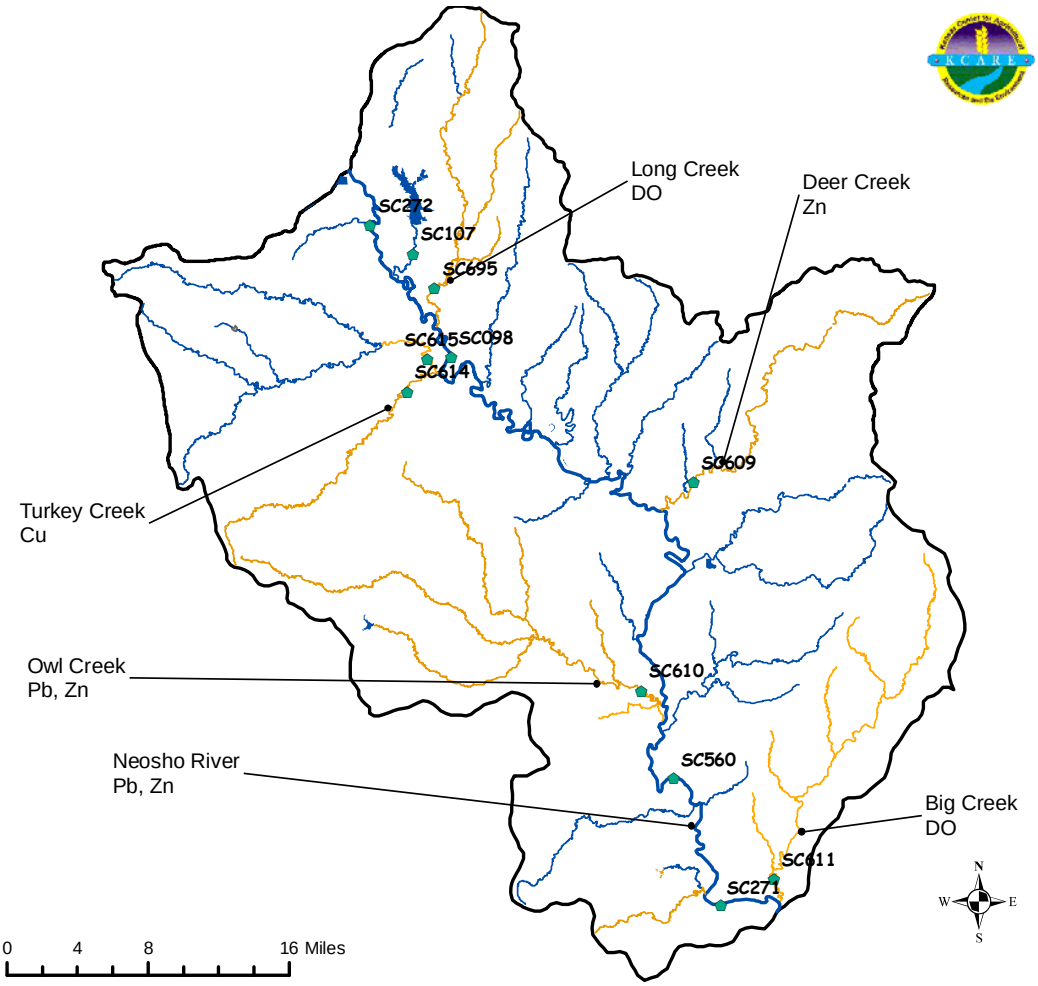


Figure 11. 303d Listings in the Watershed, 2010. [19]

3.10 Load Allocations [20]

Load allocations for phosphorus and sediment for the Upper Neosho Watershed as determined by KDHE. Typically, Grand Lake would have TMDLs that would determine load allocations for the Upper Neosho Watershed; however, no TMDLs have been implemented at the time of this WRAPS 9 Element Plan. When TMDLs in Grand Lake are established (the TMDLs are under development and the goal for establishment is 2012), this WRAPS 9 Element Plan can be adjusted to fit the load allocations needed to meet Grand Lake's TMDLs. Until that time, the Kansas Nutrient Management Plan has determined that a 30 percent load reduction in phosphorus and sediment is the reduction goal and the calculations for the Load Capacity shall be shown as 70 percent of the total in the watershed. This 30 percent reduction reflects the gain in load in the watershed from inlet to outlet, and does not include anything above the inlet point, (i.e., does not include John Redmond Lake).

Table 9. Phosphorus Load Reduction in the Upper Neosho Watershed.

Annual Load Reduction	
Phosphorus Current Condition (pounds)	560,000
Less Total Phosphorus Load Capacity (pounds)	392,000
Required Load Reduction (pounds) for the outlet of the Upper Neosho Watershed	**168,000**

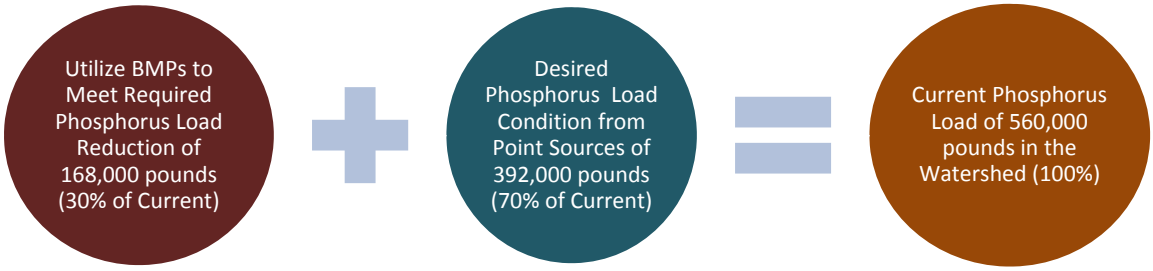
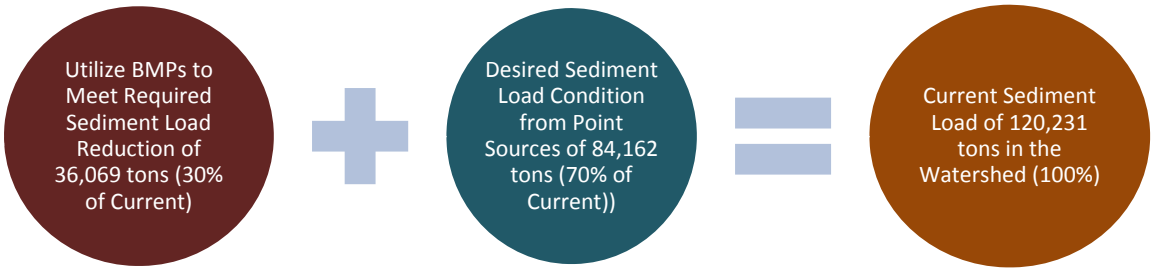


Table 10. Sediment Load Reduction in the Upper Neosho Watershed.

Annual Load Reduction	
Sediment Current Condition (tons)	120,231
Less Total Sediment Load Capacity (tons)	84,162
Required Load Reduction (tons) for the outlet of Upper Neosho Watershed	**36,069**



4.0 Critical Targeted Areas and Load Reduction Methodology

4.1 Critical Areas

In the Upper Neosho Watershed, “Critical Areas” have been identified as areas that need to be protected or restored, such as areas that have TMDLs, emerging pollutant threats, on the 303d list or contain a public water supply. Critical areas are defined by EPA as geographic areas that are critical to implement management practices in order to achieve load reductions. [21] Three areas have been identified as Critical Areas in this WRAPS:

1. Sub watersheds that have been identified by Watershed Assessment Tools as a potential source of pollutants,
2. Sub watersheds that have been identified to have a high level of pollutants, and
3. Sub watersheds with high priority TMDLs

4.2 Targeted Areas

“Targeted Areas” are those specific areas in the Critical Areas that require BMP placement in order to meet load reductions. The Targeted Areas that have been identified in this WRAPS are:

1. Cropland areas targeted for sediment runoff as identified by Assessment Tools,
2. Livestock and Cropland areas targeted for nutrients as identified by water quality monitoring, and
3. Livestock areas targeted for bacteria runoff.

4.2.1 Cropland Erosion

The Upper Neosho Watershed was assessed using the Soil and Water Assessment Tool (SWAT) by Kansas State University Department of Biological and Agricultural Engineering. SWAT was used as an assessment tool to estimate annual average pollutant loadings such as nutrients and sediment that are coming from the land into the stream. At the end of simulation runs the average annual loads are calculated for each sub watershed. Some areas have higher loads than the others. Based on experience and technical knowledge, the areas or sub watersheds with top 20-30% of the highest loads among all areas within the watershed are selected as critical (targeted) areas for cropland and livestock BMPs implementation.

The SWAT model was developed by USDA-ARS from numerous equations and relationships that have evolved from years of runoff and erosion research in combination with other models used to estimate pollutant loads from animal feedlots, fertilizer and agrochemical applications, etc. The SWAT model has been tested for a wide range of regions, conditions, practices, and time scales. Evaluation of monthly and annual streamflow and pollutant outputs indicate SWAT functioned well in a wide range of watersheds. The model directly accounts for many types of common agricultural conservation practices, including terraces and small ponds; management practices, including fertilizer applications; and common landscape features, including grass waterways. The model incorporates various grazing management practices by specifying amount of manure applied to the pasture or grassland, grazing periods, and amount of biomass consumed or trampled daily by the livestock. Septic systems, NPDES discharges, and other point-sources are considered as combined point-sources and applied to inlets of sub watersheds. These features made SWAT a good tool for assessing rural watersheds in Kansas.

The Soil and Water Assessment Tool (SWAT) model is a physically based, deterministic, continuous, watershed-scale simulation model developed by the USDA Agricultural Research Service. ArcGIS interface of ArcSWAT version 9.2 was used. It uses spatially distributed data on topography, soils, land cover, land management, and weather to predict water, sediment, nutrient, and pesticide yields. A modeled watershed is divided spatially into sub watersheds using digital elevation data according to the drainage area specified by the user. Sub watersheds are modeled as having non-uniform slope, uniform climatic conditions determined from the nearest weather station, and they are further subdivided into lumped, non-spatial hydrologic response units (HRUs) consisting of all areas within the sub watershed having similar soil, land use, and slope characteristics. The use of HRUs allows slope, soil, and land-use heterogeneity to be simulated within each sub watershed, but ignores pollutant attenuation between the source area and stream and limits spatial representation of wetlands, buffers, and other BMPs within a sub watershed.

The model includes subbasin, reservoir, and channel routing components.

1. The subbasin component simulates runoff and erosion processes, soil water movement, evapotranspiration, crop growth and yield, soil nutrient and carbon cycling, and pesticide and bacteria degradation and transport. It allows simulation of a wide array of agricultural structures and practices, including tillage, fertilizer and manure application, subsurface drainage, irrigation, ponds and wetlands, and edge-of-field buffers. Sediment yield is estimated for each subbasin with the Modified Universal Soil Loss Equation (MUSLE). The hydrology model supplies estimates of runoff volume and peak runoff rates. The crop management factor is evaluated as a function of above ground biomass, residue on the surface, and the minimum C factor for the crop.

2. The reservoir component detains water, sediments, and pollutants, and degrades nutrients, pesticides and bacteria during detention. This component was not used during the simulations.
3. The channel component routes flows, settles and entrains sediment, and degrades nutrients, pesticides and bacteria during transport. SWAT produces daily results for every sub watershed outlet, each of which can be summed to provide daily, monthly, and annual load estimates. The sediment deposition component is based on fall velocity, and the sediment degradation component is based on Bagnold's stream power concepts. Bed degradation is adjusted by the USLE soil erodibility and cover factors of the channel and the floodplain. This component was utilized in the simulations but not used in determining the critical areas.

Data for the Upper Neosho SWAT model were collected from a variety of reliable online and printed data sources and knowledgeable agency personnel within the watershed. Input data and their online sources are:

1. 30 meters DEM (USGS National Elevation Dataset)
2. 30m NLCD 2001 Land Cover data layer (USDA-NRCS)
3. STATSGO soil dataset (USDA-NRCS)
4. NCDC NOAA daily weather data (NOAA National Climatic Data Center)
5. Point sources (KDHE on county basis)
6. Septic tanks (US Census)
7. Crop rotations (local knowledge)
8. Grazing management practices (local knowledge)

In every watershed, there are specific locations that contribute a greater pollutant load due to soil type, proximity to a stream and land use practices. By focusing BMPs in these areas; pollutants can be reduced at a more efficient rate. Through research at the University of Wisconsin, it has been shown that there is a "bigger bang for the buck" with streamlining BMP placement in contrast to a "shotgun" approach of applying BMPs in a random nature throughout the watershed. The SWAT targeted area will be used for cropland BMP placement. The livestock targeted area was set by the SLT through their knowledge of the watershed and will focus BMP placement for nutrient runoff. Targeting for this watershed will be accomplished in two different areas:

1. Cropland will be targeted for sediment and nutrients,
2. Livestock areas will be targeted for nutrients and fecal coliform bacteria.

The maps produced by the modeling are displayed below. It is noted that the darker the shading in the map, the greater the potential for nitrogen, phosphorus or sediment runoff. The sub watersheds in the central portion of the watershed, show the highest potential for erosion, phosphorous, and nitrogen runoff. As stated earlier, this model accounts for land use, soil type, slope, and current conservation practices. This is the area of the watershed with the greatest percentage of cropland, which leads to a higher potential for erosion compared to areas that are mainly composed of grassland.

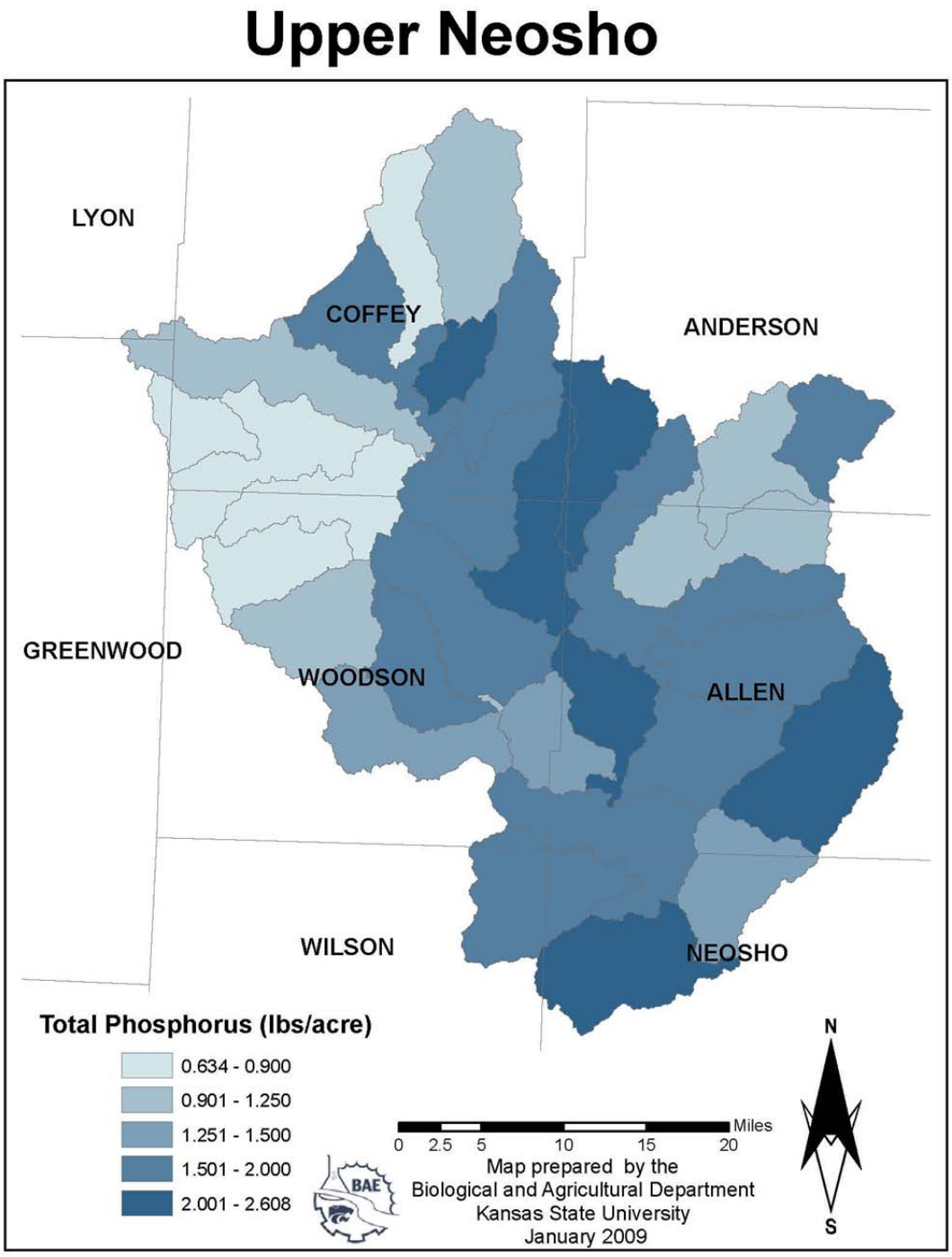


Figure 12. Phosphorus (lbs/acre) Yield as Determined by SWAT.

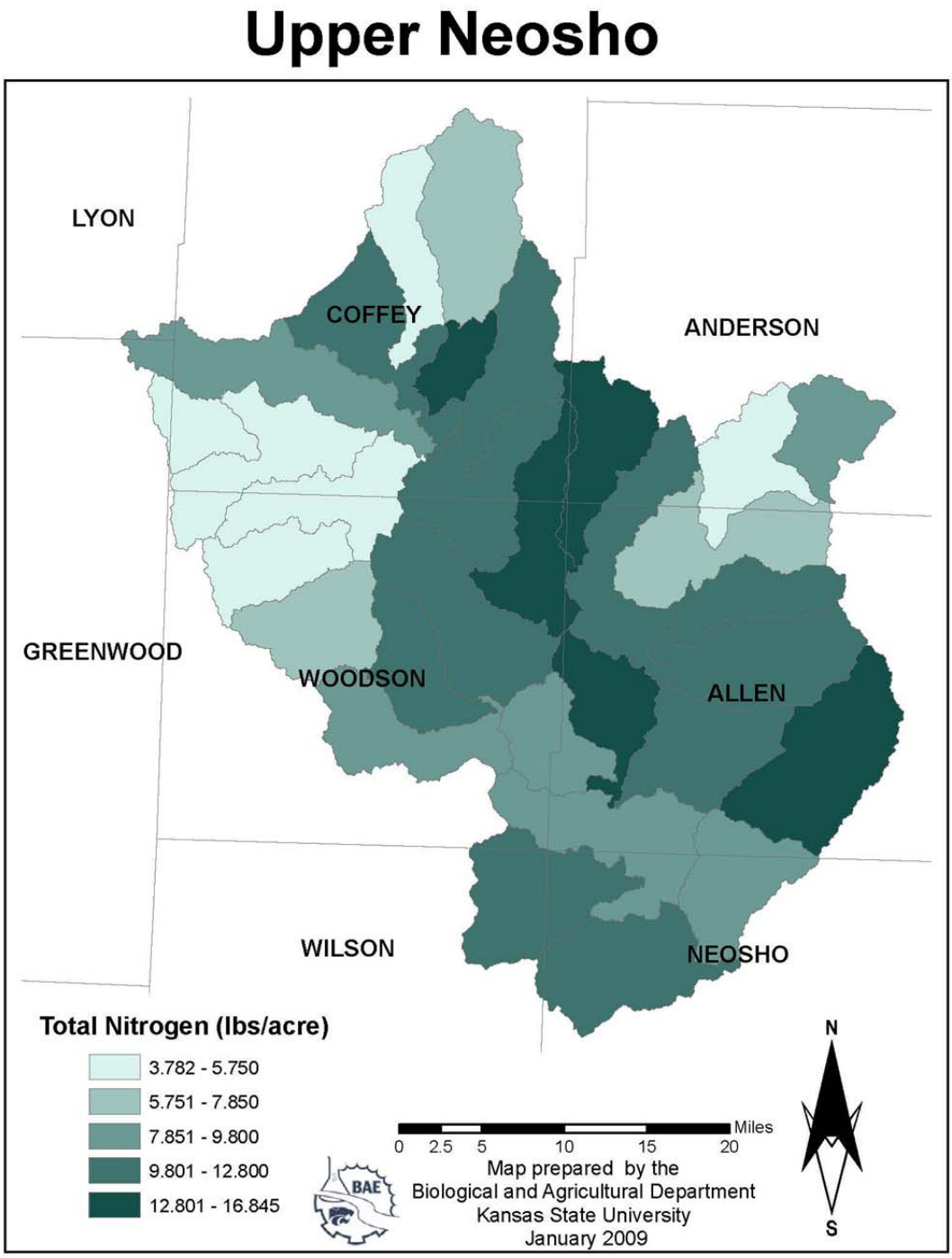


Figure 13. Nitrogen (lbs/acre) Yield as Determined by SWAT.

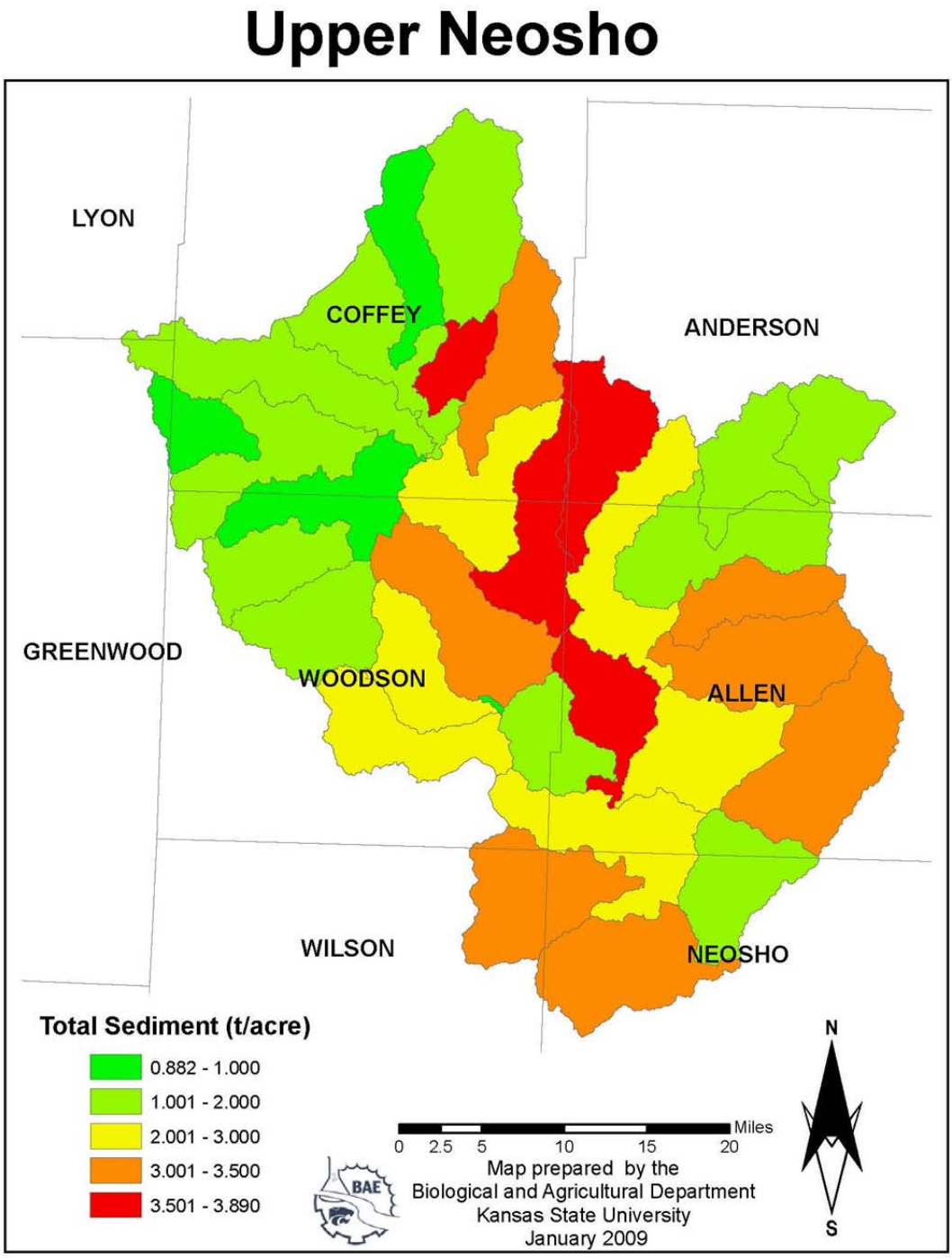


Figure 14. Sediment (tons/acre) Yield as Determined by SWAT.

After locating initial targeted areas, the area was groundtruthed. Groundtruthing is a method used to determine what BMPs are currently being utilized in the targeted areas. It involves conducting windshield surveys throughout the targeted areas identified by the watershed models to determine which BMPs are currently

installed. These surveys are conducted by local agency personnel and members of the SLT that are familiar with the area and its land use history. Groundtruthing provides the current adoption rate of BMPs, pictures of the targeted areas, and may bring forth additional water quality concerns not captured by watershed modeling. In 2009, the groundtruthing provided the current adoption rates for six common BMPs (conservation crop rotation, establishment of permanent vegetation, no-till, vegetative buffers, terraces and subsurface fertilizer) in the cropland targeted area of the watershed averaged across counties. The results are as follows:

- Conservation Crop Rotation – current adoption rate of 73%
- Permanent vegetation – current adoption rate of 0%
- No-till cultivation – current adoption rate of 0.04%
- Vegetative buffer strips – current adoption rate of 0.08%
- Terraces – current adoption rate of 73%
- Subsurface Fertilizer – 0%

The SWAT model was revised using the groundtruthing information. This allows the SWAT model to develop a more accurate determination of appropriate targeted areas. The SWAT model then determined number of acres needed to be implemented for each BMP. This information is provided in Tables 14 and 19.

Cropland targeted areas have been delineated into Tier 1 and Tier 2. Refer to the upcoming figure. Tier 1 will be addressed with BMP implementation first and after all BMPs have been implemented, Tier 2 will be addressed. This will begin in Year 31 of the watershed plan.

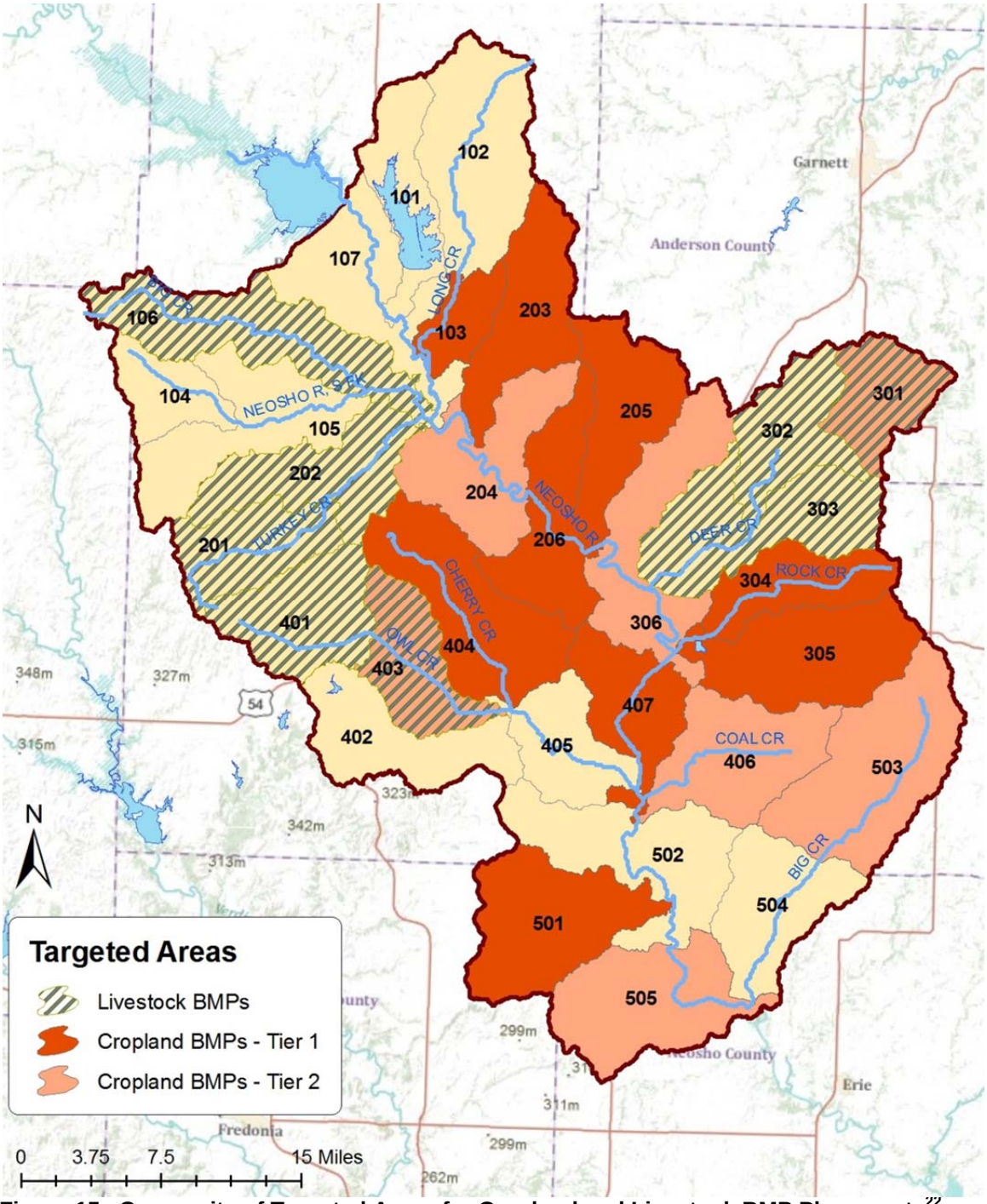


Figure 15. Composite of Targeted Areas for Cropland and Livestock BMP Placement. [22]

4.2.1.A Tier 1 Cropland Targeted Areas

The SWAT delineated (primary ranked) Cropland Targeted Area Tier 1 of this project is to be used for the determination of BMP placement for sediment (overland origin) and nutrients. This area includes a portion of the Long Creek,

Crooked Creek, Spring Creek with Neosho River, Indian Creek, Rock Creek, Cherry Creek, Onion Creek and Village Creek. This area contains HUC numbers (labels in parenthesis and on map consist of the last three digits of the HUC 12 number):

- 110702040103 (103) Long Creek
- 110702040203 (203) Crooked Creek
- 110702040205 (205) Indian Creek
- 110702040206 (206) Spring Creek Neosho River
- 110702040304 (304) Rock Creek
- 110702040305 (305) Elm Creek
- 110702040404 (404) Cherry Creek
- 110702040407 (407) Onion Creek
- 110702040501 (501) Village Creek

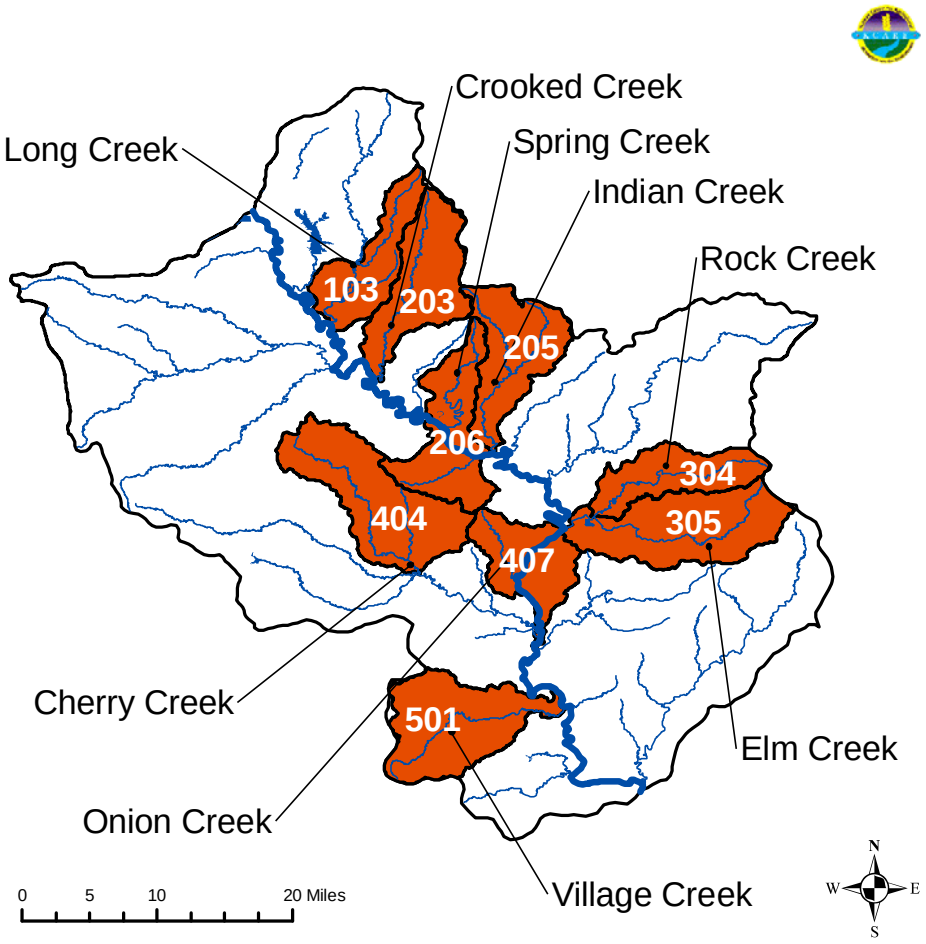


Figure 16. SWAT Cropland Targeted Area Tier 1.

Table 11. Land use in the SWAT Delineated Cropland Targeted Area Tier 1. [23]

Subbasin 110702040103

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	38	0.00	0.34
Residential-Low Density	392	0.02	3.59
Residential-Medium Density	21	0.00	0.19
Southwestern US (Arid) Range	6	0.00	0.19
Forest-Deciduous	822	0.05	7.52
Forest-Mixed	16	0.00	0.14
Range-Grasses	1,043	0.06	9.55
Hay	3,730	0.21	34.16
Agricultural Land-Row Crops	4,832	0.27	44.25
Wetlands-Forested	20	0.00	0.25
Wetlands-Non-Forested	0.9	0.00	0.01
Total	**10,920**	**0.60**	**100.00**

Subbasin 110702040203

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	88	0.00	0.32
Residential-Low Density	1,018	0.06	3.73
Residential-Medium Density	250	0.01	0.91
Residential-High Density	23	0.00	0.08
Industrial	6	0.00	0.02
Southwestern US (Arid) Range	16	0.00	0.06
Forest-Deciduous	2,638	0.15	9.65
Forest-Mixed	27	0.00	0.10
Range-Brush	14	0.00	0.05
Range-Grasses	4,771	0.27	17.46
Hay	10,434	0.58	38.17
Agricultural Land-Row Crops	7,992	0.45	29.24
Wetlands-Forested	58	0.00	0.21
Total	**27,334**	**1.53**	**100.00**

Subbasin 110702040205

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	71	0.00	0.27
Residential-Low Density	964	0.05	3.65
Residential-Medium Density	59	0.00	0.23
Residential-High Density	1	0.00	0.00
Southwestern US (Arid) Range	38	0.00	0.14
Forest-Deciduous	1,275	0.07	4.83
Forest-Mixed	12	0.00	0.04
Range-Brush	4	0.00	0.01
Range-Grasses	2,753	0.15	10.43
Hay	10,997	0.62	41.65
Agricultural Land-Row Crops	10,218	0.57	38.70
Wetlands-Forested	29	0.00	0.03

Subbasin 110702040205, cont.

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Wetlands-Non-Forested	2	0.00	0.01
Total	**26,402**	**1.48**	**100.00**

Subbasin 110702040206

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	251	0.01	0.92
Residential-Low Density	1,004	0.06	3.69
Residential-Medium Density	141	0.01	0.52
Southwestern US (arid) Range	12	0.00	0.04
Forest-Deciduous	1,624	0.09	5.97
Forest-Mixed	27	0.00	0.10
Range-Grasses	3,215	0.18	11.83
Hay	10,264	0.58	37.76
Agricultural Land-Row Crops	10,044	0.56	36.95
Wetlands-Forested	584	0.03	2.15
Wetlands-Non Forested	13	0.00	0.07
Total	**27,180**	**1.52**	**100.00**

Subbasin 110702040304

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	132	0.01	0.66
Residential-Low Density	910	0.05	4.55
Residential-Medium Density	388	0.02	1.91
Residential-High Density	113	0.01	0.57
Industrial	18	0.00	0.09
Southwestern US (arid) range	1	0.00	0.01
Forest-Deciduous	772	0.04	3.86
Forest-Mixed	35	0.00	0.18
Range-Brush	8	0.00	0.04
Range-Grasses	1,355	0.08	6.78
Hay	10,548	0.59	52.75
Agricultural Land-Row Crops	5,707	0.32	28.54
Wetlands-Forested	12	0.00	0.06
Wetlands-Non-Forested	1	0.00	0.00
Total	**19,997**	**1.12**	**100.00**

Subbasin 110702040305

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	422	0.02	1.23
Residential-Low Density	1,813	0.10	5.24
Residential-Medium Density	875	0.05	2.53
Residential-High Density	185	0.01	0.53
Industrial	35	0.00	0.10
Southwestern US (arid) range	91	0.01	0.26

Subbasin 110702040305, cont.

