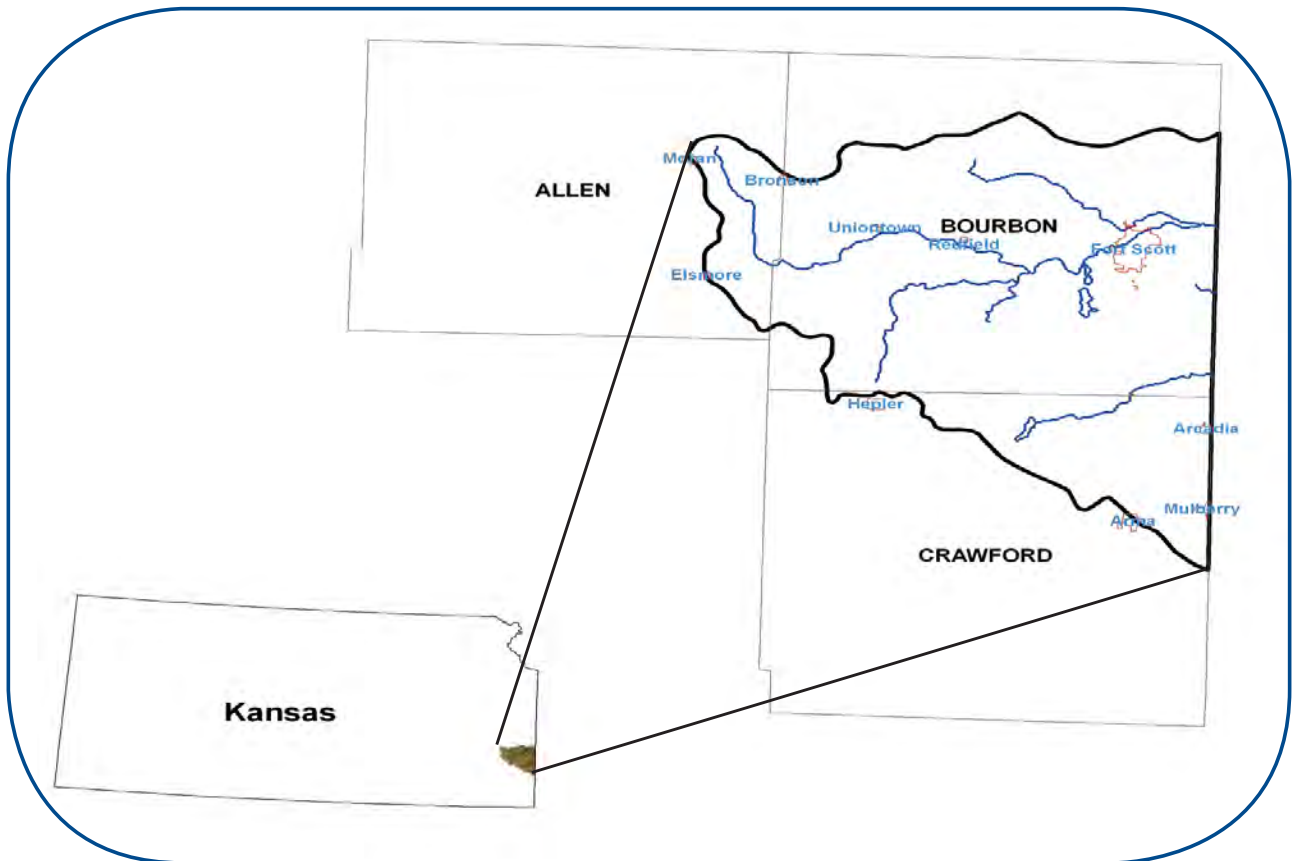


Marmaton Watershed Assessment: Preliminary Report



2009

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1.0 Marmaton Watershed Assessment

1.1 Watershed Summary

The Marmaton Watershed is located primarily in Bourbon, Crawford and Allen counties in southeast Kansas. It contains the Marmaton River, which eventually crosses the state line into Missouri. Smaller creeks and tributaries of importance are Drywood Creek, Mill Creek, Paint Creek, Wolverine Creek and Shiloh Creek.

Several small lakes are encompassed in the watershed: Bronson City Lake, Bourbon County State Fishing Lake, Gunn Park West Lake, Rock Creek Lake, Ft. Scott City Lake, Elm Creek Lake, Lake Crawford, Frisco Lake and Bone Creek Lake. According to the Kansas Unified Watershed Assessment prepared by Kansas Department of Health and Environment (KDHE) and Natural Resources Conservation Service (NRCS), the Marmaton Watershed is rated as a Category I watershed indicating the watershed is in need of restoration and protection to sustain water quality. It is ranked 17th out of 92 watersheds in the state for restoration priority.

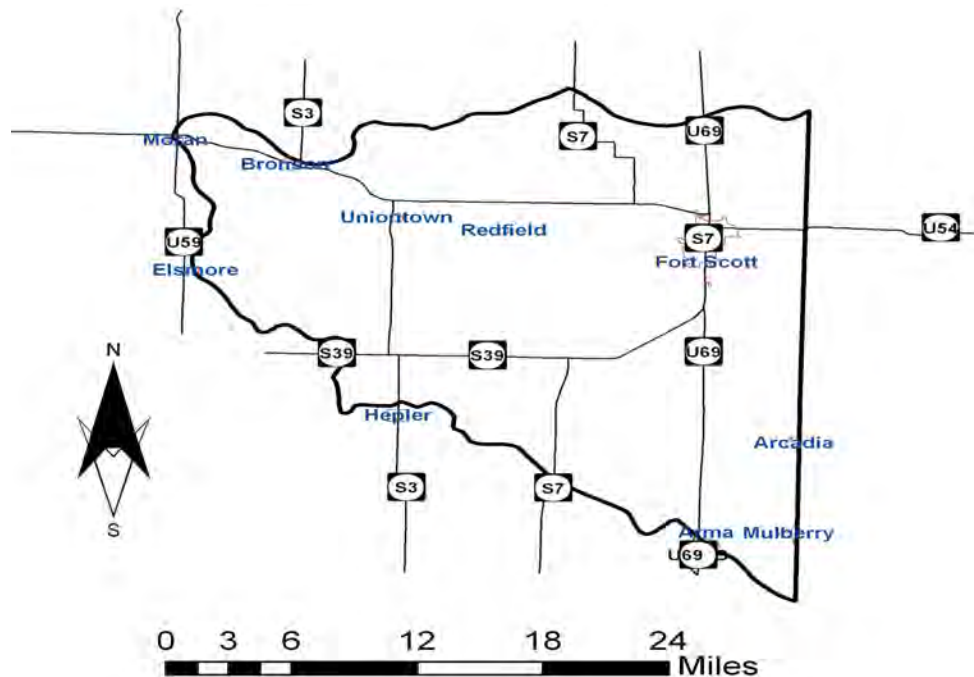


Figure 1. Major roads and cities – Marmaton Watershed

According to the KDHE Watershed Condition Report, grassland is the predominant land usage (57 percent) for the watershed. Crop production is the second largest land usage at 28 percent. Woodland, water, and urban areas constitute the remaining 15 percent of land cover²⁸.

1.2 Overview of Water Quality Issues and Potential Pollution Sources

When river segments or lakes that are monitored by KDHE have experienced poor quality, a Total Maximum Daily Load (commonly referred to as a TMDL) is established. A TMDL is the maximum amount of pollution that a surface water body can receive and still meet water quality standards.

Low dissolved oxygen is an impairment in the Marmaton River, Drywood Creek and Bourbon County State Fishing Lake. This has resulted in TMDLs aimed at increasing dissolved oxygen concentrations to provide full support of aquatic life. Riparian vegetation restoration, grass buffer strips along streams, proper manure storage and distribution, adequately functioning septic systems, and proper chemical fertilizer rates should help improve water quality and raise dissolved oxygen rates.

The Marmaton River has a TMDL for biology. There is a direct relationship between nutrient loading and biological integrity. The Macroinvertebrate Biotic Index (MBI) rates nutrient and oxygen demanding tolerance. Average MBI values in the Marmaton River were 4.92, which is considered to be partially supporting of large taxonomic aquatic groups. Control of nutrients, such as ammonia, nitrate and phosphorus, are essential in preserving the biological integrity of the river.

Eutrophication is a primary pollutant for the lakes in the watershed. Excess nutrient loading from the watershed creates conditions favorable for algae blooms and aquatic plant growth resulting in low dissolved oxygen rates and an unfavorable habitat for aquatic life. Surplus nutrients originate from manure and fertilizer runoff in rural and urban areas. Many agricultural producers in the watershed implement best management practices (known as BMPs) to prevent nutrient runoff. Some common BMPs include: the use of conservation tillage and cover crops, maintaining buffer strips along field edges, and proper timing of fertilizer application.

Bourbon County State Fishing Lake has a TMDL for pH. Nutrients that are imported into the lake cause excess photosynthesis by phytoplankton and subsequently raise the pH of the lake water. Activities to reduce nutrient loading in Bourbon County State Fishing Lake should improve the pH balance in the lake².

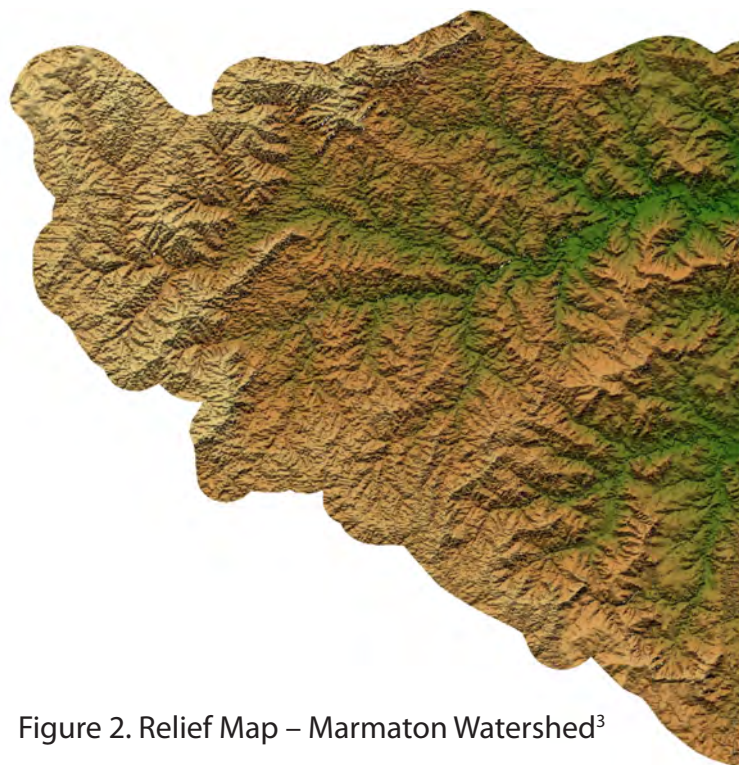


Figure 2. Relief Map – Marmaton Watershed³

2.0 Climate Mapping System

2.1 Precipitation Map⁴

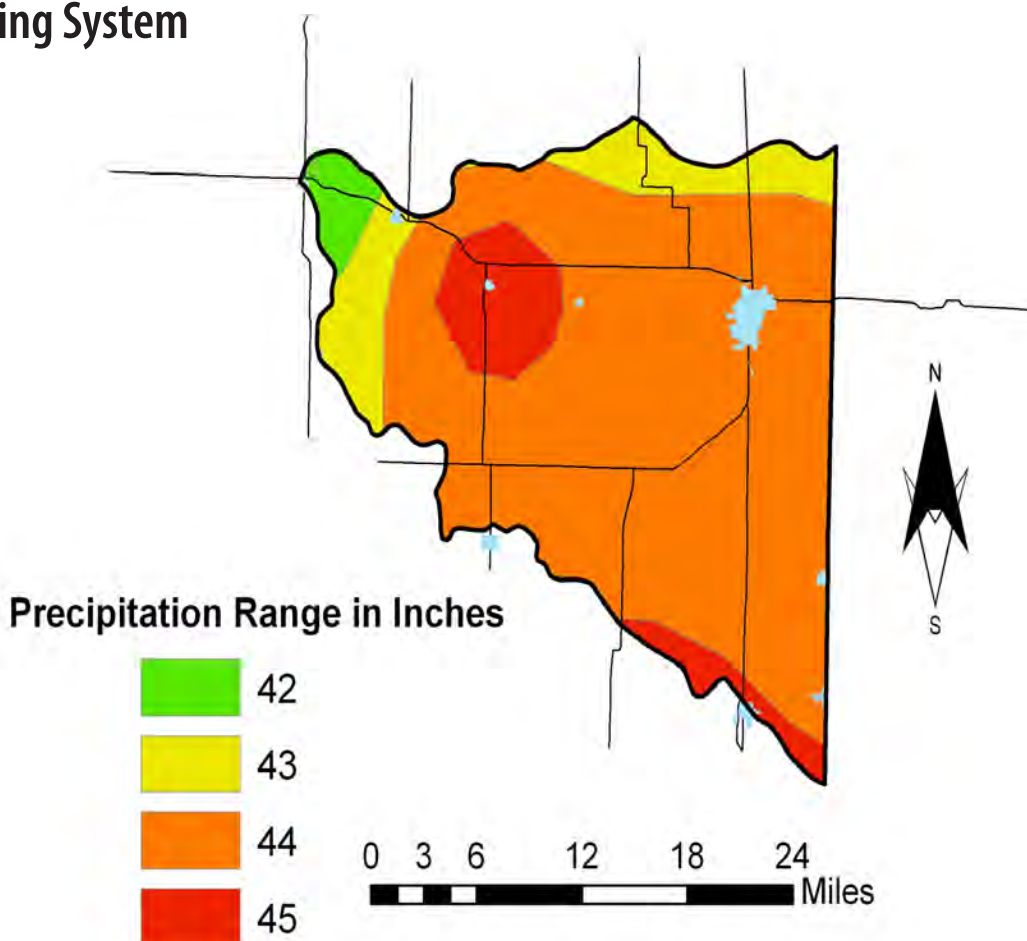


Figure 3. 30-year average annual precipitation in inches, 1971 – 2000.