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Forest-Deciduous	1,716	0.10	4.97
Forest-Mixed	37	0.00	0.11
Range-Brush	3	0.00	0.01
Range-Grasses	2,370	0.13	6.86
Hay	15,556	0.87	45.01
Agricultural Land-Row Crops	11,381	0.64	32.93
Wetlands-Forested	65	0.00	0.19
Wetlands-Non-Forested	11	0.00	0.03
Total	**34,559**	**1.93**	**100.00**

Subbasin 110702040404

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	251	0.01	0.67
Residential-Low Density	1,492	0.08	3.98
Residential-Medium Density	221	0.01	0.59
Residential-High Density	10	0.00	0.03
Industrial	4	0.00	0.01
Forest-Deciduous	2,581	0.14	6.88
Forest-Mixed	21	0.00	0.06
Range-Brush	6	0.00	0.02
Range-Grasses	6,584	0.37	17.55
Hay	16,616	0.93	44.31
Agricultural Land-Row Crops	9,656	0.54	25.75
Wetlands-Forested	59	0.00	0.16
Wetlands-Non-Forested	3	0.00	0.01
Total	**37,504**	**2.10**	**100.00**

Subbasin 110702040407

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	306	0.02	1.4
Residential-Low Density	1088.37	0.06	4.97
Residential-Medium Density	423.97	0.02	1.94
Residential-High Density	59.64	0	0.27
Industrial	18	0	0.08
Southwestern US (arid) Range	77.8022	0	0.36
Forest-Deciduous	1,570	0.09	7.18
Forest-Mixed	62	0	0.29
Range-Brush	7	0	0.03
Range-Grasses	1,525	0.09	6.97
Hay	7,924	0.44	36.22
Agricultural Land-Row Crops	8294.5	0.46	37.91
Wetlands-Forested	509	0.03	2.33
Wetlands-Non Forested	12	0	0.06
Total	**21,878**	**1.21**	**100.00**

Subbasin 110702040501			
LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	291	0.02	0.84
Residential-Low Density	1,687	0.09	4.87
Residential-Medium Density	904	0.05	2.61
Residential-High Density	272	0.02	0.79
Industrial	51	0.00	0.15
Southwestern US (arid) range	319	0.02	0.92
Forest-Deciduous	2,230	0.13	6.44
Forest-Mixed	53	0.00	0.15
Range-Brush	5	0.00	0.02
Range-Grasses	3,802	0.21	10.98
Hay	15,421	0.86	44.53
Agricultural Land-Row Crops	9,545	0.54	27.56
Wetlands-Forested	43	0.00	0.12
Wetlands-Non-Forested	5	0.00	0.02
Total	**34,629**	**1.94**	**100.00**

4.2.1.B Tier 2 Cropland Targeted Areas

The SWAT delineated Cropland Targeted Area Tier 2 of this project is to be used for the determination of BMP placement for sediment (overland origin) and nutrients after all Tier 1 projects have been completed. This area includes a portion of the Duck Creek and Neosho River, Martin Creek and Neosho River, Coal Creek, Headwaters Big Creek, and Turkey Creek and Neosho River. This area contains HUC numbers (labels in parenthesis and on map consist of the last three digits of the HUC 12 number):

- 110702040204 (204) Duck Creek Neosho River
- 110702040301 (301) Upper Deer Creek
- 110702040306 (306) Martin Creek Neosho River
- 110702040403 (403) Middle Owl Creek
- 110702040406 (406) Coal Creek
- 110702040503 (503) Headwaters Big Creek
- 110702040505 (505) Turkey Creek Neosho River

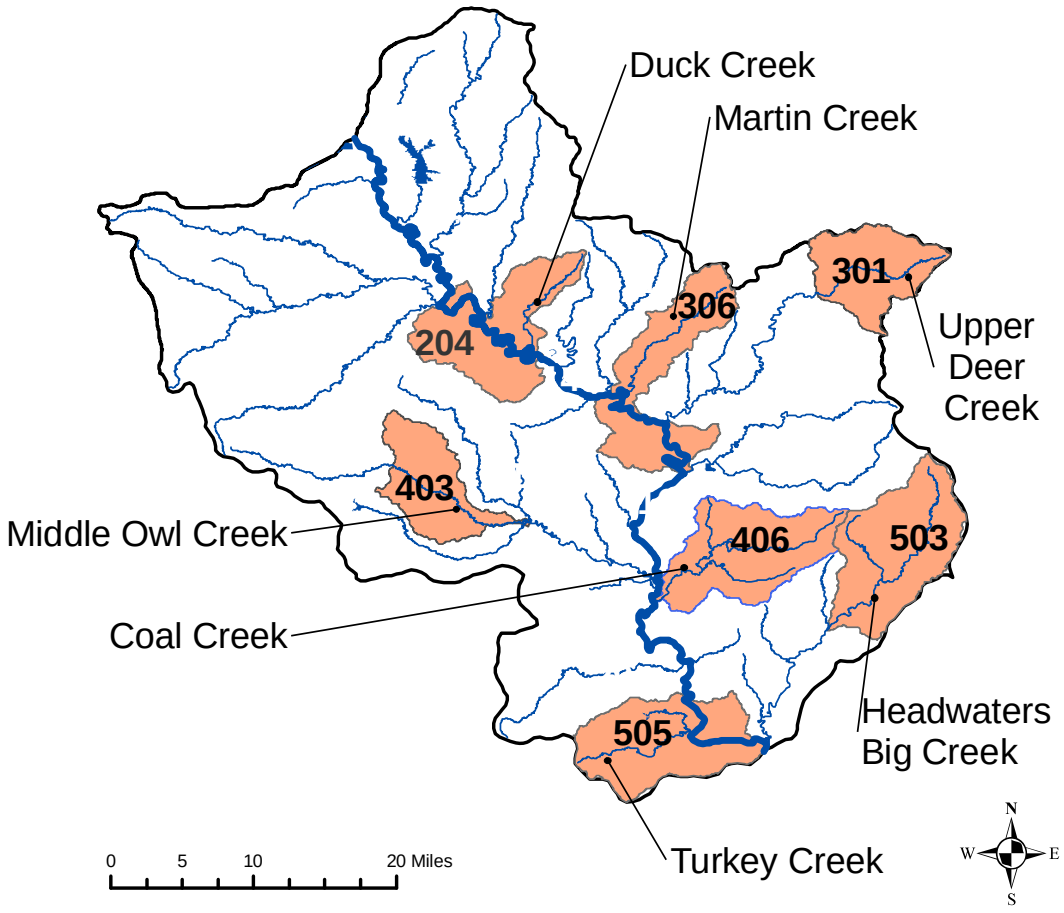


Figure 17. SWAT Cropland Targeted Area Tier 2.

Table 12. Land use in the SWAT Delineated Cropland Targeted Area Tier 2. [24]

Subbasin 110702040204			
LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	433	0.02	1.39
Residential-Low Density	1,097	0.06	3.54
Residential-Medium Density	173	0.01	0.56
Residential-High Density	7	0.00	0.02
Industrial	2	0.00	0.01
Forest-Deciduous	2,574	0.14	8.30
Forest-Mixed	26	0.00	0.09
Range-Brush	4	0.00	0.01
Range-Grasses	4,499	0.25	14.50
Hay -	12,564	0.70	40.50
Agricultural Land-Row Crops	9,317	0.52	30.03
Wetlands-Forested	315	0.02	1.02
Wetlands-Non-Forested	13	0.00	0.03

Subbasin 110702040204, cont.

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Total	**31,024**	**1.74**	**100.00**

Subbasin 110702040301

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	103	0.01	0.55
Residential-Low Density	717	0.04	3.82
Residential-Medium Density	153	0.01	0.82
Residential-High Density	2	0.00	0.01
Forest-Deciduous	958	0.05	5.11
Forest-Mixed	32	0.00	0.17
Range-Grasses	834	0.05	4.45
Hay	9,970	0.56	53.22
Agricultural Land-Row Crops	5,776	0.32	30.83
Wetlands-Forested	190	0.01	1.02
Total	**18,733**	**1.05**	**100.00**

Subbasin 110702040306

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	438	0.02	1.31
Residential-Low Density	1,705	0.10	5.09
Residential-Medium Density	915	0.05	2.73
Residential-High Density	240	0.01	0.72
Industrial	94	0.01	0.28
Forest-Deciduous	1,866	0.10	5.57
Forest-Mixed	72	0.00	0.21
Range-Brush	6	0.00	0.02
Range-Grasses	4,475	0.25	13.36
Hay	13,674	0.77	40.84
Agricultural Land-Row Crops	9,303	0.52	27.78
Wetlands-Forested	675	0.04	2.01
Wetlands-Non-Forested	25	0.00	0.08
Total	**33,486**	**1.88**	**100.00**

Subbasin 110702040403

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	132	0.01	0.66
Residential-Low Density	910	0.05	4.55
Residential-Medium Density	388	0.02	1.91
Residential-High Density	113	0.01	0.57
Industrial	18	0	0.09
Southwestern US (arid) range	1	0	0.01
Forest-Deciduous	772	0.04	3.86
Forest-Mixed	35	0	0.18
Range-Brush	8	0	0.04

Subbasin 110702040403, cont.

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Range-Grasses	1,355	0.08	6.78
Hay	10,548	0.59	52.75
Agricultural Land-Row Crops	5,707	0.32	28.54
Wetlands-Forested	12	0	0.06
Wetlands-Non-Forested	1	0	0
Total	**19,997**	**1.12**	**100.00**

Subbasin 110702040406

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	151	0.01	0.49
Residential-Low Density	1,572	0.09	5.14
Residential-Medium Density	540	0.03	1.76
Residential-High Density	129	0.01	0.42
Industrial	15	0.00	0.05
Southwestern US (Arid) Range	74	0.00	0.24
Forest-Deciduous	2,298	0.13	7.51
Forest-Mixed	87	0.00	0.28
Range-Brush	2	0.00	0.01
Range-Grasses	2,432	0.14	7.95
Hay	13,730	0.77	44.89
Agricultural Land-Row Crops	9,536	0.53	31.18
Wetlands-Forested	21	0.00	0.08
Total	**30,588**	**1.71**	**100.00**

Subbasin 110702040503

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	163	0.01	0.37
Residential-Low Density	1,890	0.11	4.30
Residential-Medium Density	153	0.01	0.35
Residential-High Density	8	0.00	0.02
Industrial	4	0.00	0.01
Forest-Deciduous	2,466	0.14	5.61
Forest-Mixed	46	0.00	0.11
Range-Brush	7	0.00	0.02
Range-Grasses	3,324	0.19	7.57
Hay	20,607	1.16	46.93
Agricultural Land-Row Crops	14,753	0.83	33.59
Wetlands-Forested	493	0.03	1.12
Wetlands-Non Forested	3	0.00	0.00
Total	**43,915**	**2.46**	**100.00**

Subbasin 110702040505

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	431	0.02	1.24

Subbasin 110702040505, cont.			
LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Residential-Low Density	1,579	0.09	4.55
Residential-Medium Density	1,071	0.06	3.08
Residential-High Density	317	0.02	0.91
Industrial	102	0.01	0.29
Southwestern US (arid) range	10	0.00	0.03
Forest-Deciduous	2,184	0.12	6.29
Forest-Mixed	73	0.00	0.21
Range-Brush	3	0.00	0.01
Range-Grasses	2,469	0.14	7.11
Hay	14,609	0.82	42.05
Agricultural Land-Row Crops	11,167	0.63	32.14
Wetlands-Forested	717	0.04	2.06
Wetlands-Non-Forested	11	0.00	0.03
Total	**34,743**	**1.95**	**100.00**

4.2.2 Livestock Targeted Areas

The SLT has determined an area for targeting **livestock** related sediment, phosphorus pollutants and bacteria. Livestock BMPs will be placed in this area. The livestock targeted areas were determined by examining monitoring site information for elevated nutrient concentrations along with SLT input and were approved by the SLT. A presentation of common livestock BMPs to reduce phosphorous and bacteria runoff from livestock facilities was given to the SLT. Livestock producers within these areas as well as local agency personnel familiar with these areas then discussed which BMPs were needed in the area. The top four livestock BMPs were selected by need, cost-effectiveness, and producer acceptability. Adoption rate goals were set for the next 40 years based on their overall need and what can be feasibly adopted. In the future, unregistered livestock facilities may need to be addressed. Creeks included in this area are Deer Creek, Big Creek Turkey Creek and Owl Creek. The HUC 12 areas and correlated SWAT delineated areas are (labels in parenthesis and on map consist of the last three digits of the HUC 12 number):

- 110702040106 (106) Big Creek
- 110702040201 (201) Headwaters Turkey Creek
- 110702040202 (202) Outlet Turkey Creek
- 110702040301 (301) Upper Deer Creek
- 110702040302 (302) Middle Deer Creek
- 110702040303 (303) Lower Deer Creek
- 110702040401 (401) Upper Owl Creek
- 110702040403 (403) Middle Owl Creek

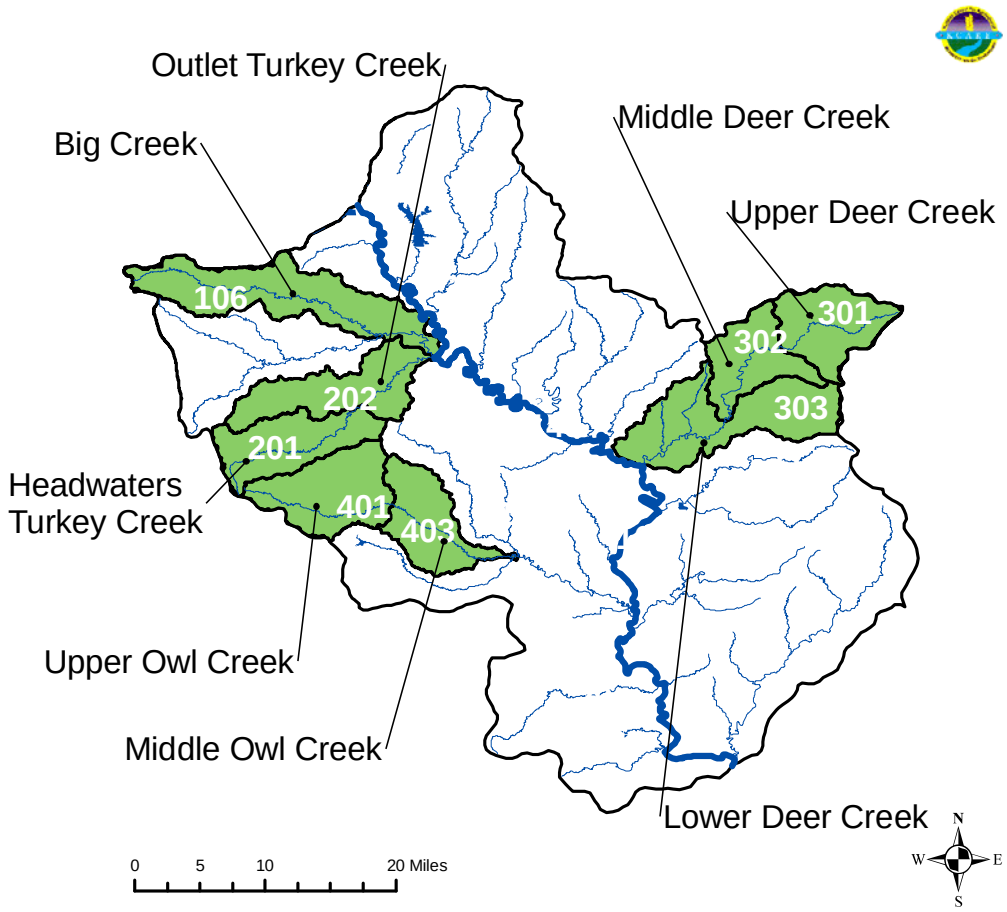


Figure 18. SLT Determined Livestock Targeted Areas.

Table 13. Land Use in the Livestock Targeted Area. [23]

Subbasin 110702040106			
LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	220	0.01	0.58
Residential-Low Density	1,403	0.08	3.67
Residential-Medium Density	119	0.01	0.31
Southwestern US (arid) range	2	0.00	0.01
Forest-Deciduous	2,248	0.13	5.88
Forest-Mixed	53	0.00	0.14
Range-Brush	4	0.00	0.01
Range-Grasses	13,505	0.76	35.35
Hay	14,414	0.81	37.73
Agricultural Land-Row Crops	6,196	0.35	16.22
Wetlands-Forested	41	0.00	0.10
Total	**38,206**	**2.14**	**100.00**

Subbasin 110702040201

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	133	0.01	0.62
Residential-Low Density	744	0.04	3.47
Residential-Medium Density	7	0.00	0.03
Southwestern US (arid) range	1	0.00	0.01
Forest-Deciduous	1,134	0.06	5.29
Forest-Mixed	10	0.00	0.05
Range-Brush	3	0.00	0.01
Range-Grasses	11,067	0.62	51.64
Hay	6,669	0.37	31.12
Agricultural Land-Row Crops	1,658	0.09	7.74
Wetlands-Forested	3	0.00	0.01
Wetlands-Non-Forested	1	0.00	0.01
Total	**21,430**	**1.20**	**100.00**

Subbasin 110702040202

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	89	0.00	0.33
Residential-Low Density	1,142	0.06	4.21
Residential-Medium Density	127	0.01	0.47
Residential-High Density	1	0.00	0.01
Southwestern US (arid) range	8	0.00	0.03
Forest-Deciduous	2,517	0.14	9.27
Forest-Mixed	37	0.00	0.14
Range-Grasses	17	0.00	0.06
Hay	9,590	0.54	35.31
Agricultural Land-Row Crops	11,242	0.63	41.39
Wetlands-Forested	2,358	0.13	8.68
Wetlands-Non-Forested	31	0.00	0.09
Total	**27,162**	**1.52**	**100.00**

Subbasin 110702040301

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	103	0.01	0.55
Residential-Low Density	717	0.04	3.82
Residential-Medium Density	153	0.01	0.82
Residential-High Density	2	0.00	0.01
Forest-Deciduous	958	0.05	5.11
Forest-Mixed	32	0.00	0.17
Range-Grasses	834	0.05	4.45
Hay	9,970	0.56	53.22
Agricultural Land-Row Crops	5,776	0.32	30.83
Wetlands-Forested	190	0.01	1.02
Total	**18,733**	**1.05**	**100.00**

Subbasin 110702040302

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	70	0.00	0.31
Residential-Low Density	837	0.05	3.68
Residential-Medium Density	123	0.01	0.54
Residential-High Density	12	0.00	0.05
Industrial	0	0.00	0.00
Southwestern US (arid) range	11	0.00	0.05
Forest-Deciduous	928	0.05	4.08
Forest-Mixed	31	0.00	0.14
Range-Brush	1	0.00	0.00
Range-Grasses	5,011	0.28	22.03
Hay	11,193	0.63	49.20
Agricultural Land-Row Crops	3,966	0.22	17.43
Wetlands-Forested	566	0.03	2.49
Total	**22,750**	**1.28**	**100.00**

Subbasin 110702040303

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	108	0.01	0.49
Residential-Low Density	886	0.05	4.08
Residential-Medium Density	196	0.01	0.90
Residential-High Density	6	0.00	0.03
Industrial	7	0.00	0.03
Forest-Deciduous	1,373	0.08	6.31
Forest-Mixed	28	0.00	0.13
Range-Brush	1	0.00	0.01
Range-Grasses	4,695	0.26	21.59
Hay	8,763	0.49	40.30
Agricultural Land-Row Crops	5,545	0.31	25.50
Wetlands-Forested	134	0.01	0.62
Wetlands-Non-Forested	2	0.00	0.01
Total	**21,743**	**1.22**	**100.00**

Subbasin 110702040401

LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	155	0.01	0.58
Residential-Low Density	1,083	0.06	4.04
Residential-Medium Density	228	0.01	0.85
Residential-High Density	28	0.00	0.10
Industrial	7	0.00	0.03
Southwestern US (arid) range	2	0.00	0.01
Forest-Deciduous	2,391	0.13	8.92
Forest-Mixed	18	0.00	0.07
Range-Brush	4	0.00	0.02
Range-Grasses	7,283	0.41	27.15

Subbasin 110702040401, cont.			
LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Hay	12,617	0.71	47.04
Agricultural Land-Row Crops	2,981	0.17	11.11
Wetlands-Forested	22	0.00	0.08
Wetlands-Non-Forested	2	0.00	0.00
Total	**26,821**	**1.50**	**100.00**
Subbasin 110702040403			
LANDUSE:	Area[acres]	%Watershed Area	%Subbasin Area
Water	132	0.01	0.66
Residential-Low Density	910	0.05	4.55
Residential-Medium Density	388	0.02	1.91
Residential-High Density	113	0.01	0.57
Industrial	18	0	0.09
Southwestern US (arid) range	1	0	0.01
Forest-Deciduous	772	0.04	3.86
Forest-Mixed	35	0	0.18
Range-Brush	8	0	0.04
Range-Grasses	1,355	0.08	6.78
Hay	10,548	0.59	52.75
Agricultural Land-Row Crops	5,707	0.32	28.54
Wetlands-Forested	12	0	0.06
Wetlands-Non-Forested	1	0	0
Total	**19,997**	**1.12**	**100.00**

4.3 Load Reduction Estimate Methodology

4.3.1 Cropland

Baseline loadings are calculated using the SWAT model delineated to the HUC 14 watershed scale. BMP load reduction efficiencies are derived from K-State Research and Extension Publication MF-2572. [25] Load reduction estimates are the product of baseline loading and the applicable BMP load reduction efficiencies.

4.3.2 Livestock

Baseline nutrient loadings per animal unit are calculated using the Livestock Waste Facilities Handbook.[26] Livestock management practice load reduction efficiencies are derived from numerous sources including K-State Research and Extension Publication MF-2737 and MF-2454.[27] Load reduction estimates are the product of baseline loading and the applicable BMP load reduction efficiencies.

NOTE: The SLT of the Upper Neosho Watershed has determined that the focus of this WRAPS process will be on three key concerns of the watershed listed in order of importance:

1. **Sedimentation**
    a. **Cropland erosion**
2. **Nutrients**
    a. **Cropland runoff of fertilizer**
    b. **Livestock runoff of manure**
3. ***E. coli* Bacteria**
    a. **Livestock manure runoff**

All goals and best management practices will be aimed at restoring water quality or protecting the watershed from further degradation. The following sections in this report will address these concerns.

5.0 Impairments Addressed by the SLT

5.1 Sediment

Reducing erosion is necessary for a reduction in sediment. Erosion can be caused by tillage practices and livestock issues. Agricultural best management practices (BMPs) such as continuous no-till, conservation tillage, grass buffer strips around cropland, terraces, grassed waterways and reducing activities within the riparian areas will reduce erosion and improve water quality.

Possible Sources of Sediment in the Watershed

Activities performed on the land affects sediment that is transported downstream to the lakes. Physical components of the terrain are important in sediment movement.

- Slope of the land, propensity to generate runoff and soil type.
- Streambank erosion and sloughing of the sides of the river and stream bank. A lack of riparian cover can cause washing on the banks of streams or rivers and enhance erosion.
- Cropland that does not have conservation practices will have a greater amount of sediment runoff than those fields with waterways or buffer strips in addition to practicing no-till or conservation tillage.
- Silt that is present in the stream from past activities and is gradually moving downstream with each high intensity rainfall event.

Activities performed on the land affects sediment that is transported downstream to the lakes. Agricultural BMPs that will help reduce sediment deposition in waterways are (in no particular order, many other BMPs exist):

- No-till
- Minimum tillage
- Vegetative buffers and riparian areas
- Grassed waterways
- Grassed terraces
- Wetland creation
- Establishing permanent vegetative cover
- Farming on the contour
- Conservation crop rotation

Cropland BMPs that have been selected by the SLT based on acceptability by the landowners, cost effectiveness and pollutant load reduction effectiveness are:

- Conservation crop rotation
- Establishing permanent vegetation in croplands
- No-till cropping practices
- Vegetative buffers
- Establishing and maintaining terraces in cropland
- Subsurface fertilization

This section will review several potential sources or environmental actions that have the potential of increasing sediment in the waters. They are (in no particular order of importance):

- Land use
- T-factor or soil loss
- Hydrologic soil groups
- Precipitation distribution

5.1.1 Cropland Erosion

The cropland erosion Targeted Areas have been selected by SWAT modeling analysis. These areas were chosen due to land use or the high density of cropland, soil types, soil slope and weather. The Targeted Areas for cropland in this watershed are divided into 2 areas: Tier 1 and Tier 2. The SLT would like to focus on Tier 1 first and then Tier 2 projects when all Tier 1 projects are complete. Causes of erosion are discussed in more detail in the rest of this section.

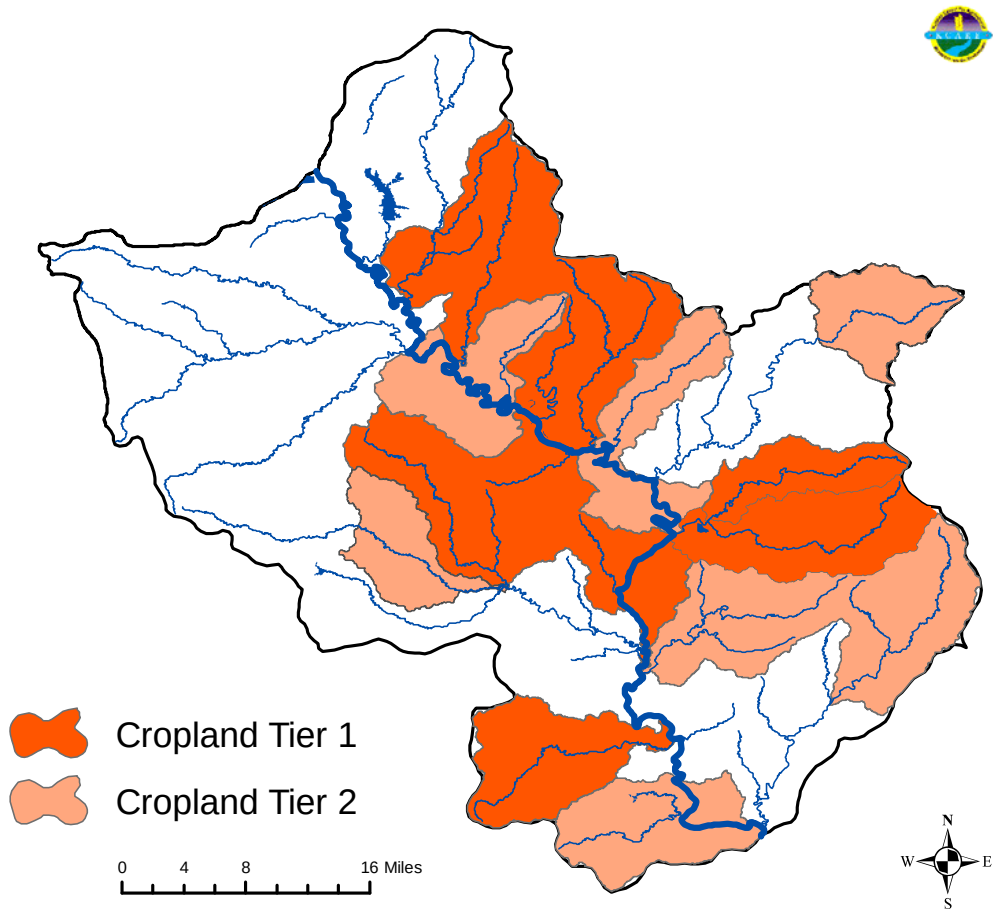


Figure 19. Targeted Area for Cropland in the Watershed as Determined by SWAT Analysis.

The Targeted Area Tier 1 encompasses 240,427 acres and is 28% of the entire watershed. The predominant land use is hay production at 42%, then row crop areas at 32%. Tier 2 encompasses 212,494 acres or 24% of the watershed. The predominant land use is hay production fields at 45%, then row crops at 31%. Implementing BMPs in the Cropland Targeted Area will reduce erosion. It is hoped that the need to develop a siltation TMDL in these sections of the watershed will be averted.

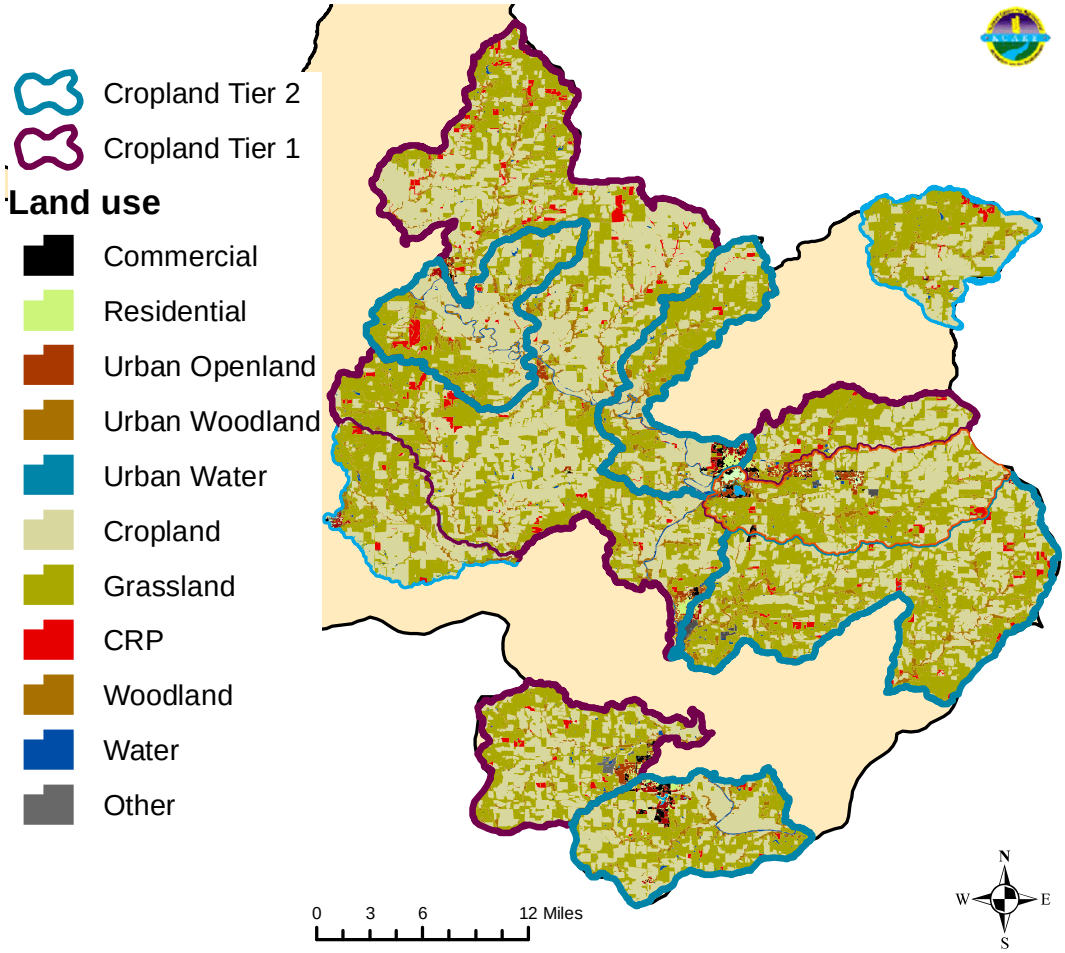


Figure 20. Land Use in the Entire Targeted Area. [3]

Table 14. Land Use in the Entire Targeted Area. [23]

Land Use	Acres		% of Entire Targeted Area
	Cropland Tier 1	Cropland Tier 2	
Water	1,850	1,851	0.82
Residential-Low Density	10,368	9,470	4.38
Residential-Medium Density	3,282	3,393	1.47
Residential-High Density	663	816	0.33
Industrial	132	235	0.08
Southwestern US (Arid) Range	560	85	0.14
Forest-Deciduous	15,228	13,118	6.26
Forest-Mixed	290	371	0.15
Range-Brush	47	30	0.02
Range-Grasses	27,418	19,388	10.33
Hay	101,490	95,702	43.54
Agricultural Land-Row Crops	77,670	65,559	31.62
Wetlands-Forested	1,379	2,423	0.84
Wetlands-Non-Forested	48	53	0.02
Total	**240,427**	**212,494**	**100.00**

5.1.1.A Soil Erosion Caused by Wind and/or Water

NRCS has established a "T factor" in evaluating soil erosion. T is the soil loss tolerance factor. It is defined as the maximum amount of erosion at which the quality of a soil as a medium for plant growth can be maintained. It is assigned to soils without respect to land use or cover and ranges from 1 ton per acre for shallow soils to 5 tons per acre for deep soils that are not as affected by loss of productivity by erosion. T factors represent the goal for maximum annual soil loss in sustaining productivity of the land use. [28]

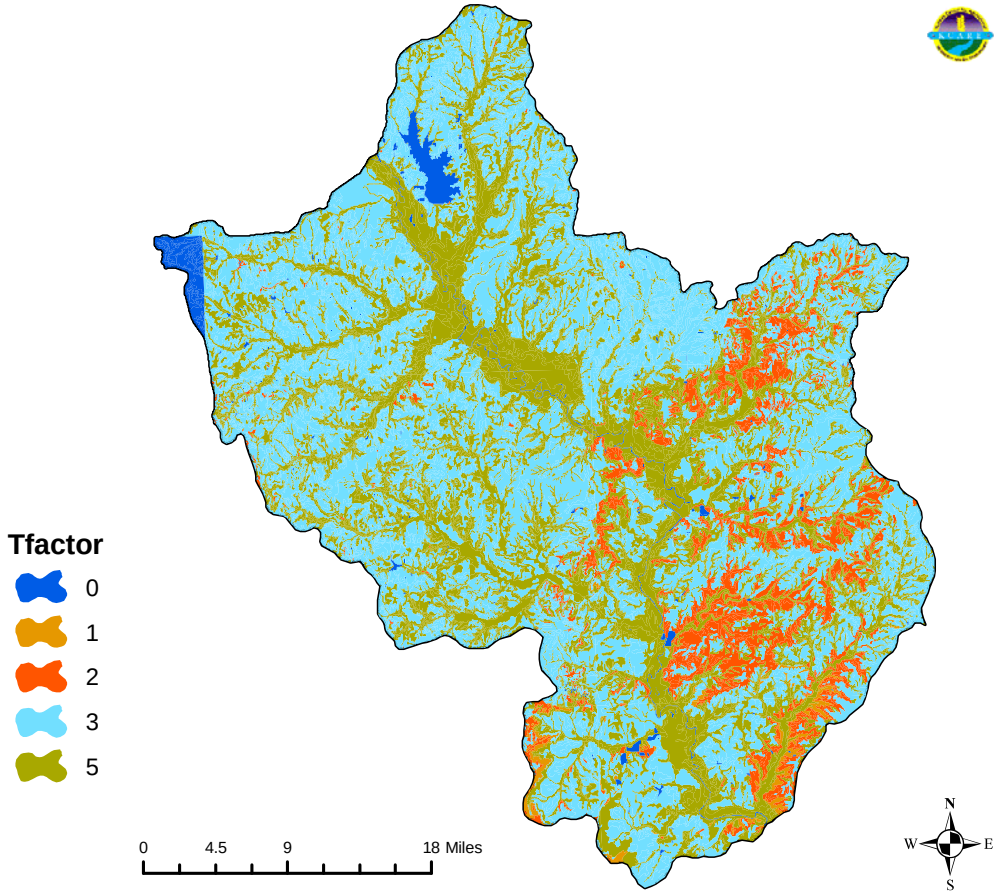


Figure 21. T Factor of the Watershed. [29]

The predominant soil loss tolerance category in the watershed is 3. This is in 52% of the soils of the watershed. This indicates that the soils are moderately deep and can be erosive and highlights the importance of proper conservation techniques to protect from soil loss.

Table 15. T Factor Summarization in the Watershed. [29]

Watershed		
T Factor	Acres in Watershed	Percent of Watershed
3	455,198	**52.14**
5	323,394	37.04

T Factor in the Watershed, cont.		
T Factor	Acres in Watershed	Percent of Watershed
2	70,341	8.06
0	16,744	1.92
1	7,316	0.84
Total	**872,993**	**100.00**

5.1.1.B Soil Erosion Influenced by Soil Type and Runoff Potential

Soil type has an influence on runoff potential and erosion throughout the watershed. Soils are classified into four hydrologic soil groups (HSG). The soils within each of these groups have the same runoff potential after a rainfall event if the same conditions exist, such as plant cover or storm intensity. Soils are categorized into four groups: A, B, C and D.

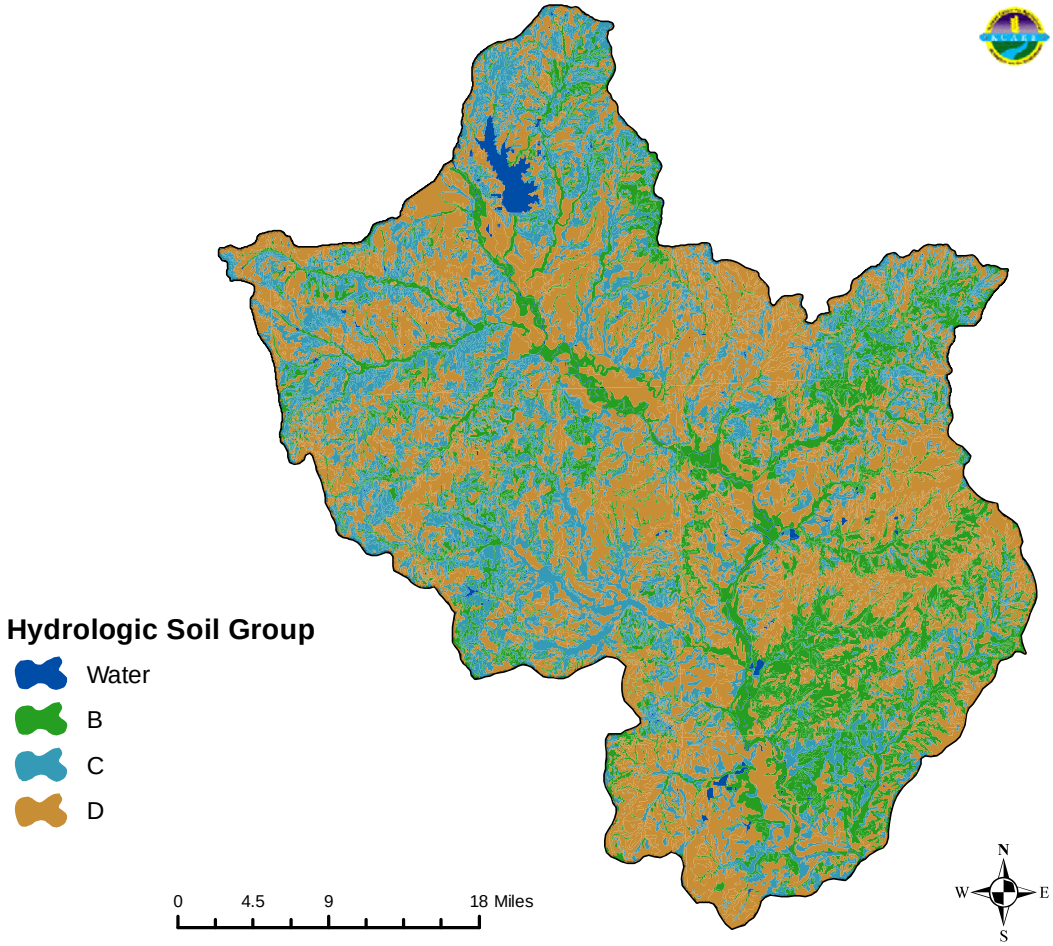


Figure 22. Hydrologic Soil Groups of the Watershed. [29]

The watershed is comprised of 48% Soil Group D. These soils have the highest runoff potential. They have slow infiltration rates and are primarily composed of

clay. Fifty percent of the soils are Groups B and C with a slower infiltration rate. These high numbers for Soil Group D highlight the importance of slowing water flow from rainfall events to allow the soil adequate time to absorb the water before it flushes across plowed fields into creeks and streams causing erosion and degradation. BMPs such as no-till, grassed waterways and buffer strips will help to slow rainfall runoff.

Table 16. Hydrologic Soil Groups of the Watershed. [29]

Entire Watershed			
Hydrologic Soil Group	**Definition**	**Acres of Watershed in HSG**	**Percentage of Watershed in HSG**
D	Soils with high runoff potential. Soils having very slow infiltration rates even when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a clay pan or clay layer at or near the surface, and shallow soils over nearly impervious material.	418,010	**47.88**
C	Soils having slow infiltration rates even when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine textures.	237,278	27.18
B	Soils having moderate infiltration rates even when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately well drained to sell drained soils with moderately fine to moderately coarse textures.	206,614	23.67
Other	Water, dams, pits, sewage lagoons	11,091	1.27
A	Soils with low runoff potential. Soils having high infiltration rates even when thoroughly wetted and consisting chiefly of deep well drained to excessively well-drained sands or gravels.	0	0
Total		**872,993**	**100.00**

5.1.1.C Rainfall and Runoff

Rainfall duration (extended duration of rainfall events causing soil saturation and subsequent runoff) and intensity (high rainfall rates overwhelming soil adsorptive capacity causing runoff) are key components that affect sediment runoff from agricultural cropland. These events can cause cropland erosion, rangeland gully erosion and sloughing of streambanks, which add sediment to streams, rivers and reservoirs. High intensity rainfall events primarily occur in the late spring and early summer in this watershed. This emphasizes the importance of utilizing no-till or conservation tillage to provide a cover on fields in the late spring. Also important are stable river banks utilizing buffer strips and cropland conservation practices to prevent soil loss. See Figure below.

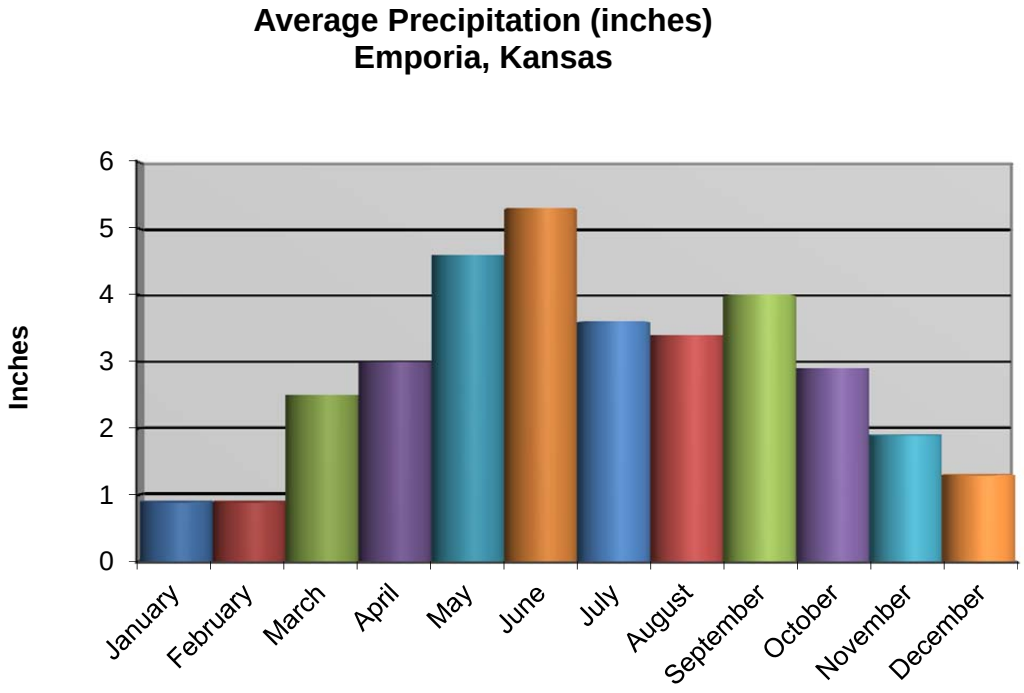


Figure 23. Average Precipitation by Month. [30]

The Upper Neosho watershed has an average rainfall range of 35 to 41 inches per year. USGS has two sampling sites, at Burlington and Iola, along the Neosho River that monitor flow. KDHE has eleven sampling sites in the watershed that monitor water quality. See figure below for site locations.