2.2 30-Year Average Daily Maximum Temperature Map⁵

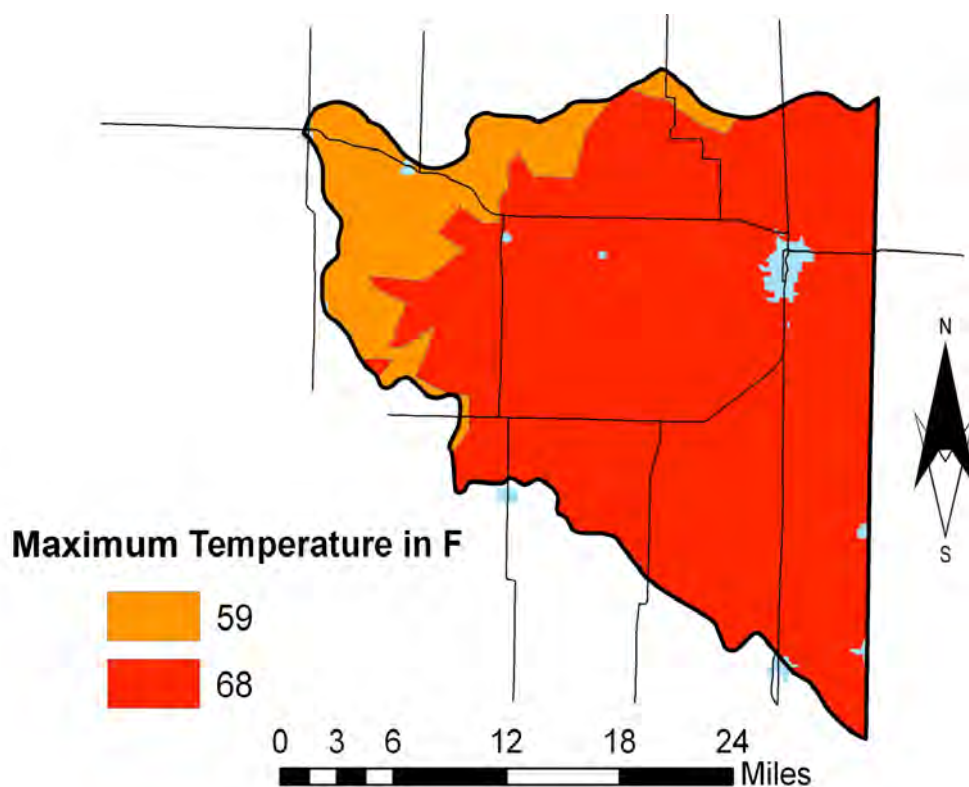


Figure 4. 30-year average daily maximum temperature in degrees Fahrenheit, 1971 – 2000

2.3 30-Year Average Daily Minimum Temperature Map⁶

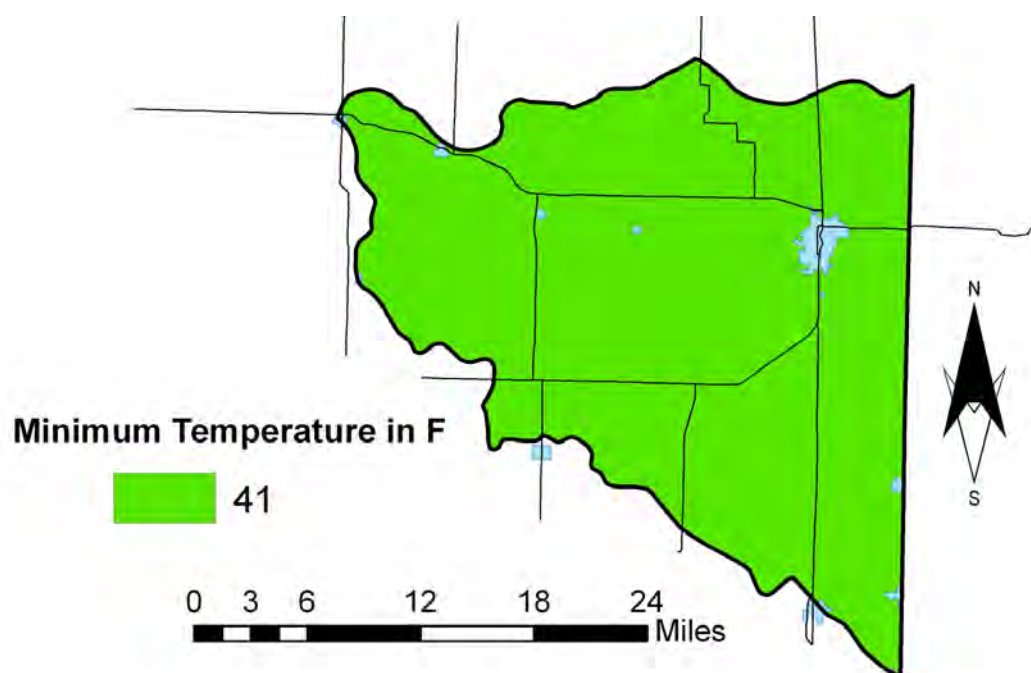


Figure 5. 30-year average daily minimum temperature in degrees Fahrenheit, 1971 – 2000

3.0 Land Use/Land Cover

3.1 Land Use (GIRAS 1980s⁷)

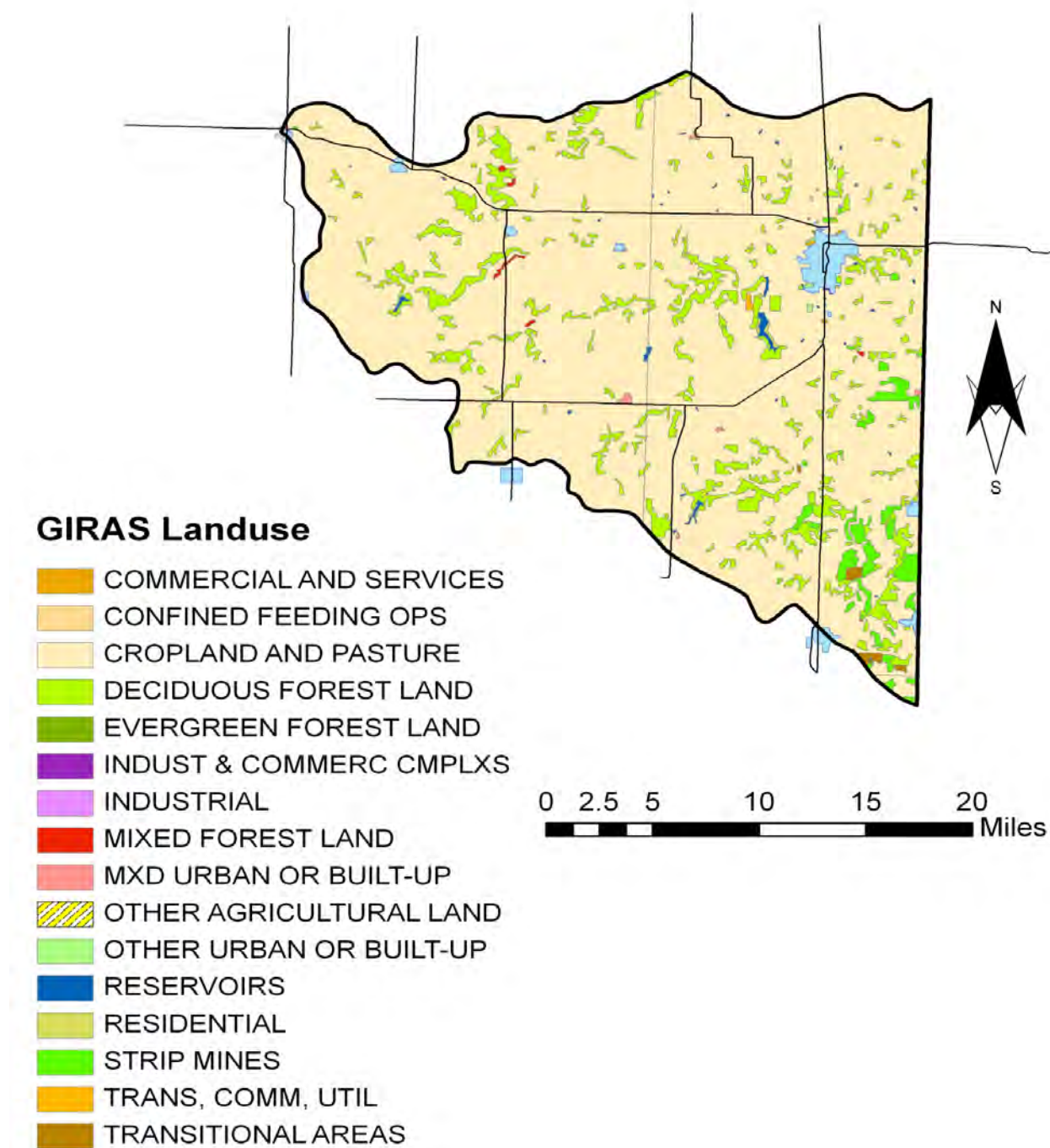


Figure 6. GIRAS 1980s land use classification.

3.2 Land Use (NLCD 1992)⁸

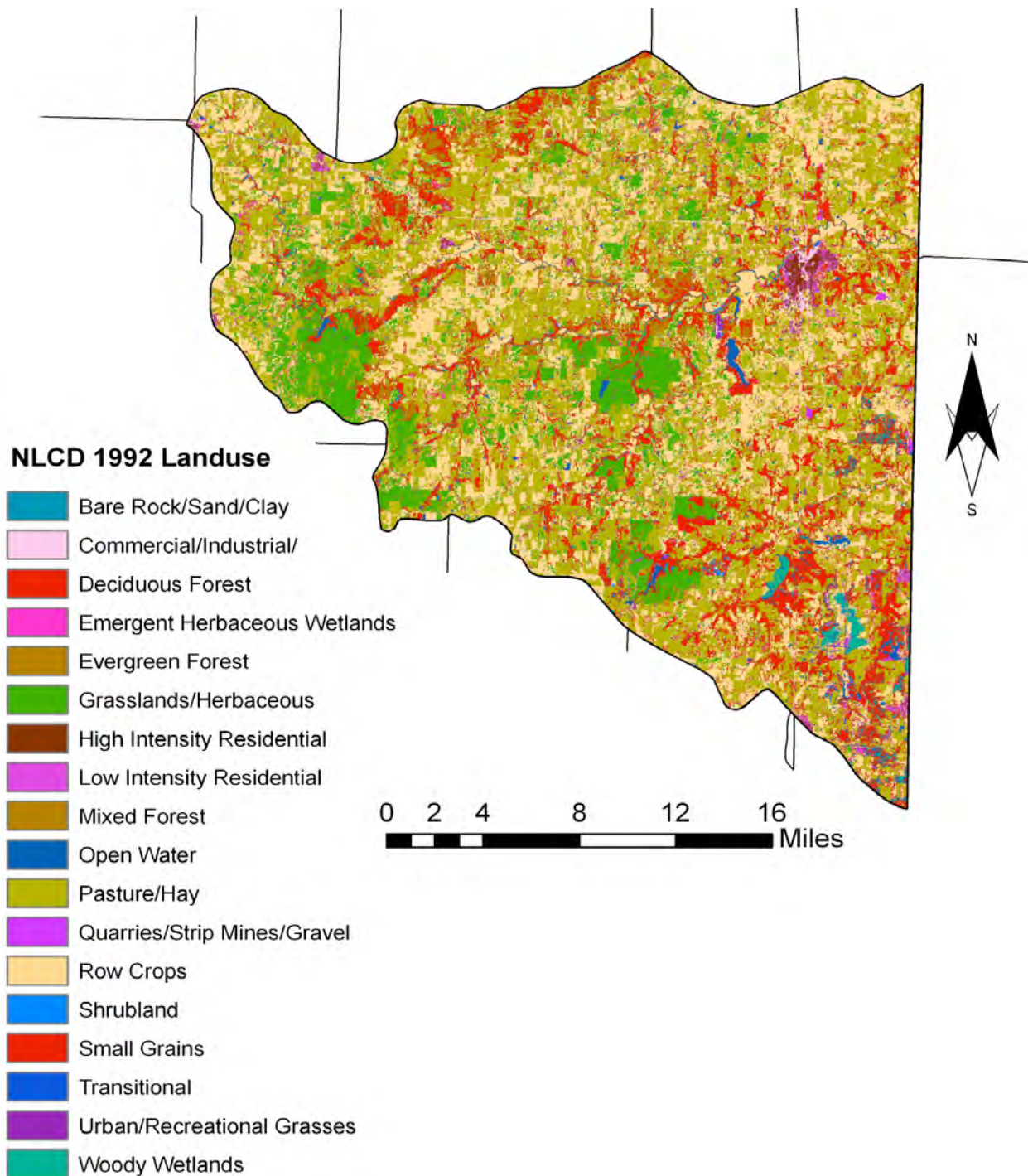


Figure 7. NLCD 1992 land use classification.

3.2.1 NLCD 1992 Land Cover Class Definitions²⁸

The following definitions are from the EPA's National Land Cover Database, found at: <http://www.epa.gov/mrlc/definitions.html#1992>

11. Open Water – all areas of open water, generally with less than 25% cover of vegetation/land cover.

21. Low Intensity Residential – Includes areas with a mixture of constructed materials and vegetation. Constructed materials account for 30-80 percent of the cover. Vegetation may account for 20 to 70 percent of the cover. These areas most commonly include single-family housing units. Population densities will be lower than in high intensity residential areas.