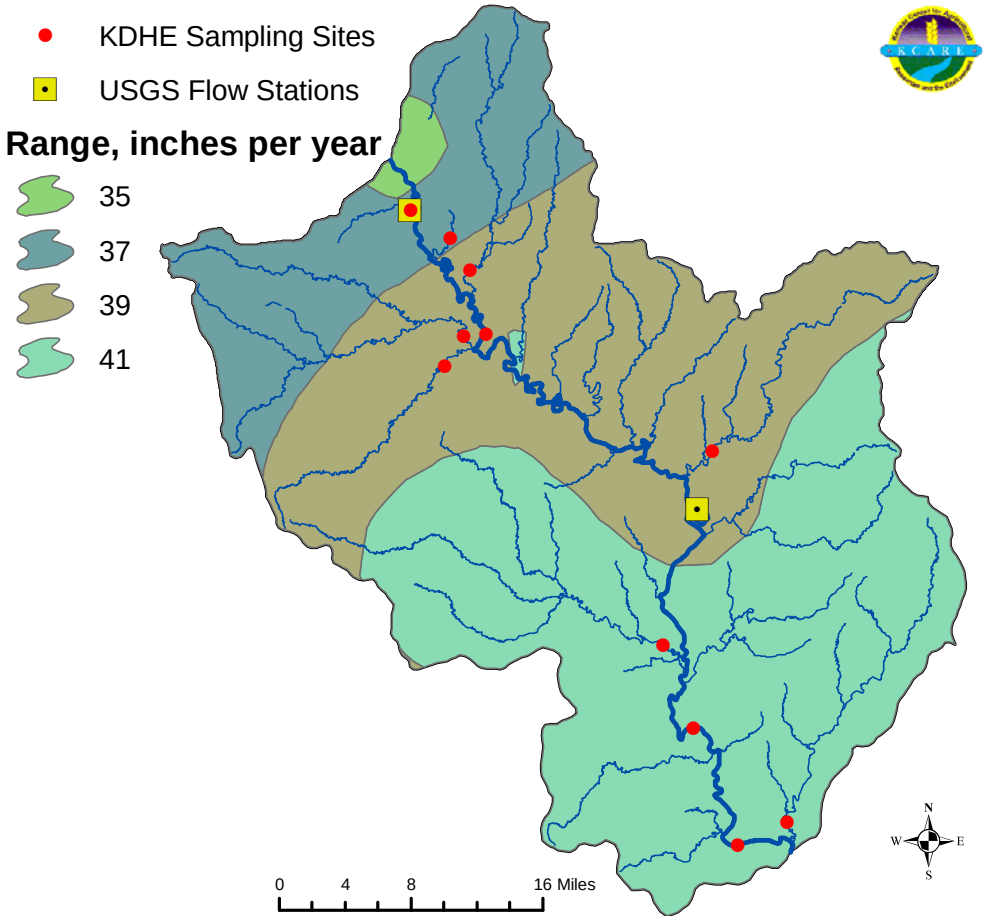
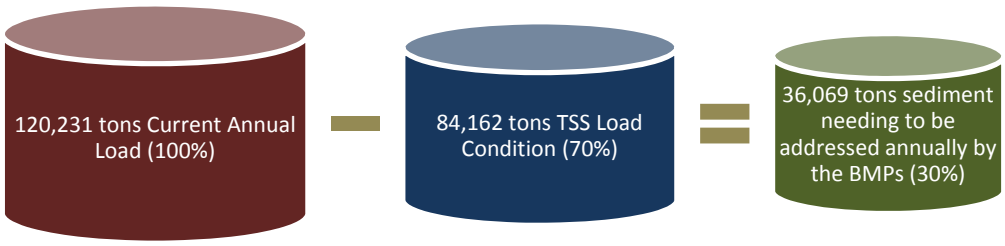


Figure 24. Rainfall in the Upper Neosho Watershed. [31]

5.1.2 Sediment Pollutant Loads and Load Reductions

The current estimated sediment load in the Upper Neosho Watershed is **120,231** tons per year according to the TMDL section of KDHE. Since there are no sediment TMDLs in the watershed at this time, the overall goal of this WRAPS as set by KDHE is to reduce sediment by 30% (36,069 tons). This is the amount of sediment reduction that will have to be met by implemented BMPs in the watershed. **At the end of this forty year plan, if all BMPs have been implemented, 36,069 tons per year of sediment will have been reduced from the watershed.**



The SLT has laid out specific BMPs that they have determined will be acceptable to watershed residents as listed below. Specific acreages or projects that need to be implemented have been determined through modeling and economic analysis and approved by the SLT as listed below. The duration of this plan is forty years as determined by the time required to meet the phosphorus reduction goal. The sediment reduction goal will be met in Year 7 of the plan if all BMPs are implemented. When the goal is met, the sediment goal will be characterized as "protection" instead of "restoration".

Table 17. BMPs in Support of the Management Practices to Reduce Sediment Contribution Aimed at Reducing Sediment by 30% as Determined by KDHE.

Protection Measures	Best Management Practices and Other Actions	Acres or Projects to be Implemented		
		Cropland Groundtruthing Determined by Adoption Rates		
1.0 Prevention of sediment contribution from **cropland**	1.1 Establish conservation crop rotation	Current adoption rate = 73%	Adoption rate goal = 93%	1,271 acres
	1.2 Establish permanent vegetation	Current adoption rate = 0%	Adoption rate goal = 10%	388 acres
	1.3 Encourage continuous no-till cultivation practices	Current adoption rate = 0.04%	Adoption rate goal = 30%	777 acres
	1.4 Establish vegetative buffer strips along crop fields	Current adoption rate = 0.08%	Adoption rate goal = 15%	478 acres treated
	1.5 Establish grassed terraces	Current adoption rate = 73%	Adoption rate goal = 88%	324 acres treated
	1.6 Implement utilization of subsurface fertilizer application	Current adoption rate = 0%	Adoption rate goal = 30%	777 acres

The table below lists the cropland BMPs and acres implemented with the associated load reductions attained by implementing all of these BMPs.

Table 18. Estimated Sediment Load Reductions for Implemented BMPs on Cropland Aimed at Reducing Sediment by 30% as Determined by KDHE.

Annual Soil Erosion Reduction (tons), Cropland BMPs							
Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	1,126	1,289	2,035	832	341	0	5,623

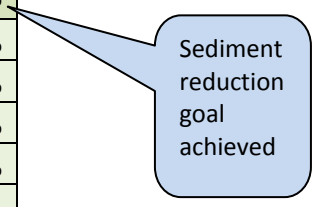
Annual Soil Erosion Reduction (tons), Cropland BMPs, cont.							
Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
2	2,251	2,578	4,070	1,663	683	0	11,245
3	3,377	3,868	6,105	2,495	1,024	0	16,868
4	4,502	5,157	8,140	3,326	1,366	0	22,491
5	5,628	6,446	10,175	4,158	1,707	0	28,114
6	6,753	7,735	12,210	4,990	2,048	0	33,736
7	7,879	9,025	14,245	5,821	2,390	0	39,359
8	9,004	10,314	16,280	6,653	2,731	0	44,982
9	10,130	11,603	18,315	7,484	3,072	0	50,605
10	11,255	12,892	20,350	8,316	3,414	0	56,227
11	11,255	14,181	22,385	9,148	3,755	0	60,724
12	11,255	15,471	24,420	9,979	4,097	0	65,222
13	11,255	16,760	26,455	10,811	4,438	0	69,719
14	11,255	18,049	28,490	11,643	4,779	0	74,216
15	11,255	19,338	30,525	12,474	5,121	0	78,713
16	11,255	20,627	32,560	13,306	5,462	0	83,210
17	11,255	21,917	34,595	14,137	5,804	0	87,708
18	11,255	23,206	36,630	14,969	6,145	0	92,205
19	11,255	24,495	38,665	15,801	6,486	0	96,702
20	11,255	25,784	40,700	16,632	6,828	0	101,199
21	11,255	25,784	42,735	17,464	7,169	0	104,407
22	11,255	25,784	44,769	18,295	7,510	0	107,615
23	11,255	25,784	46,804	19,127	7,852	0	110,823
24	11,255	25,784	48,839	19,959	8,193	0	114,031
25	11,255	25,784	50,874	20,790	8,535	0	117,239
26	11,255	25,784	52,909	21,622	8,876	0	120,447
27	11,255	25,784	54,944	22,453	9,217	0	123,655
28	11,255	25,784	56,979	23,285	9,559	0	126,863
29	11,255	25,784	59,014	24,117	9,900	0	130,071
30	11,255	25,784	61,049	24,948	10,242	0	133,279
31	12,194	26,676	62,457	25,418	10,523	0	137,268
32	13,133	27,568	63,865	25,887	10,805	0	141,257
33	14,071	28,459	65,273	26,356	11,086	0	145,246
34	15,010	29,351	66,681	26,826	11,368	0	149,235
35	15,948	30,243	68,089	27,295	11,649	0	153,224
36	16,887	31,134	69,497	27,764	11,931	0	157,213
37	17,826	32,026	70,905	28,233	12,213	0	161,202
38	18,764	32,918	72,313	28,703	12,494	0	165,191
39	19,703	33,809	73,720	29,172	12,776	0	169,180

Annual Soil Erosion Reduction (tons), Cropland BMPs, cont.							
Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
40	20,641	34,701	75,128	29,641	13,057	0	173,170

The table below shows the load reduction for sediment that is attained by implementing all cropland BMPs annually. The percent of achievement is illustrated in the right column. At the end of Year 7, if all BMPs are implemented, the need for implementing new TSS TMDLs in the Upper Neosho Watershed will be reduced as the goal of reducing sediment by 30% will be achieved.

Table 19. Cropland Sediment Reductions Aimed at Reducing Sediment by 30% as Determined by KDHE.

Year	Cropland Reduction (tons)	% of Load Reduction Goal
1	5,623	16%
2	11,245	31%
3	16,868	47%
4	22,491	62%
5	28,114	78%
6	33,736	94%
7	39,359	109%
8	44,982	125%
9	50,605	140%
10	56,227	156%
11	60,724	168%
12	65,222	181%
13	69,719	193%
14	74,216	206%
15	78,713	218%
16	83,210	231%
17	87,708	243%
18	92,205	256%
19	96,702	268%
20	101,199	281%
21	104,407	289%
22	107,615	298%
23	110,823	307%
24	114,031	316%
25	117,239	325%
26	120,447	334%



Sediment Reductions, cont.		
Year	Cropland Reduction (tons)	% of Load Reduction Goal
27	123,655	343%
28	126,863	352%
29	130,071	361%
30	133,279	370%
31	137,268	381%
32	141,257	392%
33	145,246	403%
34	149,235	414%
35	153,224	425%
36	157,213	436%
37	161,202	447%
38	165,191	458%
39	169,180	469%
40	173,170	480%

Refer to Section 7, "Costs of BMP Implementation" for specific BMP costs in order to meet the TMDL.

5.2 Nutrients and *E. coli* Bacteria

5.2.1 Nutrients

Nutrient related TMDLs in the watershed are found in Turkey Creek, Chanute Santa Fe Lake, and Gridley City Lake. [32]

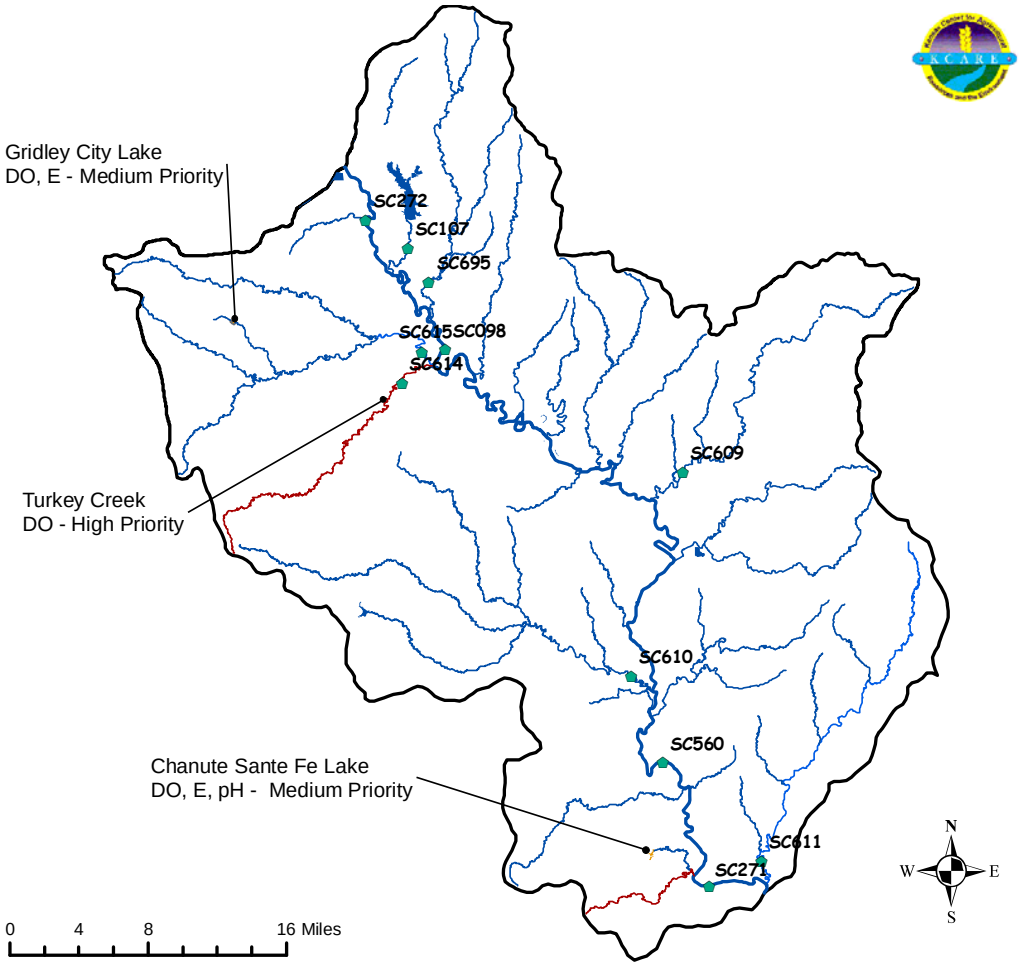


Figure 25. Nutrient Related TMDLS in the Watershed. [15] Red color indicates high priority, orange color indicates medium priority.

Nutrient related impairments that are listed on the 303d list are found in Long Creek and Big Creek in the form of dissolved oxygen impairments. [33]

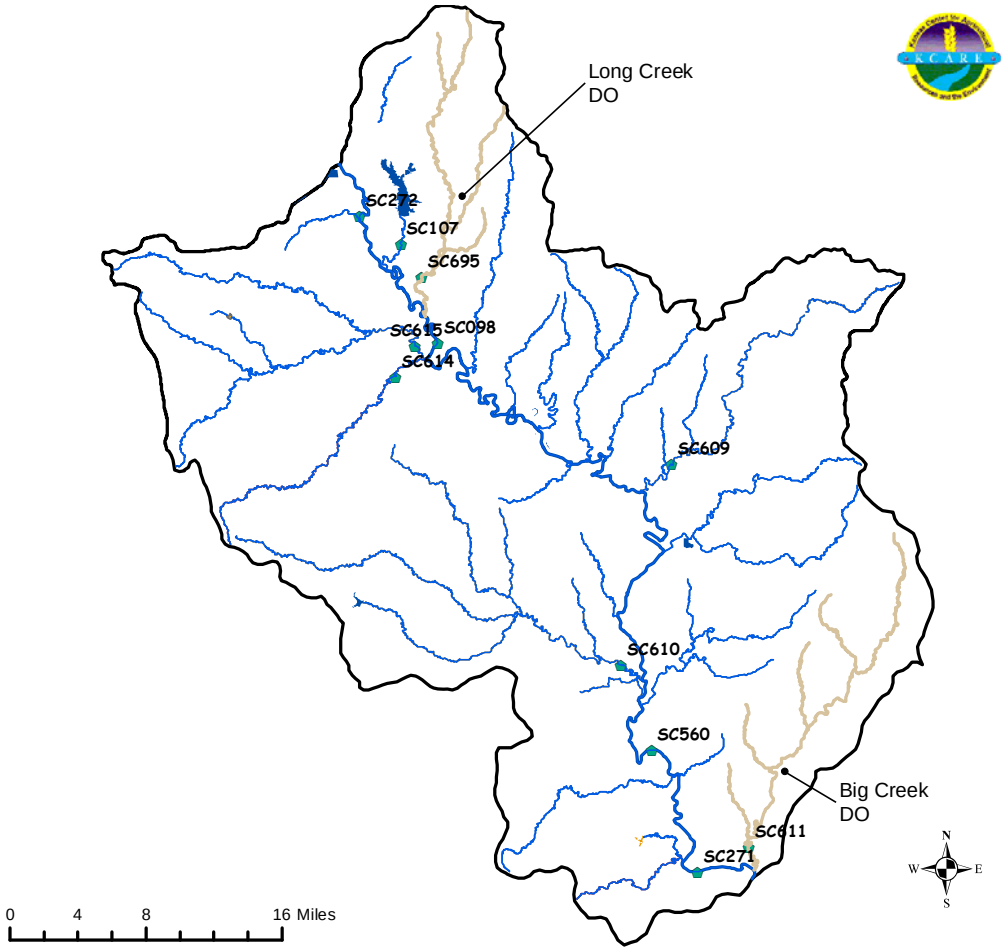


Figure 26. Nutrient Related Impairments on the 303d List. [17] Tan color indicates Low Priority.

Eutrophication is a natural process that occurs when a water body receives excess nutrients. These excess nutrients, primarily nitrogen and phosphorus, create optimum conditions that are favorable for algal blooms and plant growth. Chanute Santa Fe Lake and Gridley City Lake have TMDLs for eutrophication. Proliferation of algae and subsequent decomposition depletes available **dissolved oxygen** in the water profile. This lack of oxygen is devastating for aquatic species and can lead to fish kills. Turkey Creek, Chanute Santa Fe Lake and Gridley City Lake have TMDLs for low dissolved oxygen concentration. Also, Big Creek and Long Creek are listed on the 303d list for dissolved oxygen impairment. Desirable criteria for a healthy water profile includes dissolved oxygen (DO) rates greater than 5 milligrams per liter and **biological oxygen demand** (BOD) less than 3.5 milligrams per liter. BOD is a measure of the amount of oxygen removed in water from biodegradable organic matter. It can be used to indicate organic pollution levels. **pH** is another indicator of excess organic matter. The Neosho River near Chanute and Gridley City Lake have TMDLs for pH. Excess nutrients that contribute to these impairments can originate from failing septic systems and manure and fertilizer runoff in rural and urban areas. Nutrients, primarily phosphorus, are present in manure. Soluble

phosphorus can easily be transported in runoff from fields where livestock gather or cropland in which manure has been applied. Other nutrient issues can arise from fertilizers. Nitrogen and phosphorus can originate from fertilizer runoff caused by either excess application or a rainfall event immediately after application.

5.2.2 *E. coli* Bacteria

Livestock can cause certain pollutants in the water. Turkey Creek, Big Creek, Deer Creek and Owl Creek have TMDLs for **Fecal Coliform Bacteria** (FCB). FCB are a broad spectrum of bacteria species which includes *E. coli* bacteria. While FCB is present in the digestive tract of all warm blooded animals including humans and animals (domestic and wild), its presence in water indicates that the water has been in contact with human or animal waste. FCB is not itself harmful to humans, but its presence indicates that disease causing organisms, or pathogens, may also be present. A few of these are Giardia, Hepatitis, and Cryptosporidium. Presence of *E. coli* bacteria in waterways can originate from failing septic systems, runoff from livestock production areas, close proximity of any mammals to water sources, and manure application to agricultural fields. *E. coli* can originate in both rural and urban areas. It can be caused by both point and nonpoint sources. Failing onsite wastewater systems, manure runoff from livestock operations, improper manure disposal and livestock or wildlife access to streams can contribute to *E. coli* in streams.

FCB TMDLs in the watershed are found in Big Creek, Deer Creek, Owl Creek and Turkey Creek.

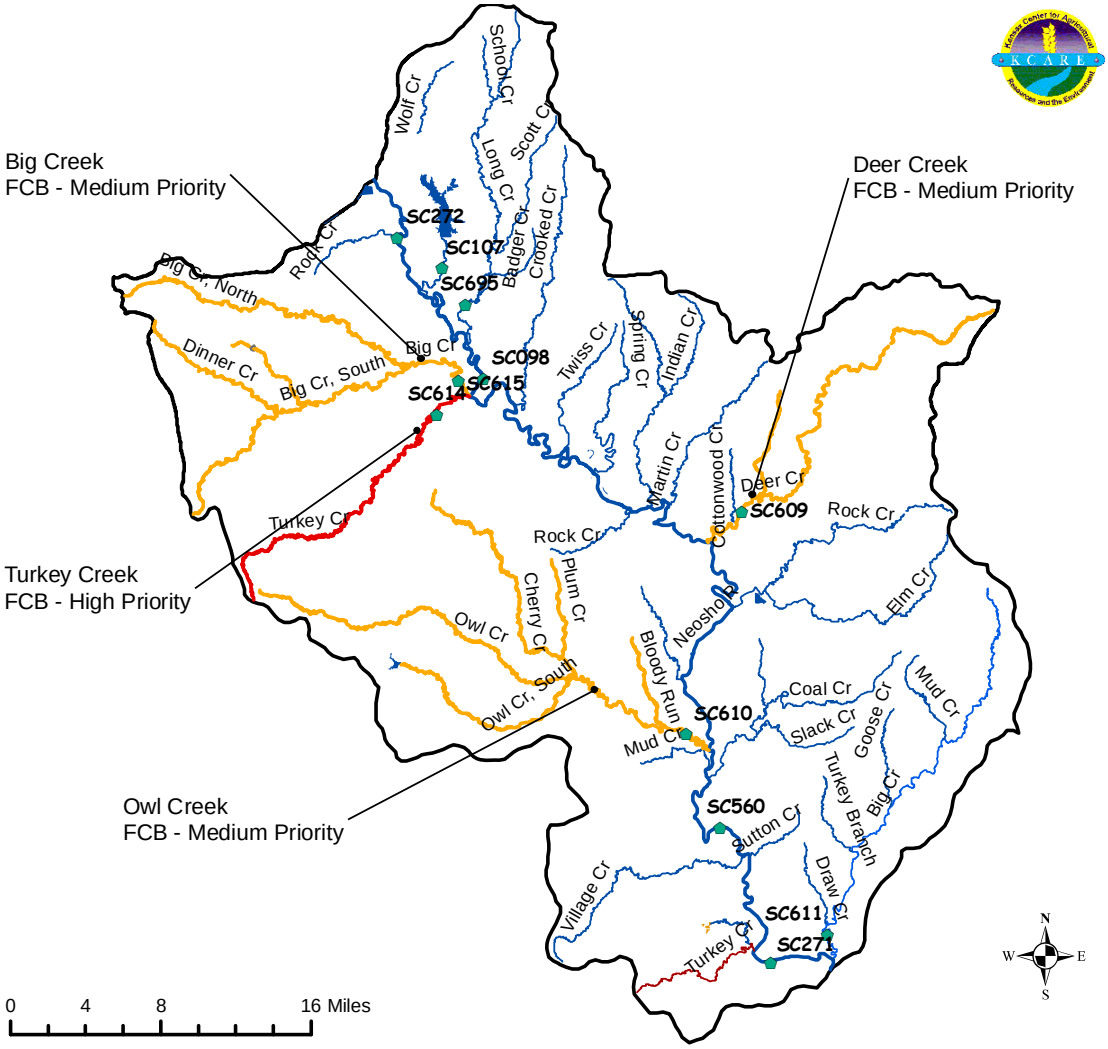


Figure 27. Fecal coliform bacteria TMDLs in the Watershed. [14] Red color indicates High Priority, orange color indicates Medium Priority.

In the past, KDHE has measured FCB in determination of issuance of a TMDL. Currently, KDHE is transitioning from measuring FCB to measuring levels of ***E. coli* bacteria** due to *E. coli* being more specific for indicating potential for human disease. In order to qualify for listing on the 303d list and subsequent TMDL, water samples will have to meet a new requirement: the average of five samples taken over a month's time will have to exceed the criteria level. In the past, one sample exceedance could require the issuance of a TMDL for FCB. Therefore, in the future, it will be more difficult for a TMDL for *E. coli* to be issued.

NOTE: Not all E. coli bacteria can be attributed to livestock. Wildlife has a contribution to E. coli loads. In addition, failing septic systems can be a source of E. coli bacteria from humans. A similar notation is that not all phosphorus and nitrogen contributions can be attributed to agricultural practices. Excess fertilization of lawns, golf courses and urban areas can

easily transport nitrogen and phosphorus downstream. However, for this WRAPS process, targeting will be for livestock.

In this WRAPS plan, the SLT has an interest in addressing the FCB TMDLs. All implemented BMPs for nutrients, expressed in terms of phosphorus reduction, will have the same positive benefit on *E. coli* reduction. Therefore, with this knowledge that the BMPs will reduce *E. coli*, *E. coli* will not be separated from phosphorus BMP implementation.

5.2.3 Possible Sources of Nutrients and *E. coli* Bacteria

An excess in nutrients can be caused by any land practice that will contribute nitrogen or phosphorus in surface waters. Examples are (but not limited to):

- Fertilizer runoff from agricultural and urban lands,
- Manure runoff (which could include fecal coliform bacteria) from domestic livestock and wildlife in close proximity to streams and rivers,
- Failing septic systems (which could include fecal coliform bacteria), and
- Phosphorus recycling from lake sediment.

Activities performed on the land affects nutrient loading in the streams and lakes of the watershed. Land use in this watershed is primarily agricultural related; therefore, agricultural BMPs are necessary for reducing nitrogen, phosphorus and fecal coliform bacteria. Some examples of applicable BMPs include:

- Soil sampling and appropriate fertilizer recommendations,
- Minimum and continuous no-till farming practices,
- Filter and buffer strips installed along waterways,
- Reduce contact to streams from domestic livestock,
- Develop nutrient management plans for manure management, and
- Replace failing septic systems.

This section will review several potential sources or environmental actions that have the potential of increasing nutrients in the waters. They are (in no order of importance):

1) Land use
   - Crop distribution in the watershed
   - Crop type in the counties of the watershed
   - Grassland distribution in the watershed
   - CRP in the watershed
2) Manure phosphorus and fecal coliform bacteria
   - Grazing density and Confined Animal Feeding Operations distribution
3) Rainfall and Runoff
4) Population and Wastewater Systems

NOTE: Not all phosphorus and nitrogen contributions can be attributed to agricultural practices. Excess fertilization of lawns, golf courses and urban areas can easily transport nitrogen and phosphorus downstream.

However, for this WRAPS process, targeting will be for cropland and livestock.

5.2.3.A Land Use

Land use activities have a significant impact on nutrients that are dissolved in water flow. Land use maps and tables have been provided in Section 3.1 of this report.

Cropland

Cropland commonly has manure applied from livestock confinement operations. This manure can wash into streams and creeks if applied too thickly, on frozen ground or immediately prior to a rainfall event. Phosphorus and nitrogen can runoff during rainfall events from fertilized fields and urban yards and contribute to eutrophication. In this watershed, the cropland is evenly distributed across the watershed with higher concentrations along the Neosho River and tributaries. Logically, most cropland is located in river and stream flood plains because over time flooding has deposited the most fertile soils. If cropland is located near a stream or river, it is important that conservation practices be employed to prevent nutrient runoff. Cropland consists of 35% of the watershed.

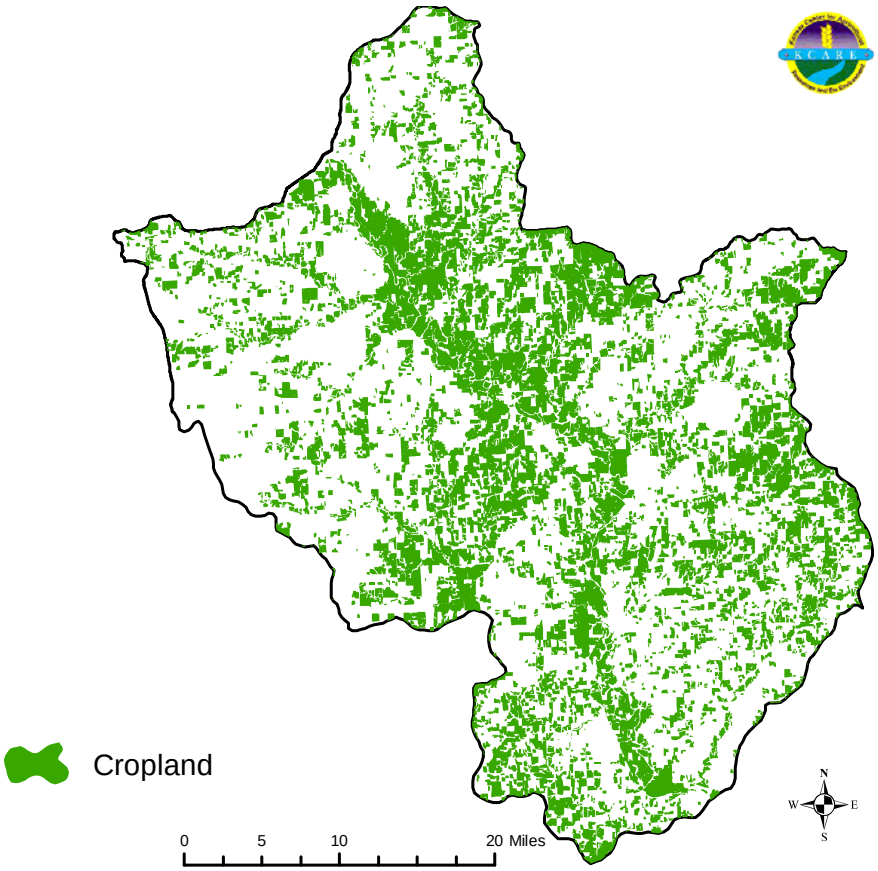


Figure 28. Cropland Distribution within the Watershed. [33]

Major crops planted in the watershed are soybeans, corn and wheat. Proportions of these crops are important due to the different fertilizer requirements of each particular crop and runoff or leaching potential of different fertilizers. Soybeans are legumes and require no additional nitrogen fertilization. Wheat requires nitrogen fertilizer. Usually nitrogen is applied in the fall when the crop is planted and again in the winter or spring when growth resumes. Corn is a heavy feeder of nitrogen and usually anhydrous ammonia is knifed in the fall. All cropland is adjusted for phosphorus by soil test results and recommended amounts. Not all crops need phosphorus application yearly. Nitrogen runoff can contribute to eutrophication, low dissolved oxygen and other nutrient related impairments. This watershed had over 50% of its cropland planted to soybeans in 2009.

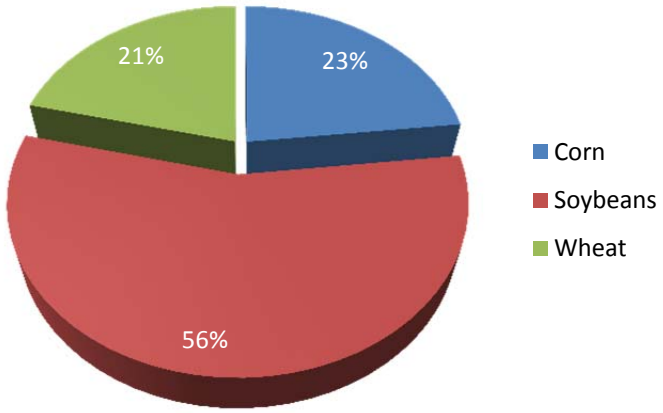


Figure 29. Three Major Crops in the Watershed, 2009. [34]

Table 20. Acres of Corn, Soybeans and Wheat in the Counties of the Watershed. [30]

County in Watershed	Corn for Grain, harvested acres, 2009	Soybeans, harvested acres, 2009	Wheat, harvested acres, 2008
Allen	26,000	79,500	38,100
Anderson	42,500	79,500	25,400
Coffey	31,500	84,500	25,800
Woodson	10,200	21,000	11,200
Total Acres	**110,200**	**264,500**	**100,500**

Grassland

Grassland with livestock that have access to streams and creeks can contribute to phosphorus loading. Cattle that are allowed to loaf in the water source during the hot summer months contribute phosphorus and fecal coliform bacteria by defecating directly in the streams. Overgrazing will lead to faster runoff of manure since there is not adequate biomass to slow water flow. Similarly, livestock that are housed in close proximity to a stream will also contribute phosphorus and fecal coliform bacteria during a runoff rainfall event. All BMPs that are to be implemented under the direction of the SLT will be directed towards restricting nutrient runoff, but will have a similar effect on fecal coliform bacteria runoff as an additional bonus. Grassland in this watershed is mainly concentrated in the western portion and consists of 51% of this watershed.

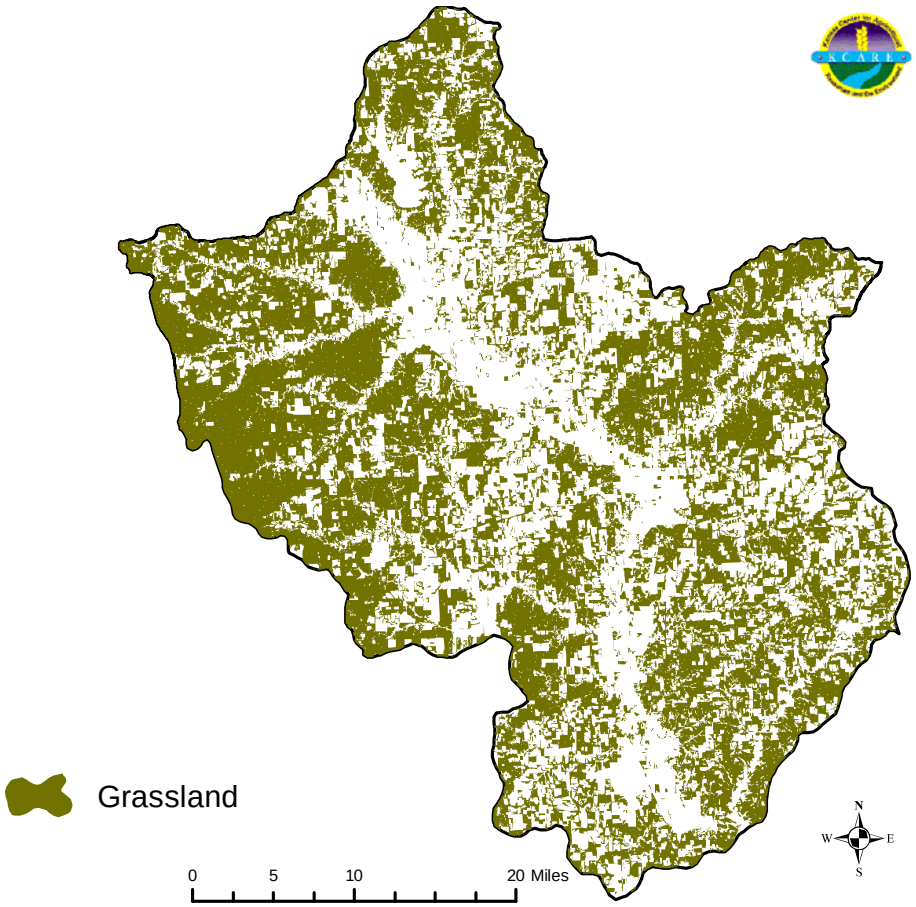


Figure 30. Grassland Distribution within the Watershed. [33]

CRP

The Conservation Reserve Program (CRP) is a USDA program that removes marginal cropland from production. The land is required to be established into permanent grass cover and the owner receives a yearly payment for the duration of the contract. This land cannot be grazed and therefore, is not fertilized so there will be no nutrient runoff or fecal coliform bacteria runoff. For this reason, CRP land is the least likely to contribute to phosphorus and eutrophication. A major concern is that with the recent high price of corn and soybeans, much of the CRP land will be returned to cropping when contracts expire. This will be a detriment to water quality. CRP is distributed in small fields equally throughout and consists of 2% of the watershed.

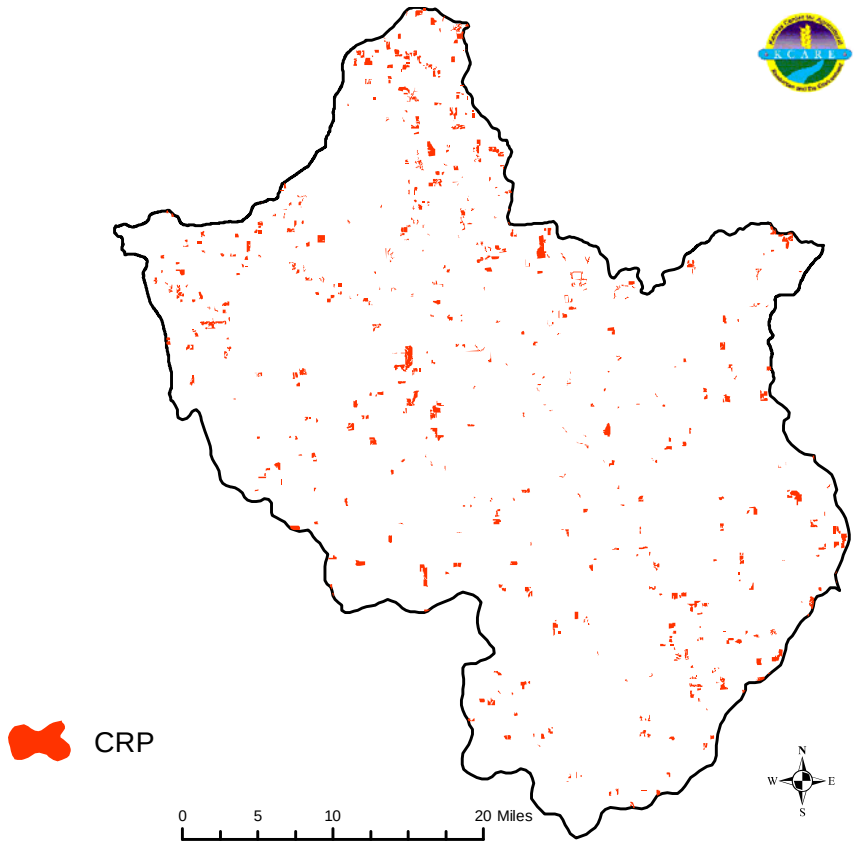


Figure 31. CRP Distribution within the Watershed. [33]

5.2.3.B Grazing Density and Confined Animal Feeding Operations

Grasslands consist of approximately 51 percent of the watershed. Grazing density will affect grass cover and potential manure runoff since a thicker and healthier grass cover will trap manure. This area also contains numerous livestock confinement operations. In Kansas, animal feeding operations (AFOs) with greater than 300 animal units must register with KDHE. Confined animal feeding operations (CAFOs), those with more than 999 animal units, must be permitted with EPA. An animal unit or AU is an equal standard for all animals based on size and manure production. For example: 1 AU=one animal weighing 1,000 pounds. The watershed contains numerous CAFOs. (This data is derived from KDHE, 2003. It may be dated and subject to change). Number of and location of CAFOs is important in nutrient reduction because of the manure that is generated and must be disposed of by the CAFOs. Most farmers haul manure to cropland and incorporate it to be used as fertilizer for the crops. However, due to hauling costs, fields close to the CAFO tend to receive more manure over the course of time than fields that are at a more distant location. These close fields will have a higher concentration of soil phosphorus and therefore, a higher incidence of runoff potential not only as ortho phosphate, but also as phosphorus that is attached to soil particles. Therefore, prevention of erosion is a part of reduction of phosphorus in surface water.

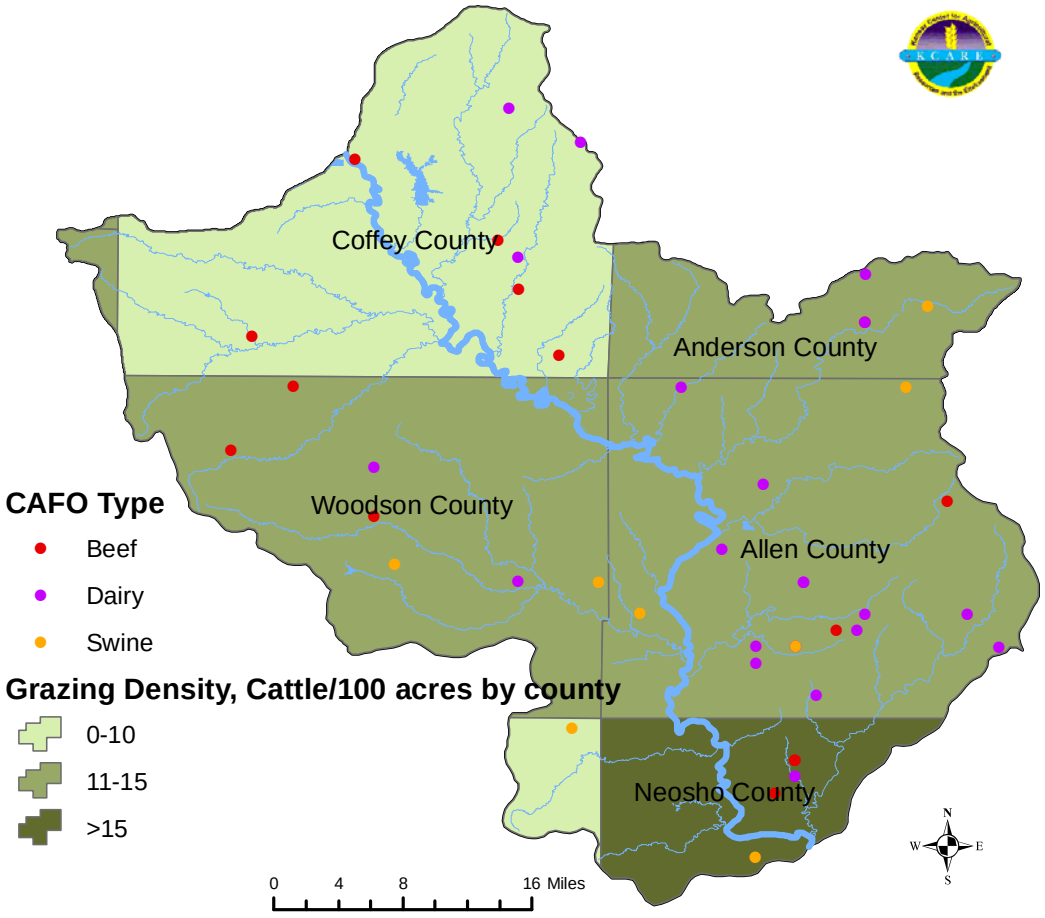


Figure 32. Grazing Density and CAFOs in the Watershed. [35]

5.2.3.C Rainfall and Runoff

Rainfall amounts and subsequent runoff along with flooding outside the stream channel can affect nutrient concentrations in the Upper Neosho Watershed. Manure runoff from livestock that are allowed access to a stream or manure applied before a rainfall or on frozen ground is washed into the stream causing a spike in phosphorus concentration. The same is true for fertilizer runoff in the streams and ultimately lakes downstream. Rainfall and runoff are discussed in greater detail in Section 5.1.1.C.

5.2.3.D Population and Wastewater Systems

Even though this WRAPS plan does not address human sources of phosphorus and fecal coliform bacteria, it must be acknowledged that there can be an impact. Failing, improperly installed or lack of an onsite wastewater system can contribute ***E. coli*** or phosphorus and nitrogen to the watershed. Thousands of onsite wastewater systems may exist in this watershed and the functional condition of these systems is generally unknown. However, best guess would be that ten percent of the wastewater systems in the watershed are insufficient or

nonexistent. [36] Therefore, the exact number of systems is directly tied to population.

Table 21. Population in the Watershed. [37]

County	Population	Persons per square mile
Coffey	8,409	14.1
Anderson	7,872	13.9
Allen	13,203	28.6
Neosho	16,223	29.7
Woodson	3,285	7.6
	Total: 22,324	**Average: 7.3**

Most of the watershed would be considered low population. The Kansas average for persons per square mile is 32.9, whereas, the average for the watershed is 7.3.

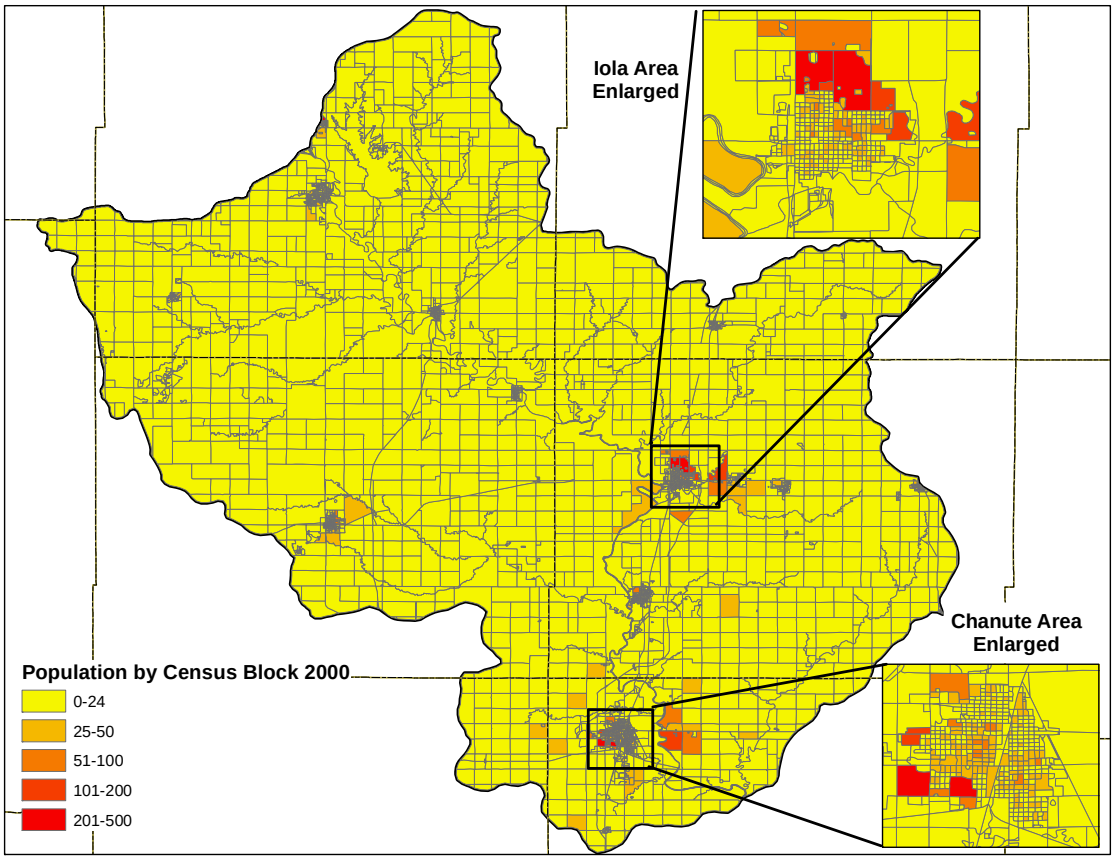


Figure 33. Census County 2000. [38]

5.2.4 Possible BMPs to Address Nutrients and *E. coli* Bacteria

BMPs that have been selected by the SLT are based on acceptability by the landowners, cost effectiveness and pollutant load reduction effectiveness.

The BMPs from cropland that are also related to nutrient runoff are:

- Conservation crop rotation
- Permanent vegetation
- Continuous no-till
- Vegetative buffers
- Grassed terraces
- Sub surface fertilization

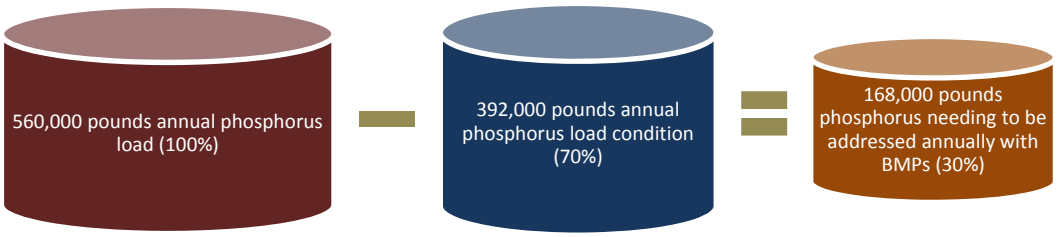
The SLT has chosen BMPs from livestock sources to implement to control nutrient runoff:

- Establishing vegetative filter strips
- Relocating feedlots
- Relocating pasture feeding sites
- Developing off-stream watering systems

5.2.5 Pollutant Loads and Load Reductions

All BMPs aimed at phosphorus, nitrogen and *E. coli* bacteria reductions will be expressed with a focus on phosphorus only. Sampling for phosphorus improvements in water quality is currently being monitored and changes in concentrations will be determined. All phosphorus BMPs will have a positive effect on *E. coli* bacteria and nitrogen concentrations

Total annual average phosphorus loads in the Upper Neosho Watershed are **560,000 pounds** according to the TMDL section of KDHE. This WRAPS will aim to achieve, as set by KDHE, a 30% reduction or 168,000 lbs, annually in phosphorous. This is the amount of phosphorus reduction that will have to be met by implemented BMPs in the watershed.



It is to be noted that the phosphorus related BMPs also support the fecal coliform bacteria and sediment TMDLs. The SLT has laid out specific BMPs that they have determined will be acceptable to watershed residents. Implementation of these BMPs is necessary to meet the required load reduction. These BMPs are listed in the table below. The acres and number of projects have been approved by the SLT. It will require forty years to meet the phosphorus goal if all BMPs are implemented.

Table 22. BMPs and Acreages or Projects to be Implemented in Support of Meeting the Dissolved Oxygen, Eutrophication and pH TMDL in Chanute Santa Fe Lake; the FCB TMDL in Turkey Creek, Deer Creek and Owl Creek; addressing the FCB 303d Listing of Big Creek and Long Creek; and a 30% Phosphorus Reduction in the Watershed.

Protection Measures	Best Management Practices and Other Actions	Acres or Projects to be Implemented Annually		
		Cropland Groundtruthing Determined by Adoption Rates		
1.0 Prevention of sediment contribution from **cropland**	1.1 Establish conservation crop rotation	Current adoption rate = 73%	Adoption rate goal = 93%	1,271 acres
	1.2 Establish permanent vegetation	Current adoption rate = 0%	Adoption rate goal = 10%	388 acres
	1.3 Encourage continuous no-till cultivation practices	Current adoption rate = 0.04%	Adoption rate goal = 30%	777 acres
	1.4 Establish vegetative buffer strips along crop fields	Current adoption rate = 0.08%	Adoption rate goal = 15%	478 acres treated
	1.5 Establish grassed terraces	Current adoption rate = 73%	Adoption rate goal = 88%	324 acres treated
	1.6 Implement utilization of subsurface fertilizer application	Current adoption rate = 0%	Adoption rate goal = 30%	777 acres
2.0 Prevention of phosphorus contribution from **livestock**	2.1 Encourage vegetative filter strips	1 site		
	2.2 Relocate feedlots	1 site every 3 years		
	2.3 Relocate pasture feeding sites	5 sites every 2 years		
	2.4 Develop off-stream watering systems	5 sites every 2 years		

The table below lists the cropland BMPs and the associated phosphorus load reductions attained by implementing all of these BMPs.

Table 23. Estimated Phosphorus Load Reductions for Implemented Cropland BMPs Aimed at Meeting the Dissolved Oxygen, Eutrophication and pH TMDL in Chanute Santa Fe Lake, and a 30% Phosphorus Reduction in the Watershed.

Annual Phosphorous Reduction (lbs), Cropland BMPs							
Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	684	783	659	509	206	824	**3,665**
2	1,367	1,566	1,318	1,018	411	1,648	**7,330**
3	2,051	2,349	1,978	1,528	617	2,472	**10,994**
4	2,735	3,132	2,637	2,037	822	3,296	**14,659**
5	3,419	3,915	3,296	2,546	1,028	4,120	**18,324**
6	4,102	4,698	3,955	3,055	1,234	4,944	**21,989**
7	4,786	5,481	4,614	3,564	1,439	5,768	**25,653**
8	5,470	6,265	5,274	4,073	1,645	6,592	**29,318**
9	6,153	7,048	5,933	4,583	1,850	7,416	**32,983**

Annual Phosphorous Reduction (lbs), Cropland BMPs, cont.							
Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
10	6,837	7,831	6,592	5,092	2,056	8,240	**36,648**
11	6,837	8,614	7,251	5,601	2,262	9,064	**39,629**
12	6,837	9,397	7,911	6,110	2,467	9,888	**42,610**
13	6,837	10,180	8,570	6,619	2,673	10,712	**45,591**
14	6,837	10,963	9,229	7,129	2,879	11,536	**48,572**
15	6,837	11,746	9,888	7,638	3,084	12,360	**51,553**
16	6,837	12,529	10,547	8,147	3,290	13,184	**54,534**
17	6,837	13,312	11,207	8,656	3,495	14,008	**57,515**
18	6,837	14,095	11,866	9,165	3,701	14,832	**60,496**
19	6,837	14,878	12,525	9,675	3,907	15,656	**63,478**
20	6,837	15,661	13,184	10,184	4,112	16,480	**66,459**
21	6,837	15,661	13,843	10,693	4,318	17,304	**68,657**
22	6,837	15,661	14,503	11,202	4,523	18,128	**70,855**
23	6,837	15,661	15,162	11,711	4,729	18,952	**73,053**
24	6,837	15,661	15,821	12,220	4,935	19,776	**75,251**
25	6,837	15,661	16,480	12,730	5,140	20,600	**77,449**
26	6,837	15,661	17,139	13,239	5,346	21,424	**79,647**
27	6,837	15,661	17,799	13,748	5,551	22,248	**81,845**
28	6,837	15,661	18,458	14,257	5,757	23,072	**84,043**
29	6,837	15,661	19,117	14,766	5,963	23,896	**86,241**
30	6,837	15,661	19,776	15,276	6,168	24,720	**88,439**
31	7,471	16,263	20,283	15,592	6,358	25,354	**91,322**
32	8,105	16,865	20,790	15,909	6,548	25,988	**94,206**
33	8,738	17,467	21,297	16,226	6,739	26,622	**97,089**
34	9,372	18,070	21,804	16,543	6,929	27,255	**99,973**
35	10,006	18,672	22,311	16,860	7,119	27,889	**102,856**
36	10,639	19,274	22,818	17,177	7,309	28,523	**105,740**
37	11,273	19,876	23,325	17,494	7,499	29,157	**108,623**
38	11,907	20,478	23,832	17,811	7,689	29,790	**111,507**
39	12,541	21,080	24,339	18,127	7,879	30,424	**114,390**
40	13,174	21,682	24,846	18,444	8,069	31,058	**117,274**

The table below lists the livestock BMPs and associated phosphorus load reductions attained by implementing all of these BMPs.

Table 24. Estimated Phosphorus Load Reductions for Implemented Livestock BMPs Aimed at Meeting the Dissolved Oxygen, Eutrophication and pH TMDL in Chanute Santa Fe Lake and a 30% Phosphorus Reduction in the Watershed.

Annual Phosphorous Load Reductions (lbs)					
Year	Vegetative Filter Strip	Relocate Feedlot	Relocate Pasture Feeding Site	Off Stream Watering System	Total
1	709	0	120	180	**1,009**
2	1,418	0	300	300	**2,018**
3	2,126	921	420	480	**3,948**
4	2,835	921	600	600	**4,956**
5	3,544	921	720	780	**5,965**
6	4,253	1,843	900	900	**7,895**
7	4,961	1,843	1,020	1,080	**8,904**
8	5,670	1,843	1,200	1,200	**9,913**
9	6,379	2,764	1,320	1,380	**11,843**
10	7,088	2,764	1,500	1,500	**12,852**
11	7,796	2,764	1,620	1,680	**13,860**
12	8,505	3,686	1,800	1,800	**15,791**
13	9,214	3,686	1,920	1,980	**16,799**
14	9,923	3,686	2,100	2,100	**17,808**
15	10,631	4,607	2,220	2,280	**19,738**
16	11,340	4,607	2,400	2,400	**20,747**
17	12,049	4,607	2,520	2,580	**21,756**
18	12,758	5,528	2,700	2,700	**23,686**
19	13,466	5,528	2,820	2,880	**24,695**
20	14,175	5,528	3,000	3,000	**25,703**
21	14,884	6,450	3,120	3,180	**27,633**
22	15,593	6,450	3,300	3,300	**28,642**
23	16,301	6,450	3,420	3,480	**29,651**
24	17,010	7,371	3,600	3,600	**31,581**
25	17,719	7,371	3,720	3,780	**32,590**
26	18,428	7,371	3,900	3,900	**33,599**
27	19,136	8,292	4,020	4,080	**35,529**
28	19,845	8,292	4,200	4,200	**36,537**
29	20,554	8,292	4,320	4,320	**37,486**
30	21,263	9,214	4,500	4,500	**39,476**
31	21,971	9,214	4,620	4,620	**40,425**
32	22,680	9,214	4,800	4,800	**41,494**
33	23,389	10,135	4,920	4,920	**43,364**
34	24,098	10,135	5,100	5,100	**44,433**
35	24,806	10,135	5,220	5,220	**45,381**

Annual Phosphorous Load Reductions (lbs), cont.					
Year	Vegetative Filter Strip	Relocate Feedlot	Relocate Pasture Feeding Site	Off Stream Watering System	Total
36	25,515	11,057	5,400	5,400	**47,372**
37	26,224	11,057	5,520	5,520	**48,320**
38	26,933	11,057	5,700	5,700	**49,389**
39	27,641	11,057	5,820	5,820	**50,338**
40	28,350	11,057	6,000	6,000	**51,407**

The table below demonstrates the combined load reduction for phosphorus that is attained if all cropland and livestock BMPs are implemented. The percent of TMDL achievement is illustrated in the right column. At the end of forty years phosphorus will be reduced to a level that will include the goal of meeting the dissolved oxygen, eutrophication and pH TMDL in Chanute Santa Fe Lake; the FCB TMDL in Turkey Creek, Deer Creek and Owl Creek; addressing the FCB 303d listing in Big Creek and Long Creek; and a 30% reduction of phosphorus as required by KDHE.

Table 25. Combined Cropland and Livestock BMP Phosphorus Load Reductions Aimed at Meeting the Dissolved Oxygen, Eutrophication and pH TMDL in Chanute Santa Fe Lake and a 30% Phosphorus Reduction in the Watershed.

Year	Cropland Reduction (lbs)	Livestock Reduction (lbs)	Total Reduction (lbs)	% of Load Reduction Goal
1	3,665	1,009	4,674	3%
2	7,330	2,018	9,347	6%
3	10,994	3,948	14,942	9%
4	14,659	4,956	19,615	12%
5	18,324	5,965	24,289	14%
6	21,989	7,895	29,884	18%
7	25,653	8,904	34,557	21%
8	29,318	9,913	39,231	23%
9	32,983	11,843	44,826	27%
10	36,648	12,852	49,499	29%
11	39,629	13,860	53,489	32%
12	42,610	15,791	58,400	35%
13	45,591	16,799	62,390	37%
14	48,572	17,808	66,380	40%
15	51,553	19,738	71,291	42%
16	54,534	20,747	75,281	45%
17	57,515	21,756	79,271	47%
18	60,496	23,686	84,182	50%
19	63,478	24,695	88,172	52%

Phosphorus Load Reductions, cont.				
Year	Cropland Reduction (lbs)	Livestock Reduction (lbs)	Total Reduction (lbs)	% of Load Reduction Goal
20	66,459	25,703	92,162	55%
21	68,657	27,633	96,290	57%
22	70,855	28,642	99,497	59%
23	73,053	29,651	102,703	61%
24	75,251	31,581	106,832	64%
25	77,449	32,590	110,038	65%
26	79,647	33,599	113,245	67%
27	81,845	35,529	117,373	70%
28	84,043	36,537	120,580	72%
29	86,241	37,486	123,727	74%
30	88,439	39,476	127,915	76%
31	91,322	40,425	131,747	78%
32	94,206	41,494	135,700	81%
33	97,089	43,364	140,453	84%
34	99,973	44,433	144,405	86%
35	102,856	45,381	148,238	88%
36	105,740	47,372	153,111	91%
37	108,623	48,320	156,944	93%
38	111,507	49,389	160,896	96%
39	114,390	50,338	164,728	98%
40	117,274	51,407	168,680	100%

Phosphorus Reduction goal achieved

Table 26. Annual Phosphorus Load Reduction by Category Aimed at Meeting the Dissolved Oxygen, Eutrophication and pH TMDL in Chanute Santa Fe Lake and a 30% Phosphorus Reduction in the Watershed.

Best Management Practice Category	Total Load Reduction (pounds)	% of Phosphorous TMDL
Cropland	3,665	78.4%
Livestock	1,009	21.6%
Total	**4,674**	**100.0 %**

Refer to Section 7, "Costs of BMP Implementation" for specific BMP costs.

6.0 Information and Education in Support of BMPs

6.1 Information and Education Activities

The SLT has determined which information and education activities will be needed in the 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. Listed below are the activities and events along with their costs and possible sponsoring agencies.

Table 27. Information and Education Activities and Events as Requested by the SLT.

Cropland BMP Implementation					
BMP	**Target Audience**	**Activity/Event**	**Time Frame**	**Estimated Costs**	**Service Providers**
Buffers	Landowners and farmers	Demonstration Projects	Annual – Spring	$5,000 per project	Conservation Districts
		Tour/Field Day highlighting grassed buffers	Annual - Summer	$1,000 per tour	Conservation Districts
		Tour/Field Day highlighting forested buffers	Annual - Summer	$1,700 per tour	Kansas Forest Service
		One-on-One Technical Assistance for Landowners	Annual - Ongoing	No cost	SCC Conservation Technician
No-Till	Farmers and Rental Operators	Scholarships for 5 farmers to attend No-Till Winter Conference	Annual – Winter	$750 ($150 per person)	No-Till on the Plains
		Tour/Field Day	Annual – Summer	$1,500	Conservation Districts County Extension Offices
		One on One Technical Assistance for Farmers	Annual - Ongoing	$2,000 per year	County Extension Offices
		Seasonal Informational Meetings	Annual – spring (plant) summer (harvest)	$5,500 ($2,750/meeting)	County Extension Offices

Cropland BMP Implementation, cont.					
BMP	**Target Audience**	**Activity/Event**	**Time Frame**	**Estimated Costs**	**Service Providers**
Subsurface Fertilizer Application	Farmers	Tour/Field Day	Annual – spring	Combine with no-till tour/field day	Conservation District and County Extension Offices
Terraces	Farmers	Tour/Field Day (covering all three BMPs)	Annual – Summer	$1,500 per tour	Conservation Districts County Extension Offices
Conservation Crop Rotations					
Permanent Vegetation					
Livestock BMP Implementation					
BMP	**Target Audience**	**Activity/Event**	**Time Frame**	**Estimated Costs**	**Service Providers**
Vegetative Filter Strips	Landowners and Ranchers	Demonstration Projects	Annual – Spring	Combined with riparian buffer demonstration	Conservation Districts
		Tour/Field Day	Annual - Summer	Combined with riparian buffer tour	Conservation Districts
		Workshop/ Informational Meeting	Annual –Winter	$1,000 per workshop	Conservation Districts
Relocate Pasture Feeding Sites	Ranchers	Demonstration Project	Annual – Spring	$5,000 per project	Kansas Rural Center
		Tour/Field Day	Annual - Summer	$500 per tour	Kansas Rural Center
		Informational Meeting/ Workshop	Annual - Fall	$500 per meeting	Kansas Rural Center

Livestock BMP Implementation, cont.					
BMP	**Target Audience**	**Activity/Event**	**Time Frame**	**Estimated Costs**	**Service Providers**
Off-Stream Watering Systems	Ranchers	Demonstration projects for pond construction and spring developments	Annual - Fall	$10,000 per project	Kansas Rural Center County Extension Offices
		Tour/Field Day	Annual - Summer	$500 per tour or field day	Kansas Rural Center County Extension Offices
		Informational Meeting/ Workshop	Annual - Fall	Combine with feeding sites meeting	Kansas Rural Center County Extension Offices
Relocate Feedlots	Landowners and Ranchers	Tour/Field Day	Annual - Summer	Combine with Feeding site meeting and tour	Kansas Rural Center County Extension Offices
General / Watershed Wide Information and Education					
BMP	**Target Audience**	**Activity/Event**	**Time Frame**	**Estimated Costs**	**Service Providers**
Educational Activities Targeting Youth	Educators, K-12 Students	Day on the Farm	Annual – Spring	$500 per event	Conservation Districts County Farm Bureau Kansas FFA Organization County Extension Offices KACEE
		Poster, essay, speech contests promoting WQ	Annual – Spring	$200	Conservation Districts KACEE
		Envirothon	Annual - Spring	$250	Conservation Districts KACEE
		Curriculum workshop for K-12 educators	Annual – Summer	$2,500 per workshop	KACEE

General / Watershed Wide Information and Education, cont.					
BMP	**Target Audience**	**Activity/Event**	**Time Frame**	**Estimated Costs**	**Service Providers**
Educational Activities Targeting Adults	Watershed residents	Newspaper/newsletter articles	Annual – Ongoing	No cost	Conservation Districts, County Extension Offices KACEE
		Presentation about water quality issues and WRAPS update at annual meetings	Annual – Winter	No cost	Conservation Districts County Extension Offices KACEE
		River Friendly Farms Information/Education and Technical Assistance	Annual - Ongoing	Included in Technical Assistance	Kansas Rural Center
Total Cost per Year				**$39,900**	

6.2 Evaluation of Information and Education Activities

All service providers conducting Information and Education (I&E) activities funded through the Upper Neosho WRAPS will be required to include an evaluation component in their project proposals and PIPs. 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 reductions.

7.0 Costs of implementing BMPs and Possible Funding Sources

The SLT has reviewed all the recommended BMPs listed in Section 6 of 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 (cropland and livestock). Most of the BMPs that are targeted will be advantageous to more than one impairment, thus being more efficient.

Summarized Derivation of Cropland BMP Cost Estimates

Conservation Crop Rotation: After being presented with information from K-State Research and Extension (Josh Roe) on the costs and benefits of conservation crop rotations, the SLT decided that a fair price to entice a producer to adopt a conservation crop rotation would be to pay them $5 an acre for 10 years, or a net present value of $38.84 per acre upfront assuming the NRCS discount rate of 4.75%

Permanent Vegetation: The cost of $150 an acre was calculated based on K-State Research and Extension estimates of the cost of planting and maintaining native grass.

No-Till: After being presented with information from K-State Research and Extension (Craig Smith and Josh Roe) on the costs and benefits of no-till, the SLT decided that a fair price to entice a producer to adopt no-till would be to pay them $10 per acre for 10 years, or a net present value of $77.69 per acre upfront assuming the NRCS discount rate of 4.75%.

Riparian Vegetative Buffer: The cost of $1,000 per acre was arrived at using average cost of installation figures from the conservation districts within the watershed and cost estimates from the KSU Vegetative Buffer Tool developed by Craig Smith.

Terraces: In consulting with numerous conservation districts, it was determined by Josh Roe that the average cost of building a terrace at this point in time is $1.25 per foot.

Sub surface Fertilization: WRAPS groups and KSU Ag Economists have decided $3.50 an acre for 10 years is an adequate payment to entice producers to convert to subsurface fertilizer application. Cost share is available through NRCS at 50%.

Summarized Derivation of Livestock BMP Cost Estimates
Vegetative Filter Strip: The cost of $714 an acre was calculated by Josh Roe and Mike Christian figuring the average filter strip in the watershed will require four hours of bulldozer work at $125 an hour plus the cost of seeding one acre in permanent vegetation estimated by Josh Roe.

Relocated Feedlot: The cost of moving a one acre feedlot of $6,621 was calculated by Josh Roe figuring the cost of fencing, a new watering system, concrete, and labor.

Relocated Pasture Feeding Site: The cost of moving a pasture feeding site of $2,203 was calculated by Josh Roe figuring the cost of building ¼ mile of fence, a permeable surface, and labor.

Off-Stream Watering System: The average cost of installing an alternative watering system of $3,500 was estimated by Herschel George, Marais des Cygnes Watershed Specialist who has installed numerous systems and has detailed average cost estimates.

Prices below reflect current prices (2010) for implementation and also include technical assistance costs such as NRCS planning and engineering design.

Table 28. Estimated Costs and Net Costs for Cropland Implemented BMPs.

Total Annual Cost, Cropland BMPs							
Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$49,346	$58,271	$60,343	$478,175	$33,076	$21,119	$700,330
2	$50,827	$60,019	$62,153	$492,520	$34,068	$21,752	$721,340
3	$52,351	$61,820	$64,017	$507,296	$35,090	$22,405	$742,980
4	$53,922	$63,675	$65,938	$522,515	$36,143	$23,077	$765,269
5	$55,540	$65,585	$67,916	$538,190	$37,227	$23,769	$788,227
6	$57,206	$67,552	$69,954	$554,336	$38,344	$24,482	$811,874
7	$58,922	$69,579	$72,052	$570,966	$39,495	$25,217	$836,230
8	$60,690	$71,666	$74,214	$588,095	$40,679	$25,973	$861,317
9	$62,510	$73,816	$76,440	$605,738	$41,900	$26,753	$887,157
10	$64,386	$76,031	$78,733	$623,910	$43,157	$27,555	$913,772
11	$0	$78,312	$81,095	$642,627	$44,451	$28,382	$874,868
12	$0	$80,661	$83,528	$661,906	$45,785	$29,233	$901,114
13	$0	$83,081	$86,034	$681,763	$47,159	$30,110	$928,147
14	$0	$85,573	$88,615	$702,216	$48,573	$31,014	$955,991
15	$0	$88,140	$91,274	$723,283	$50,030	$31,944	$984,671
16	$0	$90,785	$94,012	$744,981	$51,531	$32,902	$1,014,211

Total Annual Cost, Cropland BMPs, cont.							
Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
17	$0	$93,508	$96,832	$767,331	$53,077	$33,889	$1,044,638
18	$0	$96,313	$99,737	$790,350	$54,670	$34,906	$1,075,977
19	$0	$99,203	$102,729	$814,061	$56,310	$35,953	$1,108,256
20	$0	$102,179	$105,811	$838,483	$57,999	$37,032	$1,141,504
21	$0	$0	$108,985	$863,637	$59,739	$38,143	$1,070,505
22	$0	$0	$112,255	$889,546	$61,531	$39,287	$1,102,620
23	$0	$0	$115,623	$916,233	$63,377	$40,466	$1,135,698
24	$0	$0	$119,091	$943,720	$65,278	$41,680	$1,169,769
25	$0	$0	$122,664	$972,031	$67,237	$42,930	$1,204,862
26	$0	$0	$126,344	$1,001,192	$69,254	$44,218	$1,241,008
27	$0	$0	$130,134	$1,031,228	$71,332	$45,545	$1,278,238
28	$0	$0	$134,038	$1,062,165	$73,471	$46,911	$1,316,586
29	$0	$0	$138,060	$1,094,030	$75,676	$48,318	$1,356,083
30	$0	$0	$142,201	$1,126,851	$77,946	$49,768	$1,396,766
31	$67,992	$49,048	$50,807	$326,985	$33,352	$17,781	$545,965
32	$70,031	$50,519	$52,331	$336,795	$34,353	$18,315	$562,344
33	$72,132	$52,035	$53,901	$346,898	$35,384	$18,864	$579,214
34	$74,296	$53,596	$55,518	$357,305	$36,445	$19,430	$596,591
35	$76,525	$55,204	$57,184	$368,024	$37,538	$20,013	$614,489
36	$78,821	$56,860	$58,899	$379,065	$38,665	$20,614	$632,923
37	$81,185	$58,566	$60,666	$390,437	$39,825	$21,232	$651,911
38	$83,621	$60,323	$62,486	$402,150	$41,019	$21,869	$671,468
39	$86,130	$62,132	$64,361	$414,215	$42,250	$22,525	$691,612
40	$88,713	$63,996	$66,292	$426,641	$43,517	$23,201	$712,361
3% Cost Inflation							

Total Annual Cost After Cost-Share, Cropland BMPs							
Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$49,346	$29,136	$36,809	$47,818	$16,538	$21,119	$200,765
2	$50,827	$30,010	$37,913	$49,252	$17,034	$21,752	$206,788
3	$52,351	$30,910	$39,051	$50,730	$17,545	$22,405	$212,992
4	$53,922	$31,837	$40,222	$52,251	$18,072	$23,077	$219,381
5	$55,540	$32,792	$41,429	$53,819	$18,614	$23,769	$225,963
6	$57,206	$33,776	$42,672	$55,434	$19,172	$24,482	$232,742
7	$58,922	$34,789	$43,952	$57,097	$19,747	$25,217	$239,724
8	$60,690	$35,833	$45,270	$58,809	$20,340	$25,973	$246,916
9	$62,510	$36,908	$46,629	$60,574	$20,950	$26,753	$254,323

Total Annual Cost After Cost-Share, Cropland BMPs, cont.							
Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
10	$64,386	$38,015	$48,027	$62,391	$21,578	$27,555	$261,953
11	$0	$39,156	$49,468	$64,263	$22,226	$28,382	$203,494
12	$0	$40,331	$50,952	$66,191	$22,892	$29,233	$209,599
13	$0	$41,540	$52,481	$68,176	$23,579	$30,110	$215,887
14	$0	$42,787	$54,055	$70,222	$24,287	$31,014	$222,364
15	$0	$44,070	$55,677	$72,328	$25,015	$31,944	$229,035
16	$0	$45,392	$57,347	$74,498	$25,766	$32,902	$235,906
17	$0	$46,754	$59,068	$76,733	$26,539	$33,889	$242,983
18	$0	$48,157	$60,840	$79,035	$27,335	$34,906	$250,272
19	$0	$49,601	$62,665	$81,406	$28,155	$35,953	$257,781
20	$0	$51,089	$64,545	$83,848	$29,000	$37,032	$265,514
21	$0	$0	$66,481	$86,364	$29,870	$38,143	$220,857
22	$0	$0	$68,476	$88,955	$30,766	$39,287	$227,483
23	$0	$0	$70,530	$91,623	$31,689	$40,466	$234,307
24	$0	$0	$72,646	$94,372	$32,639	$41,680	$241,337
25	$0	$0	$74,825	$97,203	$33,618	$42,930	$248,577
26	$0	$0	$77,070	$100,119	$34,627	$44,218	$256,034
27	$0	$0	$79,382	$103,123	$35,666	$45,545	$263,715
28	$0	$0	$81,763	$106,216	$36,736	$46,911	$271,626
29	$0	$0	$84,216	$109,403	$37,838	$48,318	$279,775
30	$0	$0	$86,743	$112,685	$38,973	$49,768	$288,169
31	$67,992	$24,524	$30,992	$32,699	$16,676	$17,781	$190,664
32	$70,031	$25,260	$31,922	$33,679	$17,177	$18,315	$196,384
33	$72,132	$26,017	$32,880	$34,690	$17,692	$18,864	$202,275
34	$74,296	$26,798	$33,866	$35,731	$18,223	$19,430	$208,343
35	$76,525	$27,602	$34,882	$36,802	$18,769	$20,013	$214,594
36	$78,821	$28,430	$35,928	$37,907	$19,332	$20,614	$221,032
37	$81,185	$29,283	$37,006	$39,044	$19,912	$21,232	$227,663
38	$83,621	$30,161	$38,117	$40,215	$20,510	$21,869	$234,492
39	$86,130	$31,066	$39,260	$41,421	$21,125	$22,525	$241,527
40	$88,713	$31,998	$40,438	$42,664	$21,759	$23,201	$248,773
3% Cost Inflation							

Table 29. Estimated Costs of Implementing Livestock BMPs.

Annual Cost of Implementing Livestock BMPs					
Year	Vegetative Filter Strip	Relocate Feedlot	Relocate Pasture Feeding Site	Off Stream Watering System	Total
1	$357	$0	$2,203	$5,693	**$8,253**
2	$368	$0	$3,404	$3,909	**$7,680**
3	$379	$3,512	$2,337	$6,039	**$12,267**
4	$390	$0	$3,611	$4,147	**$8,148**
5	$402	$0	$2,479	$6,407	**$9,288**
6	$414	$3,838	$3,831	$4,399	**$12,482**
7	$426	$0	$2,630	$6,797	**$9,854**
8	$439	$0	$4,064	$4,667	**$9,171**
9	$452	$4,194	$2,791	$7,211	**$14,648**
10	$466	$0	$4,312	$4,952	**$9,729**
11	$480	$0	$2,961	$7,650	**$11,091**
12	$494	$4,583	$4,574	$5,253	**$14,904**
13	$509	$0	$3,141	$8,116	**$11,766**
14	$524	$0	$4,853	$5,573	**$10,950**
15	$540	$5,007	$3,332	$8,610	**$17,490**
16	$556	$0	$5,148	$5,912	**$11,617**
17	$573	$0	$3,535	$9,135	**$13,243**
18	$590	$5,472	$5,462	$6,273	**$17,796**
19	$608	$0	$3,750	$9,691	**$14,049**
20	$626	$0	$5,794	$6,655	**$13,075**
21	$645	$5,979	$3,979	$10,281	**$20,884**
22	$664	$0	$6,147	$7,060	**$13,871**
23	$684	$0	$4,221	$10,907	**$15,813**
24	$705	$6,534	$6,522	$7,490	**$21,250**
25	$726	$0	$4,478	$11,572	**$16,776**
26	$747	$0	$6,919	$7,946	**$15,612**
27	$770	$7,139	$4,751	$12,276	**$24,937**
28	$793	$0	$7,340	$8,430	**$16,563**
29	$817	$0	$5,040	$8,683	**$14,540**
30	$841	$7,801	$7,787	$13,415	**$29,845**
31	$867	$0	$5,347	$9,211	**$15,425**
32	$893	$0	$8,262	$14,232	**$23,386**
33	$919	$8,525	$5,673	$9,772	**$24,889**
34	$947	$0	$8,765	$15,098	**$24,810**
35	$975	$0	$6,018	$10,368	**$17,361**
36	$1,005	$9,315	$9,298	$16,018	**$35,636**
37	$1,035	$0	$6,385	$10,999	**$18,419**

Annual Cost of Implementing Livestock BMPs, cont.					
Year	**Vegetative Filter Strip**	**Relocate Feedlot**	**Relocate Pasture Feeding Site**	**Off Stream Watering System**	**Total**
38	$1,066	$0	$9,865	$16,993	**$27,924**
39	$1,098	$0	$6,774	$11,669	**$19,540**
40	$1,131	$0	$10,465	$18,028	**$29,624**
3% Cost Inflation					

Table 30. Technical Assistance Needed to Implement BMPs.

BMP		***Technical Assistance***	***Projected Annual Cost***
Cropland	1. Conservation Crop Rotation	SCC Buffer Technician KRC River Friendly Farms Technician Watershed Specialist	NRCS District Conservationist No Charge Conservation District Soil Technician No Charge SCC Buffer Technician No Charge Watershed Specialist No charge (could be subject to change) KRC River Friendly Farms Technician $20,000
	2. Permanent Vegetation	SCC Buffer Technician KRC River Friendly Farms Technician Watershed Specialist	
	3. No-till	KRC River Friendly Farms Technician Watershed Specialist	
	4. Buffers	SCC Buffer Technician KRC River Friendly Farms Technician	
	5. Terraces	SCC Buffer Technician KRC River Friendly Farms Technician Watershed Specialist	
	6. Sub surface Fertilization	Watershed Specialist KRC River Friendly Farms Technician	
Livestock	1. Vegetative filter strips	SCC Buffer Technician KRC River Friendly Farms Technician Watershed Specialist	
	2. Relocate feedlots	KRC River Friendly Farms Technician Watershed Specialist	
	3. Relocate pasture feeding sites	KRC River Friendly Farms Technician Watershed Specialist	
	4. Establish off stream watering systems	KRC River Friendly Farms Technician Watershed Specialist	
Total			**$20,000**

Table 31. Total Annual Costs for Implementing Entire WRAPS Plan in Support of Attaining TMDLs and Improvement in Impairments on the 303d List.