- 22. High Intensity Residential** – Includes highly developed areas where people reside in high numbers. Examples include apartment complexes and row houses. Vegetation accounts for less than 20 percent of the cover. Constructed materials account for 80 to 100 percent of the cover.
- 23. Commercial/Industrial/Transportation** – Includes infrastructure (e.g. roads, railroads, etc.) and all highly developed areas not classified as High Intensity Residential.
- 31. Bare Rock/Sand/Clay** – Perennially barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, beaches, and other accumulations of earthen material.
- 32. Quarries/Strip Mines/Gravel Pits** – Areas of extractive mining activities with significant surface expression.
- 33. Transitional** – Areas of sparse vegetative cover (less than 25 percent of cover) that are dynamically changing from one land cover to another, often because of land use activities. Examples include forest clearcuts, a transition phase between forest and agricultural land, the temporary clearing of vegetation, and changes due to natural causes (e.g. fire, flood, etc.)
- 41. Deciduous Forest** – Areas dominated by trees where 75 percent or more of the tree species shed foliage simultaneously in response to seasonal change.
- 42. Evergreen Forest** – Areas dominated by trees where 75 percent or more of the tree species maintain their leaves all year. Canopy is never without green foliage.
- 43. Mixed Forest** – Areas dominated by trees where neither deciduous nor evergreen species represent more than 75 percent of the cover present.
- 51. Shrubland** – Areas dominated by shrubs; shrub canopy accounts for 25-100 percent of the cover. Shrub cover is generally greater than 25 percent when tree cover is less than 25 percent. Shrub cover may be less than 25 percent in cases when the cover of other life forms (e.g. herbaceous or tree) is less than 25 percent and shrubs cover exceeds the cover of the other life forms.
- 71. Grasslands/Herbaceous** – Areas dominated by upland grasses and forbs. In rare cases, herbaceous cover is less than 25 percent, but exceeds the combined cover of the woody species present. These areas are not subject to intensive management, but they are often utilized for grazing.
- 81. Pasture/Hay** – Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops.
- 82. Row Crops** – Areas used for the production of crops, such as corn, soybeans, vegetables, tobacco, and cotton.
- 83. Small Grains** – Areas used for the production of graminoid crops such as wheat, barley, oats, and rice.
- 85. Urban/Recreational Grasses** – Vegetation (primarily grasses) planted in developed settings for recreation, erosion control, or aesthetic purposes. Examples include parks, lawns, golf courses, airport grasses, and industrial site grasses.
- 91. Woody Wetlands** – Areas where forest or shrubland vegetation accounts for 25-100 percent of the cover and the soil or substrate is periodically saturated with or covered with water.
- 92. Emergent Herbaceous Wetlands** – Areas where perennial herbaceous vegetation accounts for 75-100 percent of the cover and the soil or substrate is periodically saturated with or covered with water.

3.3 Land Use (NLCD 2001)¹

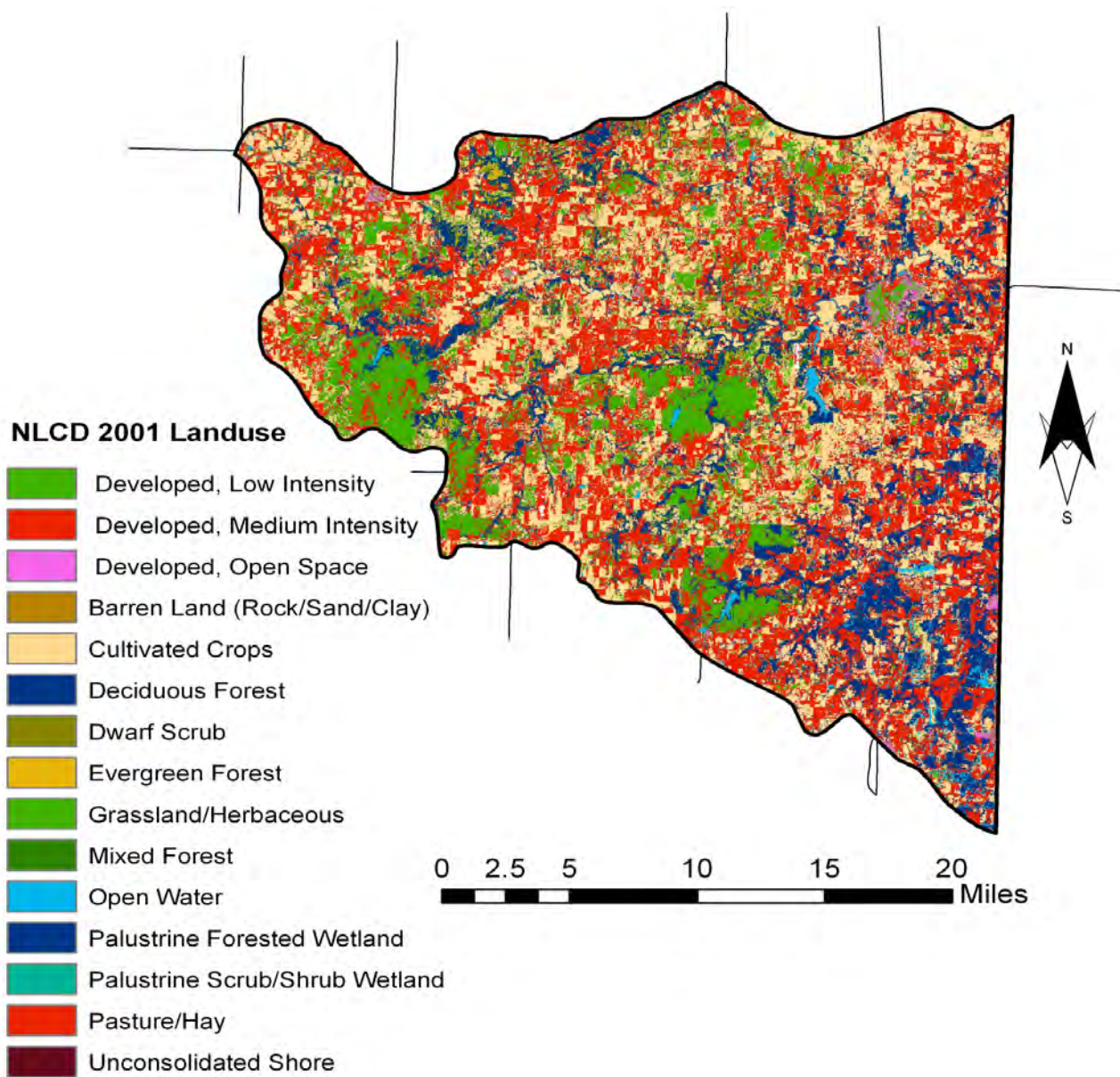


Figure 8. NLCD 2001 land use classification.

3.3.1 NLCD 2001 Land Cover Class Definitions²⁹

The following definitions are from the EPA's National Land Cover Database, found at: <http://www.epa.gov/mrlc/definitions.html#2001>

- 11. Open Water** – All areas of open water, generally with less than 25% cover of vegetation or soil.
- 21. Developed, Open Space** – Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
- 22. Developed, Low Intensity** – Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.
- 23. Developed, Medium Intensity** – Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.

- 31. Barren Land (Rock/Sand/Clay)** – Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.
- 32. Unconsolidated Shore*** – Unconsolidated material such as silt, sand, or gravel that is subject to inundation and redistribution due to the action of water. Characterized by substrates lacking vegetation except for pioneering plants that become established during brief periods when growing conditions are favorable. Erosion and deposition by waves and currents produce a number of landforms representing this class.
- 41. Deciduous Forest** – Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.
- 42. Evergreen Forest** – Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.
- 43. Mixed Forest** – Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.
- 51. Dwarf Scrub** – Alaska only areas dominated by shrubs less than 20 centimeters tall with shrub canopy typically greater than 20% of total vegetation. This type is often co-associated with grasses, sedges, herbs, and non-vascular vegetation.
- 71. Grassland/Herbaceous** – Areas dominated by grammanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
- 81. Pasture/Hay** – Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.
- 82. Cultivated Crops** – Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.
- 91. Palustrine Forested Wetland*** – Includes all tidal and non-tidal wetlands dominated by woody vegetation greater than or equal to 5 meters in height and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salts is below 0.5 percent. Total vegetation coverage is greater than 20 percent.
- 92. Palustrine Scrub/Shrub Wetland*** – Includes all tidal and non-tidal wetlands dominated by woody vegetation less than 5 meters in height, and all such wetlands that occur in tidal areas in which salinity due to ocean-derived salts is below 0.5 percent. Total vegetation coverage is greater than 20 percent. The species present could be true shrubs, young trees and shrubs or trees that are small or stunted due to environmental conditions.

*Data generated by Coastal Change Analysis Program (C-CAP), a project of NOAA; <http://www.csc.noaa.gov/crs/lca/ccap.html>

Table 1. Summary of land use covers

Land Use Type	Agriculture			Barren Land	Forest Land	Grassland	Urban	Wetlands/ Water	Shrub	Total
	Cropland	Pasture	Total							
GIRAS 1980s	341052		341052	7879	34714	0	4697	1122	0	389464
NLCD 1992	112256	137475	249731	567	65639	51306	4299	15692	2233	389467
NLCD 2001	58096	204906	263002	350	55793	39782	20599	9433	292	389251

4.0 River Network⁹

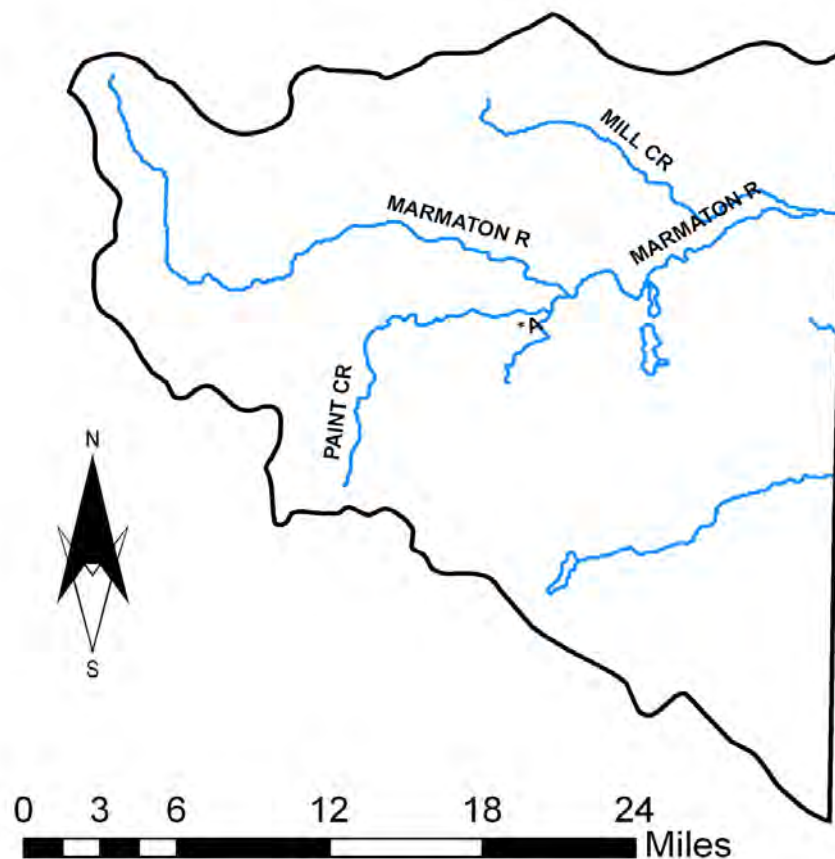


Figure 9. River network – Marmaton Watershed

5.0 Hydrologic Soil Groups¹⁰

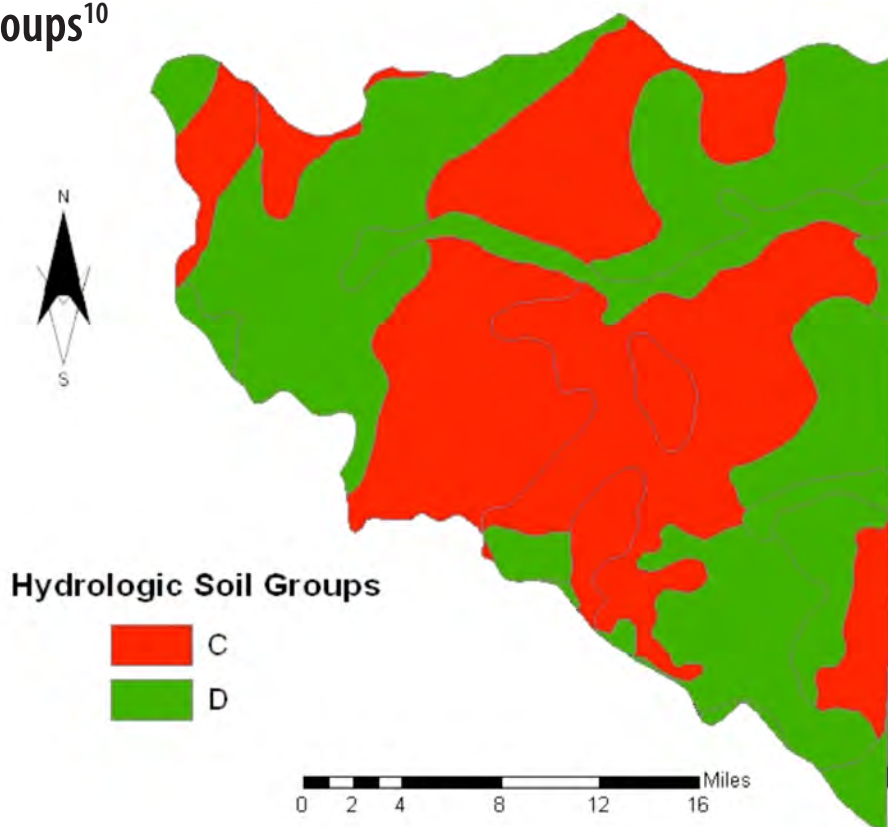


Figure 10. Hydrologic Soil Groups – STASTGO Database – Marmaton Watershed.

6.0 Water Quality Conditions

6.1 The 303d List of Impaired Waterbodies²

This map shows all impaired streams that are not meeting their designated uses (impaired waters) because of excess pollutants as defined in Section 303(d) of the Clean Water Act. The list of impaired waterways is updated by the states every two years. This can be used to identify specific stream segments and lakes for which, in accordance with their priority ranking, TMDLs may need to be developed.