Total Annual Costs of Implementing Cropland, Livestock, Streambank and Rangeland BMPs, in addition to Information and Education and Technical Assistance					
	BMPs Implemented		**I&E and Technical Assistance**		
Year	**Cropland**	**Livestock**	**I&E**	**Technical Assistance**	**Total**
1	$200,765	$8,253	$39,900	$20,000	**$268,918**
2	$206,788	$7,680	$41,097	$20,600	**$276,165**
3	$212,992	$12,267	$42,330	$21,218	**$288,807**

Total Annual Costs of Implementing Cropland, Livestock, Streambank and Rangeland BMPs, in addition to Information and Education and Technical Assistance, cont.					
	BMPs Implemented		I&E and Technical Assistance		
Year	Cropland	Livestock	I&E	Technical Assistance	Total
4	$219,381	$8,148	$43,600	$21,855	**$292,984**
5	$225,963	$9,288	$44,908	$22,510	**$302,669**
6	$232,742	$12,482	$46,255	$23,185	**$314,664**
7	$239,724	$9,854	$47,643	$23,881	**$321,102**
8	$246,916	$9,171	$49,072	$24,597	**$329,756**
9	$254,323	$14,648	$50,544	$25,335	**$344,850**
10	$261,953	$9,729	$52,060	$26,095	**$349,838**
11	$203,494	$11,091	$53,622	$26,878	**$295,086**
12	$209,599	$14,904	$55,231	$27,685	**$307,419**
13	$215,887	$11,766	$56,888	$28,515	**$313,056**
14	$222,364	$10,950	$58,594	$29,371	**$321,279**
15	$229,035	$17,490	$60,352	$30,252	**$337,129**
16	$235,906	$11,617	$62,163	$31,159	**$340,845**
17	$242,983	$13,243	$64,028	$32,094	**$352,348**
18	$250,272	$17,796	$65,949	$33,057	**$367,074**
19	$257,781	$14,049	$67,927	$34,049	**$373,806**
20	$265,514	$13,075	$69,965	$35,070	**$383,624**
21	$220,857	$20,884	$72,064	$36,122	**$349,927**
22	$227,483	$13,871	$74,226	$37,206	**$352,786**
23	$234,307	$15,813	$76,453	$38,322	**$364,895**
24	$241,337	$21,250	$78,746	$39,472	**$380,804**
25	$248,577	$16,776	$81,108	$40,656	**$387,117**
26	$256,034	$15,612	$83,542	$41,876	**$397,064**
27	$263,715	$24,937	$86,048	$43,132	**$417,831**
28	$271,626	$16,563	$88,629	$44,426	**$421,245**
29	$279,775	$14,540	$91,288	$45,759	**$431,362**
30	$288,169	$29,845	$94,027	$47,131	**$459,172**
31	$190,664	$15,425	$96,848	$48,545	**$351,482**
32	$196,384	$23,386	$99,753	$50,002	**$369,524**
33	$202,275	$24,889	$102,746	$51,502	**$381,412**
34	$208,343	$24,810	$105,828	$53,047	**$392,028**
35	$214,594	$17,361	$109,003	$54,638	**$395,596**
36	$221,032	$35,636	$112,273	$56,277	**$425,218**
37	$227,663	$18,419	$115,641	$57,966	**$419,688**

Total Annual Costs of Implementing Cropland, Livestock, Streambank and Rangeland BMPs, in addition to Information and Education and Technical Assistance, cont.					
	BMPs Implemented		I&E and Technical Assistance		
Year	Cropland	Livestock	I&E	Technical Assistance	Total
38	$234,492	$27,924	$119,111	$59,705	**$441,231**
39	$241,527	$19,540	$122,684	$61,496	**$445,247**
40	$248,773	$29,624	$126,364	$63,341	**$468,102**

Potential funding sources for these BMPs are (but not limited to) the following organizations:

Table 32. 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) Forest Legacy Program Farmable Wetlands Program (FWP)
EPA/KDHE	319 Funding Grants EPA WRAPS Funding Clean Water Neighbor Grants
Kansas Department of Wildlife and Parks	Partnering for Wildlife
Kansas Alliance for Wetlands and Streams	
State Conservation Commission	
Conservation Districts	
No-till on the Plains	
Kansas Forest Service	
US Fish and Wildlife	

Table 33. Potential Service Providers for BMP Implementation.

BMP		Services Needed to Implement BMP		Service Provider **
		Technical Assistance	***Information and Education***	
Cropland	1. Conservation Crop Rotation	Design, cost share and maintenance	BMP workshops, tours, field days	NRCS KRC SCC No-Till on the Plains KSRE CD KDWP KFS
	2. Grassed Waterways	Design, cost share and maintenance	BMP workshops, tours, field days	
	3. No-till	Design, cost share and maintenance	BMP workshops	
	4. Buffers	Design, cost share and maintenance	BMP workshops, field days, tours	
	5. Terraces	Design, cost share and maintenance	BMP workshops, field days, tours	
	6.Sub surface fertilization	Design, cost share and maintenance	BMP workshops, field days, tours	
Livestock	1. Vegetative filter strips	Design, cost share and maintenance	BMP workshops, field days, tours	KSRE NRCS SCC KRC CD KDWP Watershed Specialist
	2. Relocate feedlots	Design, cost share and maintenance	BMP workshops, field days, tours	
	3. Relocate pasture feeding sites	Design, cost share and maintenance	BMP workshops, field days, tours	
	4. Establish off stream watering systems	Design, cost share and maintenance	BMP workshops, field days, tours	
***** See Appendix for service provider directory***				

** All service providers are responsible for evaluation of the installed or implemented BMPs and/or other services provided and will report to SLT for completion approval.*

8.0 Timeframe

The SLT will request an update of monitoring data from KDHE and COE every year, however, the plan will be reviewed every five years starting in 2015. In 2015, the SLT will request a review of data by KDHE for the Neosho River Basin. In 2013 the TMDLs will officially be reviewed for additions or revisions. The timeframe of this document for BMP implementation to meet both sediment and phosphorus TMDLs would be forty years from the date of publication of this report. Sediment and phosphorus reductions in the water column will not be noticeable by the year 2015 due to a lag time from implementation of BMPs and resulting improvements in water quality. Therefore, the SLT will review sediment and phosphorus concentrations in year 2020. They will examine BMP placement and implementation in 2015 and every subsequent five years after.

Table 34. Review Schedule for Pollutants and BMPs.

Review Year	Sediment	Phosphorus	BMP Placement
2015			X
2020	X	X	X
2025	X	X	X
2030	X	X	X
2035	X	X	X
2040	X	X	X
2045	X	X	X
2050	X	X	X

Targeting and BMP implementation might shift over time in order to achieve TMDLs.

- The timeframe for meeting the **sediment goal** will be Year 7 of implementation. If all BMPs are installed, the 30% sediment reduction goal will be met. After the sediment goal is met, the BMPs directed at sediment will be considered “protection measures” instead of “restoration measures”. At this point, the SLT may decide to redirect their funding to phosphorus related BMPs.
- The timeframe for meeting the **phosphorus goal** will be forty years. If all BMPs are installed, the 30% phosphorus reduction goal will be met. In addition to meeting the phosphorus goal, the dissolved oxygen eutrophication and pH TMDL in Chanute Santa Fe Lake will be met. Also, the FCB TMDL in Turkey Creek, Deer Creek and Owl Creek will be simultaneously addressed by livestock BMPs. And, it is the anticipation of the SLT, that Big Creek and Long Creek will not have to be listed as TMDLs for dissolved oxygen.

9.0 Interim Measureable Milestones

9.1 Adoption Rates

Milestones will be determined by number of acres treated, projects installed, contacts made to residents of the watershed or load reductions at the end of each five year period. The SLT will examine the number of acres treated or the load reduction to determine if adequate progress has been made from the current BMP implementations.

Table 35. Short, Medium and Long Term Goals for BMP Cropland Adoption Rate in the Cropland Targeted Area to Address Sediment and Nutrients.

Total Annual Adoption Rates for Cropland BMPs, acres								
	Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
Short-Term	1	1,271	388	777	478	324	777	4,015
	2	1,271	388	777	478	324	777	4,015
	3	1,271	388	777	478	324	777	4,015
	4	1,271	388	777	478	324	777	4,015
	5	1,271	388	777	478	324	777	4,015
Total		*6,353*	*1,942*	*3,884*	*2,391*	*1,621*	*3,884*	*20,074*
Medium-Term	6	1,271	388	777	478	324	777	4,015
	7	1,271	388	777	478	324	777	4,015
	8	1,271	388	777	478	324	777	4,015
	9	1,271	388	777	478	324	777	4,015
	10	1,271	388	777	478	324	777	4,015
Total		*12,705*	*3,885*	*7,767*	*4,782*	*3,243*	*7,767*	*40,148*
Long-Term	11	0	388	777	478	324	777	2,744
	12	0	388	777	478	324	777	2,744
	13	0	388	777	478	324	777	2,744
	14	0	388	777	478	324	777	2,744
	15	0	388	777	478	324	777	2,744
	16	0	388	777	478	324	777	2,744
	17	0	388	777	478	324	777	2,744
	18	0	388	777	478	324	777	2,744
	19	0	388	777	478	324	777	2,744
	20	0	388	777	478	324	777	2,744
	21	0	0	777	478	324	777	2,356
	22	0	0	777	478	324	777	2,356
	23	0	0	777	478	324	777	2,356
	24	0	0	777	478	324	777	2,356

Total Annual Adoption Rates for Cropland BMPs, acres, cont.								
	Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
Long Term	25	0	0	777	478	324	777	2,356
	26	0	0	777	478	324	777	2,356
	27	0	0	777	478	324	777	2,356
	28	0	0	777	478	324	777	2,356
	29	0	0	777	478	324	777	2,356
	30	0	0	777	478	324	777	2,356
	31	1,308	327	654	327	327	654	3,597
	32	1,308	327	654	327	327	654	3,597
	33	1,308	327	654	327	327	654	3,597
	34	1,308	327	654	327	327	654	3,597
	35	1,308	327	654	327	327	654	3,597
	36	1,308	327	654	327	327	654	3,597
	37	1,308	327	654	327	327	654	3,597
	38	1,308	327	654	327	327	654	3,597
	39	1,308	327	654	327	327	654	3,597
	40	1,308	327	654	327	327	654	3,597
Total		*25,784*	*11,039*	*29,841*	*17,615*	*12,998*	*29,841*	*127,119*

Table 36. Short, Medium and Long Term Goals for BMP Livestock Adoption Rate in the Livestock Targeted Area to Address Nutrients and *E.coli* Bacteria.

Total Annual Adoption Rates Livestock BMPs, projects					
	Year	Vegetative Filter Strip	Relocate Feedlot	Relocate Pasture Feeding Site	Off Stream Watering System
Short-Term	1	1		2	3
	2	1		3	2
	3	1	1	2	3
	4	1		3	2
	5	1		2	3
Total		*5*	*1*	*12*	*13*
Medium-Term	6	1	1	3	2
	7	1		2	3
	8	1		3	2
	9	1	1	2	3
	10	1		3	2
Total		*10*	*3*	*25*	*25*
Long-Term	11	1		2	3
	12	1	1	3	2
	13	1		2	3

Total Annual Adoption Rates Livestock BMPs, projects, cont.					
	Year	Vegetative Filter Strip	Relocate Feedlot	Relocate Pasture Feeding Site	Off Stream Watering System
Long Term	14	1		3	2
	15	1	1	2	3
	16	1		3	2
	17	1		2	3
	18	1	1	3	2
	19	1		2	3
	20	1		3	2
	21	1	1	2	3
	22	1		3	2
	23	1		2	3
	24	1	1	3	2
	25	1		2	3
	26	1		3	2
	27	1	1	2	3
	28	1		3	2
	29	1		2	2
	30	1	1	3	3
	31	1		2	2
	32	1		3	3
	33	1	1	2	2
	34	1		3	3
	35	1		2	2
	36	1	1	3	3
	37	1		2	2
	38	1		3	3
	39	1		2	2
	40	1		3	3
Total	*Total*	*40*	*12*	*100*	*100*

Table 37. Short, Medium and Long Term Goals for Information and Education Adoption Rates in the Entire Watershed to Address All Impairments.

	Year	Demo Projects	Workshops	Tours and Field Days	Presentations, Informational Meetings	Newsletter Inserts	Technical Assistance One on One Programs	Conference Attendees	Educational Events	Educational Curriculum	Contacts made by Technical Assistance
Short Term	1	3	1	6	4	1	2	5	3	1	250
	2	3	1	6	4	1	2	5	3	1	250
	3	3	1	6	4	1	2	5	3	1	250
	4	3	1	6	4	1	2	5	3	1	250
	5	3	1	6	4	1	2	5	3	1	250
	Total	***15***	***5***	***30***	***20***	***5***	***10***	***25***	***15***	***5***	***1,250***
Medium Term	6	3	1	6	4	1	2	5	3	1	250
	7	3	1	6	4	1	2	5	3	1	250
	8	3	1	6	4	1	2	5	3	1	250
	9	3	1	6	4	1	2	5	3	1	250
	10	3	1	6	4	1	2	5	3	1	250
	Total	***30***	***10***	***60***	***40***	***10***	***20***	***50***	***30***	***10***	***2,500***
Long Term	11	3	1	6	4	1	2	5	3	1	250
	12	3	1	6	4	1	2	5	3	1	250
	13	3	1	6	4	1	2	5	3	1	250
	14	3	1	6	4	1	2	5	3	1	250
	15	3	1	6	4	1	2	5	3	1	250
	16	3	1	6	4	1	2	5	3	1	250
	17	3	1	6	4	1	2	5	3	1	250
	18	3	1	6	4	1	2	5	3	1	250
	19	3	1	6	4	1	2	5	3	1	250
	20	3	1	6	4	1	2	5	3	1	250
	21	3	1	6	4	1	2	5	3	1	250
	22	3	1	6	4	1	2	5	3	1	250
	23	3	1	6	4	1	2	5	3	1	250
	24	3	1	6	4	1	2	5	3	1	250
	25	3	1	6	4	1	2	5	3	1	250
	26	3	1	6	4	1	2	5	3	1	250
	27	3	1	6	4	1	2	5	3	1	250
	28	3	1	6	4	1	2	5	3	1	250
	29	3	1	6	4	1	2	5	3	1	250
	30	3	1	6	4	1	2	5	3	1	250
	31	3	1	6	4	1	2	5	3	1	250
	32	3	1	6	4	1	2	5	3	1	250

I&E Goals, cont.											
	Year	Demo Projects	Workshops	Tours and Field Days	Presentations, Informational Meetings	Newsletter Inserts	Technical Assistance One on One Programs	Conference Attendees	Educational Events	Educational Curriculum	Contacts made by Technical Assistance
Long Term	33	3	1	6	4	1	2	5	3	1	250
	34	3	1	6	4	1	2	5	3	1	250
	35	3	1	6	4	1	2	5	3	1	250
	36	3	1	6	4	1	2	5	3	1	250
	37	3	1	6	4	1	2	5	3	1	250
	38	3	1	6	4	1	2	5	3	1	250
	39	3	1	6	4	1	2	5	3	1	250
	40	3	1	6	4	1	2	5	3	1	250
	Total	***120***	***40***	***240***	***160***	***40***	***80***	***200***	***120***	***40***	***10,000***

9.2 Benchmarks to Measure Water Quality and Social Progress

Over a forty year time frame, this WRAPS project hopes to improve water quality throughout the watershed and downstream to Grand Lake. After reviewing the benchmark criteria, the SLT will assess and revise the overall strategy plan for the watershed. New goals will be set and new BMPs will be implemented in order to achieve improved water quality.

If a water quality milestone is not reached by the timeline listed, the SLT will assess the significance of the data to determine if outside factors (i.e. atmospheric loads or weather) contributed to this milestone not being met. If needed, the SLT will assess the effectiveness of the BMPs installed and determine if additional implementation is needed.

Table 38. Benchmarks to Measure Water Quality Progress.

Criteria to Measure Water Quality Progress	Information Source
No taste and odor problems in any public water supplies	KDHE
No health advisories for recreating in Neosho River or tributaries	KDHE
No fish kills	KDWP
Fewer high event stream flow rates indicating better retention and slower release of storm water in the upper end of the watershed due to an increase in BMPs that slow flow (buffers, riparian areas, no-till, grassed waterways, etc)	USGS
No listing of Neosho River for TSS, phosphorus or bacteria	KDHE

Benchmarks, cont.	
Criteria to Measure Water Quality Progress	**Information Source**
No detection of cryptosporidium in public water suppliers on the Neosho River	KDHE
Turbidity in Grand Lake improves over 2000-2009 conditions	Oklahoma Department of Natural Resources
Social Indicators to Measure Water Quality Progress	**Information Source**
Survey of water quality issues to determine whether information and education programs are having an effect on public perception	KSRE
Number of attendees at workshops and field days	KSRE
BMP adoptability rates	NRCS

9.3 Phosphorus, Sediment and Fecal Coliform Bacteria Milestones [39]

At the end of forty years (long term milestone), the SLT will be able to examine water quality data for phosphorus (eutrophication, dissolved oxygen and pH determination) and suspended solids (sediment determination) to determine if progress has been made in improving water quality. It is estimated that it will require ten years to see progress after BMP implementation on phosphorus and sediment reduction in the waterways. KDHE has outlined water quality goals for total phosphorus and total suspended solids. These short term milestones are presented below.

9.3.1 Short Term Water Quality Milestones

9.3.1.A Dissolved Oxygen and Phosphorus Milestones

Dissolved oxygen is a contributing factor to eutrophication along with phosphorus. DO is a TMDL in Turkey Creek and listed on the 303d list for Big Creek and Long Creek. Long Creek has had 5 excursions where DO dropped below 5ppm since 2002. Big Creek and Turkey Creek have had no excursions since 2002. By reducing phosphorus and TSS loads in these streams, their channel conditions will improve and the introduction or production of organic material in the streams will diminish, lowering the probability of low DO.

KDHE has determined that a **milestones for dissolved oxygen** [39] is

1. Only one incident of DO < 5 ppm will occur over 2012 to 2020 on DO impaired streams.

Phosphorus is also a contributor to eutrophication in streams and lakes. KDHE has determined the **milestones for phosphorus** [39] to be:

1. Median TP values for Neosho River and tributary stations are reduced by 10% over 2012 – 2020.
2. 2012-2020 average loads at Subbasin outlets are reduced by 10%
    - Total Phosphorus = 507 T/yr @ Upper Neosho

Table 39. Water Quality Goals for Phosphorus. [39]

Sampling Station	Current Median TP	2010-2020 Median TP
Neosho R below Chanute	190 ppb	171 ppb
Big Creek – LeRoy	140 ppb	126 ppb
Long Creek	167 ppb	150 ppb
Turkey Creek	89 ppb	80 ppb
Deer Creek	99 ppb	89 ppb
Owl Creek	126 ppb	113 ppb
Big Creek – Chanute	90 ppb	81 ppb

9.3.1.B Sediment Milestones

KDHE has determined that the **milestones for sediment** [39] are:

1. 2012-2020 average loads at Subbasin outlets are reduced by 10%
    a. Total Suspended Solids = 198,677 T/yr @ Upper Neosho

Table 40. Water Quality Goals for Sediment. [39]

Sampling Station	Current Median TSS	2010-2020 Median TSS
Neosho R below Chanute	47 ppm	42 ppm
Big Creek – LeRoy	39 ppm	35 ppm
Long Creek	27 ppm	24 ppm
Turkey Creek	26 ppm	23 ppm
Deer Creek	24 ppm	22 ppm
Owl Creek	33 ppm	30 ppm
Big Creek – Chanute	26 ppm	23 ppm

9.3.1.C E. coli Bacteria Milestones

E. coli bacteria is addressed in this report as a TMDL that will benefit from BMPs that are implemented for phosphorus. For this reason, KDHE has determined **milestones for *E. coli*** [39] impairments:

1. *E. coli* bacteria reductions should be observed in five years after the onset of any implementation of BMPs in the four Upper Neosho tributaries with *E. coli* bacteria TMDLs
2. The milestone will be reducing the percentage of samples that exceed the criterion (427) such that at least 90 percent of samples are below that value.
3. Because of violations of the geometric mean sampling, emphasis should be placed on reducing bacteria loadings in Turkey Creek.
4. Although Deer Creek did not violate geometric mean sampling, further reduction of *E. coli* bacteria should ensue so as to assure continued compliance with the water quality standard.

5. For Deer and Turkey Creeks, current samplings indicate that 80% of the samples are below the criterion; the proportion should increase to 90% by 2015.

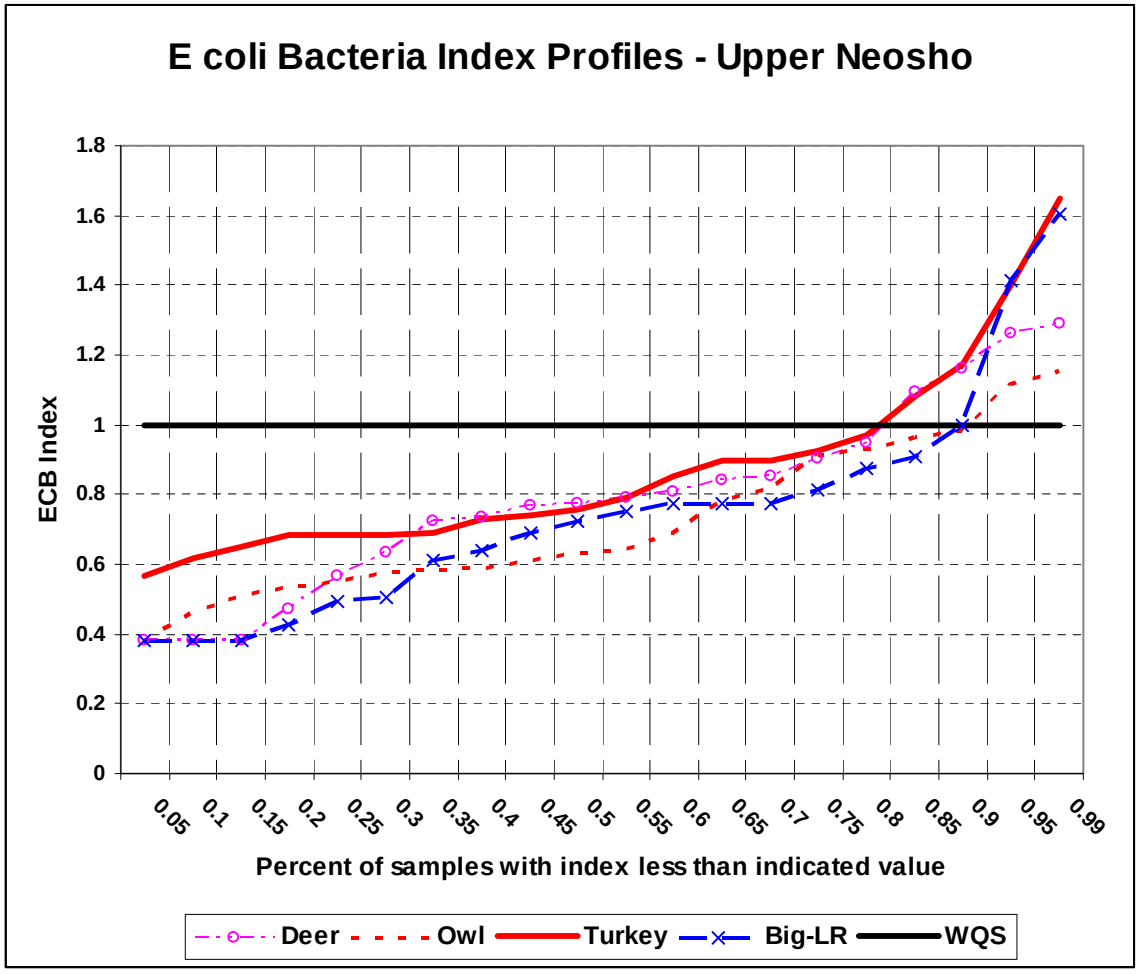


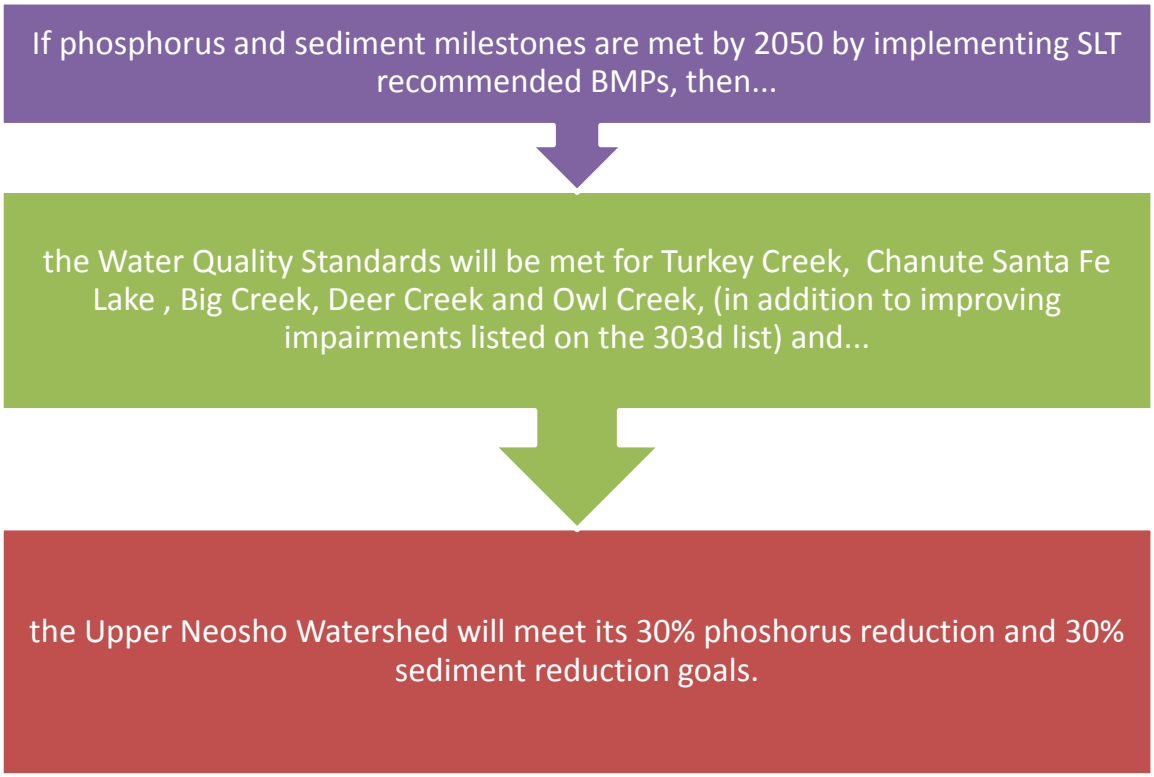
Figure 34. *E. coli* bacteria Index Profiles. [39]

9.3.2 Mid Term Water Quality Milestones

The expectation of midterm water quality milestones is that the improved water quality from the short term milestones would continue to trend toward improvement over the midterm life of the plan.

9.3.2 Long Term Water Quality Milestones

Long term water quality milestones at the end of the plan will constitute that the water quality standards for all waterways will be met, and therefore, the 30 percent reduction goals for phosphorus and sediment will be accomplished.


If phosphorus and sediment milestones are met by 2050 by implementing SLT recommended BMPs, then...
the Water Quality Standards will be met for Turkey Creek, Chanute Santa Fe Lake , Big Creek, Deer Creek and Owl Creek, (in addition to improving impairments listed on the 303d list) and...
the Upper Neosho Watershed will meet its 30% phoshorus reduction and 30% sediment reduction goals.

9.4 BMP Implementation Milestones

The SLT will review the number of acres, projects or contacts made in the watershed every five years until the end of this WRAPS plan, which is the year 2050. At the end of each five year period, the SLT will have the option to reassess the goals and alter BMP implementations as they determine is best. Below is the outline of BMP implementations over a forty year period.

Table 41. Cumulative BMP Implementation Milestones from 2015 to 2050.

	Cropland						**Livestock**				**Information and Education**	
Year	Conservation Crop Rotation, acres	Permanent Vegetation acres	No-till, acres	Buffers, acres	Terraces, acres	Sub Surface Fertilization, acres	Filter strips, number	Relocate Feedlots, number	Relocate Pasture Feeding Sites, number	Off-stream Watering Systems, number	Demonstrations/Workshops/ Tours/Field Days. number	I&E and Technical Assistance Contacts/Participants, number
2015	*6,353*	*1,942*	*3,884*	*2,391*	*1,621*	*3,884*	*5*	*1*	*12*	*13*	*50*	*1,250*
2020	*12,705*	*3,885*	*7,767*	*4,782*	*3,243*	*7,767*	*10*	*3*	*25*	*25*	*100*	*2,500*
Short term	***12,705***	***3,885***	***7,767***	***4,782***	***3,243***	***7,767***	***10***	***3***	***25***	***25***	***100***	***2,500***
2025	*12,705*	*5,827*	*11,655*	*7,170*	*4,860*	*11,655*	*15*	*5*	*37*	*38*	*150*	*3,750*

Cumulative Milestones, cont.												
	Cropland						Livestock				Information and Education	
2030	*12,705*	*7,769*	*15,540*	*9,560*	*6,480*	*15,540*	*20*	*6*	*50*	*50*	*200*	*5,000*
2035	*12,705*	*7,769*	*19,425*	*11,950*	*8,100*	*19,425*	*25*	*8*	*62*	*63*	*250*	*6,250*
Medium term	***12,705***	***7,769***	***19,425***	***11,950***	***8,100***	***19,425***	***25***	***8***	***62***	***63***	***250***	***6,250***
2040	*12,705*	*7,769*	*23,310*	*14,340*	*9,720*	*23,310*	*30*	*10*	*75*	*75*	*300*	*7,500*
2045	*19,245*	*9,404*	*26,580*	*15,975*	*11,355*	*26,580*	*35*	*11*	*87*	*88*	*350*	*8,750*
2050	*25,784*	*11,039*	*29,841*	*17,615*	*12,998*	*29,841*	*40*	*12*	*100*	*100*	*400*	*10,000*
Long term	***25,784***	***11,039***	***29,841***	***17,615***	***12,998***	***29,841***	***40***	***12***	***100***	***100***	***400***	***10,000***

10.0 Monitoring Water Quality Progress

The KDHE sampling data will be reviewed by the SLT every year. Data collected in the Targeted Areas will be of special interest. A composite review of BMPs implemented and monitoring data will be analyzed for effects resulting from the BMPs. The SLT will also ask KDHE to review analyzed data from all monitoring sources on a yearly basis. Data will also be requested from the Corps of Engineers (COE) from Grand Lake to monitor progress in the lake.

KDHE has ongoing monitoring sites in the watershed. There are two types of monitoring sites utilized by KDHE: permanent and rotational. Permanent sites are continuously sampled, whereas rotational sites are only sampled every fourth year. All sampling sites will be continued into the future. Each site is tested for nutrients, metals, ammonia, solid fractions, turbidity, alkalinity, pH, dissolved oxygen, *e. coli* bacteria and chemicals. Not all sites are tested for these pollutant indicators at each collection time. This is dependent upon the anticipated pollutant concern as well as other factors. For example, herbicide analysis would not be necessary in the winter months as there are no applications at that time.

There are two USGS stream flow data stations in the watershed. The flow data derived from the gaging stations will assist the SLT in determining if BMPs have reduced streamflow by absorbing and slowly releasing rainfall thereby lessening the detrimental effects of high flow.

There are no US Army Corps of Engineers sampling sites in this watershed.

Much of the evaluative information can be obtained through the existing networks and sampling plans of KDHE and the Tulsa District, Corps of Engineers at Grand Lake. Some communications with the Kansas Department of Parks and Wildlife will supplement any information on the conditions in the Upper Neosho Watershed drainage.

Monitoring data will be used to direct the SLT in their evaluation of water quality progress. The table below indicates which current monitoring sites data will be used by the SLT in determination of effectiveness of BMP implementation.

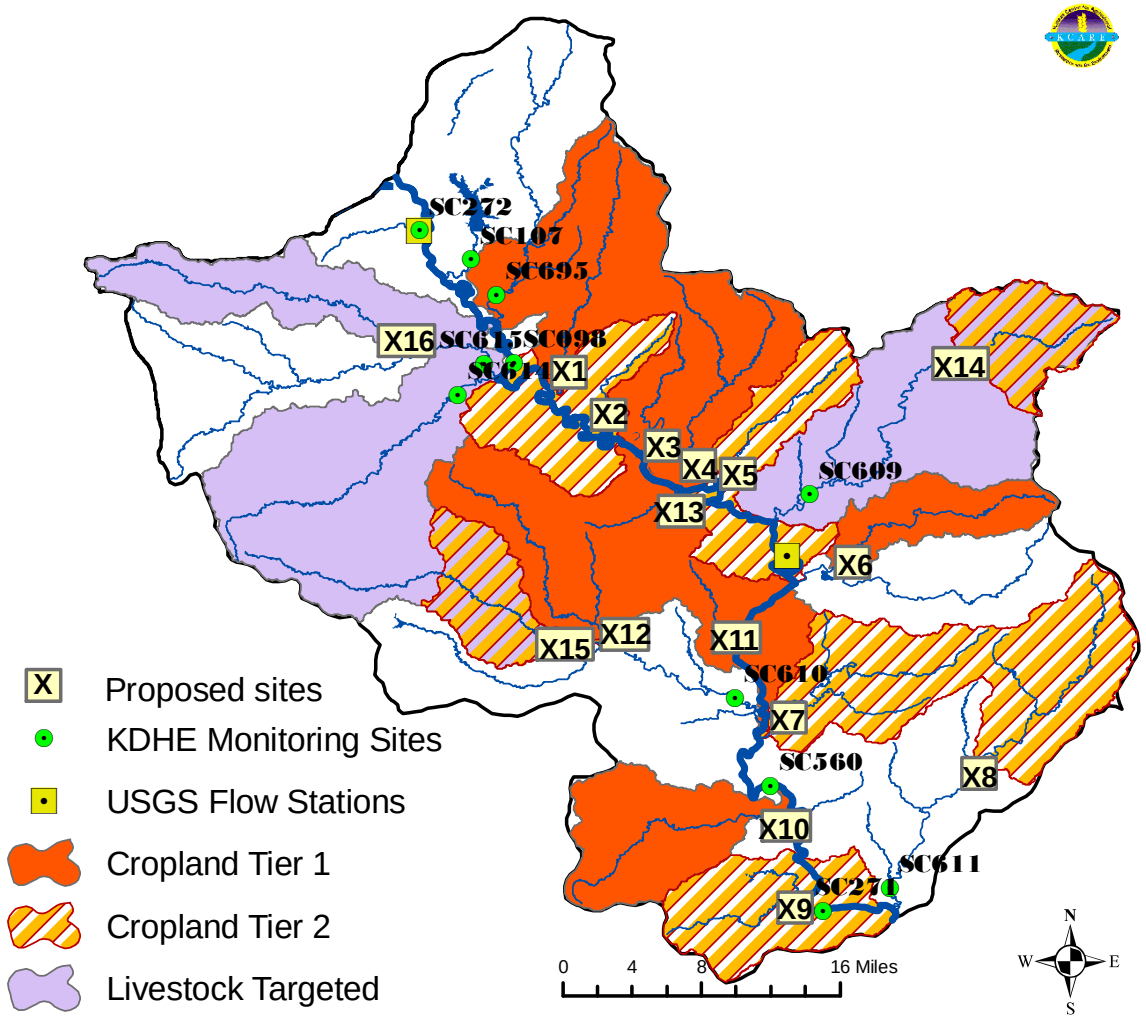


Figure 35. Monitoring Sites in the Watershed. [40]

Monitoring data will be used to direct the SLT in their evaluation of water quality progress. The table below indicates at which current monitoring sites data will be used by the SLT in determination of effectiveness of BMP implementation. KDHE will be requested to provide additional monitoring sites needing to be installed. The cost and implementation of these sites will be dependent on KDHE funding.

Table 42. Monitoring Sites and Tests Needed to Direct SLT in Water Quality Evaluation.
Proposed monitoring sites are indicated on map below.

Cropland Targeted Area				
Agency	**Site Number or Name**	**Pollutant Target**	**River, Stream or Lake**	**Sampling Tests Needed**
KDHE	SC695	Sediment	Long Creek	TSS, Turbidity
KDHE	Proposed Site X1		Crooked Creek	
KDHE	Proposed Site X2		Swiss Creek	
KDHE	Proposed Site X3		Spring Creek	
KDHE	Proposed Site X4		Indian Creek	

Cropland Targeted Area, cont.				
Agency	**Site Number or Name**	**Pollutant Target**	**River, Stream or Lake**	**Sampling Tests Needed**
KDHE	Proposed Site X5	Sediment	Martin Creek	TSS, Turbidity
KDHE	Proposed Site X6		Rock Creek	
KDHE	Proposed Site X7		Slack Creek	
KDHE	Proposed Site X8		Mud Creek	
KDHE	Proposed Site X9		Turkey Creek	
KDHE	Proposed Site X10		Village Creek	
KDHE	Proposed Site X11		Onion Creek	
KDHE	Proposed Site X12		Cherry Creek	
KDHE	Proposed Site X13		Rock Creek	
KDHE	Proposed Site X14		Upper Deer Creek	
KDHE	Proposed Site X15		Middle Owl Creek	
Livestock Targeted Area				
Agency	**Site Number or Name**	**Pollutant Target**	**River, Stream or Lake**	**Sampling Tests Needed**
KDHE	SC614	Nutrients, fecal coliform bacteria	Turkey Creek	TP, pH, DO, TN, e.coli bacteria
KDHE	Proposed Site X15		Owl North	
KDHE	SC615		Big Creek	
KDHE	Proposed Site X16		Big Creek North	
KDHE	SC609		Deer Creek	

Monitoring site data that is being generated at this time will be helpful to the SLT. Many of the existing monitoring sites located on the Neosho River will benefit multiple Targeted Areas. However, additional site placement to support BMP evaluation could be used in the targeted areas:

- The Cropland Targeted Area could benefit with an additional monitoring sites on
  a) Crooked Creek (site X1 on Figure 34),
  b) Swiss Creek (site X2 on Figure 34)
  c) Spring Creek (site X3 on Figure 34),
  d) Indian Creek (site X4 on Figure 34),
  e) Martin Creek (site X5 on Figure 34)
  f) Rock Creek (site X6 on Figure 34 – east of Neosho River)
  g) Slack Creek (site X7 on Figure 34)
  h) Mud Creek (site X8 on Figure 34)
  i) Turkey Creek (site X9 on Figure 34)
  j) Village Creek (site X10 on Figure 34)
  k) Onion Creek (site X11 on Figure 34)
  l) Cherry Creek (site X12 on Figure 34)
  m) Rock Creek (site X13 on Figure 34 – west of Neosho River)
  n) Upper Deer Creek (site X14 on Figure 34)
  o) Middle Owl Creek (site X16 on Figure 34)
- The Livestock Targeted Area could benefit from additional monitoring sites on
  a) Owl Creek (site X15 on Figure 34)
  b) Big Creek North (site X16 on Figure 34)

Analysis of the data generated will be used to determine effectiveness of implemented BMPs. If the SLT decides at some point in the future that more data is required, they can discuss this with KDHE. All KDHE, COE and USGS data will be shared with the SLT and can then be passed on to the watershed residents by way of the information and education efforts discussed previously.

Monitoring data will be used to direct the SLT in their evaluation of water quality progress. KDHE and COE will be requested to meet with the SLT to review the monitoring data accumulated by their sites on a yearly basis. However, the overall strategy and alterations of the WRAPS plan will be discussed with KDHE immediately after each update of the 303d list and subsequent TMDL designation. The upcoming years for this in the Upper Neosho Watershed are 2013 and 2018. At this time, the plan can be altered or modified in order to meet the water quality goals as assigned by the SLT in the beginning of the WRAPS process.

11.0 Review of the Watershed Plan in 2015

In the year 2015, the plan will be reviewed and revised according to results acquired from monitoring data. At this time, the SLT will review the following criteria in addition to any other concerns that may occur at that time:

1. The SLT will ask KDHE for a report on the milestone achievements in **sediment** load reductions. The SLT will request a report from KDHE concerning the revisions of the TMDLs from 2013.
2. The SLT will request from KDHE a report on the milestone achievements in **phosphorus** load reductions. The SLT will request a report from KDHE concerning the revisions of the TMDLs from 2013.
3. The SLT will request a report on the milestone achievements in ***E. coli* bacteria** load reductions. The SLT will request a report from KDHE concerning the revisions of the TMDLs from 2013.
4. The SLT will request a report from KDHE on trends in water quality in watershed lakes.
5. The SLT will request a report from Oklahoma Department of Natural Resources on trends in water quality in Grand Lake.
6. The SLT will request a report from Kansas Department of Wildlife and Parks on trends in water quality and fish health and quantity in the Neosho River, Chanute Santa Fe Lake and Gridley Lake.
7. The SLT will report on progress towards achieving the adoption rates listed in Section 9.1 of this report.
8. The SLT will report on progress towards achieving the benchmarks listed in Section 9.2 of this report.
9. The SLT will report on progress towards achieving the BMP implementations in Section 9.3 of this report.
10. The SLT will discuss impairments on the 303d list and the possibility of addressing these impairments prior to them being listed as TMDLs.
11. The SLT will discuss the effect of implementing BMPs aimed at specific TMDLs on the impairments listed on the 303d list.
12. The SLT will discuss necessary adjustments and revisions needed in the targets listed in this plan.

12.0 Appendix

12.1 Service Providers

Table 43. 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 Association for Conservation and Environmental Education	Project Learning Tree WILD & WILD Aquatic WET Leopold Education Project	Promotes and provides effective, non-biased and science-based environmental education to all Kansas.	Technical	www.kacee.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**	**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.kdhe.state.ks.us

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

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	http://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	http://www.krwa.net

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

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

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 Geological Survey	National Streamflow Information Program Water Cooperative Program	Provide streamflow data Provide cooperative studies and water-quality information	Technical	www.water.usgs.gov www.nrtwq.usgs.gov
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

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.		

12.2 BMP Definitions

Cropland

Vegetative Buffer
-Area of field maintained in permanent vegetation to help reduce nutrient and sediment loss from agricultural fields, improve runoff water quality, and provide habitat for wildlife.
-On average for Kansas fields, 1 acre buffer treats 15 acres of cropland.
-50% erosion reduction efficiency, 50% phosphorous reduction efficiency
-Approx. $1,000/acre, 90% cost-share available from NRCS.

Grassed Waterway
-Grassed strip used as an outlet to prevent silt and gully formation.
-Can also be used as outlets for water from terraces.
-On average for Kansas fields, 1 acre waterway will treat 10 acres of cropland.
-40% erosion reduction efficiency, 40% phosphorous reduction efficiency.
-$800 an acre, 50% cost-share available from NRCS.

No-Till
-A management system in which chemicals may be used for weed control and seedbed preparation.
-The soil surface is never disturbed except for planting or drilling operations in a 100% no-till system.
-75% erosion reduction efficiency, 40% phosphorous reduction efficiency.
-WRAPS groups and KSU Ag Economists have decided $10 an acre for 10 years is an adequate payment to entice producers to convert, 50% cost-share available from NRCS.

Conservation Crop Rotation
-Growing various crops on the same piece of land in a planned rotation.
-High residue crops (corn) with low residue crops (wheat, soybeans).
-Low residue crops in succession may encourage erosion.
-25% Erosion Reduction Efficiency, 25% phosphorous reduction efficiency
-WRAPS groups and KSU Ag Economists have decided $5 an acre for 10 years is an adequate payment to entice producers to convert.

Terraces
-Earth embankment and/or channel constructed across the slope to intercept runoff water and trap soil.
-One of the oldest/most common BMPs
-30% Erosion Reduction Efficiency, 30% phosphorous reduction efficiency
-$1.02 per linear foot, 50% cost-share available from NRCS

Nutrient Management Plan

-Managing the amount, source, placement, form and timing of the application of nutrients and soil amendments.
-Intensive soil testing
-25% erosion and 25% P reduction efficiency.
-WRAPS groups and KSU Ag Economists have decided $7.30 an acre for 10 years is an adequate payment to entice producers to convert, 50% cost-share is available from NRCS.

Subsurface Fertilizer Application
-Placing or injecting fertilizer beneath the soil surface.
-Reduces fertilizer runoff.
-0% soil and 50% P reduction efficiency.
-$3.50 an acre for 10 years, no cost-share.
-WRAPS groups and KSU Ag Economists have decided $3.50 an acre for 10 years is an adequate payment to entice producers to convert, 50% cost-share is available from NRCS.

Livestock

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
-Feedlot- 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%

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.

Pond
-Water impoundment made by constructing an earthen dam.
-Traps sediment and nutrients from leaving edge of pasture.

-Provides source of water.
-50% P Reduction.
-Approximately $12,000

Rotational Grazing
-Rotating livestock within a pasture to spread manure more uniformly and allow grass to regenerate.
-May involve significant cross fencing and additional watering sites.
-50-75% P Reduction.
-Approximately $7,000 with complex systems significantly more expensive.

Stream Fencing
-Fencing out streams and ponds to prevent livestock from entering.
-95% P Reduction.
-25 year life expectancy.
-Approximately $4,106 per ¼ mile of fence, including labor, materials, and maintenance.

12.3 Appendix Tables

12.3.1 Sediment Load Reductions by Sub Watershed

Table 44. Sediment Load Reductions by Sub Watershed.

Tier 1 Targeted Area							
Sub Watershed #110702040407 Annual Soil Erosion Reduction (tons), Cropland BMPs							
Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	158	150	236	79	47	0	670
2	315	300	473	158	95	0	1,340
3	473	449	709	237	142	0	2,010
4	630	599	946	315	189	0	2,680
5	788	749	1,182	394	237	0	3,350
6	946	899	1,418	473	284	0	4,020
7	1,103	1,049	1,655	552	331	0	4,690
8	1,261	1,199	1,891	631	378	0	5,360
9	1,418	1,348	2,128	710	426	0	6,030
10	1,576	1,498	2,364	789	473	0	6,700
11	1,576	1,648	2,600	867	520	0	7,212
12	1,576	1,798	2,837	946	568	0	7,725
13	1,576	1,948	3,073	1,025	615	0	8,237
14	1,576	2,097	3,310	1,104	662	0	8,749

15	1,576	2,247	3,546	1,183	710	0	9,262
16	1,576	2,397	3,783	1,262	757	0	9,774
17	1,576	2,547	4,019	1,340	804	0	10,287
18	1,576	2,697	4,255	1,419	852	0	10,799
19	1,576	2,846	4,492	1,498	899	0	11,311
20	1,576	2,996	4,728	1,577	946	0	11,824
21	1,576	2,996	4,965	1,656	994	0	12,186
22	1,576	2,996	5,201	1,735	1,041	0	12,549
23	1,576	2,996	5,437	1,814	1,088	0	12,911
24	1,576	2,996	5,674	1,892	1,135	0	13,274
25	1,576	2,996	5,910	1,971	1,183	0	13,637
26	1,576	2,996	6,147	2,050	1,230	0	13,999
27	1,576	2,996	6,383	2,129	1,277	0	14,362
28	1,576	2,996	6,619	2,208	1,325	0	14,724
29	1,576	2,996	6,856	2,287	1,372	0	15,087
30	1,576	2,996	7,092	2,366	1,419	0	15,449

Sub Watershed #110702040501 Annual Soil Erosion Reduction (tons), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	162	154	243	81	49	0	690
2	325	308	487	162	97	0	1,379
3	487	462	730	243	146	0	2,069
4	649	617	974	325	195	0	2,759
5	811	771	1,217	406	243	0	3,448
6	974	925	1,460	487	292	0	4,138
7	1,136	1,079	1,704	568	341	0	4,827
8	1,298	1,233	1,947	649	389	0	5,517
9	1,460	1,387	2,191	730	438	0	6,207
10	1,623	1,542	2,434	811	487	0	6,896
11	1,623	1,696	2,677	892	535	0	7,424
12	1,623	1,850	2,921	974	584	0	7,951
13	1,623	2,004	3,164	1,055	633	0	8,478
14	1,623	2,158	3,408	1,136	682	0	9,006
15	1,623	2,312	3,651	1,217	730	0	9,533
16	1,623	2,466	3,894	1,298	779	0	10,060
17	1,623	2,621	4,138	1,379	828	0	10,588
18	1,623	2,775	4,381	1,460	876	0	11,115
19	1,623	2,929	4,625	1,542	925	0	11,643
20	1,623	3,083	4,868	1,623	974	0	12,170
21	1,623	3,083	5,111	1,704	1,022	0	12,543
22	1,623	3,083	5,355	1,785	1,071	0	12,916
23	1,623	3,083	5,598	1,866	1,120	0	13,290

24	1,623	3,083	5,842	1,947	1,168	0	13,663
25	1,623	3,083	6,085	2,028	1,217	0	14,036
26	1,623	3,083	6,328	2,109	1,266	0	14,409
27	1,623	3,083	6,572	2,191	1,314	0	14,782
28	1,623	3,083	6,815	2,272	1,363	0	15,156
29	1,623	3,083	7,059	2,353	1,412	0	15,529
30	1,623	3,083	7,302	2,434	1,460	0	15,902

Sub Watershed #110702040305 Annual Soil Erosion Reduction (tons), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	176	168	265	88	53	0	750
2	353	335	529	176	106	0	1,499
3	529	503	794	265	159	0	2,249
4	706	670	1,058	353	212	0	2,999
5	882	838	1,323	441	265	0	3,748
6	1,058	1,005	1,588	529	318	0	4,498
7	1,235	1,173	1,852	617	370	0	5,248
8	1,411	1,341	2,117	706	423	0	5,997
9	1,588	1,508	2,381	794	476	0	6,747
10	1,764	1,676	2,646	882	529	0	7,497
11	1,764	1,843	2,911	970	582	0	8,070
12	1,764	2,011	3,175	1,058	635	0	8,643
13	1,764	2,178	3,440	1,147	688	0	9,217
14	1,764	2,346	3,705	1,235	741	0	9,790
15	1,764	2,514	3,969	1,323	794	0	10,363
16	1,764	2,681	4,234	1,411	847	0	10,937
17	1,764	2,849	4,498	1,499	900	0	11,510
18	1,764	3,016	4,763	1,588	953	0	12,083
19	1,764	3,184	5,028	1,676	1,005	0	12,656
20	1,764	3,351	5,292	1,764	1,058	0	13,230
21	1,764	3,351	5,557	1,852	1,111	0	13,635
22	1,764	3,351	5,821	1,940	1,164	0	14,041
23	1,764	3,351	6,086	2,028	1,217	0	14,447
24	1,764	3,351	6,351	2,117	1,270	0	14,853
25	1,764	3,351	6,615	2,205	1,323	0	15,258
26	1,764	3,351	6,880	2,293	1,376	0	15,664
27	1,764	3,351	7,144	2,381	1,429	0	16,070
28	1,764	3,351	7,409	2,469	1,482	0	16,475
29	1,764	3,351	7,674	2,558	1,535	0	16,881
30	1,764	3,351	7,938	2,646	1,588	0	17,287

Sub Watershed #110702040103 Annual Soil Erosion Reduction (tons), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	57	83	130	104	0	0	374
2	113	166	261	209	0	0	748
3	170	248	391	313	0	0	1,122
4	226	331	522	418	0	0	1,497
5	283	414	652	522	0	0	1,871
6	339	497	783	626	0	0	2,245
7	396	579	913	731	0	0	2,619
8	452	662	1,044	835	0	0	2,993
9	509	745	1,174	940	0	0	3,367
10	565	828	1,305	1,044	0	0	3,741
11	565	910	1,435	1,148	0	0	4,059
12	565	993	1,566	1,253	0	0	4,377
13	565	1,076	1,696	1,357	0	0	4,694
14	565	1,159	1,826	1,462	0	0	5,012
15	565	1,241	1,957	1,566	0	0	5,330
16	565	1,324	2,087	1,670	0	0	5,647
17	565	1,407	2,218	1,775	0	0	5,965
18	565	1,490	2,348	1,879	0	0	6,283
19	565	1,573	2,479	1,984	0	0	6,600
20	565	1,655	2,609	2,088	0	0	6,918
21	565	1,655	2,740	2,192	0	0	7,153
22	565	1,655	2,870	2,297	0	0	7,387
23	565	1,655	3,001	2,401	0	0	7,622
24	565	1,655	3,131	2,506	0	0	7,857
25	565	1,655	3,262	2,610	0	0	8,092
26	565	1,655	3,392	2,714	0	0	8,327
27	565	1,655	3,523	2,819	0	0	8,562
28	565	1,655	3,653	2,923	0	0	8,797
29	565	1,655	3,783	3,028	0	0	9,032
30	565	1,655	3,914	3,132	0	0	9,266

Sub Watershed #110702040203 Annual Soil Erosion Reduction (tons), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	86	125	198	158	0	0	567
2	171	251	396	316	0	0	1,134
3	257	376	593	475	0	0	1,701
4	343	502	791	633	0	0	2,269
5	429	627	989	791	0	0	2,836
6	514	752	1,187	949	0	0	3,403
7	600	878	1,385	1,108	0	0	3,970

8	686	1,003	1,582	1,266	0	0	4,537
9	771	1,129	1,780	1,424	0	0	5,104
10	857	1,254	1,978	1,582	0	0	5,672
11	857	1,379	2,176	1,741	0	0	6,153
12	857	1,505	2,374	1,899	0	0	6,634
13	857	1,630	2,571	2,057	0	0	7,116
14	857	1,756	2,769	2,215	0	0	7,597
15	857	1,881	2,967	2,374	0	0	8,079
16	857	2,006	3,165	2,532	0	0	8,560
17	857	2,132	3,363	2,690	0	0	9,042
18	857	2,257	3,560	2,848	0	0	9,523
19	857	2,383	3,758	3,006	0	0	10,004
20	857	2,508	3,956	3,165	0	0	10,486
21	857	2,508	4,154	3,323	0	0	10,842
22	857	2,508	4,352	3,481	0	0	11,198
23	857	2,508	4,549	3,639	0	0	11,554
24	857	2,508	4,747	3,798	0	0	11,910
25	857	2,508	4,945	3,956	0	0	12,266
26	857	2,508	5,143	4,114	0	0	12,622
27	857	2,508	5,341	4,272	0	0	12,978
28	857	2,508	5,538	4,431	0	0	13,334
29	857	2,508	5,736	4,589	0	0	13,690
30	857	2,508	5,934	4,747	0	0	14,046

Sub Watershed #110702040205 Annual Soil Erosion Reduction (tons), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	194	184	291	97	58	0	825
2	388	369	582	194	116	0	1,650
3	582	553	874	291	175	0	2,475
4	777	738	1,165	388	233	0	3,300
5	971	922	1,456	485	291	0	4,126
6	1,165	1,107	1,747	582	349	0	4,951
7	1,359	1,291	2,038	679	408	0	5,776
8	1,553	1,475	2,330	777	466	0	6,601
9	1,747	1,660	2,621	874	524	0	7,426
10	1,941	1,844	2,912	971	582	0	8,251
11	1,941	2,029	3,203	1,068	641	0	8,882
12	1,941	2,213	3,495	1,165	699	0	9,513
13	1,941	2,398	3,786	1,262	757	0	10,144
14	1,941	2,582	4,077	1,359	815	0	10,775
15	1,941	2,767	4,368	1,456	874	0	11,406
16	1,941	2,951	4,659	1,553	932	0	12,037

17	1,941	3,135	4,951	1,650	990	0	12,668
18	1,941	3,320	5,242	1,747	1,048	0	13,299
19	1,941	3,504	5,533	1,844	1,107	0	13,930
20	1,941	3,689	5,824	1,941	1,165	0	14,561
21	1,941	3,689	6,115	2,038	1,223	0	15,007
22	1,941	3,689	6,407	2,136	1,281	0	15,454
23	1,941	3,689	6,698	2,233	1,340	0	15,900
24	1,941	3,689	6,989	2,330	1,398	0	16,347
25	1,941	3,689	7,280	2,427	1,456	0	16,793
26	1,941	3,689	7,572	2,524	1,514	0	17,240
27	1,941	3,689	7,863	2,621	1,573	0	17,686
28	1,941	3,689	8,154	2,718	1,631	0	18,133
29	1,941	3,689	8,445	2,815	1,689	0	18,579
30	1,941	3,689	8,736	2,912	1,747	0	19,026

Sub Watershed #110702040206 Annual Soil Erosion Reduction (tons), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	196	186	294	98	59	0	832
2	392	372	588	196	118	0	1,665
3	588	558	881	294	176	0	2,497
4	783	744	1,175	392	235	0	3,330
5	979	930	1,469	490	294	0	4,162
6	1,175	1,116	1,763	588	353	0	4,994
7	1,371	1,302	2,057	686	411	0	5,827
8	1,567	1,489	2,350	783	470	0	6,659
9	1,763	1,675	2,644	881	529	0	7,492
10	1,959	1,861	2,938	979	588	0	8,324
11	1,959	2,047	3,232	1,077	646	0	8,961
12	1,959	2,233	3,525	1,175	705	0	9,597
13	1,959	2,419	3,819	1,273	764	0	10,234
14	1,959	2,605	4,113	1,371	823	0	10,870
15	1,959	2,791	4,407	1,469	881	0	11,507
16	1,959	2,977	4,701	1,567	940	0	12,143
17	1,959	3,163	4,994	1,665	999	0	12,780
18	1,959	3,349	5,288	1,763	1,058	0	13,416
19	1,959	3,535	5,582	1,861	1,116	0	14,053
20	1,959	3,721	5,876	1,959	1,175	0	14,689
21	1,959	3,721	6,170	2,057	1,234	0	15,140
22	1,959	3,721	6,463	2,154	1,293	0	15,590
23	1,959	3,721	6,757	2,252	1,351	0	16,041
24	1,959	3,721	7,051	2,350	1,410	0	16,491
25	1,959	3,721	7,345	2,448	1,469	0	16,942

26	1,959	3,721	7,638	2,546	1,528	0	17,392
27	1,959	3,721	7,932	2,644	1,586	0	17,843
28	1,959	3,721	8,226	2,742	1,645	0	18,293
29	1,959	3,721	8,520	2,840	1,704	0	18,744
30	1,959	3,721	8,814	2,938	1,763	0	19,194

Sub Watershed #110702040304 Annual Soil Erosion Reduction (tons), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	97	92	146	49	29	0	412
2	194	184	291	97	58	0	825
3	291	277	437	146	87	0	1,237
4	388	369	582	194	116	0	1,650
5	485	461	728	243	146	0	2,062
6	582	553	873	291	175	0	2,474
7	679	645	1,019	340	204	0	2,887
8	776	737	1,164	388	233	0	3,299
9	873	830	1,310	437	262	0	3,712
10	970	922	1,456	485	291	0	4,124
11	970	1,014	1,601	534	320	0	4,439
12	970	1,106	1,747	582	349	0	4,755
13	970	1,198	1,892	631	378	0	5,070
14	970	1,291	2,038	679	408	0	5,385
15	970	1,383	2,183	728	437	0	5,701
16	970	1,475	2,329	776	466	0	6,016
17	970	1,567	2,474	825	495	0	6,332
18	970	1,659	2,620	873	524	0	6,647
19	970	1,751	2,766	922	553	0	6,962
20	970	1,844	2,911	970	582	0	7,278
21	970	1,844	3,057	1,019	611	0	7,501
22	970	1,844	3,202	1,067	640	0	7,724
23	970	1,844	3,348	1,116	670	0	7,947
24	970	1,844	3,493	1,164	699	0	8,170
25	970	1,844	3,639	1,213	728	0	8,394
26	970	1,844	3,784	1,261	757	0	8,617
27	970	1,844	3,930	1,310	786	0	8,840
28	970	1,844	4,076	1,359	815	0	9,063
29	970	1,844	4,221	1,407	844	0	9,286
30	970	1,844	4,367	1,456	873	0	9,510

Sub Watershed #110702040404 Annual Soil Erosion Reduction (tons), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	0	147	232	77	46	0	502

2	0	294	463	155	93	0	1,004
3	0	440	695	232	139	0	1,507
4	0	587	927	309	185	0	2,009
5	0	734	1,159	386	232	0	2,511
6	0	881	1,390	464	278	0	3,013
7	0	1,028	1,622	541	325	0	3,516
8	0	1,175	1,854	618	371	0	4,018
9	0	1,321	2,086	696	417	0	4,520
10	0	1,468	2,317	773	464	0	5,022
11	0	1,615	2,549	850	510	0	5,524
12	0	1,762	2,781	927	556	0	6,027
13	0	1,909	3,013	1,005	603	0	6,529
14	0	2,056	3,244	1,082	649	0	7,031
15	0	2,202	3,476	1,159	696	0	7,533
16	0	2,349	3,708	1,236	742	0	8,036
17	0	2,496	3,940	1,314	788	0	8,538
18	0	2,643	4,171	1,391	835	0	9,040
19	0	2,790	4,403	1,468	881	0	9,542
20	0	2,937	4,635	1,546	927	0	10,044
21	0	2,937	4,867	1,623	974	0	10,400
22	0	2,937	5,098	1,700	1,020	0	10,755
23	0	2,937	5,330	1,777	1,066	0	11,111
24	0	2,937	5,562	1,855	1,113	0	11,466
25	0	2,937	5,794	1,932	1,159	0	11,821
26	0	2,937	6,025	2,009	1,206	0	12,177
27	0	2,937	6,257	2,087	1,252	0	12,532
28	0	2,937	6,489	2,164	1,298	0	12,888
29	0	2,937	6,721	2,241	1,345	0	13,243
30	0	2,937	6,952	2,318	1,391	0	13,598

Tier 2 Targeted Area

Sub Watershed #110702040503 Annual Soil Erosion Reduction (tons), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
31	243	231	365	122	73	0	1,035
32	487	463	730	243	146	0	2,069
33	730	694	1,095	365	219	0	3,104
34	974	925	1,461	487	292	0	4,138
35	1,217	1,156	1,826	609	365	0	5,173
36	1,461	1,388	2,191	730	438	0	6,207
37	1,704	1,619	2,556	852	511	0	7,242
38	1,947	1,850	2,921	974	584	0	8,276
39	2,191	2,081	3,286	1,095	657	0	9,311

40	2,434	2,313	3,651	1,217	730	0	10,346

Sub Watershed #110702040505 Annual Soil Erosion Reduction (tons), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
31	168	159	251	84	50	0	712
32	335	318	503	168	101	0	1,424
33	503	477	754	251	151	0	2,136
34	670	637	1,005	335	201	0	2,848
35	838	796	1,256	419	251	0	3,559
36	1,005	955	1,508	503	302	0	4,271
37	1,173	1,114	1,759	586	352	0	4,983
38	1,340	1,273	2,010	670	402	0	5,695
39	1,508	1,432	2,261	754	452	0	6,407
40	1,675	1,591	2,513	838	503	0	7,119

Sub Watershed #110702040204 Annual Soil Erosion Reduction (tons), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
31	130	124	196	65	39	0	554
32	261	248	391	130	78	0	1,109
33	391	372	587	196	117	0	1,663
34	522	496	783	261	157	0	2,217
35	652	620	978	326	196	0	2,772
36	783	743	1,174	391	235	0	3,326
37	913	867	1,370	457	274	0	3,881
38	1,044	991	1,565	522	313	0	4,435
39	1,174	1,115	1,761	587	352	0	4,989
40	1,304	1,239	1,957	652	391	0	5,544

Sub Watershed #110702040403 Annual Soil Erosion Reduction (tons), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
31	75	71	112	37	22	0	318
32	150	142	225	75	45	0	636
33	225	213	337	112	67	0	954
34	299	284	449	150	90	0	1,273
35	374	356	561	187	112	0	1,591
36	449	427	674	225	135	0	1,909
37	524	498	786	262	157	0	2,227
38	599	569	898	299	180	0	2,545
39	674	640	1,011	337	202	0	2,863
40	749	711	1,123	374	225	0	3,181

Sub Watershed #110702040406 Annual Soil Erosion Reduction (tons), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
31	143	136	215	72	43	0	608
32	286	272	429	143	86	0	1,216
33	429	408	644	215	129	0	1,824
34	572	544	858	286	172	0	2,432
35	715	679	1,073	358	215	0	3,040
36	858	815	1,287	429	257	0	3,648
37	1,001	951	1,502	501	300	0	4,255
38	1,144	1,087	1,716	572	343	0	4,863
39	1,287	1,223	1,931	644	386	0	5,471
40	1,430	1,359	2,146	715	429	0	6,079

Sub Watershed #110702040306 Annual Soil Erosion Reduction (tons), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
31	130	124	195	65	39	0	554
32	260	247	391	130	78	0	1,107
33	391	371	586	195	117	0	1,661
34	521	495	781	260	156	0	2,214
35	651	619	977	326	195	0	2,768
36	781	742	1,172	391	234	0	3,321
37	912	866	1,368	456	274	0	3,875
38	1,042	990	1,563	521	313	0	4,428
39	1,172	1,114	1,758	586	352	0	4,982
40	1,302	1,237	1,954	651	391	0	5,535

Sub Watershed #110702040301 Annual Soil Erosion Reduction (tons), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
31	49	47	74	25	15	0	209
32	98	93	147	49	29	0	417
33	147	140	221	74	44	0	626
34	196	187	295	98	59	0	835
35	245	233	368	123	74	0	1,043
36	295	280	442	147	88	0	1,252
37	344	326	516	172	103	0	1,461
38	393	373	589	196	118	0	1,669
39	442	420	663	221	133	0	1,878
40	491	466	736	245	147	0	2,087

12.3.2 Phosphorus Load Reductions by Sub Watershed

Table 45. Phosphorus Load Reductions by Sub Watershed.

Tier 1 Targeted Area

Sub Watershed #110702040407 Annual Phosphorous Reduction (lbs), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	100	95	80	50	30	100	453
2	199	189	159	100	60	199	906
3	299	284	239	149	90	299	1,359
4	398	378	319	199	120	398	1,812
5	498	473	398	249	149	498	2,265
6	597	568	478	299	179	597	2,718
7	697	662	557	349	209	697	3,171
8	796	757	637	398	239	796	3,624
9	896	852	717	448	269	896	4,077
10	995	946	796	498	299	995	4,530
11	995	1,041	876	548	329	1,095	4,884
12	995	1,135	956	598	359	1,194	5,237
13	995	1,230	1,035	647	388	1,294	5,591
14	995	1,325	1,115	697	418	1,394	5,944
15	995	1,419	1,194	747	448	1,493	6,297
16	995	1,514	1,274	797	478	1,593	6,651
17	995	1,609	1,354	847	508	1,692	7,004
18	995	1,703	1,433	896	538	1,792	7,358
19	995	1,798	1,513	946	568	1,891	7,711
20	995	1,892	1,593	996	598	1,991	8,065
21	995	1,892	1,672	1,046	627	2,090	8,324
22	995	1,892	1,752	1,096	657	2,190	8,583
23	995	1,892	1,832	1,145	687	2,289	8,841
24	995	1,892	1,911	1,195	717	2,389	9,100
25	995	1,892	1,991	1,245	747	2,489	9,359
26	995	1,892	2,070	1,295	777	2,588	9,618
27	995	1,892	2,150	1,345	807	2,688	9,877
28	995	1,892	2,230	1,394	837	2,787	10,136
29	995	1,892	2,309	1,444	867	2,887	10,395
30	995	1,892	2,389	1,494	896	2,986	10,653

Sub Watershed #110702040501 Annual Phosphorous Reduction (lbs), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	91	86	73	45	27	91	413
2	181	172	145	91	54	181	825

3	272	258	218	136	82	272	1,238
4	363	345	290	181	109	363	1,650
5	453	431	363	227	136	453	2,063
6	544	517	435	272	163	544	2,475
7	635	603	508	317	190	635	2,888
8	725	689	580	363	218	725	3,301
9	816	775	653	408	245	816	3,713
10	907	861	725	453	272	907	4,126
11	907	948	798	499	299	997	4,448
12	907	1,034	871	544	326	1,088	4,770
13	907	1,120	943	589	354	1,179	5,092
14	907	1,206	1,016	635	381	1,269	5,413
15	907	1,292	1,088	680	408	1,360	5,735
16	907	1,378	1,161	725	435	1,451	6,057
17	907	1,464	1,233	771	462	1,542	6,379
18	907	1,551	1,306	816	490	1,632	6,701
19	907	1,637	1,378	861	517	1,723	7,023
20	907	1,723	1,451	907	544	1,814	7,345
21	907	1,723	1,523	952	571	1,904	7,581
22	907	1,723	1,596	997	598	1,995	7,816
23	907	1,723	1,668	1,043	626	2,086	8,052
24	907	1,723	1,741	1,088	653	2,176	8,288
25	907	1,723	1,814	1,133	680	2,267	8,524
26	907	1,723	1,886	1,179	707	2,358	8,759
27	907	1,723	1,959	1,224	734	2,448	8,995
28	907	1,723	2,031	1,269	762	2,539	9,231
29	907	1,723	2,104	1,315	789	2,630	9,467
30	907	1,723	2,176	1,360	816	2,720	9,702

Sub Watershed #110702040305 Annual Phosphorous Reduction (lbs), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	108	103	86	54	32	108	492
2	216	205	173	108	65	216	984
3	324	308	259	162	97	324	1,476
4	432	411	346	216	130	432	1,968
5	541	514	432	270	162	541	2,460
6	649	616	519	324	195	649	2,952
7	757	719	605	378	227	757	3,443
8	865	822	692	432	259	865	3,935
9	973	924	778	486	292	973	4,427
10	1,081	1,027	865	541	324	1,081	4,919
11	1,081	1,130	951	595	357	1,189	5,303

12	1,081	1,232	1,038	649	389	1,297	5,687
13	1,081	1,335	1,124	703	422	1,406	6,071
14	1,081	1,438	1,211	757	454	1,514	6,454
15	1,081	1,541	1,297	811	486	1,622	6,838
16	1,081	1,643	1,384	865	519	1,730	7,222
17	1,081	1,746	1,470	919	551	1,838	7,606
18	1,081	1,849	1,557	973	584	1,946	7,990
19	1,081	1,951	1,643	1,027	616	2,054	8,373
20	1,081	2,054	1,730	1,081	649	2,162	8,757
21	1,081	2,054	1,816	1,135	681	2,271	9,038
22	1,081	2,054	1,903	1,189	714	2,379	9,319
23	1,081	2,054	1,989	1,243	746	2,487	9,601
24	1,081	2,054	2,076	1,297	778	2,595	9,882
25	1,081	2,054	2,162	1,351	811	2,703	10,163
26	1,081	2,054	2,249	1,405	843	2,811	10,444
27	1,081	2,054	2,335	1,459	876	2,919	10,725
28	1,081	2,054	2,422	1,514	908	3,027	11,006
29	1,081	2,054	2,508	1,568	941	3,135	11,287
30	1,081	2,054	2,595	1,622	973	3,244	11,568

Sub Watershed #110702040103 Annual Phosphorous Reduction (lbs), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	41	60	50	75	0	63	289
2	82	120	101	151	0	126	578
3	122	179	151	226	0	188	867
4	163	239	201	302	0	251	1,156
5	204	299	251	377	0	314	1,445
6	245	359	302	452	0	377	1,734
7	286	418	352	528	0	440	2,023
8	327	478	402	603	0	503	2,313
9	367	538	452	679	0	565	2,602
10	408	598	503	754	0	628	2,891
11	408	658	553	829	0	691	3,139
12	408	717	603	905	0	754	3,387
13	408	777	653	980	0	817	3,635
14	408	837	704	1,056	0	879	3,884
15	408	897	754	1,131	0	942	4,132
16	408	956	804	1,206	0	1,005	4,380
17	408	1,016	854	1,282	0	1,068	4,628
18	408	1,076	905	1,357	0	1,131	4,877
19	408	1,136	955	1,433	0	1,194	5,125
20	408	1,195	1,005	1,508	0	1,256	5,373

21	408	1,195	1,055	1,583	0	1,319	5,562
22	408	1,195	1,106	1,659	0	1,382	5,750
23	408	1,195	1,156	1,734	0	1,445	5,938
24	408	1,195	1,206	1,810	0	1,508	6,127
25	408	1,195	1,256	1,885	0	1,570	6,315
26	408	1,195	1,307	1,960	0	1,633	6,504
27	408	1,195	1,357	2,036	0	1,696	6,692
28	408	1,195	1,407	2,111	0	1,759	6,881
29	408	1,195	1,457	2,187	0	1,822	7,069
30	408	1,195	1,508	2,262	0	1,884	7,258

Sub Watershed #110702040203 Annual Phosphorous Reduction (lbs), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	49	72	61	91	0	76	349
2	99	144	121	182	0	152	699
3	148	217	182	273	0	228	1,048
4	197	289	243	364	0	304	1,397
5	247	361	304	456	0	380	1,747
6	296	433	364	547	0	456	2,096
7	345	505	425	638	0	531	2,445
8	395	578	486	729	0	607	2,795
9	444	650	547	820	0	683	3,144
10	494	722	607	911	0	759	3,493
11	494	794	668	1,002	0	835	3,793
12	494	866	729	1,093	0	911	4,093
13	494	939	790	1,184	0	987	4,393
14	494	1,011	850	1,275	0	1,063	4,693
15	494	1,083	911	1,367	0	1,139	4,993
16	494	1,155	972	1,458	0	1,215	5,293
17	494	1,227	1,033	1,549	0	1,291	5,593
18	494	1,300	1,093	1,640	0	1,367	5,893
19	494	1,372	1,154	1,731	0	1,443	6,193
20	494	1,444	1,215	1,822	0	1,518	6,493
21	494	1,444	1,276	1,913	0	1,594	6,721
22	494	1,444	1,336	2,004	0	1,670	6,948
23	494	1,444	1,397	2,095	0	1,746	7,176
24	494	1,444	1,458	2,187	0	1,822	7,404
25	494	1,444	1,518	2,278	0	1,898	7,632
26	494	1,444	1,579	2,369	0	1,974	7,859
27	494	1,444	1,640	2,460	0	2,050	8,087
28	494	1,444	1,701	2,551	0	2,126	8,315
29	494	1,444	1,761	2,642	0	2,202	8,543

30	494	1,444	1,822	2,733	0	2,278	8,771

Sub Watershed #110702040205 Annual Phosphorous Reduction (lbs), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	123	116	98	61	37	123	558
2	245	233	196	123	74	245	1,116
3	368	349	294	184	110	368	1,674
4	490	466	392	245	147	490	2,232
5	613	582	490	307	184	613	2,790
6	736	699	589	368	221	736	3,347
7	858	815	687	429	257	858	3,905
8	981	932	785	490	294	981	4,463
9	1,104	1,048	883	552	331	1,104	5,021
10	1,226	1,165	981	613	368	1,226	5,579
11	1,226	1,281	1,079	674	405	1,349	6,014
12	1,226	1,398	1,177	736	441	1,471	6,450
13	1,226	1,514	1,275	797	478	1,594	6,885
14	1,226	1,631	1,373	858	515	1,717	7,320
15	1,226	1,747	1,471	920	552	1,839	7,755
16	1,226	1,864	1,569	981	589	1,962	8,191
17	1,226	1,980	1,668	1,042	625	2,084	8,626
18	1,226	2,097	1,766	1,104	662	2,207	9,061
19	1,226	2,213	1,864	1,165	699	2,330	9,497
20	1,226	2,330	1,962	1,226	736	2,452	9,932
21	1,226	2,330	2,060	1,287	772	2,575	10,251
22	1,226	2,330	2,158	1,349	809	2,698	10,569
23	1,226	2,330	2,256	1,410	846	2,820	10,888
24	1,226	2,330	2,354	1,471	883	2,943	11,207
25	1,226	2,330	2,452	1,533	920	3,065	11,526
26	1,226	2,330	2,550	1,594	956	3,188	11,845
27	1,226	2,330	2,649	1,655	993	3,311	12,164
28	1,226	2,330	2,747	1,717	1,030	3,433	12,482
29	1,226	2,330	2,845	1,778	1,067	3,556	12,801
30	1,226	2,330	2,943	1,839	1,104	3,678	13,120

Sub Watershed #110702040206 Annual Phosphorous Reduction (lbs), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	116	110	92	58	35	116	526
2	231	219	185	116	69	231	1,051
3	347	329	277	173	104	347	1,577
4	462	439	370	231	139	462	2,102
5	578	549	462	289	173	578	2,628

6	693	658	554	347	208	693	3,153
7	809	768	647	404	243	809	3,679
8	924	878	739	462	277	924	4,204
9	1,040	988	832	520	312	1,040	4,730
10	1,155	1,097	924	578	347	1,155	5,256
11	1,155	1,207	1,016	635	381	1,271	5,666
12	1,155	1,317	1,109	693	416	1,386	6,076
13	1,155	1,426	1,201	751	450	1,502	6,486
14	1,155	1,536	1,294	809	485	1,617	6,896
15	1,155	1,646	1,386	866	520	1,733	7,306
16	1,155	1,756	1,478	924	554	1,848	7,716
17	1,155	1,865	1,571	982	589	1,964	8,126
18	1,155	1,975	1,663	1,040	624	2,079	8,536
19	1,155	2,085	1,756	1,097	658	2,195	8,946
20	1,155	2,195	1,848	1,155	693	2,310	9,356
21	1,155	2,195	1,941	1,213	728	2,426	9,656
22	1,155	2,195	2,033	1,271	762	2,541	9,957
23	1,155	2,195	2,125	1,328	797	2,657	10,257
24	1,155	2,195	2,218	1,386	832	2,772	10,557
25	1,155	2,195	2,310	1,444	866	2,888	10,858
26	1,155	2,195	2,403	1,502	901	3,003	11,158
27	1,155	2,195	2,495	1,559	936	3,119	11,458
28	1,155	2,195	2,587	1,617	970	3,234	11,759
29	1,155	2,195	2,680	1,675	1,005	3,350	12,059
30	1,155	2,195	2,772	1,733	1,040	3,465	12,359

Sub Watershed #110702040304 Annual Phosphorous Reduction (lbs), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	57	54	46	29	17	57	260
2	114	108	91	57	34	114	519
3	171	163	137	86	51	171	779
4	228	217	183	114	68	228	1,039
5	285	271	228	143	86	285	1,299
6	342	325	274	171	103	342	1,558
7	400	380	320	200	120	400	1,818
8	457	434	365	228	137	457	2,078
9	514	488	411	257	154	514	2,337
10	571	542	457	285	171	571	2,597
11	571	596	502	314	188	628	2,800
12	571	651	548	342	205	685	3,002
13	571	705	594	371	223	742	3,205
14	571	759	639	400	240	799	3,408

15	571	813	685	428	257	856	3,610
16	571	868	731	457	274	913	3,813
17	571	922	776	485	291	970	4,016
18	571	976	822	514	308	1,027	4,218
19	571	1,030	868	542	325	1,085	4,421
20	571	1,085	913	571	342	1,142	4,623
21	571	1,085	959	599	360	1,199	4,772
22	571	1,085	1,005	628	377	1,256	4,920
23	571	1,085	1,050	656	394	1,313	5,069
24	571	1,085	1,096	685	411	1,370	5,217
25	571	1,085	1,142	714	428	1,427	5,366
26	571	1,085	1,187	742	445	1,484	5,514
27	571	1,085	1,233	771	462	1,541	5,662
28	571	1,085	1,279	799	479	1,598	5,811
29	571	1,085	1,324	828	497	1,655	5,959
30	571	1,085	1,370	856	514	1,712	6,108

Sub Watershed #110702040404 Annual Phosphorous Reduction (lbs), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
1	0	87	73	46	28	92	326
2	0	174	147	92	55	183	651
3	0	262	220	138	83	275	977
4	0	349	294	184	110	367	1,303
5	0	436	367	229	138	459	1,629
6	0	523	440	275	165	550	1,954
7	0	610	514	321	193	642	2,280
8	0	697	587	367	220	734	2,606
9	0	785	660	413	248	826	2,931
10	0	872	734	459	275	917	3,257
11	0	959	807	505	303	1,009	3,583
12	0	1,046	881	551	330	1,101	3,909
13	0	1,133	954	597	358	1,193	4,234
14	0	1,221	1,027	642	385	1,284	4,560
15	0	1,308	1,101	688	413	1,376	4,886
16	0	1,395	1,174	734	440	1,468	5,211
17	0	1,482	1,248	780	468	1,559	5,537
18	0	1,569	1,321	826	496	1,651	5,863
19	0	1,656	1,394	872	523	1,743	6,189
20	0	1,744	1,468	918	551	1,835	6,514
21	0	1,744	1,541	964	578	1,926	6,753
22	0	1,744	1,614	1,009	606	2,018	6,991
23	0	1,744	1,688	1,055	633	2,110	7,230

24	0	1,744	1,761	1,101	661	2,202	7,468
25	0	1,744	1,835	1,147	688	2,293	7,707
26	0	1,744	1,908	1,193	716	2,385	7,946
27	0	1,744	1,981	1,239	743	2,477	8,184
28	0	1,744	2,055	1,285	771	2,568	8,423
29	0	1,744	2,128	1,331	798	2,660	8,661
30	0	1,744	2,202	1,377	826	2,752	8,900

Tier 2 Targeted Area

Sub Watershed #110702040503 Annual Phosphorous Reduction (lbs), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
31	170	161	136	85	51	170	772
32	339	322	271	170	102	339	1,544
33	509	484	407	254	153	509	2,316
34	679	645	543	339	204	679	3,088
35	848	806	679	424	254	848	3,860
36	1,018	967	814	509	305	1,018	4,632
37	1,188	1,128	950	594	356	1,188	5,404
38	1,357	1,289	1,086	679	407	1,357	6,176
39	1,527	1,451	1,222	763	458	1,527	6,948
40	1,697	1,612	1,357	848	509	1,697	7,720

Sub Watershed #110702040505 Annual Phosphorous Reduction (lbs), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
31	112	106	89	56	34	112	508
32	223	212	179	112	67	223	1,016
33	335	318	268	168	101	335	1,524
34	447	424	357	223	134	447	2,032
35	558	530	447	279	168	558	2,540
36	670	637	536	335	201	670	3,049
37	782	743	625	391	235	782	3,557
38	893	849	715	447	268	893	4,065
39	1,005	955	804	503	302	1,005	4,573
40	1,117	1,061	893	558	335	1,117	5,081

Sub Watershed #110702040204 Annual Phosphorous Reduction (lbs), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
31	89	84	71	44	27	89	403
32	177	168	142	89	53	177	805
33	266	252	212	133	80	266	1,208
34	354	336	283	177	106	354	1,611

35	443	420	354	221	133	443	2,014
36	531	505	425	266	159	531	2,416
37	620	589	496	310	186	620	2,819
38	708	673	566	354	212	708	3,222
39	797	757	637	398	239	797	3,625
40	885	841	708	443	266	885	4,027

Sub Watershed #110702040403 Annual Phosphorous Reduction (lbs), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
31	50	47	40	25	15	50	227
32	100	95	80	50	30	100	454
33	150	142	120	75	45	150	681
34	200	190	160	100	60	200	908
35	250	237	200	125	75	250	1,135
36	299	284	240	150	90	299	1,362
37	349	332	279	175	105	349	1,589
38	399	379	319	200	120	399	1,817
39	449	427	359	225	135	449	2,044
40	499	474	399	250	150	499	2,271

Sub Watershed #110702040406 Annual Phosphorous Reduction (lbs), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
31	86	82	69	43	26	86	390
32	172	163	137	86	51	172	781
33	257	245	206	129	77	257	1,171
34	343	326	275	172	103	343	1,562
35	429	408	343	215	129	429	1,952
36	515	489	412	257	154	515	2,343
37	601	571	481	300	180	601	2,733
38	687	652	549	343	206	687	3,124
39	772	734	618	386	232	772	3,514
40	858	815	687	429	257	858	3,905

Sub Watershed #110702040306 Annual Phosphorous Reduction (lbs), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
31	79	75	63	40	24	79	360
32	158	150	127	79	47	158	720
33	237	225	190	119	71	237	1,079
34	316	300	253	158	95	316	1,439
35	395	376	316	198	119	395	1,799
36	474	451	380	237	142	474	2,159

37	554	526	443	277	166	554	2,519
38	633	601	506	316	190	633	2,878
39	712	676	569	356	214	712	3,238
40	791	751	633	395	237	791	3,598

Sub Watershed #110702040301 Annual Phosphorous Reduction (lbs), Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Load Reduction
31	49	47	39	25	15	49	223
32	98	93	79	49	29	98	447
33	147	140	118	74	44	147	670
34	196	187	157	98	59	196	894
35	245	233	196	123	74	245	1,117
36	295	280	236	147	88	295	1,340
37	344	326	275	172	103	344	1,564
38	393	373	314	196	118	393	1,787
39	442	420	353	221	133	442	2,010
40	491	466	393	245	147	491	2,234

12.3.3 Cropland Adoption Rates by Sub Watershed

Table 46. Cropland Adoption Rates by Sub Watershed.