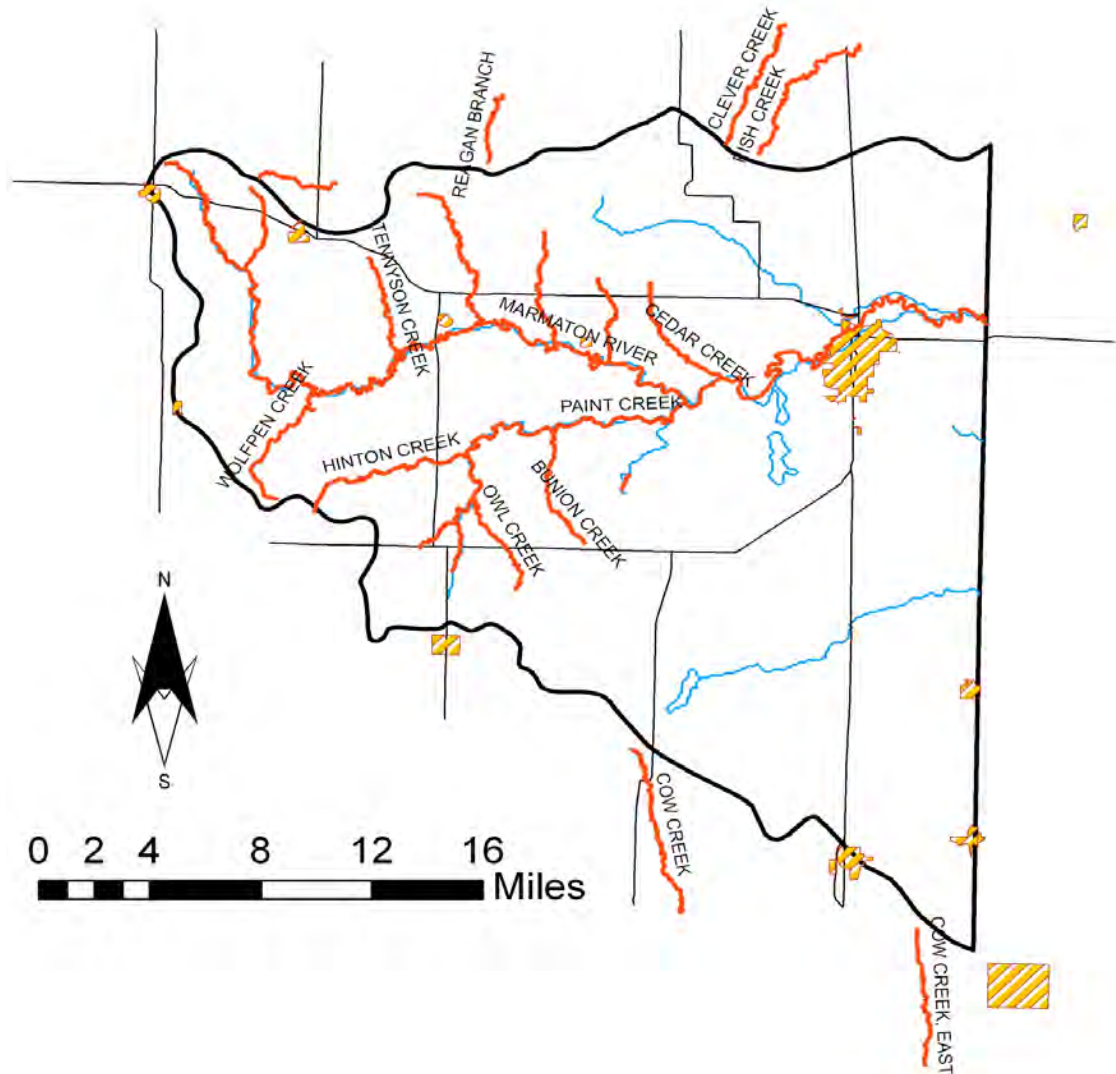


Figure 11. Impaired Waterbodies based on The 303d List – Marmaton Watershed.

Table 2. The 303d List of Impaired Waterbodies

State	Waterbody Name	Impairment
KS	Reagan Branch	Fecal Coliform
KS	Limestone Creek	Fecal Coliform
KS	Clever Creek	Fecal Coliform
KS	Fish Creek	Fecal Coliform
KS	Wolfpen Creek	Low Dissolved Oxygen
KS	Marmaton River	Fecal Coliform, Low Dissolved Oxygen, NH3
KS	Marmaton River	Nutrients Oxygen Demand
KS	Marmaton River	Low Dissolved Oxygen
KS	Paint Creek	Low Dissolved Oxygen
KS	Walnut Creek	Low Dissolved Oxygen
KS	Prong Creek	Low Dissolved Oxygen
KS	Sweet Branch	Low Dissolved Oxygen
KS	Turkey Creek	Low Dissolved Oxygen
KS	Hinton Creek	Low Dissolved Oxygen
KS	Bunion Creek	Low Dissolved Oxygen
KS	Owl Creek	Low Dissolved Oxygen
KS	Tennyson Creek	Low Dissolved Oxygen
KS	Elm Creek Lake	Eutrophication
KS	Cedar Creek	Low Dissolved Oxygen
KS	Robison Branch	Low Dissolved Oxygen
KS	Cow Creek	Chlordane, Fecal Coliform
KS	Cow Creek, East	Chlordane

6.2 Water Quality Observation Stations¹¹

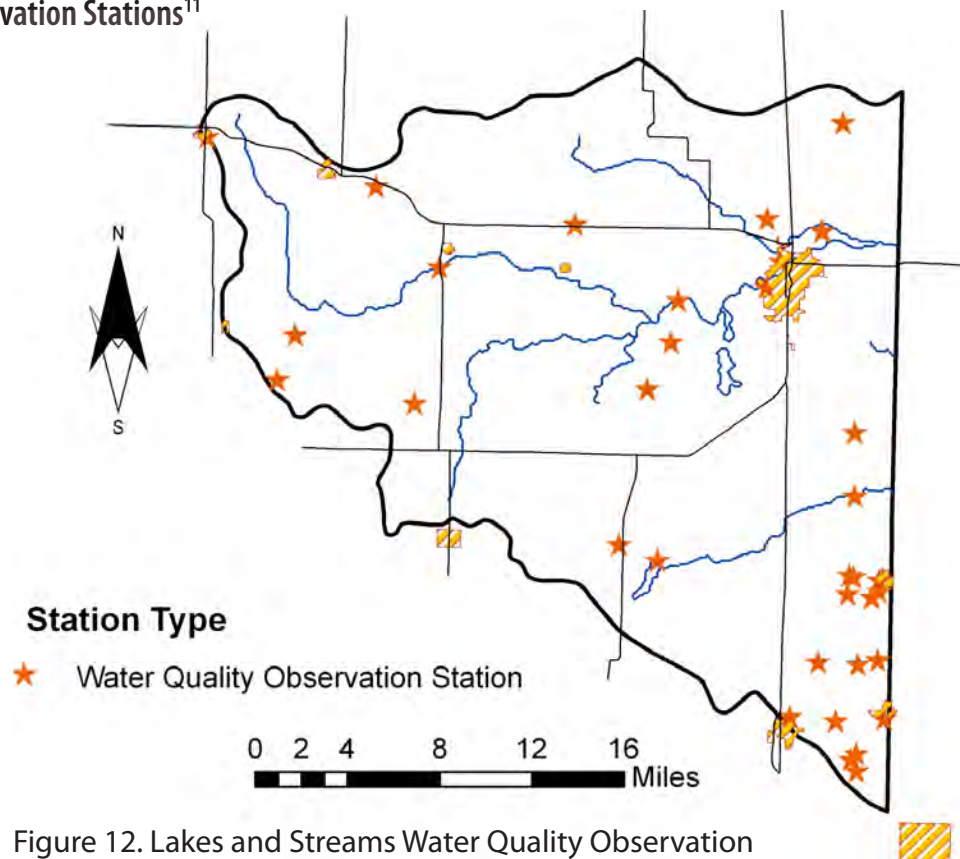


Figure 12. Lakes and Streams Water Quality Observation Stations – Marmaton Watershed.

Table 3. Water Quality Observation Station

State	Agency	Station ID	Station Name
KS	Corps of Engineering, Kansas City Districts	180616	Farm Pond/Hinton Cr KS Hwy 3 S Of Petersburg, KS
KS	Corps of Engineering, Kansas City Districts	180613	Pawnee Cr 4Mi N And 2.5Mi E Of Hiattville, KS
KS	Corps of Engineering, Kansas City Districts	180612	S F Marmaton R 2.5Mi E &.75Mi N Of Petersburg, KS
KS	Corps of Engineering, Kansas City Districts	180611	S F Marmaton R 3Mi S Of Redfield,KS
KS	Corps of Engineering, Kansas City Districts	180603	Marmaton R 2Mi S And 4Mi W Of Fort Scott, KS
KS	Corps of Engineering, Kansas City Districts	180606	Marmaton R 0.9Mi S And 1.1Mi W Of Marmaton, KS
KS	Corps of Engineering, Kansas City Districts	180607	Marmaton River South Of Redfield,KS
KS	Corps of Engineering, Kansas City Districts	180609	Marmaton R At KS Hwy 3 Bridge S. Of Uniontown, KS
KS	Corps of Engineering, Kansas City Districts	180602	Marmaton R-2Nd St Fort Scott,KS
KS	Corps of Engineering, Kansas City Districts	180608	Marmaton R Approx. 1.6 Mi East Of Uniontown, KS
KS	Corps of Engineering, Kansas City Districts	180615	Turkey Cr%Trib. Of Marmaton R< E Of Uniontown, KS
KS	Corps of Engineering, Kansas City Districts	180601	Marmaton R 3.7Mi E And 1Mi N Of Fort Scott, KS
KS	KDHE	066001	Mulberry City Park Lake Sta. No. 1
KS	KDHE	011103	Crawford Co State Lake Sta 3
KS	KDHE	011102	Crawford Co State Lake Sta 2
KS	KDHE	011101	Crawford Co State Lake Sta 1
KS	KDHE	000617	Drywood Creek Near Garland
KS	KDHE	044801	Elm Creek Lake
KS	KDHE	045001	Fort Scott City Lake
KS	KDHE	013303	Bourbon Co State Lake Sta 3
KS	KDHE	013302	Bourbon Co State Lake Sta 2
KS	KDHE	013301	Bourbon Co State Lake Sta 1
KS	KDHE	000559	Marmation River Near Fort Scott
KS	KDHE	045201	Rock Creek Lake
KS	KDHE	065501	Gunn Park West Lake Sta. No. 1
KS	KDHE	065401	Gunn Park East Lake Sta. No. 1
KS	KDHE	000208	Marmaton R. Nr Ft. Scott
KS	KDHE	002908	Marmation River Near Fort Scott
KS	KDHE	046201	Bronson City Lake
KS	USGS	373106094383700	Pit 06
KS	USGS	373133094385300	Pit 05
KS	USGS	373146094383700	Pit 04
KS	USGS	373512094383700	Cox C 1 Mile Nw Of Mulberry, KS
KS	USGS	373516094403100	Pit 03
KS	USGS	373518094400500	Dry Branch C 2 Miles Nw Of Mulberry, KS
KS	USGS	373747094380200	Cox C 1 Mile S Of Arcadia, KS
KS	USGS	373833094385400	Pit 01
KS	USGS	373836094390601	28S 25E 03Aaa 01
KS	USGS	374139094385500	W Fk Dry Wood C 3 Miles N Of Arcadia, KS
KS	USGS	374405094385801	26S 25E 35Ccb 01
KS	USGS	374537094485201	26S 24E 29Bbb 01
KS	USGS	06917400	Marmaton R Tr Nr Fort Scott, KS
KS	USGS	06917380	Marmaton R Nr Marmaton, KS
KS	USGS	06917500	Marmaton R Nr Fort Scott, KS

6.3 USGS Gage Stations¹²

USGS inventory of surface water gaging station data including 7Q10 low and monthly mean stream flow.

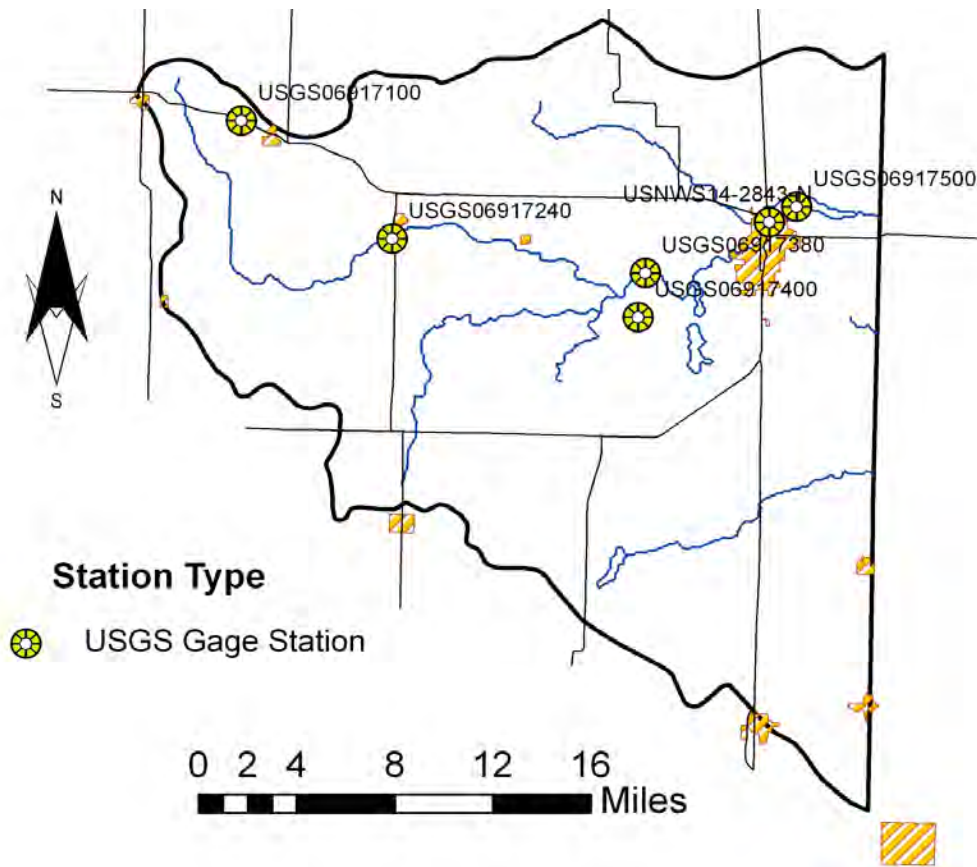


Figure 13. USGS Gage Stations – Marmaton Watershed.