Tier 1 Targeted Area

Sub Watershed #110702040407 Total Annual Adoption, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
1	166	42	83	42	42	83	456
2	166	42	83	42	42	83	456
3	166	42	83	42	42	83	456
4	166	42	83	42	42	83	456
5	166	42	83	42	42	83	456
	830	*208*	*415*	*208*	*208*	*415*	*2,282*
6	166	42	83	42	42	83	456
7	166	42	83	42	42	83	456
8	166	42	83	42	42	83	456
9	166	42	83	42	42	83	456
10	166	42	83	42	42	83	456
	1,659	*415*	*830*	*415*	*415*	*830*	*4,563*
11	0	42	83	42	42	83	290
12	0	42	83	42	42	83	290

13	0	42	83	42	42	83	290
14	0	42	83	42	42	83	290
15	0	42	83	42	42	83	290
16	0	42	83	42	42	83	290
17	0	42	83	42	42	83	290
18	0	42	83	42	42	83	290
19	0	42	83	42	42	83	290
20	0	42	83	42	42	83	290
21	0	0	83	42	42	83	249
22	0	0	83	42	42	83	249
23	0	0	83	42	42	83	249
24	0	0	83	42	42	83	249
25	0	0	83	42	42	83	249
26	0	0	83	42	42	83	249
27	0	0	83	42	42	83	249
28	0	0	83	42	42	83	249
29	0	0	83	42	42	83	249
30	0	0	83	42	42	83	249
	1,659	*830*	*2,489*	*1,245*	*1,245*	*2,489*	*9,956*

Sub Watershed #110702040501 Total Annual Adoption, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
1	191	48	95	48	48	95	525
2	191	48	95	48	48	95	525
3	191	48	95	48	48	95	525
4	191	48	95	48	48	95	525
5	191	48	95	48	48	95	525
	955	*239*	*477*	*239*	*239*	*477*	*2,625*
6	191	48	95	48	48	95	525
7	191	48	95	48	48	95	525
8	191	48	95	48	48	95	525
9	191	48	95	48	48	95	525
10	191	48	95	48	48	95	525
	1,909	*477*	*955*	*477*	*477*	*955*	*5,250*
11	0	48	95	48	48	95	334
12	0	48	95	48	48	95	334
13	0	48	95	48	48	95	334
14	0	48	95	48	48	95	334
15	0	48	95	48	48	95	334

16	0	48	95	48	48	95	334
17	0	48	95	48	48	95	334
18	0	48	95	48	48	95	334
19	0	48	95	48	48	95	334
20	0	48	95	48	48	95	334
21	0	0	95	48	48	95	286
22	0	0	95	48	48	95	286
23	0	0	95	48	48	95	286
24	0	0	95	48	48	95	286
25	0	0	95	48	48	95	286
26	0	0	95	48	48	95	286
27	0	0	95	48	48	95	286
28	0	0	95	48	48	95	286
29	0	0	95	48	48	95	286
30	0	0	95	48	48	95	286
	1,909	*955*	*2,864*	*1,432*	*1,432*	*2,864*	*11,454*

Sub Watershed #110702040305 Total Annual Adoption, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
1	228	57	114	57	57	114	626
2	228	57	114	57	57	114	626
3	228	57	114	57	57	114	626
4	228	57	114	57	57	114	626
5	228	57	114	57	57	114	626
	1,138	*285*	*569*	*285*	*285*	*569*	*3,130*
6	228	57	114	57	57	114	626
7	228	57	114	57	57	114	626
8	228	57	114	57	57	114	626
9	228	57	114	57	57	114	626
10	228	57	114	57	57	114	626
	2,276	*569*	*1,138*	*569*	*569*	*1,138*	*6,259*
11	0	57	114	57	57	114	398
12	0	57	114	57	57	114	398
13	0	57	114	57	57	114	398
14	0	57	114	57	57	114	398
15	0	57	114	57	57	114	398
16	0	57	114	57	57	114	398
17	0	57	114	57	57	114	398
18	0	57	114	57	57	114	398

19	0	57	114	57	57	114	398
20	0	57	114	57	57	114	398
21	0	0	114	57	57	114	341
22	0	0	114	57	57	114	341
23	0	0	114	57	57	114	341
24	0	0	114	57	57	114	341
25	0	0	114	57	57	114	341
26	0	0	114	57	57	114	341
27	0	0	114	57	57	114	341
28	0	0	114	57	57	114	341
29	0	0	114	57	57	114	341
30	0	0	114	57	57	114	341
	2,276	*1,138*	*3,414*	*1,707*	*1,707*	*3,414*	*13,657*

Sub Watershed #110702040103 Total Annual Adoption, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
1	63	24	48	58	0	48	242
2	63	24	48	58	0	48	242
3	63	24	48	58	0	48	242
4	63	24	48	58	0	48	242
5	63	24	48	58	0	48	242
	314	*121*	*242*	*290*	*0*	*242*	*1,208*
6	63	24	48	58	0	48	242
7	63	24	48	58	0	48	242
8	63	24	48	58	0	48	242
9	63	24	48	58	0	48	242
10	63	24	48	58	0	48	242
	628	*242*	*483*	*580*	*0*	*483*	*2,416*
11	0	24	48	58	0	48	179
12	0	24	48	58	0	48	179
13	0	24	48	58	0	48	179
14	0	24	48	58	0	48	179
15	0	24	48	58	0	48	179
16	0	24	48	58	0	48	179
17	0	24	48	58	0	48	179
18	0	24	48	58	0	48	179
19	0	24	48	58	0	48	179
20	0	24	48	58	0	48	179
21	0	0	48	58	0	48	155

22	0	0	48	58	0	48	155
23	0	0	48	58	0	48	155
24	0	0	48	58	0	48	155
25	0	0	48	58	0	48	155
26	0	0	48	58	0	48	155
27	0	0	48	58	0	48	155
28	0	0	48	58	0	48	155
29	0	0	48	58	0	48	155
30	0	0	48	58	0	48	155
	628	*484*	*1,450*	*1,740*	*0*	*1,450*	*5,751*

Sub Watershed #110702040203 Total Annual Adoption, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
1	104	40	80	96	0	80	400
2	104	40	80	96	0	80	400
3	104	40	80	96	0	80	400
4	104	40	80	96	0	80	400
5	104	40	80	96	0	80	400
	520	*200*	*400*	*480*	*0*	*400*	*1,998*
6	104	40	80	96	0	80	400
7	104	40	80	96	0	80	400
8	104	40	80	96	0	80	400
9	104	40	80	96	0	80	400
10	104	40	80	96	0	80	400
	1,039	*400*	*799*	*959*	*0*	*799*	*3,996*
11	0	40	80	96	0	80	296
12	0	40	80	96	0	80	296
13	0	40	80	96	0	80	296
14	0	40	80	96	0	80	296
15	0	40	80	96	0	80	296
16	0	40	80	96	0	80	296
17	0	40	80	96	0	80	296
18	0	40	80	96	0	80	296
19	0	40	80	96	0	80	296
20	0	40	80	96	0	80	296
21	0	0	80	96	0	80	256
22	0	0	80	96	0	80	256
23	0	0	80	96	0	80	256
24	0	0	80	96	0	80	256

25	0	0	80	96	0	80	256
26	0	0	80	96	0	80	256
27	0	0	80	96	0	80	256
28	0	0	80	96	0	80	256
29	0	0	80	96	0	80	256
30	0	0	80	96	0	80	256
	1,039	*800*	*2,398*	*2,877*	*0*	*2,398*	*9,511*

Sub Watershed #110702040205 Total Annual Adoption, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
1	204	51	102	51	51	102	562
2	204	51	102	51	51	102	562
3	204	51	102	51	51	102	562
4	204	51	102	51	51	102	562
5	204	51	102	51	51	102	562
	1,022	*255*	*511*	*255*	*255*	*511*	*2,810*
6	204	51	102	51	51	102	562
7	204	51	102	51	51	102	562
8	204	51	102	51	51	102	562
9	204	51	102	51	51	102	562
10	204	51	102	51	51	102	562
	2,044	*511*	*1,022*	*511*	*511*	*1,022*	*5,620*
11	0	51	102	51	51	102	358
12	0	51	102	51	51	102	358
13	0	51	102	51	51	102	358
14	0	51	102	51	51	102	358
15	0	51	102	51	51	102	358
16	0	51	102	51	51	102	358
17	0	51	102	51	51	102	358
18	0	51	102	51	51	102	358
19	0	51	102	51	51	102	358
20	0	51	102	51	51	102	358
21	0	0	102	51	51	102	307
22	0	0	102	51	51	102	307
23	0	0	102	51	51	102	307
24	0	0	102	51	51	102	307
25	0	0	102	51	51	102	307
26	0	0	102	51	51	102	307
27	0	0	102	51	51	102	307

28	0	0	102	51	51	102	307
29	0	0	102	51	51	102	307
30	0	0	102	51	51	102	307
	2,044	*1,022*	*3,065*	*1,533*	*1,533*	*3,065*	*12,262*

Sub Watershed #110702040206 Total Annual Adoption, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
1	201	50	100	50	50	100	552
2	201	50	100	50	50	100	552
3	201	50	100	50	50	100	552
4	201	50	100	50	50	100	552
5	201	50	100	50	50	100	552
	1,004	*251*	*502*	*251*	*251*	*502*	*2,762*
6	201	50	100	50	50	100	552
7	201	50	100	50	50	100	552
8	201	50	100	50	50	100	552
9	201	50	100	50	50	100	552
10	201	50	100	50	50	100	552
	2,009	*502*	*1,004*	*502*	*502*	*1,004*	*5,524*
11	0	50	100	50	50	100	352
12	0	50	100	50	50	100	352
13	0	50	100	50	50	100	352
14	0	50	100	50	50	100	352
15	0	50	100	50	50	100	352
16	0	50	100	50	50	100	352
17	0	50	100	50	50	100	352
18	0	50	100	50	50	100	352
19	0	50	100	50	50	100	352
20	0	50	100	50	50	100	352
21	0	0	100	50	50	100	301
22	0	0	100	50	50	100	301
23	0	0	100	50	50	100	301
24	0	0	100	50	50	100	301
25	0	0	100	50	50	100	301
26	0	0	100	50	50	100	301
27	0	0	100	50	50	100	301
28	0	0	100	50	50	100	301
29	0	0	100	50	50	100	301
30	0	0	100	50	50	100	301

	2,009	*1,004*	*3,013*	*1,507*	*1,507*	*3,013*	*12,053*

Sub Watershed #110702040304 Total Annual Adoption, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
1	114	29	57	29	29	57	314
2	114	29	57	29	29	57	314
3	114	29	57	29	29	57	314
4	114	29	57	29	29	57	314
5	114	29	57	29	29	57	314
	571	*143*	*285*	*143*	*143*	*285*	*1,570*
6	114	29	57	29	29	57	314
7	114	29	57	29	29	57	314
8	114	29	57	29	29	57	314
9	114	29	57	29	29	57	314
10	114	29	57	29	29	57	314
	1,142	*285*	*571*	*285*	*285*	*571*	*3,139*
11	0	29	57	29	29	57	200
12	0	29	57	29	29	57	200
13	0	29	57	29	29	57	200
14	0	29	57	29	29	57	200
15	0	29	57	29	29	57	200
16	0	29	57	29	29	57	200
17	0	29	57	29	29	57	200
18	0	29	57	29	29	57	200
19	0	29	57	29	29	57	200
20	0	29	57	29	29	57	200
21	0	0	57	29	29	57	171
22	0	0	57	29	29	57	171
23	0	0	57	29	29	57	171
24	0	0	57	29	29	57	171
25	0	0	57	29	29	57	171
26	0	0	57	29	29	57	171
27	0	0	57	29	29	57	171
28	0	0	57	29	29	57	171
29	0	0	57	29	29	57	171
30	0	0	57	29	29	57	171
	1,142	*571*	*1,712*	*856*	*856*	*1,712*	*6,850*

Sub Watershed #110702040404 Total Annual Adoption, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
1	0	48	97	48	48	97	338
2	0	48	97	48	48	97	338
3	0	48	97	48	48	97	338
4	0	48	97	48	48	97	338
5	0	48	97	48	48	97	338
	0	*242*	*483*	*242*	*242*	*483*	*1,690*
6	0	48	97	48	48	97	338
7	0	48	97	48	48	97	338
8	0	48	97	48	48	97	338
9	0	48	97	48	48	97	338
10	0	48	97	48	48	97	338
	0	*483*	*966*	*483*	*483*	*966*	*3,380*
11	0	48	97	48	48	97	338
12	0	48	97	48	48	97	338
13	0	48	97	48	48	97	338
14	0	48	97	48	48	97	338
15	0	48	97	48	48	97	338
16	0	48	97	48	48	97	338
17	0	48	97	48	48	97	338
18	0	48	97	48	48	97	338
19	0	48	97	48	48	97	338
20	0	48	97	48	48	97	338
21	0	0	97	48	48	97	290
22	0	0	97	48	48	97	290
23	0	0	97	48	48	97	290
24	0	0	97	48	48	97	290
25	0	0	97	48	48	97	290
26	0	0	97	48	48	97	290
27	0	0	97	48	48	97	290
28	0	0	97	48	48	97	290
29	0	0	97	48	48	97	290
30	0	0	97	48	48	97	290
	0	*966*	*2,897*	*1,449*	*1,449*	*2,897*	*9,658*

Tier 2 Targeted Area

Sub Watershed #110702040503 Total Annual Adoption, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
31	295	74	148	74	74	148	811
32	295	74	148	74	74	148	811
33	295	74	148	74	74	148	811
34	295	74	148	74	74	148	811
35	295	74	148	74	74	148	811
	1,475	*369*	*738*	*369*	*369*	*738*	*4,057*
36	295	74	148	74	74	148	811
37	295	74	148	74	74	148	811
38	295	74	148	74	74	148	811
39	295	74	148	74	74	148	811
40	295	74	148	74	74	148	811
	2,951	*738*	*1,475*	*738*	*738*	*1,475*	*8,114*

Sub Watershed #110702040505 Total Annual Adoption, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
31	223	56	112	56	56	112	614
32	223	56	112	56	56	112	614
33	223	56	112	56	56	112	614
34	223	56	112	56	56	112	614
35	223	56	112	56	56	112	614
	1,117	*279*	*558*	*279*	*279*	*558*	*3,071*
36	223	56	112	56	56	112	614
37	223	56	112	56	56	112	614
38	223	56	112	56	56	112	614
39	223	56	112	56	56	112	614
40	223	56	112	56	56	112	614
	2,233	*558*	*1,117*	*558*	*558*	*1,117*	*6,142*

Sub Watershed #110702040204 Total Annual Adoption, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
31	186	47	93	47	47	93	512
32	186	47	93	47	47	93	512

33	186	47	93	47	47	93	512
34	186	47	93	47	47	93	512
35	186	47	93	47	47	93	512
	932	*233*	*466*	*233*	*233*	*466*	*2,562*
36	186	47	93	47	47	93	512
37	186	47	93	47	47	93	512
38	186	47	93	47	47	93	512
39	186	47	93	47	47	93	512
40	186	47	93	47	47	93	512
	1,863	*466*	*932*	*466*	*466*	*932*	*5,124*

Sub Watershed #110702040403 Total Annual Adoption, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
31	111	28	55	28	28	55	305
32	111	28	55	28	28	55	305
33	111	28	55	28	28	55	305
34	111	28	55	28	28	55	305
35	111	28	55	28	28	55	305
	555	*139*	*277*	*139*	*139*	*277*	*1,525*
36	111	28	55	28	28	55	305
37	111	28	55	28	28	55	305
38	111	28	55	28	28	55	305
39	111	28	55	28	28	55	305
40	111	28	55	28	28	55	305
	1,109	*277*	*555*	*277*	*277*	*555*	*3,050*

Sub Watershed #110702040406 Total Annual Adoption, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
31	191	48	95	48	48	95	524
32	191	48	95	48	48	95	524
33	191	48	95	48	48	95	524
34	191	48	95	48	48	95	524
35	191	48	95	48	48	95	524
	954	*238*	*477*	*238*	*238*	*477*	*2,622*
36	191	48	95	48	48	95	524
37	191	48	95	48	48	95	524

38	191	48	95	48	48	95	524
39	191	48	95	48	48	95	524
40	191	48	95	48	48	95	524
	1,907	*477*	*954*	*477*	*477*	*954*	*5,245*

Sub Watershed #110702040306 Total Annual Adoption, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
31	186	47	93	47	47	93	512
32	186	47	93	47	47	93	512
33	186	47	93	47	47	93	512
34	186	47	93	47	47	93	512
35	186	47	93	47	47	93	512
	930	*233*	*465*	*233*	*233*	*465*	*2,558*
36	186	47	93	47	47	93	512
37	186	47	93	47	47	93	512
38	186	47	93	47	47	93	512
39	186	47	93	47	47	93	512
40	186	47	93	47	47	93	512
	1,861	*465*	*930*	*465*	*465*	*930*	*5,117*

Sub Watershed #110702040301 Total Annual Adoption, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Annual Adoption
31	116	29	58	29	29	58	318
32	116	29	58	29	29	58	318
33	116	29	58	29	29	58	318
34	116	29	58	29	29	58	318
35	116	29	58	29	29	58	318
	578	*144*	*289*	*144*	*144*	*289*	*1,588*
36	116	29	58	29	29	58	318
37	116	29	58	29	29	58	318
38	116	29	58	29	29	58	318
39	116	29	58	29	29	58	318
40	116	29	58	29	29	58	318
	1,155	*289*	*578*	*289*	*289*	*578*	*3,177*

12.3.4 Cropland Costs Before Cost Share by Sub Watershed

Table 47. Cropland Costs Before Cost Share by Sub Watershed.

Tier 1 Targeted Area

Sub Watershed #110702040407 Total Annual Cost, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$6,444	$6,225	$6,444	$41,500	$4,233	$2,255	$67,101
2	$6,637	$6,412	$6,638	$42,745	$4,360	$2,323	$69,114
3	$6,836	$6,604	$6,837	$44,027	$4,491	$2,393	$71,188
4	$7,041	$6,802	$7,042	$45,348	$4,626	$2,465	$73,323
5	$7,252	$7,006	$7,253	$46,709	$4,764	$2,538	$75,523
6	$7,470	$7,216	$7,471	$48,110	$4,907	$2,615	$77,789
7	$7,694	$7,433	$7,695	$49,553	$5,054	$2,693	$80,123
8	$7,925	$7,656	$7,926	$51,040	$5,206	$2,774	$82,526
9	$8,163	$7,886	$8,164	$52,571	$5,362	$2,857	$85,002
10	$8,407	$8,122	$8,408	$54,148	$5,523	$2,943	$87,552
11	$0	$8,366	$8,661	$55,773	$5,689	$3,031	$81,519
12	$0	$8,617	$8,921	$57,446	$5,859	$3,122	$83,965
13	$0	$8,875	$9,188	$59,169	$6,035	$3,216	$86,484
14	$0	$9,142	$9,464	$60,944	$6,216	$3,312	$89,078
15	$0	$9,416	$9,748	$62,772	$6,403	$3,412	$91,750
16	$0	$9,698	$10,040	$64,656	$6,595	$3,514	$94,503
17	$0	$9,989	$10,341	$66,595	$6,793	$3,619	$97,338
18	$0	$10,289	$10,652	$68,593	$6,997	$3,728	$100,258
19	$0	$10,598	$10,971	$70,651	$7,206	$3,840	$103,266
20	$0	$10,916	$11,300	$72,771	$7,423	$3,955	$106,364
21	$0	$0	$11,639	$74,954	$7,645	$4,074	$98,312
22	$0	$0	$11,988	$77,202	$7,875	$4,196	$101,261
23	$0	$0	$12,348	$79,518	$8,111	$4,322	$104,299
24	$0	$0	$12,719	$81,904	$8,354	$4,451	$107,428
25	$0	$0	$13,100	$84,361	$8,605	$4,585	$110,651
26	$0	$0	$13,493	$86,892	$8,863	$4,722	$113,970
27	$0	$0	$13,898	$89,499	$9,129	$4,864	$117,389
28	$0	$0	$14,315	$92,183	$9,403	$5,010	$120,911
29	$0	$0	$14,744	$94,949	$9,685	$5,160	$124,538
30	$0	$0	$15,187	$97,797	$9,975	$5,315	$128,274

Sub Watershed #110702040501 Total Annual Cost, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$7,415	$7,159	$7,416	$47,725	$4,868	$2,595	$77,177
2	$7,637	$7,374	$7,638	$49,157	$5,014	$2,673	$79,492
3	$7,866	$7,595	$7,867	$50,631	$5,164	$2,753	$81,877
4	$8,102	$7,823	$8,103	$52,150	$5,319	$2,836	$84,333
5	$8,345	$8,057	$8,346	$53,715	$5,479	$2,921	$86,863
6	$8,596	$8,299	$8,597	$55,326	$5,643	$3,009	$89,469
7	$8,853	$8,548	$8,855	$56,986	$5,813	$3,099	$92,153
8	$9,119	$8,804	$9,120	$58,696	$5,987	$3,192	$94,918
9	$9,393	$9,068	$9,394	$60,457	$6,167	$3,288	$97,766
10	$9,674	$9,341	$9,676	$62,270	$6,352	$3,386	$100,699
11	$0	$9,621	$9,966	$64,138	$6,542	$3,488	$93,755
12	$0	$9,909	$10,265	$66,063	$6,738	$3,592	$96,568
13	$0	$10,207	$10,573	$68,044	$6,941	$3,700	$99,465
14	$0	$10,513	$10,890	$70,086	$7,149	$3,811	$102,449
15	$0	$10,828	$11,217	$72,188	$7,363	$3,926	$105,522
16	$0	$11,153	$11,553	$74,354	$7,584	$4,043	$108,688
17	$0	$11,488	$11,900	$76,585	$7,812	$4,165	$111,948
18	$0	$11,832	$12,257	$78,882	$8,046	$4,290	$115,307
19	$0	$12,187	$12,624	$81,249	$8,287	$4,418	$118,766
20	$0	$12,553	$13,003	$83,686	$8,536	$4,551	$122,329
21	$0	$0	$13,393	$86,197	$8,792	$4,687	$113,069
22	$0	$0	$13,795	$88,783	$9,056	$4,828	$116,461
23	$0	$0	$14,209	$91,446	$9,327	$4,973	$119,955
24	$0	$0	$14,635	$94,189	$9,607	$5,122	$123,554
25	$0	$0	$15,074	$97,015	$9,896	$5,276	$127,261
26	$0	$0	$15,526	$99,926	$10,192	$5,434	$131,078
27	$0	$0	$15,992	$102,923	$10,498	$5,597	$135,011
28	$0	$0	$16,472	$106,011	$10,813	$5,765	$139,061
29	$0	$0	$16,966	$109,191	$11,138	$5,938	$143,233
30	$0	$0	$17,475	$112,467	$11,472	$6,116	$147,530

Sub Watershed #110702040305 Total Annual Cost, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$8,840	$8,535	$8,842	$56,900	$5,804	$3,094	$92,015
2	$9,105	$8,791	$9,107	$58,607	$5,978	$3,187	$94,776
3	$9,378	$9,055	$9,380	$60,365	$6,157	$3,283	$97,619
4	$9,660	$9,326	$9,662	$62,176	$6,342	$3,381	$100,547
5	$9,949	$9,606	$9,952	$64,041	$6,532	$3,483	$103,564

6	$10,248	$9,894	$10,250	$65,963	$6,728	$3,587	$106,671
7	$10,555	$10,191	$10,558	$67,942	$6,930	$3,695	$109,871
8	$10,872	$10,497	$10,874	$69,980	$7,138	$3,806	$113,167
9	$11,198	$10,812	$11,201	$72,079	$7,352	$3,920	$116,562
10	$11,534	$11,136	$11,537	$74,242	$7,573	$4,038	$120,059
11	$0	$11,470	$11,883	$76,469	$7,800	$4,159	$111,781
12	$0	$11,814	$12,239	$78,763	$8,034	$4,284	$115,134
13	$0	$12,169	$12,606	$81,126	$8,275	$4,412	$118,588
14	$0	$12,534	$12,985	$83,560	$8,523	$4,544	$122,146
15	$0	$12,910	$13,374	$86,066	$8,779	$4,681	$125,810
16	$0	$13,297	$13,775	$88,648	$9,042	$4,821	$129,584
17	$0	$13,696	$14,189	$91,308	$9,313	$4,966	$133,472
18	$0	$14,107	$14,614	$94,047	$9,593	$5,115	$137,476
19	$0	$14,530	$15,053	$96,868	$9,881	$5,268	$141,600
20	$0	$14,966	$15,504	$99,774	$10,177	$5,426	$145,848
21	$0	$0	$15,969	$102,768	$10,482	$5,589	$134,808
22	$0	$0	$16,449	$105,851	$10,797	$5,757	$138,853
23	$0	$0	$16,942	$109,026	$11,121	$5,929	$143,018
24	$0	$0	$17,450	$112,297	$11,454	$6,107	$147,309
25	$0	$0	$17,974	$115,666	$11,798	$6,290	$151,728
26	$0	$0	$18,513	$119,136	$12,152	$6,479	$156,280
27	$0	$0	$19,068	$122,710	$12,516	$6,674	$160,968
28	$0	$0	$19,640	$126,391	$12,892	$6,874	$165,797
29	$0	$0	$20,230	$130,183	$13,279	$7,080	$170,771
30	$0	$0	$20,837	$134,089	$13,677	$7,292	$175,895

Sub Watershed #110702040103 Total Annual Cost, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$2,439	$3,630	$3,754	$58,000	$0	$1,314	$69,137
2	$2,512	$3,739	$3,867	$59,740	$0	$1,353	$71,211
3	$2,588	$3,851	$3,983	$61,532	$0	$1,394	$73,347
4	$2,665	$3,967	$4,102	$63,378	$0	$1,436	$75,548
5	$2,745	$4,086	$4,225	$65,280	$0	$1,479	$77,814
6	$2,828	$4,208	$4,352	$67,238	$0	$1,523	$80,149
7	$2,912	$4,334	$4,482	$69,255	$0	$1,569	$82,553
8	$3,000	$4,464	$4,617	$71,333	$0	$1,616	$85,030
9	$3,090	$4,598	$4,755	$73,473	$0	$1,664	$87,581
10	$3,183	$4,736	$4,898	$75,677	$0	$1,714	$90,208
11	$0	$4,878	$5,045	$77,947	$0	$1,766	$89,636
12	$0	$5,025	$5,196	$80,286	$0	$1,819	$92,325

13	$0	$5,176	$5,352	$82,694	$0	$1,873	$95,095
14	$0	$5,331	$5,513	$85,175	$0	$1,929	$97,948
15	$0	$5,491	$5,678	$87,730	$0	$1,987	$100,886
16	$0	$5,655	$5,849	$90,362	$0	$2,047	$103,913
17	$0	$5,825	$6,024	$93,073	$0	$2,108	$107,030
18	$0	$6,000	$6,205	$95,865	$0	$2,172	$110,241
19	$0	$6,180	$6,391	$98,741	$0	$2,237	$113,549
20	$0	$6,365	$6,583	$101,703	$0	$2,304	$116,955
21	$0	$0	$6,780	$104,754	$0	$2,373	$113,907
22	$0	$0	$6,984	$107,897	$0	$2,444	$117,325
23	$0	$0	$7,193	$111,134	$0	$2,517	$120,844
24	$0	$0	$7,409	$114,468	$0	$2,593	$124,470
25	$0	$0	$7,631	$117,902	$0	$2,671	$128,204
26	$0	$0	$7,860	$121,439	$0	$2,751	$132,050
27	$0	$0	$8,096	$125,082	$0	$2,833	$136,011
28	$0	$0	$8,339	$128,835	$0	$2,918	$140,092
29	$0	$0	$8,589	$132,700	$0	$3,006	$144,295
30	$0	$0	$8,847	$136,681	$0	$3,096	$148,623

Sub Watershed #110702040203 Total Annual Cost, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$4,035	$6,000	$6,209	$95,900	$0	$2,173	$114,317
2	$4,157	$6,180	$6,395	$98,777	$0	$2,238	$117,747
3	$4,281	$6,365	$6,587	$101,740	$0	$2,305	$121,279
4	$4,410	$6,556	$6,785	$104,793	$0	$2,375	$124,918
5	$4,542	$6,753	$6,988	$107,936	$0	$2,446	$128,665
6	$4,678	$6,956	$7,198	$111,174	$0	$2,519	$132,525
7	$4,819	$7,164	$7,414	$114,510	$0	$2,595	$136,501
8	$4,963	$7,379	$7,636	$117,945	$0	$2,673	$140,596
9	$5,112	$7,601	$7,865	$121,483	$0	$2,753	$144,814
10	$5,265	$7,829	$8,101	$125,128	$0	$2,835	$149,158
11	$0	$8,063	$8,344	$128,882	$0	$2,920	$148,210
12	$0	$8,305	$8,595	$132,748	$0	$3,008	$152,656
13	$0	$8,555	$8,853	$136,730	$0	$3,098	$157,236
14	$0	$8,811	$9,118	$140,832	$0	$3,191	$161,953
15	$0	$9,076	$9,392	$145,057	$0	$3,287	$166,811
16	$0	$9,348	$9,673	$149,409	$0	$3,386	$171,816
17	$0	$9,628	$9,964	$153,891	$0	$3,487	$176,970
18	$0	$9,917	$10,263	$158,508	$0	$3,592	$182,279
19	$0	$10,215	$10,570	$163,263	$0	$3,699	$187,748

20	$0	$10,521	$10,887	$168,161	$0	$3,810	$193,380
21	$0	$0	$11,214	$173,206	$0	$3,925	$188,345
22	$0	$0	$11,551	$178,402	$0	$4,042	$193,995
23	$0	$0	$11,897	$183,754	$0	$4,164	$199,815
24	$0	$0	$12,254	$189,267	$0	$4,289	$205,810
25	$0	$0	$12,622	$194,945	$0	$4,417	$211,984
26	$0	$0	$13,000	$200,793	$0	$4,550	$218,343
27	$0	$0	$13,390	$206,817	$0	$4,686	$224,894
28	$0	$0	$13,792	$213,022	$0	$4,827	$231,640
29	$0	$0	$14,206	$219,412	$0	$4,972	$238,590
30	$0	$0	$14,632	$225,995	$0	$5,121	$245,747

Sub Watershed #110702040205 Total Annual Cost, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$7,937	$7,664	$7,938	$51,090	$5,211	$2,778	$82,619
2	$8,175	$7,893	$8,177	$52,623	$5,368	$2,862	$85,097
3	$8,421	$8,130	$8,422	$54,201	$5,529	$2,947	$87,650
4	$8,673	$8,374	$8,674	$55,827	$5,694	$3,036	$90,280
5	$8,934	$8,625	$8,935	$57,502	$5,865	$3,127	$92,988
6	$9,202	$8,884	$9,203	$59,227	$6,041	$3,221	$95,778
7	$9,478	$9,151	$9,479	$61,004	$6,222	$3,317	$98,651
8	$9,762	$9,425	$9,763	$62,834	$6,409	$3,417	$101,611
9	$10,055	$9,708	$10,056	$64,719	$6,601	$3,519	$104,659
10	$10,356	$9,999	$10,358	$66,661	$6,799	$3,625	$107,799
11	$0	$10,299	$10,668	$68,661	$7,003	$3,734	$100,365
12	$0	$10,608	$10,989	$70,721	$7,213	$3,846	$103,376
13	$0	$10,926	$11,318	$72,842	$7,430	$3,961	$106,478
14	$0	$11,254	$11,658	$75,027	$7,653	$4,080	$109,672
15	$0	$11,592	$12,007	$77,278	$7,882	$4,202	$112,962
16	$0	$11,939	$12,368	$79,597	$8,119	$4,328	$116,351
17	$0	$12,298	$12,739	$81,984	$8,362	$4,458	$119,842
18	$0	$12,667	$13,121	$84,444	$8,613	$4,592	$123,437
19	$0	$13,047	$13,515	$86,977	$8,872	$4,730	$127,140
20	$0	$13,438	$13,920	$89,587	$9,138	$4,872	$130,954
21	$0	$0	$14,338	$92,274	$9,412	$5,018	$121,042
22	$0	$0	$14,768	$95,042	$9,694	$5,168	$124,673
23	$0	$0	$15,211	$97,894	$9,985	$5,323	$128,413
24	$0	$0	$15,667	$100,831	$10,285	$5,483	$132,265
25	$0	$0	$16,137	$103,855	$10,593	$5,648	$136,233
26	$0	$0	$16,621	$106,971	$10,911	$5,817	$140,320

27	$0	$0	$17,120	$110,180	$11,238	$5,992	$144,530
28	$0	$0	$17,633	$113,486	$11,576	$6,171	$148,866
29	$0	$0	$18,162	$116,890	$11,923	$6,356	$153,332
30	$0	$0	$18,707	$120,397	$12,280	$6,547	$157,932

Sub Watershed #110702040206 Total Annual Cost, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$7,802	$7,533	$7,803	$50,220	$5,122	$2,731	$81,212
2	$8,036	$7,759	$8,037	$51,727	$5,276	$2,813	$83,648
3	$8,277	$7,992	$8,278	$53,278	$5,434	$2,897	$86,158
4	$8,526	$8,232	$8,527	$54,877	$5,597	$2,984	$88,742
5	$8,781	$8,478	$8,783	$56,523	$5,765	$3,074	$91,405
6	$9,045	$8,733	$9,046	$58,219	$5,938	$3,166	$94,147
7	$9,316	$8,995	$9,317	$59,965	$6,116	$3,261	$96,971
8	$9,596	$9,265	$9,597	$61,764	$6,300	$3,359	$99,880
9	$9,884	$9,543	$9,885	$63,617	$6,489	$3,460	$102,877
10	$10,180	$9,829	$10,181	$65,526	$6,684	$3,563	$105,963
11	$0	$10,124	$10,487	$67,491	$6,884	$3,670	$98,656
12	$0	$10,427	$10,801	$69,516	$7,091	$3,780	$101,616
13	$0	$10,740	$11,125	$71,602	$7,303	$3,894	$104,665
14	$0	$11,062	$11,459	$73,750	$7,522	$4,011	$107,804
15	$0	$11,394	$11,803	$75,962	$7,748	$4,131	$111,039
16	$0	$11,736	$12,157	$78,241	$7,981	$4,255	$114,370
17	$0	$12,088	$12,522	$80,588	$8,220	$4,382	$117,801
18	$0	$12,451	$12,897	$83,006	$8,467	$4,514	$121,335
19	$0	$12,824	$13,284	$85,496	$8,721	$4,649	$124,975
20	$0	$13,209	$13,683	$88,061	$8,982	$4,789	$128,724
21	$0	$0	$14,093	$90,703	$9,252	$4,932	$118,980
22	$0	$0	$14,516	$93,424	$9,529	$5,080	$122,550
23	$0	$0	$14,952	$96,227	$9,815	$5,233	$126,226
24	$0	$0	$15,400	$99,114	$10,110	$5,390	$130,013
25	$0	$0	$15,862	$102,087	$10,413	$5,551	$133,914
26	$0	$0	$16,338	$105,150	$10,725	$5,718	$137,931
27	$0	$0	$16,828	$108,304	$11,047	$5,890	$142,069
28	$0	$0	$17,333	$111,553	$11,378	$6,066	$146,331
29	$0	$0	$17,853	$114,900	$11,720	$6,248	$150,721
30	$0	$0	$18,389	$118,347	$12,071	$6,436	$155,242

Sub Watershed #110702040304 Total Annual Cost, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$4,434	$4,281	$4,435	$28,540	$2,911	$1,552	$46,153
2	$4,567	$4,409	$4,568	$29,396	$2,998	$1,599	$47,537
3	$4,704	$4,542	$4,705	$30,278	$3,088	$1,647	$48,963
4	$4,845	$4,678	$4,846	$31,186	$3,181	$1,696	$50,432
5	$4,990	$4,818	$4,991	$32,122	$3,276	$1,747	$51,945
6	$5,140	$4,963	$5,141	$33,086	$3,375	$1,799	$53,504
7	$5,294	$5,112	$5,295	$34,078	$3,476	$1,853	$55,109
8	$5,453	$5,265	$5,454	$35,101	$3,580	$1,909	$56,762
9	$5,617	$5,423	$5,618	$36,154	$3,688	$1,966	$58,465
10	$5,785	$5,586	$5,786	$37,238	$3,798	$2,025	$60,219
11	$0	$5,753	$5,960	$38,355	$3,912	$2,086	$56,066
12	$0	$5,926	$6,138	$39,506	$4,030	$2,148	$57,748
13	$0	$6,104	$6,323	$40,691	$4,151	$2,213	$59,481
14	$0	$6,287	$6,512	$41,912	$4,275	$2,279	$61,265
15	$0	$6,475	$6,708	$43,169	$4,403	$2,348	$63,103
16	$0	$6,670	$6,909	$44,464	$4,535	$2,418	$64,996
17	$0	$6,870	$7,116	$45,798	$4,671	$2,491	$66,946
18	$0	$7,076	$7,330	$47,172	$4,812	$2,565	$68,955
19	$0	$7,288	$7,550	$48,587	$4,956	$2,642	$71,023
20	$0	$7,507	$7,776	$50,045	$5,105	$2,721	$73,154
21	$0	$0	$8,009	$51,546	$5,258	$2,803	$67,617
22	$0	$0	$8,250	$53,093	$5,415	$2,887	$69,645
23	$0	$0	$8,497	$54,686	$5,578	$2,974	$71,734
24	$0	$0	$8,752	$56,326	$5,745	$3,063	$73,886
25	$0	$0	$9,015	$58,016	$5,918	$3,155	$76,103
26	$0	$0	$9,285	$59,756	$6,095	$3,250	$78,386
27	$0	$0	$9,564	$61,549	$6,278	$3,347	$80,738
28	$0	$0	$9,850	$63,396	$6,466	$3,447	$83,160
29	$0	$0	$10,146	$65,297	$6,660	$3,551	$85,655
30	$0	$0	$10,450	$67,256	$6,860	$3,657	$88,224