Table 4. USGS Gage Station¹²

Gage ID	Stream Flow (cfs)												
	Mean	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
USGS06917100	-	-	-	-	-	-	-	-	-	-	-	-	-
USGS06917500	284.02	185.54	192.68	266.42	483.80	538.47	509.77	312.67	86.31	254.79	244.72	211.60	113.17
USNWS14-2843-N	-	-	-	-	-	-	-	-	-	-	-	-	-
USGS06917380	289.78	323.96	276.75	764.77	299.44	180.01	573.80	150.45	61.97	166.02	104.05	462.07	168.53
USGS06917400	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 5. Estimated peak-streamflow frequencies for selected gaging stations with at least 10 years of annual peak-discharge data for unregulated, rural streams in Kansas¹³

Station Name	Drainage Area (mi ²)	2-year ft ³ /s	5-year ft ³ /s	10-year ft ³ /s	25-year ft ³ /s	50-year ft ³ /s	100-year ft ³ /s	200-year ft ³ /s
Marmaton River tributary near Bronson	0.88	204	349	455	597	707	820	935
Marmaton River near Fort Scott	408	11800	22900	32100	45600	56900	69300	82700
Marmaton River near Marmaton	292	16600	27900	36900	50000	61100	73200	86600
Marmaton River tributary near Fort Scott	2.80	923	1430	1770	2190	2500	2800	3100

Table 6. USGS gaging stations period of record for Marmaton¹²

USGS ID	Drainage Area (mi ²)	Period of record	
		Begin	End
06917500	408	08/04/1921	09/30/1970
06917380	292	04/30/1971	present
06917240	84	04/01/2001	present

6.4 Permitted Point Source Facilities¹⁴

NPDES permit-holding facility information; contains parameter-specific loadings to surface waters computed using the EPA Effluent Decision Support System (EDSS) for 1990-1999. The summary of discharge concentrations and loads allows the user to perform a planning-level assessment of the magnitude and severity of point source contributions. Analyzing the data for different years can provide information to evaluate changes in contributions from various point sources over time and support trend analysis.

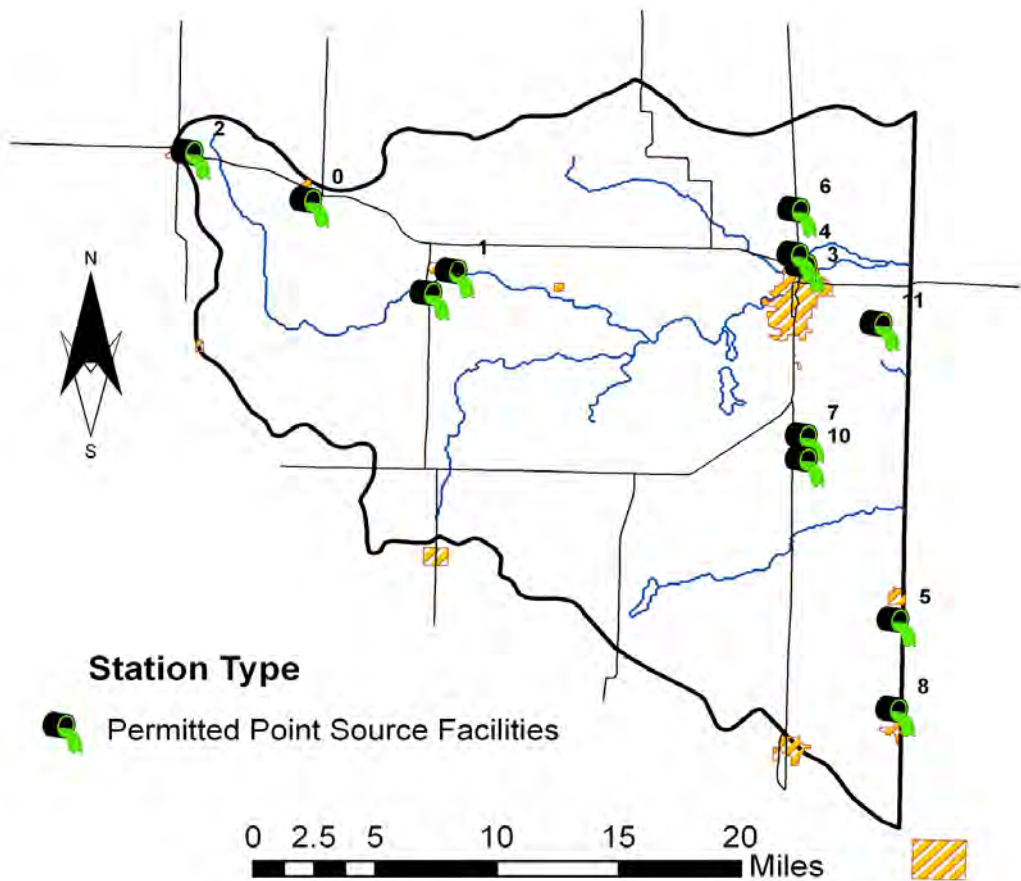


Figure 14. NPDES permit-holding facilities – Marmaton Watershed.

Table 7. Permitted Point Source Facilities¹⁴

ID	NPDES	Facility Name	Ownership	Description	Industrial Classification	City	County	Flow Rate (Million Gallons/Day)
0	KS0045942	Bronson City Of Stp	Public	Sewerage Systems	Municipal	Bronson	Bourbon	0.00000
1	KS0046051	Uniontown City Of Stp	Public	Sewerage Systems	Municipal	Uniontown	Bourbon	0.00000
2	KS0047490	Moran Municipal Wwt Plant	Public	Sewerage Systems	Municipal	Moran	Allen	0.00000
3	KS0052116	Fort Scott Wwtfp	Public	Sewerage Systems	Municipal	Fort Scott	Bourbon	3.00000
4	KS0079111	Koa Kampground Wwtp	Public	Sewerage Systems	Municipal	Fort Scott	Bourbon	8.20000
5	KS0080683	Arcadia Wastewater Treatment F	Public	Sewerage Systems	Municipal	Arcadia	Crawford	0.00000
6	KS0081094	Maple Ridge Park Wwtp	Public	Sewerage Systems	Municipal	Little River	Rice	3.30000
7	KS0081655	Culler Quarry #2	Private	Crushed And Broken Limestone	On Elg	Fort Scott	Bourbon	0.00000
8	KS0087467	Mulberry- Proposed Facility	Pub Pri			Mulberry	Crawford	0.00000
9	KS0090221	Ash Grove - Union	Pub Pri			Uniontown	Bourbon	0.00000
10	KS0092754	Branding Iron	Pub Pri			Fort Scott	Bourbon	0.00000
11	KS0117552	Cullor Inc. Quarry #1	Private	Crushed And Broken Limestone	On Elg	Fort Scott	Bourbon	0.00000

6.5 Confined Animal Feeding Operations (CAFOs)¹⁵

Animal feeding operations classified as large or presenting a high risk to discharge can be classified as CAFOs and are likely required to have an NPDES permit. This maps shows the locations and permit numbers for these sites in the Marmaton watershed.

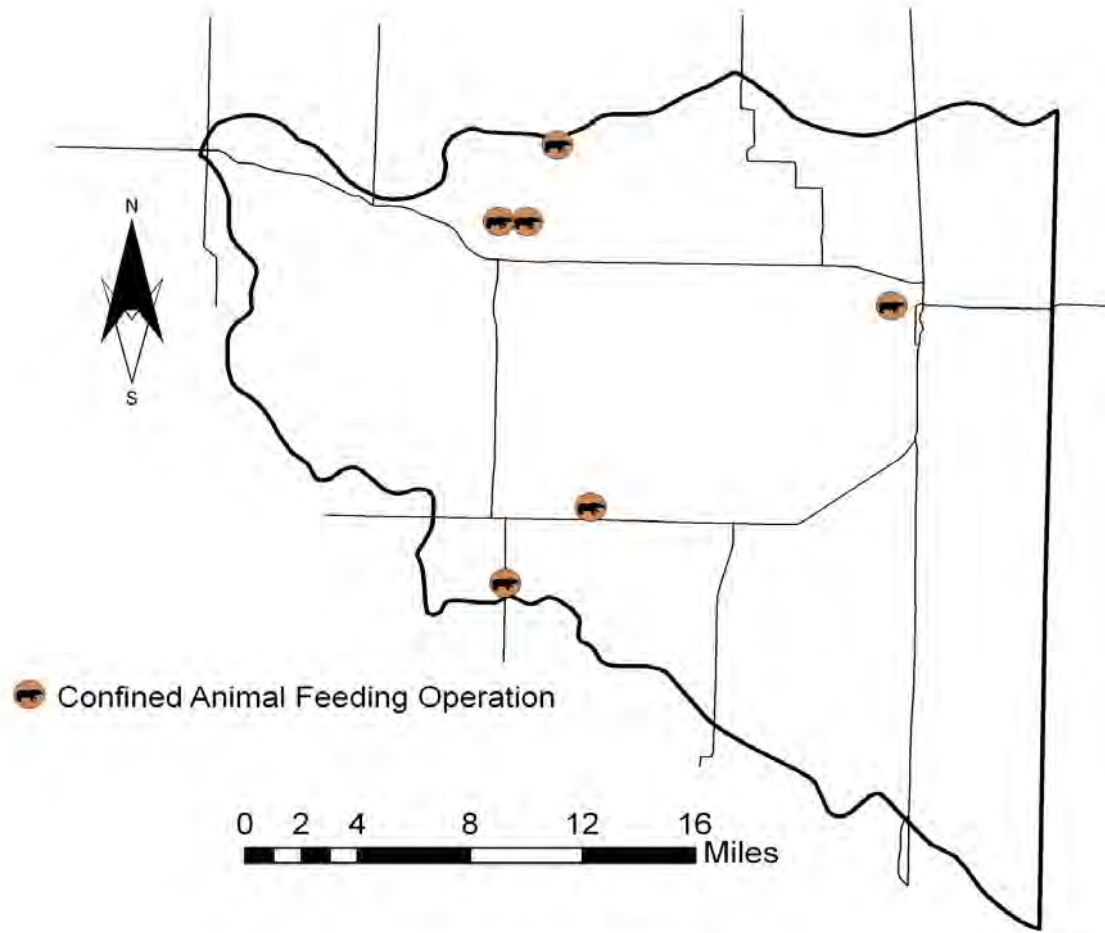


Figure 15. Confined Animal Feeding Operations facilities – Marmaton Watershed.

Table 8. Confined Animal Feeding Operations¹⁵

ID	Permit No.	Total Head	KS_AUS*	FED_AUS	Animal Type
0	A-MCBB-BA05	200	100	200	Beef
1	A-MCBB-M003	200	280	280	Dairy
2	A-MCBB-S009	700	280	280	Swine
3	A-MCBB-BA01	300	300	300	Beef
4	A-MCBB-K001	440	0	0	Kennel
5	A-MCBB-BA06	200	100	200	Beef
6	A-MCBB-MA06	50	70	70	Dairy

* Animal System Unit

6.6 1990 Population and Sewerage by Census Tract¹⁶

The 1990 Population and Sewerage by Census Tract can be used to examine specific areas for population density and the prevalence of septic systems, which can be significant sources of pathogens, household chemicals, and nutrients (especially nitrate) escaping into groundwater and nearby receiving water bodies.

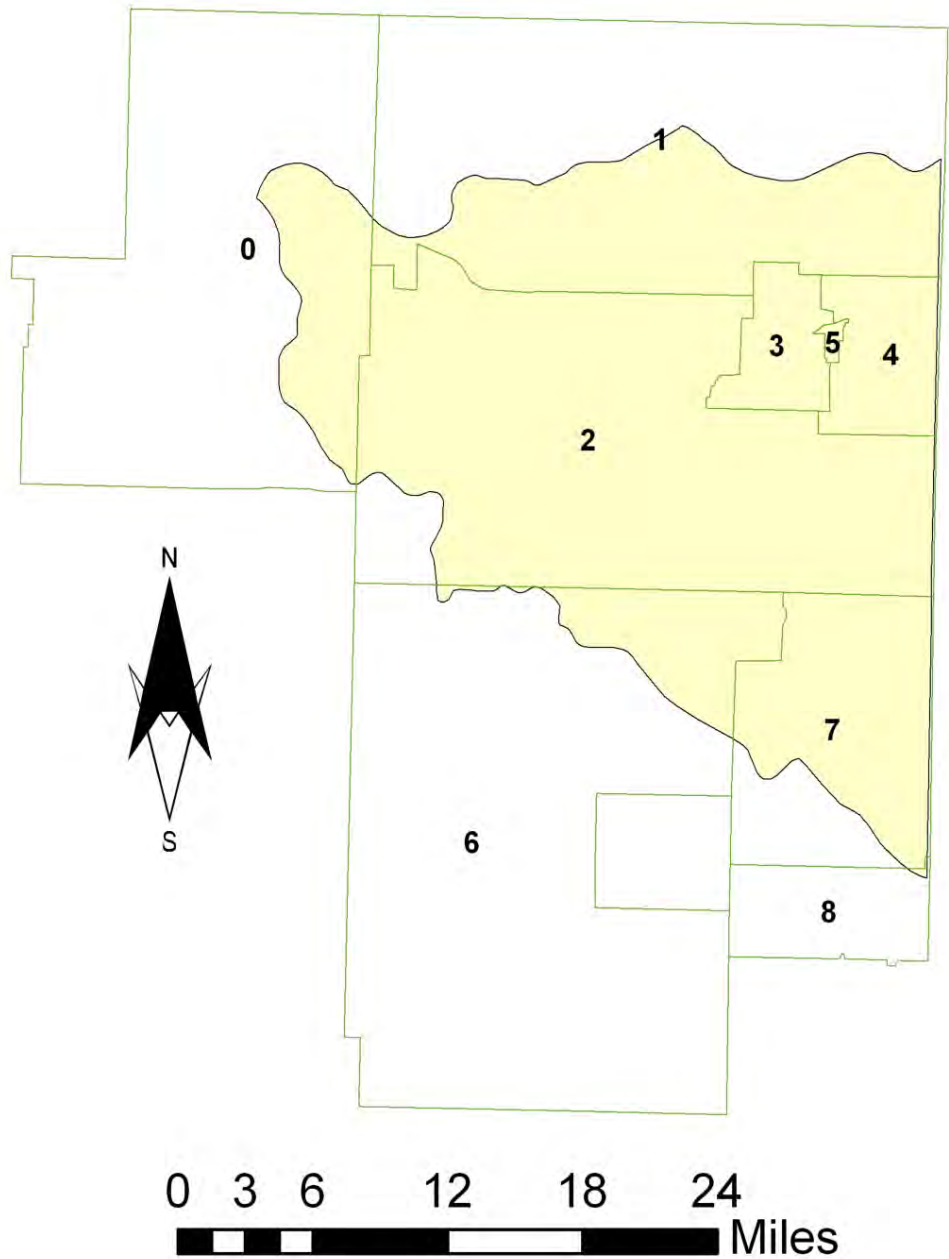


Figure 16. Population and Sewerage by Census – Marmaton Watershed.