Sub Watershed #110702040404 Total Annual Cost, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$0	$7,245	$7,502	$48,300	$4,927	$2,625	$70,599
2	$0	$7,462	$7,727	$49,749	$5,074	$2,704	$72,717
3	$0	$7,686	$7,959	$51,241	$5,227	$2,785	$74,898
4	$0	$7,917	$8,197	$52,779	$5,383	$2,869	$77,145
5	$0	$8,154	$8,443	$54,362	$5,545	$2,955	$79,460

6	$0	$8,399	$8,697	$55,993	$5,711	$3,044	$81,843
7	$0	$8,651	$8,957	$57,673	$5,883	$3,135	$84,299
8	$0	$8,910	$9,226	$59,403	$6,059	$3,229	$86,828
9	$0	$9,178	$9,503	$61,185	$6,241	$3,326	$89,432
10	$0	$9,453	$9,788	$63,021	$6,428	$3,426	$92,115
11	$0	$9,737	$10,082	$64,911	$6,621	$3,528	$94,879
12	$0	$10,029	$10,384	$66,858	$6,820	$3,634	$97,725
13	$0	$10,330	$10,696	$68,864	$7,024	$3,743	$100,657
14	$0	$10,640	$11,017	$70,930	$7,235	$3,856	$103,677
15	$0	$10,959	$11,347	$73,058	$7,452	$3,971	$106,787
16	$0	$11,287	$11,687	$75,250	$7,675	$4,090	$109,991
17	$0	$11,626	$12,038	$77,507	$7,906	$4,213	$113,290
18	$0	$11,975	$12,399	$79,833	$8,143	$4,339	$116,689
19	$0	$12,334	$12,771	$82,228	$8,387	$4,470	$120,190
20	$0	$12,704	$13,154	$84,694	$8,639	$4,604	$123,795
21	$0	$0	$13,549	$87,235	$8,898	$4,742	$114,424
22	$0	$0	$13,955	$89,852	$9,165	$4,884	$117,857
23	$0	$0	$14,374	$92,548	$9,440	$5,031	$121,392
24	$0	$0	$14,805	$95,324	$9,723	$5,182	$125,034
25	$0	$0	$15,250	$98,184	$10,015	$5,337	$128,785
26	$0	$0	$15,707	$101,129	$10,315	$5,497	$132,649
27	$0	$0	$16,178	$104,163	$10,625	$5,662	$136,628
28	$0	$0	$16,664	$107,288	$10,943	$5,832	$140,727
29	$0	$0	$17,163	$110,507	$11,272	$6,007	$144,949
30	$0	$0	$17,678	$113,822	$11,610	$6,187	$149,297

Tier 2 Targeted Area

Sub Watershed #110702040503 Total Annual Cost, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
31	$28,651	$11,065	$11,462	$73,765	$7,524	$4,011	$136,478
32	$29,511	$11,397	$11,805	$75,978	$7,750	$4,132	$140,572
33	$30,396	$11,739	$12,160	$78,257	$7,982	$4,256	$144,789
34	$31,308	$12,091	$12,524	$80,605	$8,222	$4,383	$149,133
35	$32,247	$12,453	$12,900	$83,023	$8,468	$4,515	$153,607
36	$33,215	$12,827	$13,287	$85,514	$8,722	$4,650	$158,215
37	$34,211	$13,212	$13,686	$88,079	$8,984	$4,790	$162,962
38	$35,237	$13,608	$14,096	$90,722	$9,254	$4,933	$167,851
39	$36,295	$14,016	$14,519	$93,443	$9,531	$5,081	$172,886
40	$37,383	$14,437	$14,955	$96,247	$9,817	$5,234	$178,073

Sub Watershed #110702040505 Total Annual Cost, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
31	$8,675	$8,375	$8,676	$55,835	$5,695	$3,036	$90,292
32	$8,935	$8,627	$8,936	$57,510	$5,866	$3,127	$93,001
33	$9,203	$8,885	$9,204	$59,235	$6,042	$3,221	$95,791
34	$9,479	$9,152	$9,480	$61,012	$6,223	$3,318	$98,664
35	$9,763	$9,426	$9,765	$62,843	$6,410	$3,417	$101,624
36	$10,056	$9,709	$10,057	$64,728	$6,602	$3,520	$104,673
37	$10,358	$10,000	$10,359	$66,670	$6,800	$3,626	$107,813
38	$10,669	$10,301	$10,670	$68,670	$7,004	$3,734	$111,048
39	$10,989	$10,610	$10,990	$70,730	$7,214	$3,846	$114,379
40	$11,318	$10,928	$11,320	$72,852	$7,431	$3,962	$117,810

Sub Watershed #110702040204 Total Annual Cost, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
31	$7,237	$6,988	$7,238	$46,585	$4,752	$2,533	$75,334
32	$7,455	$7,197	$7,456	$47,983	$4,894	$2,609	$77,594
33	$7,678	$7,413	$7,679	$49,422	$5,041	$2,688	$79,921
34	$7,909	$7,636	$7,910	$50,905	$5,192	$2,768	$82,319
35	$8,146	$7,865	$8,147	$52,432	$5,348	$2,851	$84,789
36	$8,390	$8,101	$8,391	$54,005	$5,508	$2,937	$87,332
37	$8,642	$8,344	$8,643	$55,625	$5,674	$3,025	$89,952
38	$8,901	$8,594	$8,902	$57,294	$5,844	$3,116	$92,651
39	$9,168	$8,852	$9,169	$59,012	$6,019	$3,209	$95,430
40	$9,443	$9,117	$9,444	$60,783	$6,200	$3,305	$98,293

Sub Watershed #110702040403 Total Annual Cost, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
31	$4,307	$4,159	$4,308	$27,725	$2,828	$1,508	$44,835
32	$4,437	$4,284	$4,437	$28,557	$2,913	$1,553	$46,180
33	$4,570	$4,412	$4,570	$29,413	$3,000	$1,600	$47,565
34	$4,707	$4,544	$4,707	$30,296	$3,090	$1,647	$48,992
35	$4,848	$4,681	$4,849	$31,205	$3,183	$1,697	$50,462
36	$4,993	$4,821	$4,994	$32,141	$3,278	$1,748	$51,976
37	$5,143	$4,966	$5,144	$33,105	$3,377	$1,800	$53,535

38	$5,298	$5,115	$5,298	$34,098	$3,478	$1,854	$55,141
39	$5,456	$5,268	$5,457	$35,121	$3,582	$1,910	$56,795
40	$5,620	$5,426	$5,621	$36,175	$3,690	$1,967	$58,499

Sub Watershed #110702040406 Total Annual Cost, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
31	$7,408	$7,152	$7,409	$47,680	$4,863	$2,593	$77,104
32	$7,630	$7,367	$7,631	$49,110	$5,009	$2,671	$79,417
33	$7,859	$7,588	$7,860	$50,584	$5,160	$2,751	$81,800
34	$8,094	$7,815	$8,095	$52,101	$5,314	$2,833	$84,254
35	$8,337	$8,050	$8,338	$53,664	$5,474	$2,918	$86,782
36	$8,587	$8,291	$8,589	$55,274	$5,638	$3,006	$89,385
37	$8,845	$8,540	$8,846	$56,932	$5,807	$3,096	$92,067
38	$9,110	$8,796	$9,112	$58,640	$5,981	$3,189	$94,829
39	$9,384	$9,060	$9,385	$60,400	$6,161	$3,285	$97,673
40	$9,665	$9,332	$9,666	$62,212	$6,346	$3,383	$100,604

Sub Watershed #110702040306 Total Annual Cost, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
31	$7,227	$6,977	$7,228	$46,515	$4,745	$2,529	$75,220
32	$7,443	$7,187	$7,444	$47,910	$4,887	$2,605	$77,477
33	$7,667	$7,402	$7,668	$49,348	$5,033	$2,684	$79,801
34	$7,897	$7,624	$7,898	$50,828	$5,184	$2,764	$82,195
35	$8,134	$7,853	$8,135	$52,353	$5,340	$2,847	$84,661
36	$8,378	$8,089	$8,379	$53,924	$5,500	$2,932	$87,201
37	$8,629	$8,331	$8,630	$55,541	$5,665	$3,020	$89,817
38	$8,888	$8,581	$8,889	$57,208	$5,835	$3,111	$92,512
39	$9,154	$8,839	$9,156	$58,924	$6,010	$3,204	$95,287
40	$9,429	$9,104	$9,430	$60,692	$6,191	$3,300	$98,145

Sub Watershed #110702040301 Total Annual Cost, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
31	$4,487	$4,332	$4,487	$28,880	$2,946	$1,570	$46,702
32	$4,621	$4,462	$4,622	$29,746	$3,034	$1,618	$48,103
33	$4,760	$4,596	$4,761	$30,639	$3,125	$1,666	$49,547

34	$4,903	$4,734	$4,903	$31,558	$3,219	$1,716	$51,033
35	$5,050	$4,876	$5,051	$32,505	$3,315	$1,768	$52,564
36	$5,201	$5,022	$5,202	$33,480	$3,415	$1,821	$54,141
37	$5,357	$5,173	$5,358	$34,484	$3,517	$1,875	$55,765
38	$5,518	$5,328	$5,519	$35,519	$3,623	$1,932	$57,438
39	$5,684	$5,488	$5,684	$36,584	$3,732	$1,989	$59,161
40	$5,854	$5,652	$5,855	$37,682	$3,844	$2,049	$60,936

12.3.5 Cropland Costs After Cost Share by Sub Watershed

Table 48. Cropland Costs After Cost Share by Sub Watershed.

Tier 1 Targeted Area

Sub Watershed #110702040206 Total Annual Cost After Cost-Share, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$6,444	$3,113	$3,931	$4,150	$2,117	$2,255	$22,009
2	$6,637	$3,206	$4,049	$4,275	$2,180	$2,323	$22,669
3	$6,836	$3,302	$4,170	$4,403	$2,245	$2,393	$23,349
4	$7,041	$3,401	$4,296	$4,535	$2,313	$2,465	$24,050
5	$7,252	$3,503	$4,424	$4,671	$2,382	$2,538	$24,771
6	$7,470	$3,608	$4,557	$4,811	$2,454	$2,615	$25,515
7	$7,694	$3,716	$4,694	$4,955	$2,527	$2,693	$26,280
8	$7,925	$3,828	$4,835	$5,104	$2,603	$2,774	$27,068
9	$8,163	$3,943	$4,980	$5,257	$2,681	$2,857	$27,880
10	$8,407	$4,061	$5,129	$5,415	$2,762	$2,943	$28,717
11	$0	$4,183	$5,283	$5,577	$2,844	$3,031	$20,919
12	$0	$4,308	$5,442	$5,745	$2,930	$3,122	$21,546
13	$0	$4,438	$5,605	$5,917	$3,018	$3,216	$22,193
14	$0	$4,571	$5,773	$6,094	$3,108	$3,312	$22,858
15	$0	$4,708	$5,946	$6,277	$3,201	$3,412	$23,544
16	$0	$4,849	$6,124	$6,466	$3,297	$3,514	$24,251
17	$0	$4,995	$6,308	$6,660	$3,396	$3,619	$24,978
18	$0	$5,144	$6,497	$6,859	$3,498	$3,728	$25,727
19	$0	$5,299	$6,692	$7,065	$3,603	$3,840	$26,499
20	$0	$5,458	$6,893	$7,277	$3,711	$3,955	$27,294
21	$0	$0	$7,100	$7,495	$3,823	$4,074	$22,491
22	$0	$0	$7,313	$7,720	$3,937	$4,196	$23,166
23	$0	$0	$7,532	$7,952	$4,055	$4,322	$23,861
24	$0	$0	$7,758	$8,190	$4,177	$4,451	$24,577
25	$0	$0	$7,991	$8,436	$4,302	$4,585	$25,314

26	$0	$0	$8,231	$8,689	$4,431	$4,722	$26,074
27	$0	$0	$8,478	$8,950	$4,564	$4,864	$26,856
28	$0	$0	$8,732	$9,218	$4,701	$5,010	$27,662
29	$0	$0	$8,994	$9,495	$4,842	$5,160	$28,492
30	$0	$0	$9,264	$9,780	$4,988	$5,315	$29,346

Sub Watershed #110702040501 Total Annual Cost After Cost-Share, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$7,415	$3,579	$4,523	$4,773	$2,434	$2,595	$25,319
2	$7,637	$3,687	$4,659	$4,916	$2,507	$2,673	$26,079
3	$7,866	$3,797	$4,799	$5,063	$2,582	$2,753	$26,861
4	$8,102	$3,911	$4,943	$5,215	$2,660	$2,836	$27,667
5	$8,345	$4,029	$5,091	$5,371	$2,739	$2,921	$28,497
6	$8,596	$4,149	$5,244	$5,533	$2,822	$3,009	$29,352
7	$8,853	$4,274	$5,401	$5,699	$2,906	$3,099	$30,232
8	$9,119	$4,402	$5,563	$5,870	$2,993	$3,192	$31,139
9	$9,393	$4,534	$5,730	$6,046	$3,083	$3,288	$32,074
10	$9,674	$4,670	$5,902	$6,227	$3,176	$3,386	$33,036
11	$0	$4,810	$6,079	$6,414	$3,271	$3,488	$24,062
12	$0	$4,955	$6,262	$6,606	$3,369	$3,592	$24,784
13	$0	$5,103	$6,449	$6,804	$3,470	$3,700	$25,528
14	$0	$5,256	$6,643	$7,009	$3,574	$3,811	$26,294
15	$0	$5,414	$6,842	$7,219	$3,682	$3,926	$27,082
16	$0	$5,577	$7,047	$7,435	$3,792	$4,043	$27,895
17	$0	$5,744	$7,259	$7,658	$3,906	$4,165	$28,732
18	$0	$5,916	$7,477	$7,888	$4,023	$4,290	$29,594
19	$0	$6,094	$7,701	$8,125	$4,144	$4,418	$30,481
20	$0	$6,276	$7,932	$8,369	$4,268	$4,551	$31,396
21	$0	$0	$8,170	$8,620	$4,396	$4,687	$25,873
22	$0	$0	$8,415	$8,878	$4,528	$4,828	$26,649
23	$0	$0	$8,667	$9,145	$4,664	$4,973	$27,449
24	$0	$0	$8,927	$9,419	$4,804	$5,122	$28,272
25	$0	$0	$9,195	$9,702	$4,948	$5,276	$29,120
26	$0	$0	$9,471	$9,993	$5,096	$5,434	$29,994
27	$0	$0	$9,755	$10,292	$5,249	$5,597	$30,894
28	$0	$0	$10,048	$10,601	$5,407	$5,765	$31,820
29	$0	$0	$10,349	$10,919	$5,569	$5,938	$32,775
30	$0	$0	$10,660	$11,247	$5,736	$6,116	$33,758

Sub Watershed #110702040305 Total Annual Cost After Cost-Share, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$8,840	$4,268	$5,394	$5,690	$2,902	$3,094	$30,187
2	$9,105	$4,396	$5,555	$5,861	$2,989	$3,187	$31,093
3	$9,378	$4,527	$5,722	$6,037	$3,079	$3,283	$32,026
4	$9,660	$4,663	$5,894	$6,218	$3,171	$3,381	$32,987
5	$9,949	$4,803	$6,070	$6,404	$3,266	$3,483	$33,976
6	$10,248	$4,947	$6,253	$6,596	$3,364	$3,587	$34,996
7	$10,555	$5,096	$6,440	$6,794	$3,465	$3,695	$36,045
8	$10,872	$5,248	$6,633	$6,998	$3,569	$3,806	$37,127
9	$11,198	$5,406	$6,832	$7,208	$3,676	$3,920	$38,241
10	$11,534	$5,568	$7,037	$7,424	$3,786	$4,038	$39,388
11	$0	$5,735	$7,248	$7,647	$3,900	$4,159	$28,689
12	$0	$5,907	$7,466	$7,876	$4,017	$4,284	$29,550
13	$0	$6,084	$7,690	$8,113	$4,137	$4,412	$30,436
14	$0	$6,267	$7,921	$8,356	$4,262	$4,544	$31,349
15	$0	$6,455	$8,158	$8,607	$4,389	$4,681	$32,290
16	$0	$6,649	$8,403	$8,865	$4,521	$4,821	$33,259
17	$0	$6,848	$8,655	$9,131	$4,657	$4,966	$34,256
18	$0	$7,054	$8,915	$9,405	$4,796	$5,115	$35,284
19	$0	$7,265	$9,182	$9,687	$4,940	$5,268	$36,343
20	$0	$7,483	$9,458	$9,977	$5,088	$5,426	$37,433
21	$0	$0	$9,741	$10,277	$5,241	$5,589	$30,848
22	$0	$0	$10,034	$10,585	$5,398	$5,757	$31,774
23	$0	$0	$10,335	$10,903	$5,560	$5,929	$32,727
24	$0	$0	$10,645	$11,230	$5,727	$6,107	$33,709
25	$0	$0	$10,964	$11,567	$5,899	$6,290	$34,720
26	$0	$0	$11,293	$11,914	$6,076	$6,479	$35,762
27	$0	$0	$11,632	$12,271	$6,258	$6,674	$36,834
28	$0	$0	$11,981	$12,639	$6,446	$6,874	$37,940
29	$0	$0	$12,340	$13,018	$6,639	$7,080	$39,078
30	$0	$0	$12,710	$13,409	$6,839	$7,292	$40,250

Sub Watershed #110702040103 Total Annual Cost After Cost-Share, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$2,439	$1,815	$2,290	$5,800	$0	$1,314	$13,658
2	$2,512	$1,869	$2,359	$5,974	$0	$1,353	$14,068
3	$2,588	$1,926	$2,429	$6,153	$0	$1,394	$14,490
4	$2,665	$1,983	$2,502	$6,338	$0	$1,436	$14,924

5	$2,745	$2,043	$2,577	$6,528	$0	$1,479	$15,372
6	$2,828	$2,104	$2,655	$6,724	$0	$1,523	$15,833
7	$2,912	$2,167	$2,734	$6,926	$0	$1,569	$16,308
8	$3,000	$2,232	$2,816	$7,133	$0	$1,616	$16,797
9	$3,090	$2,299	$2,901	$7,347	$0	$1,664	$17,301
10	$3,183	$2,368	$2,988	$7,568	$0	$1,714	$17,820
11	$0	$2,439	$3,077	$7,795	$0	$1,766	$15,077
12	$0	$2,512	$3,170	$8,029	$0	$1,819	$15,529
13	$0	$2,588	$3,265	$8,269	$0	$1,873	$15,995
14	$0	$2,665	$3,363	$8,517	$0	$1,929	$16,475
15	$0	$2,745	$3,464	$8,773	$0	$1,987	$16,969
16	$0	$2,828	$3,568	$9,036	$0	$2,047	$17,478
17	$0	$2,913	$3,675	$9,307	$0	$2,108	$18,003
18	$0	$3,000	$3,785	$9,587	$0	$2,172	$18,543
19	$0	$3,090	$3,898	$9,874	$0	$2,237	$19,099
20	$0	$3,183	$4,015	$10,170	$0	$2,304	$19,672
21	$0	$0	$4,136	$10,475	$0	$2,373	$16,984
22	$0	$0	$4,260	$10,790	$0	$2,444	$17,494
23	$0	$0	$4,388	$11,113	$0	$2,517	$18,019
24	$0	$0	$4,519	$11,447	$0	$2,593	$18,559
25	$0	$0	$4,655	$11,790	$0	$2,671	$19,116
26	$0	$0	$4,795	$12,144	$0	$2,751	$19,689
27	$0	$0	$4,938	$12,508	$0	$2,833	$20,280
28	$0	$0	$5,087	$12,883	$0	$2,918	$20,888
29	$0	$0	$5,239	$13,270	$0	$3,006	$21,515
30	$0	$0	$5,396	$13,668	$0	$3,096	$22,161

Sub Watershed #110702040203 Total Annual Cost After Cost-Share, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$4,035	$3,000	$3,787	$9,590	$0	$2,173	$22,586
2	$4,157	$3,090	$3,901	$9,878	$0	$2,238	$23,264
3	$4,281	$3,183	$4,018	$10,174	$0	$2,305	$23,961
4	$4,410	$3,278	$4,139	$10,479	$0	$2,375	$24,680
5	$4,542	$3,377	$4,263	$10,794	$0	$2,446	$25,421
6	$4,678	$3,478	$4,391	$11,117	$0	$2,519	$26,183
7	$4,819	$3,582	$4,522	$11,451	$0	$2,595	$26,969
8	$4,963	$3,690	$4,658	$11,794	$0	$2,673	$27,778
9	$5,112	$3,800	$4,798	$12,148	$0	$2,753	$28,611
10	$5,265	$3,914	$4,942	$12,513	$0	$2,835	$29,470
11	$0	$4,032	$5,090	$12,888	$0	$2,920	$24,930

12	$0	$4,153	$5,243	$13,275	$0	$3,008	$25,678
13	$0	$4,277	$5,400	$13,673	$0	$3,098	$26,449
14	$0	$4,406	$5,562	$14,083	$0	$3,191	$27,242
15	$0	$4,538	$5,729	$14,506	$0	$3,287	$28,059
16	$0	$4,674	$5,901	$14,941	$0	$3,386	$28,901
17	$0	$4,814	$6,078	$15,389	$0	$3,487	$29,768
18	$0	$4,959	$6,260	$15,851	$0	$3,592	$30,661
19	$0	$5,107	$6,448	$16,326	$0	$3,699	$31,581
20	$0	$5,261	$6,641	$16,816	$0	$3,810	$32,528
21	$0	$0	$6,841	$17,321	$0	$3,925	$28,086
22	$0	$0	$7,046	$17,840	$0	$4,042	$28,929
23	$0	$0	$7,257	$18,375	$0	$4,164	$29,796
24	$0	$0	$7,475	$18,927	$0	$4,289	$30,690
25	$0	$0	$7,699	$19,494	$0	$4,417	$31,611
26	$0	$0	$7,930	$20,079	$0	$4,550	$32,559
27	$0	$0	$8,168	$20,682	$0	$4,686	$33,536
28	$0	$0	$8,413	$21,302	$0	$4,827	$34,542
29	$0	$0	$8,665	$21,941	$0	$4,972	$35,578
30	$0	$0	$8,925	$22,599	$0	$5,121	$36,646

Sub Watershed #110702040205 Total Annual Cost After Cost-Share, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$7,937	$3,832	$4,842	$5,109	$2,606	$2,778	$27,104
2	$8,175	$3,947	$4,988	$5,262	$2,684	$2,862	$27,917
3	$8,421	$4,065	$5,137	$5,420	$2,764	$2,947	$28,755
4	$8,673	$4,187	$5,291	$5,583	$2,847	$3,036	$29,618
5	$8,934	$4,313	$5,450	$5,750	$2,933	$3,127	$30,506
6	$9,202	$4,442	$5,614	$5,923	$3,021	$3,221	$31,421
7	$9,478	$4,575	$5,782	$6,100	$3,111	$3,317	$32,364
8	$9,762	$4,713	$5,956	$6,283	$3,205	$3,417	$33,335
9	$10,055	$4,854	$6,134	$6,472	$3,301	$3,519	$34,335
10	$10,356	$5,000	$6,318	$6,666	$3,400	$3,625	$35,365
11	$0	$5,150	$6,508	$6,866	$3,502	$3,734	$25,759
12	$0	$5,304	$6,703	$7,072	$3,607	$3,846	$26,532
13	$0	$5,463	$6,904	$7,284	$3,715	$3,961	$27,328
14	$0	$5,627	$7,111	$7,503	$3,826	$4,080	$28,147
15	$0	$5,796	$7,325	$7,728	$3,941	$4,202	$28,992
16	$0	$5,970	$7,544	$7,960	$4,059	$4,328	$29,862
17	$0	$6,149	$7,771	$8,198	$4,181	$4,458	$30,757
18	$0	$6,333	$8,004	$8,444	$4,307	$4,592	$31,680

19	$0	$6,523	$8,244	$8,698	$4,436	$4,730	$32,631
20	$0	$6,719	$8,491	$8,959	$4,569	$4,872	$33,609
21	$0	$0	$8,746	$9,227	$4,706	$5,018	$27,697
22	$0	$0	$9,008	$9,504	$4,847	$5,168	$28,528
23	$0	$0	$9,279	$9,789	$4,993	$5,323	$29,384
24	$0	$0	$9,557	$10,083	$5,142	$5,483	$30,265
25	$0	$0	$9,844	$10,386	$5,297	$5,648	$31,173
26	$0	$0	$10,139	$10,697	$5,456	$5,817	$32,109
27	$0	$0	$10,443	$11,018	$5,619	$5,992	$33,072
28	$0	$0	$10,756	$11,349	$5,788	$6,171	$34,064
29	$0	$0	$11,079	$11,689	$5,961	$6,356	$35,086
30	$0	$0	$11,411	$12,040	$6,140	$6,547	$36,139

Sub Watershed #110702040206 Total Annual Cost After Cost-Share, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$7,802	$3,767	$4,760	$5,022	$2,561	$2,731	$26,643
2	$8,036	$3,879	$4,903	$5,173	$2,638	$2,813	$27,442
3	$8,277	$3,996	$5,050	$5,328	$2,717	$2,897	$28,265
4	$8,526	$4,116	$5,201	$5,488	$2,799	$2,984	$29,113
5	$8,781	$4,239	$5,357	$5,652	$2,883	$3,074	$29,987
6	$9,045	$4,366	$5,518	$5,822	$2,969	$3,166	$30,886
7	$9,316	$4,497	$5,684	$5,997	$3,058	$3,261	$31,813
8	$9,596	$4,632	$5,854	$6,176	$3,150	$3,359	$32,767
9	$9,884	$4,771	$6,030	$6,362	$3,244	$3,460	$33,750
10	$10,180	$4,914	$6,211	$6,553	$3,342	$3,563	$34,763
11	$0	$5,062	$6,397	$6,749	$3,442	$3,670	$25,320
12	$0	$5,214	$6,589	$6,952	$3,545	$3,780	$26,080
13	$0	$5,370	$6,787	$7,160	$3,652	$3,894	$26,862
14	$0	$5,531	$6,990	$7,375	$3,761	$4,011	$27,668
15	$0	$5,697	$7,200	$7,596	$3,874	$4,131	$28,498
16	$0	$5,868	$7,416	$7,824	$3,990	$4,255	$29,353
17	$0	$6,044	$7,638	$8,059	$4,110	$4,382	$30,234
18	$0	$6,225	$7,867	$8,301	$4,233	$4,514	$31,141
19	$0	$6,412	$8,103	$8,550	$4,360	$4,649	$32,075
20	$0	$6,605	$8,347	$8,806	$4,491	$4,789	$33,037
21	$0	$0	$8,597	$9,070	$4,626	$4,932	$27,226
22	$0	$0	$8,855	$9,342	$4,765	$5,080	$28,042
23	$0	$0	$9,121	$9,623	$4,908	$5,233	$28,884
24	$0	$0	$9,394	$9,911	$5,055	$5,390	$29,750
25	$0	$0	$9,676	$10,209	$5,206	$5,551	$30,643

26	$0	$0	$9,966	$10,515	$5,363	$5,718	$31,562
27	$0	$0	$10,265	$10,830	$5,524	$5,890	$32,509
28	$0	$0	$10,573	$11,155	$5,689	$6,066	$33,484
29	$0	$0	$10,890	$11,490	$5,860	$6,248	$34,489
30	$0	$0	$11,217	$11,835	$6,036	$6,436	$35,523

Sub Watershed #110702040304 Total Annual Cost After Cost-Share, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$4,434	$2,141	$2,705	$2,854	$1,456	$1,552	$15,141
2	$4,567	$2,205	$2,786	$2,940	$1,499	$1,599	$15,595
3	$4,704	$2,271	$2,870	$3,028	$1,544	$1,647	$16,063
4	$4,845	$2,339	$2,956	$3,119	$1,591	$1,696	$16,545
5	$4,990	$2,409	$3,045	$3,212	$1,638	$1,747	$17,041
6	$5,140	$2,481	$3,136	$3,309	$1,687	$1,799	$17,553
7	$5,294	$2,556	$3,230	$3,408	$1,738	$1,853	$18,079
8	$5,453	$2,633	$3,327	$3,510	$1,790	$1,909	$18,622
9	$5,617	$2,712	$3,427	$3,615	$1,844	$1,966	$19,180
10	$5,785	$2,793	$3,530	$3,724	$1,899	$2,025	$19,756
11	$0	$2,877	$3,635	$3,836	$1,956	$2,086	$14,389
12	$0	$2,963	$3,744	$3,951	$2,015	$2,148	$14,821
13	$0	$3,052	$3,857	$4,069	$2,075	$2,213	$15,266
14	$0	$3,143	$3,972	$4,191	$2,138	$2,279	$15,724
15	$0	$3,238	$4,092	$4,317	$2,202	$2,348	$16,195
16	$0	$3,335	$4,214	$4,446	$2,268	$2,418	$16,681
17	$0	$3,435	$4,341	$4,580	$2,336	$2,491	$17,182
18	$0	$3,538	$4,471	$4,717	$2,406	$2,565	$17,697
19	$0	$3,644	$4,605	$4,859	$2,478	$2,642	$18,228
20	$0	$3,753	$4,743	$5,005	$2,552	$2,721	$18,775
21	$0	$0	$4,886	$5,155	$2,629	$2,803	$15,472
22	$0	$0	$5,032	$5,309	$2,708	$2,887	$15,936
23	$0	$0	$5,183	$5,469	$2,789	$2,974	$16,415
24	$0	$0	$5,339	$5,633	$2,873	$3,063	$16,907
25	$0	$0	$5,499	$5,802	$2,959	$3,155	$17,414
26	$0	$0	$5,664	$5,976	$3,048	$3,250	$17,937
27	$0	$0	$5,834	$6,155	$3,139	$3,347	$18,475
28	$0	$0	$6,009	$6,340	$3,233	$3,447	$19,029
29	$0	$0	$6,189	$6,530	$3,330	$3,551	$19,600
30	$0	$0	$6,375	$6,726	$3,430	$3,657	$20,188

Sub Watershed #110702040404 Total Annual Cost After Cost-Share, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
1	$0	$3,623	$4,576	$4,830	$2,463	$2,625	$18,117
2	$0	$3,731	$4,713	$4,975	$2,537	$2,704	$18,661
3	$0	$3,843	$4,855	$5,124	$2,613	$2,785	$19,221
4	$0	$3,958	$5,000	$5,278	$2,692	$2,869	$19,797
5	$0	$4,077	$5,150	$5,436	$2,772	$2,955	$20,391
6	$0	$4,199	$5,305	$5,599	$2,856	$3,044	$21,003
7	$0	$4,325	$5,464	$5,767	$2,941	$3,135	$21,633
8	$0	$4,455	$5,628	$5,940	$3,030	$3,229	$22,282
9	$0	$4,589	$5,797	$6,118	$3,120	$3,326	$22,950
10	$0	$4,727	$5,971	$6,302	$3,214	$3,426	$23,639
11	$0	$4,868	$6,150	$6,491	$3,310	$3,528	$24,348
12	$0	$5,014	$6,334	$6,686	$3,410	$3,634	$25,079
13	$0	$5,165	$6,524	$6,886	$3,512	$3,743	$25,831
14	$0	$5,320	$6,720	$7,093	$3,617	$3,856	$26,606
15	$0	$5,479	$6,922	$7,306	$3,726	$3,971	$27,404
16	$0	$5,644	$7,129	$7,525	$3,838	$4,090	$28,226
17	$0	$5,813	$7,343	$7,751	$3,953	$4,213	$29,073
18	$0	$5,987	$7,564	$7,983	$4,071	$4,339	$29,945
19	$0	$6,167	$7,790	$8,223	$4,194	$4,470	$30,844
20	$0	$6,352	$8,024	$8,469	$4,319	$4,604	$31,769
21	$0	$0	$8,265	$8,724	$4,449	$4,742	$26,179
22	$0	$0	$8,513	$8,985	$4,582	$4,884	$26,965
23	$0	$0	$8,768	$9,255	$4,720	$5,031	$27,774
24	$0	$0	$9,031	$9,532	$4,862	$5,182	$28,607
25	$0	$0	$9,302	$9,818	$5,007	$5,337	$29,465
26	$0	$0	$9,581	$10,113	$5,158	$5,497	$30,349
27	$0	$0	$9,869	$10,416	$5,312	$5,662	$31,259
28	$0	$0	$10,165	$10,729	$5,472	$5,832	$32,197
29	$0	$0	$10,470	$11,051	$5,636	$6,007	$33,163
30	$0	$0	$10,784	$11,382	$5,805	$6,187	$34,158

Tier 2 Targeted Area

Sub Watershed #110702040503 Total Annual Cost After Cost-Share, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
31	$28,651	$5,532	$6,992	$7,377	$3,762	$4,011	$56,325
32	$29,511	$5,698	$7,201	$7,598	$3,875	$4,132	$58,015

33	$30,396	$5,869	$7,417	$7,826	$3,991	$4,256	$59,755
34	$31,308	$6,045	$7,640	$8,061	$4,111	$4,383	$61,548
35	$32,247	$6,227	$7,869	$8,302	$4,234	$4,515	$63,394
36	$33,215	$6,414	$8,105	$8,551	$4,361	$4,650	$65,296
37	$34,211	$6,606	$8,348	$8,808	$4,492	$4,790	$67,255
38	$35,237	$6,804	$8,599	$9,072	$4,627	$4,933	$69,273
39	$36,295	$7,008	$8,857	$9,344	$4,766	$5,081	$71,351
40	$37,383	$7,218	$9,122	$9,625	$4,909	$5,234	$73,491

Sub Watershed #110702040505 Total Annual Cost After Cost-Share, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
31	$8,675	$4,188	$5,292	$5,584	$2,848	$3,036	$29,622
32	$8,935	$4,313	$5,451	$5,751	$2,933	$3,127	$30,510
33	$9,203	$4,443	$5,614	$5,924	$3,021	$3,221	$31,426
34	$9,479	$4,576	$5,783	$6,101	$3,112	$3,318	$32,368
35	$9,763	$4,713	$5,956	$6,284	$3,205	$3,417	$33,339
36	$10,056	$4,855	$6,135	$6,473	$3,301	$3,520	$34,340
37	$10,358	$5,000	$6,319	$6,667	$3,400	$3,626	$35,370
38	$10,669	$5,150	$6,509	$6,867	$3,502	$3,734	$36,431
39	$10,989	$5,305	$6,704	$7,073	$3,607	$3,846	$37,524
40	$11,318	$5,464	$6,905	$7,285	$3,715	$3,962	$38,650

Sub Watershed #110702040204 Total Annual Cost After Cost-Share, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
31	$7,237	$3,494	$4,415	$4,659	$2,376	$2,533	$24,714
32	$7,455	$3,599	$4,548	$4,798	$2,447	$2,609	$25,456
33	$7,678	$3,707	$4,684	$4,942	$2,521	$2,688	$26,219
34	$7,909	$3,818	$4,825	$5,090	$2,596	$2,768	$27,006
35	$8,146	$3,932	$4,970	$5,243	$2,674	$2,851	$27,816
36	$8,390	$4,050	$5,119	$5,400	$2,754	$2,937	$28,651
37	$8,642	$4,172	$5,272	$5,562	$2,837	$3,025	$29,510
38	$8,901	$4,297	$5,430	$5,729	$2,922	$3,116	$30,396
39	$9,168	$4,426	$5,593	$5,901	$3,010	$3,209	$31,307
40	$9,443	$4,559	$5,761	$6,078	$3,100	$3,305	$32,247

Sub Watershed #110702040403 Total Annual Cost After Cost-Share, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
31	$4,307	$2,079	$2,628	$2,773	$1,414	$1,508	$14,709
32	$4,437	$2,142	$2,707	$2,856	$1,456	$1,553	$15,150
33	$4,570	$2,206	$2,788	$2,941	$1,500	$1,600	$15,604
34	$4,707	$2,272	$2,871	$3,030	$1,545	$1,647	$16,073
35	$4,848	$2,340	$2,958	$3,120	$1,591	$1,697	$16,555
36	$4,993	$2,411	$3,046	$3,214	$1,639	$1,748	$17,051
37	$5,143	$2,483	$3,138	$3,311	$1,688	$1,800	$17,563
38	$5,298	$2,557	$3,232	$3,410	$1,739	$1,854	$18,090
39	$5,456	$2,634	$3,329	$3,512	$1,791	$1,910	$18,633
40	$5,620	$2,713	$3,429	$3,617	$1,845	$1,967	$19,192

Sub Watershed #110702040406 Total Annual Cost After Cost-Share, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
31	$7,408	$3,576	$4,519	$4,768	$2,432	$2,593	$25,295
32	$7,630	$3,683	$4,655	$4,911	$2,505	$2,671	$26,054
33	$7,859	$3,794	$4,794	$5,058	$2,580	$2,751	$26,836
34	$8,094	$3,908	$4,938	$5,210	$2,657	$2,833	$27,641
35	$8,337	$4,025	$5,086	$5,366	$2,737	$2,918	$28,470
36	$8,587	$4,146	$5,239	$5,527	$2,819	$3,006	$29,324
37	$8,845	$4,270	$5,396	$5,693	$2,904	$3,096	$30,204
38	$9,110	$4,398	$5,558	$5,864	$2,991	$3,189	$31,110
39	$9,384	$4,530	$5,725	$6,040	$3,080	$3,285	$32,043
40	$9,665	$4,666	$5,897	$6,221	$3,173	$3,383	$33,005

Sub Watershed #110702040306 Total Annual Cost After Cost-Share, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
31	$7,227	$3,489	$4,409	$4,652	$2,372	$2,529	$24,677
32	$7,443	$3,593	$4,541	$4,791	$2,443	$2,605	$25,418
33	$7,667	$3,701	$4,677	$4,935	$2,517	$2,684	$26,180
34	$7,897	$3,812	$4,818	$5,083	$2,592	$2,764	$26,965
35	$8,134	$3,926	$4,962	$5,235	$2,670	$2,847	$27,774
36	$8,378	$4,044	$5,111	$5,392	$2,750	$2,932	$28,608
37	$8,629	$4,166	$5,264	$5,554	$2,833	$3,020	$29,466
38	$8,888	$4,291	$5,422	$5,721	$2,918	$3,111	$30,350
39	$9,154	$4,419	$5,585	$5,892	$3,005	$3,204	$31,260

40	$9,429	$4,552	$5,752	$6,069	$3,095	$3,300	$32,198

Sub Watershed #110702040301 Total Annual Cost After Cost-Share, Cropland BMPs

Year	Conservation Rotations	Permanent Vegetation	No-Till	Vegetative Buffers	Terraces	Sub Surface Fertilizer	Total Cost
31	$4,487	$2,166	$2,737	$2,888	$1,473	$1,570	$15,321
32	$4,621	$2,231	$2,819	$2,975	$1,517	$1,618	$15,781
33	$4,760	$2,298	$2,904	$3,064	$1,563	$1,666	$16,255
34	$4,903	$2,367	$2,991	$3,156	$1,609	$1,716	$16,742
35	$5,050	$2,438	$3,081	$3,250	$1,658	$1,768	$17,244
36	$5,201	$2,511	$3,173	$3,348	$1,707	$1,821	$17,762
37	$5,357	$2,586	$3,268	$3,448	$1,759	$1,875	$18,295
38	$5,518	$2,664	$3,367	$3,552	$1,811	$1,932	$18,843
39	$5,684	$2,744	$3,468	$3,658	$1,866	$1,989	$19,409
40	$5,854	$2,826	$3,572	$3,768	$1,922	$2,049	$19,991

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