Table 9. 1990 Population and Sewerage by Census Tract¹⁶

ID	Tract	Population	House Units	Sewerage Public	Sewerage Septic	Sewerage Other
0	9526	2187	960	360	569	31
1	9556	2458	1123	330	782	11
2	9557	2341	1061	171	832	58
3	9558	3669	1596	1247	349	0
4	9559	3528	1508	1053	446	9
5	9560	2970	1632	1621	11	0
6	9567	3855	1776	732	1024	20
7	9566	4162	1975	960	984	31
8	9569	3414	1532	1100	419	13

7.0. Agricultural Economy

7.1 Corn Cost-Return Budget¹⁷

Table 10. Cost-return projections for corn crops in the Marmaton Watershed, 2006.

Corn	Yield Level (bu)		
	80	110	140
Income Per Acre			
A. Yield per acre	80	110	140
B. Price per bushel	\$2.70	\$2.70	\$2.70
C. Net government payment	\$10.48	\$11.39	\$12.30
D. Indemnity payments			
E. Miscellaneous income			
F. Returns/acre ((AxB)+C+D+E)	\$226.48	\$308.39	\$390.30
Costs Per Acre			
1. Seed	\$32.43	\$32.43	\$36.66
2. Herbicide	33.85	33.85	33.85
3. Insecticide/Fungicide	0.27	0.27	0.27
4. Fertilizer and Lime	37.48	45.40	53.32
5. Crop Consulting			
6. Crop Insurance			
7. Drying			
8. Miscellaneous	7.00	7.00	7.00
9. Custom Hire / Machinery Expense	90.16	98.83	107.50
10. Non-machinery Labor	10.19	11.17	12.15
11. Irrigation			
12. Land Charge/Rent	34.40	43.00	51.60
G. Sub Total	\$245.77	\$271.94	\$302.34
13. Interest on ½ Nonland Costs	9.51	10.30	11.28
H. Total Costs	\$255.28	\$282.25	\$313.63
I. Returns Over Costs (F-H)	-\$28.81	\$26.14	\$76.68
J. Total Costs/bushel (H/A)	\$3.19	\$2.57	\$2.24
K. Return To Annual Cost (I+13)/G	-7.85%	13.40%	29.09%

Table 11. Southeast Kansas Farm Management Association profit Center Analysis: 5-year Average & 2006 Nonirrigated Corn.²⁶

	2001-2005 Average			2006		
Number of Farms	55			38		
Crop Acres	402			529		
Acres Owned	121			155		
Acres Rented	281			374		
Yield / Acre	109			95		
Bushels	36,359			40,404		
Operator Percentage	83.15%			80.47%		
Gross Income / Acre	\$233.40			\$242.68		
Variable Costs / Acre	\$160.45			\$178.68		
Total Expense / Acre	\$230.79			\$248.23		
Gross Income / Bushel	\$2.58			\$3.18		
Total Expense / Bushel	\$2.55			\$3.25		

	Total Dollars	\$/Bushel	\$/Acre	Total Dollars	\$/Bushel	\$/Acre
INCOME:						
Corn (Operator's Share)	\$80,290.82	\$2.21	\$199.63	\$120,532.52	\$2.98	\$227.85
Patronage Refunds	\$266.75	0.01	0.66	\$673.05	0.02	1.27
Government Payments	\$12,131.76	0.33	30.16	\$6,674.57	0.17	12.62
Miscellaneous Income	\$20.08	0.00	0.05	(\$147.10)	(0.00)	(0.28)
Crop Insurance Proceeds	\$1,163.31	0.03	2.89	\$645.16	0.02	1.22
OTHER INCOME	\$13,581.90	\$0.37	\$33.77	\$7,845.68	\$0.19	\$14.83
GROSS INCOME	\$93,872.72	\$2.58	\$233.40	\$128,378.20	\$3.18	\$242.68
EXPENSES:						
Labor Hired	\$3,453.01	\$0.09	\$8.59	\$4,657.12	\$0.12	\$8.80
General Machinery Repairs	\$6,156.94	0.17	15.31	\$8,142.53	0.20	15.39
Interest Paid	\$3,812.10	0.10	9.48	\$6,394.41	0.16	12.09
Seed / Other Crop Expense	\$12,012.77	0.33	29.87	\$18,201.43	0.45	34.41
Crop Insurance	\$2,119.32	0.06	5.27	\$3,501.80	0.09	6.62
Fertilizer / Lime	\$16,167.67	0.44	40.20	\$25,235.64	0.62	47.70
Machine Hire - Lease	\$2,389.04	0.07	5.94	\$2,745.59	0.07	5.19
Farm Org Fees / Travel / Publ	\$655.92	0.02	1.63	\$877.00	0.02	1.66
Gas / Fuel / Oil	\$4,069.75	0.11	10.12	\$7,761.81	0.19	14.67
Crop Storage & Marketing	\$498.96	0.01	1.24	\$551.75	0.01	1.04
Personal Property Tax	\$292.99	0.01	0.73	\$331.64	0.01	0.63
General Farm Insurance	\$1,099.50	0.03	2.73	\$1,398.60	0.03	2.64
Utilities	\$843.34	0.02	2.10	\$974.65	0.02	1.84
Cash Farm Rent	\$3,252.51	0.09	8.09	\$2,491.15	0.06	4.71
Herbicide / Insecticide	\$7,424.28	0.20	18.46	\$10,987.66	0.27	20.77
Conservation	\$42.18	0.00	0.10	\$0.58	0.00	0.00
Auto Expense	\$241.21	0.01	0.60	\$265.72	0.01	0.50
TOTAL VARIABLE COSTS	\$64,531.50	\$1.77	\$160.45	\$94,519.08	\$2.34	\$178.68
RETURN ABOVE VARIABLE COSTS	\$29,341.23	\$0.81	\$72.95	\$33,859.12	\$0.84	\$64.01
Depreciation	\$8,551.91	0.24	21.26	\$11,757.89	0.29	22.23
Real Estate Tax	\$1,014.99	0.03	2.52	\$1,207.60	0.03	2.28
Unpaid Operator Labor	\$6,259.53	0.17	15.56	\$6,654.67	0.16	12.58
Interest Charge *	\$2,730.39	0.08	6.79	\$2,664.72	0.07	5.04
TOTAL FIXED COSTS	\$18,556.82	\$0.51	\$46.14	\$22,284.88	\$0.55	\$42.13
Land Charge **	\$9,735.65	\$0.27	\$24.21	\$14,510.87	\$0.36	\$27.43
TOTAL EXPENSE	\$92,823.97	\$2.55	\$230.79	\$131,314.83	\$3.25	\$248.23
NET RETURN TO MANAGEMENT	\$1,048.75	\$0.03	\$2.61	(\$2,936.63)	(\$0.07)	(\$5.55)
NET RETURN TO LABOR-MGT	\$10,761.29	\$0.30	\$26.76	\$8,375.16	\$0.21	\$15.83

*Interest charge equals: ((8.0% times three-fourths the variable costs) plus (4.0% times depreciation times 8)) minus cash interest paid.

**Land charge represents a charge (equal to landlord's share) on owned land and equals (production from owned acres X price / unit X 33.33%). Crop production paid to the landlord on rented land (already removed above), or cash rent is the charge on rented land.

This crop enterprise is based on the operator's share of production, and thus includes only production expenses paid by the operator. A charge for management is not included in the expenses.

7.2 Soybean Cost-Return Budget¹⁷

Table 12. Cost-return projections for soybean crops in the Marmaton Watershed, 2006.

Soybeans	Yield Level (bu)		
	25	35	45
Income Per Acre			
A. Yield per acre	25	35	45
B. Price per bushel	\$6.08	\$6.08	\$6.08
C. Net government payment	\$10.48	\$11.39	\$12.30
D. Indemnity payments			
E. Miscellaneous income			
F. Returns/acre ((AxB)+C+D+E)	\$162.48	\$224.19	\$285.90
Costs Per Acre			
1. Seed	\$30.60	\$30.60	\$32.95
2. Herbicide	8.86	8.86	8.86
3. Insecticide/Fungicide			
4. Fertilizer and Lime	16.41	17.70	21.20
5. Crop Consulting			
6. Crop Insurance			
7. Drying			
8. Miscellaneous	7.00	7.00	7.00
9. Custom Hire / Machinery Expense	73.03	77.25	80.22
10. Non-machinery Labor	8.25	8.75	9.06
11. Irrigation			
12. Land Charge / Rent	34.40	43.00	51.60
G. Sub Total	\$178.55	\$193.14	\$210.89
13. Interest on ½ Nonland Costs	6.49	6.76	7.17
H. Total Costs	\$185.03	\$199.89	\$218.06
I. Returns Over Costs (F-H)	-\$22.56	\$24.30	\$67.84
J. Total Costs/bushel (H/A)	\$7.40	\$5.71	\$4.85
K. Return To Annual Cost (I+13)/G	-9.00%	16.08%	35.57%

Table 13. Southeast Kansas Farm Management Association profit Center Analysis: 5-year Average & 2006 Nonirrigated Soybeans.²⁶

	2001-2005 Average			2006		
Number of Farms	71			49		
Crop Acres	476			442		
Acres Owned	113			101		
Acres Rented	362			342		
Yield / Acre	28			26		
Bushels	10,662			8,906		
Operator Percentage	80.73%			78.77%		
Gross Income / Acre	\$149.07			\$148.18		
Variable Costs / Acre	\$94.54			\$105.63		
Total Expense / Acre	\$145.78			\$154.47		
Gross Income / Bushel	\$6.65			\$7.35		
Total Expense / Bushel	\$6.50			\$7.67		

	Total Dollars	\$/Bushel	\$/Acre	Total Dollars	\$/Bushel	\$/Acre
INCOME:						
Soybeans (Operator's Share)	\$58,823.37	\$5.52	\$123.68	\$56,216.35	\$6.31	\$127.19
Patronage Refunds	\$300.71	0.03	0.63	\$402.25	0.05	0.91
Government Payments	\$9,645.70	0.90	20.28	\$5,941.08	0.67	13.44
Miscellaneous Income	\$23.47	0.00	0.05	(\$1.98)	(0.00)	(0.00)
Crop Insurance Proceeds	\$2,103.66	0.20	4.42	\$2,937.50	0.33	6.65
OTHER INCOME	\$12,073.55	\$1.13	\$25.39	\$9,278.85	\$1.04	\$20.99
GROSS INCOME	\$70,896.91	\$6.65	\$149.07	\$65,495.20	\$7.35	\$148.18
EXPENSES:						
Labor Hired	\$2,364.92	\$0.22	\$4.97	\$3,016.89	\$0.34	\$6.83
General Machinery Repairs	\$5,957.40	0.56	12.53	\$5,633.38	0.63	12.75
Interest Paid	\$4,288.15	0.40	9.02	\$4,077.73	0.46	9.23
Seed / Other Crop Expense	\$8,987.19	0.84	18.90	\$10,131.36	1.14	22.92
Crop Insurance	\$2,024.04	0.19	4.26	\$2,890.62	0.32	6.54
Fertilizer / Lime	\$1,917.37	0.18	4.03	\$2,658.14	0.30	6.01
Machine Hire - Lease	\$2,164.97	0.20	4.55	\$1,534.20	0.17	3.47
Farm Org Fees / Travel / Publ	\$659.88	0.06	1.39	\$795.70	0.09	1.80
Gas / Fuel / Oil	\$3,999.51	0.38	8.41	\$5,529.03	0.62	12.51
Crop Storage & Marketing	\$343.58	0.03	0.72	\$290.45	0.03	0.66
Personal Property Tax	\$283.04	0.03	0.60	\$305.12	0.03	0.69
General Farm Insurance	\$1,112.99	0.10	2.34	\$1,079.54	0.12	2.44
Utilities	\$932.69	0.09	1.96	\$797.39	0.09	1.80
Cash Farm Rent	\$3,457.04	0.32	7.27	\$2,897.97	0.33	6.56
Herbicide / Insecticide	\$6,090.26	0.57	12.81	\$4,872.54	0.55	11.02
Conservation	\$44.19	0.00	0.09	\$0.20	0.00	0.00
Auto Expense	\$334.90	0.03	0.70	\$177.81	0.02	0.40
TOTAL VARIABLE COSTS	\$44,962.11	\$4.22	\$94.54	\$46,688.07	\$5.24	\$105.63
RETURN ABOVE VARIABLE COSTS	\$25,934.80	\$2.43	\$54.53	\$18,807.13	\$2.11	\$42.55
Depreciation	\$8,254.98	0.77	17.36	\$8,348.84	0.94	18.89
Real Estate Tax	\$1,057.10	0.10	2.22	\$922.51	0.10	2.09
Unpaid Operator Labor	\$8,002.74	0.75	16.83	\$6,059.39	0.68	13.71
Interest Charge *	\$994.65	0.09	2.09	\$1,152.23	0.13	2.61
TOTAL FIXED COSTS	\$18,309.47	\$1.72	\$38.50	\$16,482.97	\$1.85	\$37.29
Land Charge **	\$6,060.95	\$0.57	\$12.74	\$5,103.12	\$0.57	\$11.55
TOTAL EXPENSE	\$69,332.53	\$6.50	\$145.78	\$68,274.16	\$7.67	\$154.47
NET RETURN TO MANAGEMENT	\$1,564.38	\$0.15	\$3.29	(\$2,778.96)	(\$0.31)	(\$6.29)
NET RETURN TO LABOR-MGT	\$11,932.05	\$1.12	\$25.09	\$6,297.32	\$0.71	\$14.25

*Interest charge equals: ((8.0% times three-fourths the variable costs) plus (4.0% times depreciation times 8)) minus cash interest paid.

**Land charge represents a charge (equal to landlord's share) on owned land and equals (production from owned acres X price / unit X 33.33%). Crop production paid to the landlord on rented land (already removed above), or cash rent is the charge on rented land.

This crop enterprise is based on the operator's share of production, and thus includes only production expenses paid by the operator. A charge for management is not included in the expenses.

7.3 Wheat Cost-Return Budget¹⁷

Table 14. Cost-return projections for wheat crops in the Marmaton Watershed, 2006.

Wheat	Yield Level (bu)		
	35	45	55
Income Per Acre			
A. Yield per acre	35	45	55
B. Price per bushel	\$4.41	\$4.41	\$4.41
C. Net government payment	\$10.48	\$11.39	\$12.30
D. Indemnity payments			
E. Miscellaneous income			
F. Returns/acre ((AxB)+C+D+E)	\$164.83	\$209.84	\$254.85
Costs Per Acre			
1. Seed	\$9.90	\$9.90	\$9.90
2. Herbicide	2.75	2.75	2.75
3. Insecticide/Fungicide			
4. Fertilizer and Lime	36.65	43.71	52.06
5. Crop Consulting			
6. Crop Insurance			
7. Drying			
8. Miscellaneous	7.00	7.00	7.00
9. Custom Hire / Machinery Expense	60.61	63.62	66.63
10. Non-machinery Labor	6.85	7.19	7.53
11. Irrigation			
12. Land Charge / Rent	34.40	43.00	51.60
G. Sub Total	\$158.16	\$177.17	\$197.47
13. Interest on ½ Nonland Costs	5.57	6.04	6.56
H. Total Costs	\$163.73	\$183.20	\$204.04
I. Returns Over Costs (F-H)	\$1.10	\$26.64	\$50.81
J. Total Costs/bushel (H/A)	\$4.68	\$4.07	\$3.71
K. Return To Annual Cost (I+13)/G	4.22%	18.44%	29.06%

Table 15. Southeast Kansas Farm Management Association profit Center Analysis: 5-year Average & 2006 Nonirrigated Wheat.²⁶

	2001-2005 Average			2006		
Number of Farms		73			48	
Crop Acres		429			524	
Acres Owned		93			126	
Acres Rented		337			398	
Yield / Acre		45			40	
Bushels		15,355			16,758	
Operator Percentage		79.19%			80.78%	
Gross Income / Acre		\$136.15			\$157.92	
Variable Costs / Acre		\$88.81			\$106.21	
Total Expense / Acre		\$133.82			\$156.76	
Gross Income / Bushel		\$3.81			\$4.94	
Total Expense / Bushel		\$3.74			\$4.90	

	Total Dollars	\$/Bushel	\$/Acre	Total Dollars	\$/Bushel	\$/Acre
INCOME:						
Wheat (Operator's Share)	\$50,409.65	\$3.28	\$117.45	\$73,816.79	\$4.40	\$140.87
Patronage Refunds	\$398.25	0.03	0.93	\$692.50	0.04	1.32
Government Payments	\$6,980.10	0.45	16.26	\$6,865.51	0.41	13.10
Miscellaneous Income	\$37.94	0.00	0.09	\$24.76	0.00	0.05
Crop Insurance Proceeds	\$610.26	0.04	1.42	\$1,349.38	0.08	2.58
OTHER INCOME	\$8,026.55	\$0.52	\$18.70	\$8,932.15	\$0.53	\$17.05
GROSS INCOME	\$58,436.20	\$3.81	\$136.15	\$82,748.94	\$4.94	\$157.92
EXPENSES:						
Labor Hired	\$2,566.56	\$0.17	\$5.98	\$3,476.58	\$0.21	\$6.63
General Machinery Repairs	\$5,037.99	0.33	11.74	\$6,209.33	0.37	11.85
Interest Paid	\$3,870.05	0.25	9.02	\$5,123.64	0.31	9.78
Seed / Other Crop Expense	\$2,669.10	0.17	6.22	\$4,401.92	0.26	8.40
Crop Insurance	\$1,180.39	0.08	2.75	\$2,280.47	0.14	4.35
Fertilizer / Lime	\$11,256.34	0.73	26.23	\$18,173.35	1.08	34.68
Machine Hire - Lease	\$1,570.07	0.10	3.66	\$852.43	0.05	1.63
Farm Org Fees / Travel / Publ	\$528.11	0.03	1.23	\$628.46	0.04	1.20
Gas / Fuel / Oil	\$3,361.19	0.22	7.83	\$5,860.11	0.35	11.18
Crop Storage & Marketing	\$286.55	0.02	0.67	\$383.48	0.02	0.73
Personal Property Tax	\$219.98	0.01	0.51	\$282.79	0.02	0.54
General Farm Insurance	\$985.82	0.06	2.30	\$1,416.01	0.08	2.70
Utilities	\$748.60	0.05	1.74	\$778.21	0.05	1.49
Cash Farm Rent	\$2,512.88	0.16	5.85	\$2,920.36	0.17	5.57
Herbicide / Insecticide	\$1,088.84	0.07	2.54	\$2,669.37	0.16	5.09
Conservation	\$46.99	0.00	0.11	\$0.39	0.00	0.00
Auto Expense	\$185.99	0.01	0.43	\$198.85	0.01	0.38
TOTAL VARIABLE COSTS	\$38,115.46	\$2.48	\$88.81	\$55,655.75	\$3.32	\$106.21
RETURN ABOVE VARIABLE COSTS	\$20,320.74	\$1.32	\$47.35	\$27,093.19	\$1.62	\$51.70
Depreciation	\$7,038.32	0.46	16.40	\$9,641.06	0.58	18.40
Real Estate Tax	\$745.82	0.05	1.74	\$1,177.16	0.07	2.25
Unpaid Operator Labor	\$6,218.48	0.40	14.49	\$6,997.50	0.42	13.35
Interest Charge *	\$663.69	0.04	1.55	\$994.86	0.06	1.90
TOTAL FIXED COSTS	\$14,666.31	\$0.96	\$34.17	\$18,810.58	\$1.12	\$35.90
Land Charge **	\$4,654.48	\$0.30	\$10.84	\$7,675.82	\$0.46	\$14.65
TOTAL EXPENSE	\$57,436.25	\$3.74	\$133.82	\$82,142.15	\$4.90	\$156.76
NET RETURN TO MANAGEMENT	\$999.95	\$0.07	\$2.33	\$606.79	\$0.04	\$1.16
NET RETURN TO LABOR-MGT	\$9,785.00	\$0.64	\$22.80	\$11,080.87	\$0.66	\$21.15

*Interest charge equals: ((8.0% times three-fourths the variable costs) plus (4.0% times depreciation times 8)) minus cash interest paid.

**Land charge represents a charge (equal to landlord's share) on owned land and equals (production from owned acres X price / unit X 33.33%). Crop production paid to the landlord on rented land (already removed above), or cash rent is the charge on rented land.

This crop enterprise is based on the operator's share of production, and thus includes only production expenses paid by the operator. A charge for management is not included in the expenses.

7.4 Grain Sorghum Cost-Return Budget¹⁷

Table 16. Cost-return projections for grain sorghum crops in the Marmaton Watershed, 2006.

Grain Sorghum	Yield Level (bu)		
	70	85	110
Income Per Acre			
A. Yield per acre	70	85	110
B. Price per bushel	\$2.82	\$2.82	\$2.82
C. Net government payment	\$10.48	\$11.39	\$12.30
D. Indemnity payments			
E. Miscellaneous income			
F. Returns/acre ((AxB)+C+D+E)	\$207.88	\$207.88	\$207.88
Costs Per Acre			
1. Seed	\$12.29	\$12.29	\$12.29
2. Herbicide	20.34	20.34	20.34
3. Insecticide/Fungicide	5.90	5.90	5.90
4. Fertilizer and Lime	39.68	43.64	50.24
5. Crop Consulting			
6. Crop Insurance			
7. Drying			
8. Miscellaneous	7.00	7.00	7.00
9. Custom Hire / Machinery Expense	82.39	86.92	94.47
10. Non-machinery Labor	9.31	9.82	10.68
11. Irrigation			
12. Land Charge / Rent	34.40	43.00	51.60
G. Sub Total	\$211.30	\$228.90	\$252.51
13. Interest on ½ Nonland Costs	7.96	8.37	9.04
H. Total Costs	\$219.26	\$237.27	\$261.55
I. Returns Over Costs (F-H)	-\$11.38	\$13.82	\$60.95
J. Total Costs/bushel (H/A)	\$3.13	\$2.79	\$2.38
K. Return To Annual Cost (I+13)/G	-1.62%	9.69%	27.72%

Table 17. Southeast Kansas Farm Management Association profit Center Analysis: 5-year Average & 2006 Nonirrigated Sorghum.²⁶

	2001-2005 Average			2006		
Number of Farms	50			20		
Crop Acres	231			206		
Acres Owned	46			20		
Acres Rented	185			186		
Yield / Acre	80			63		
Bushels	14,154			9,948		
Operator Percentage	76.56%			77.01%		
Gross Income / Acre	\$147.94			\$162.55		
Variable Costs / Acre	\$109.23			\$123.03		
Total Expense / Acre	\$161.11			\$169.51		
Gross Income / Bushel	\$2.42			\$3.37		
Total Expense / Bushel	\$2.63			\$3.51		

	Total Dollars	\$/Bushel	\$/Acre	Total Dollars	\$/Bushel	\$/Acre
INCOME:						
Grain Sorghum (Operator's Share)	\$28,484.90	\$2.01	\$123.10	\$28,576.75	\$2.87	\$138.72
Patronage Refunds	\$183.45	0.01	0.79	\$244.77	0.02	1.19
Government Payments	\$5,171.17	0.37	22.35	\$3,028.68	0.30	14.70
Miscellaneous Income	\$15.62	0.00	0.07	(\$5.39)	(0.00)	(0.03)
Crop Insurance Proceeds	\$377.57	0.03	1.63	\$1,641.25	0.16	7.97
OTHER INCOME	\$5,747.80	\$0.41	\$24.84	\$4,909.31	\$0.49	\$23.83
GROSS INCOME	\$34,232.69	\$2.42	\$147.94	\$33,486.06	\$3.37	\$162.55
EXPENSES:						
Labor Hired	\$776.03	\$0.05	\$3.35	\$1,020.45	\$0.10	\$4.95
General Machinery Repairs	\$2,973.93	0.21	12.85	\$2,416.47	0.24	11.73
Interest Paid	\$1,990.96	0.14	8.60	\$1,830.30	0.18	8.88
Seed / Other Crop Expense	\$2,291.49	0.16	9.90	\$2,124.92	0.21	10.32
Crop Insurance	\$755.85	0.05	3.27	\$892.81	0.09	4.33
Fertilizer / Lime	\$6,805.97	0.48	29.41	\$7,084.17	0.71	34.39
Machine Hire - Lease	\$867.87	0.06	3.75	\$349.53	0.04	1.70
Farm Org Fees / Travel / Publ	\$300.03	0.02	1.30	\$232.82	0.02	1.13
Gas / Fuel / Oil	\$1,957.06	0.14	8.46	\$2,555.35	0.26	12.40
Crop Storage & Marketing	\$159.04	0.01	0.69	\$238.19	0.02	1.16
Personal Property Tax	\$138.23	0.01	0.60	\$155.67	0.02	0.76
General Farm Insurance	\$555.12	0.04	2.40	\$490.42	0.05	2.38
Utilities	\$416.80	0.03	1.80	\$306.05	0.03	1.49
Cash Farm Rent	\$1,021.00	0.07	4.41	\$1,759.59	0.18	8.54
Herbicide / Insecticide	\$4,093.49	0.29	17.69	\$3,824.34	0.38	18.56
Conservation	\$23.29	0.00	0.10	\$0.00	-	-
Auto Expense	\$148.86	0.01	0.64	\$63.88	0.01	0.31
TOTAL VARIABLE COSTS	\$25,275.01	\$1.79	\$109.23	\$25,344.96	\$2.55	\$123.03
RETURN ABOVE VARIABLE COSTS	\$8,957.68	\$0.63	\$38.71	\$8,141.10	\$0.82	\$39.52
Depreciation	\$4,067.83	0.29	17.58	\$3,728.53	0.37	18.10
Real Estate Tax	\$417.68	0.03	1.81	\$335.16	0.03	1.63
Unpaid Operator Labor	\$4,148.64	0.29	17.93	\$3,421.13	0.34	16.61
Interest Charge *	\$809.19	0.06	3.50	\$775.81	0.08	3.77
TOTAL FIXED COSTS	\$9,443.33	\$0.67	\$40.81	\$8,260.63	\$0.83	\$40.10
Land Charge **	\$2,562.55	\$0.18	\$11.07	\$1,313.88	\$0.13	\$6.38
TOTAL EXPENSE	\$37,280.89	\$2.63	\$161.11	\$34,919.47	\$3.51	\$169.51
NET RETURN TO MANAGEMENT	(\$3,048.20)	(\$0.22)	(\$13.17)	(\$1,433.41)	(\$0.14)	(\$6.96)
NET RETURN TO LABOR-MGT	\$1,876.47	\$0.13	\$8.11	\$3,008.17	\$0.30	\$14.60

*Interest charge equals: ((8.0% times three-fourths the variable costs) plus (4.0% times depreciation times 8)) minus cash interest paid.

**Land charge represents a charge (equal to landlord's share) on owned land and equals (production from owned acres X price / unit X 33.33%). Crop production paid to the landlord on rented land (already removed above), or cash rent is the charge on rented land.

This crop enterprise is based on the operator's share of production, and thus includes only production expenses paid by the operator. A charge for management is not included in the expenses.

7.5 Alfalfa Cost-Return Budget¹⁷

Table 18. Cost-return projections for alfalfa crops in the Marmaton Watershed, 2006.

Alfalfa	Yield Level (ton)		
	3.0	3.5	4.0
Income Per Acre			
A. Yield per acre	3.0	3.5	4.0
B. Price per bushel	\$101.00	\$101.00	\$101.00
C. Net government payment	\$12.30	\$13.37	\$14.44
D. Indemnity payments			
E. Miscellaneous income			
F. Returns/acre ((AxB)+C+D+E)	\$315.30	\$366.87	\$418.44
Costs Per Acre			
1. Seed	\$10.17	\$10.17	\$10.17
2. Herbicide	2.51	2.51	2.51
3. Insecticide/Fungicide	7.08	7.08	7.08
4. Fertilizer and Lime	19.90	26.89	33.88
5. Crop Consulting			
6. Crop Insurance			
7. Drying			
8. Miscellaneous	6.38	6.38	6.38
9. Custom Hire / Machinery Expense	109.42	118.08	126.61
10. Non-machinery Labor	12.36	13.34	14.31
11. Irrigation			
12. Land Charge / Rent	31.60	39.50	47.40
G. Sub Total	\$199.43	\$223.96	\$248.34
13. Interest on ½ Nonland Costs	7.55	8.30	9.04
H. Total Costs	\$206.98	\$232.26	\$257.38
I. Returns Over Costs (F-H)	\$108.32	\$134.61	\$161.06
J. Total Costs/bushel (H/A)	\$68.99	\$66.36	\$64.35
K. Return To Annual Cost (I+13)/G	58.10%	63.81%	68.50%

Table 19. Southeast Kansas Farm Management Association profit Center Analysis: 5-year Average & 2006 Nonirrigated Alfalfa.²⁶

	2001-2005 Average			2006		
Number of Farms	13			10		
Crop Acres	141			158		
Acres Owned	31			10		
Acres Rented	110			148		
Yield / Acre	3.3			2.4		
Tons	400			317		
Operator Percentage	84.86%			83.95%		
Gross Income / Acre	\$233.47			\$246.44		
Variable Costs / Acre	\$157.84			\$169.51		
Total Expense / Acre	\$227.09			\$226.92		
Gross Income / Ton	\$82.37			\$122.83		
Total Expense / Ton	\$80.12			\$113.10		

	Total Dollars	\$/Ton	\$/Acre	Total Dollars	\$/Ton	\$/Acre
INCOME:						
Alfalfa (Operator's Share)	\$30,456.04	\$76.10	\$215.69	\$36,468.80	\$115.04	\$230.82
Patronage Refunds	\$146.31	0.37	1.04	\$81.22	0.26	0.51
Government Payments	\$2,240.67	5.60	15.87	\$2,558.32	8.07	16.19
Miscellaneous Income	\$122.68	0.31	0.87	(\$171.53)	(0.54)	(1.09)
OTHER INCOME	\$2,509.66	\$6.27	\$17.77	\$2,468.01	\$7.79	\$15.62
GROSS INCOME	\$32,965.70	\$82.37	\$233.47	\$38,936.81	\$122.83	\$246.44
EXPENSES:						
Labor Hired	\$1,925.16	\$4.81	\$13.63	\$2,961.95	\$9.34	\$18.75
General Machinery Repairs	\$2,912.30	7.28	20.63	\$2,898.55	9.14	18.35
Interest Paid	\$2,045.40	5.11	14.49	\$2,090.90	6.60	13.23
Seed / Other Crop Expense	\$1,719.19	4.30	12.18	\$2,812.50	8.87	17.80
Crop Insurance	\$371.29	0.93	2.63	\$60.00	0.19	0.38
Fertilizer / Lime	\$2,595.20	6.48	18.38	\$2,223.55	7.01	14.07
Machine Hire - Lease	\$3,509.54	8.77	24.86	\$4,540.56	14.32	28.74
Farm Org Fees / Travel / Publ	\$639.87	1.60	4.53	\$306.15	0.97	1.94
Gas / Fuel / Oil	\$1,209.12	3.02	8.56	\$1,786.21	5.63	11.31
Crop Storage & Marketing	\$180.84	0.45	1.28	\$147.76	0.47	0.94
Personal Property Tax	\$185.47	0.46	1.31	\$187.51	0.59	1.19
General Farm Insurance	\$539.39	1.35	3.82	\$825.63	2.60	5.23
Utilities	\$796.46	1.99	5.64	\$204.08	0.64	1.29
Cash Farm Rent	\$1,851.47	4.63	13.11	\$3,112.89	9.82	19.70
Herbicide / Insecticide	\$1,683.03	4.21	11.92	\$2,497.13	7.88	15.80
Conservation	\$24.43	0.06	0.17	\$0.13	0.00	0.00
Auto Expense	\$99.50	0.25	0.70	\$126.75	0.40	0.80
TOTAL VARIABLE COSTS	\$22,287.65	\$55.69	\$157.84	\$26,782.25	\$84.49	\$169.51
RETURN ABOVE VARIABLE COSTS	\$10,678.05	\$26.68	\$75.62	\$12,154.56	\$38.34	\$76.93
Depreciation	\$3,138.56	7.84	22.23	\$4,010.39	12.65	25.38
Real Estate Tax	\$373.53	0.93	2.65	\$279.01	0.88	1.77
Unpaid Operator Labor	\$3,236.12	8.09	22.92	\$2,916.00	9.20	18.46
Interest Charge *	\$314.16	0.79	2.22	\$687.45	2.17	4.35
TOTAL FIXED COSTS	\$7,062.36	\$17.65	\$50.02	\$7,892.85	\$24.90	\$49.95
Land Charge **	\$2,715.60	\$6.79	\$19.23	\$1,178.81	\$3.72	\$7.46
TOTAL EXPENSE	\$32,065.61	\$80.12	\$227.09	\$35,853.91	\$113.10	\$226.92
NET RETURN TO MANAGEMENT	\$900.09	\$2.25	\$6.37	\$3,082.90	\$9.73	\$19.51
NET RETURN TO LABOR-MGT	\$6,061.36	\$15.15	\$42.93	\$8,960.85	\$28.27	\$56.71

* Interest charge equals: ((8.0% times three-fourths the variable costs) plus (4.0% times depreciation times 8)) minus cash interest paid.

** Land charge represents a charge (equal to landlord's share) on owned land and equals (production from owned acres X price / unit X 33.33%). Crop production paid to the landlord on rented land (already removed above), or cash rent is the charge on rented land.

This crop enterprise is based on the operator's share of production, and thus includes only production expenses paid by the operator. A charge for management is not included in the expenses.

7.6 Common Cropland BMPs in Marmaton Watershed

BMPs help reduce the amount of soil and nutrients that run off of cropland fields. Keeping these valuable inputs (soil and nutrients) in the field can be of benefit to both the landowner/producer and to society as a whole. Here are just a couple of the benefits:

1. Top soil savings can result in higher yields and lower fertilizer costs.
2. Certain BMPs can offer both water quality protection and wildlife habitat.

Below are some of the more popular BMPs in use throughout the state of Kansas and in the Marmaton Watershed.

Contour farming²⁴ is farming the land, tillage and planting of the crop, on the level around the hill. By doing this, each furrow or ridge left by the different implements acts as a miniature dam, trapping water, allowing more to soak into the ground. Each row of crop also slows the water. Combined, less water runs off. Soil erosion is reduced. Crop yields are increased in arid areas.

Grassed waterways²⁵ are used as outlets to prevent silt and gully formation. The vegetation cover slows the water flow and minimizes channel surface erosion. They can also be used as outlets for water from terraces.

Vegetative buffers²⁵ are areas of land that are maintained in permanent vegetation to help reduce nutrient and sediment loss from agricultural fields, improve runoff water quality, and provide habitat for wildlife. Because of these societal benefits, there are several federal and state programs that encourage the installation and maintenance of vegetative buffers.

No-till²⁵ is a form of conservation tillage in which chemicals are used in place of tillage for weed control and seedbed preparation. In other words, the soil surface is never disturbed except for planting or drilling operations in a 100 percent no-till system. Two other forms of tillage, **reduced tillage** and **rotational no-till**, involve a light to moderate use of tillage equipment. These forms of tillage also control erosion and nutrient runoff, but are not as effective as 100 percent no-till.

Terraces²⁵ are embankments constructed perpendicular to the slope of the field and are designed to reduce the length of a field slope and catch water flowing off the slope. Terraces reduce the rate of runoff and allow soil particles to settle out.

Streambank stabilization²⁵ projects can reduce the amount of streambank erosion and help prevent the loss of valuable cropland. Stabilization techniques reduce streambank erosion through diverting and/or slowing the movement of water in a stream channel. Some methods that can be employed include bendway-weirs, stone toes, pools and riffles, stream barbs, and willow post plantings.

The following pages contain typical BMP budgets and economic analyses for vegetative buffers and streambank stabilization projects in the Marmaton Watershed. These reports were generated using the KSU-Vegetative Buffer and KSU-Streambank Stabilization Decision-Making Tools²⁷.

7.6.1 Vegetative Buffer: Economic Analysis

Your project area is located in Bourbon County, Kansas.

Your project area (buffer size) is 1.0 acres.

The results are based upon the following assumptions:

One time Costs: \$187.28	One time Cost-Share Payments: \$268.55	Time Period Selected: 10 years
Annual Costs: \$6.67	Annual Incentive Payments: \$96.53	Opportunity Cost of Your Money: 5.00%

The first year out-of-pocket costs of the vegetative buffer would be **\$0.00** this accounts for any cost-share payments you may receive.

Based on the information you have provided, a vegetative buffer on the project area would **return \$99.17** per acre annually.

Based on the information you have provided, a vegetative buffer on the project area would **return \$99.17** annually.

Based on the information you have provided, cropland on the project area would return **\$42.64** per acre annually.

Based on the information you have provided, cropland on the project area would return **\$42.64** annually.

Take Home Message:

You would be **\$56.53** per year **better off** installing this area to a vegetative buffer versus using it for crop production.

Discussion

In order to effectively compare scenarios which occur over multiple years (10 to 15 years), we must convert all costs and returns to today's dollars (e.g., 2008 dollars).

Net Present Value calculations convert future values into today's dollars. The net present value analysis uses a discount factor to equate a series of future cash flows into an equivalent amount of cash today. For example, if you are considering enrolling land into a 15 year Continuous Conservation Reserve Program (CRP) program, the projected net income in years 2 through 15 is discounted back to its equivalent value in today's dollars. Because a dollar today can earn interest until next year, it will be valued more highly than a dollar received in the future

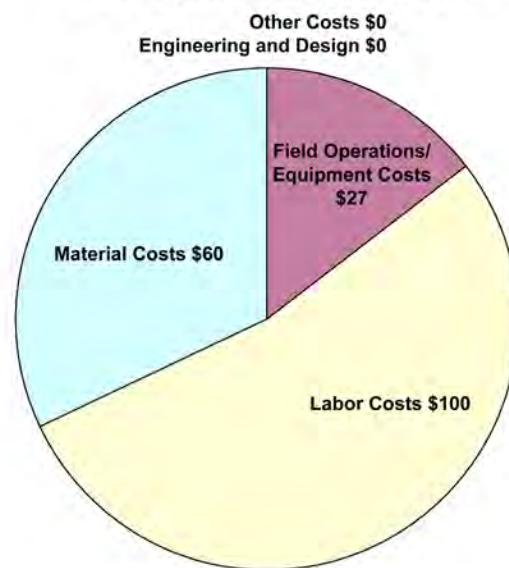
For more information regarding the economics of vegetative buffers, check out K-State Research and Extension publication MF-2536 "Using Conservation Buffers to Protect Water Quality and Enhance Agricultural Profitability." <http://www.oznet.ksu.edu/library/h20ql2/mf2536.pdf>

For vegetative buffer assistance, be sure to contact your local county conservation district. A Kansas Conservation District Directory can be found at: http://scc.ks.gov/index.php?option=com_content&task=view&id=779&Itemid=178

If you have any questions regarding this decision-making tool, please contact:

Craig Smith
Ph.D. Graduate Student
Kansas State University
craigsmith@agecon.ksu.edu

One Time Costs of the Vegetative Buffer



Annual Net Returns to the Project Area



Annual net returns

Budget information for the vegetative buffer project

General Data For Vegetative Buffer				
Discount Rate			5.00%	
Cropland Rental Rate - not CCRP rental rate			\$37.53	
Annual Cropland Rental Growth Rate			3.07%	
Total Annual Costs			\$6.67	
Inflation Rate of Annual Costs			4.00%	
Project Length (feet)			660	
Project Width (feet)			66	
Acres (length x width/43,560)			1.00	
Length of analysis (years)			10	
Cropland Property Tax (\$/acre)			\$5.00	
Tame Grass Property Tax (\$/acre)			\$5.00	
Costs			Payments Received	
Total one-time	\$187.28		Total one-time	\$268.55
Total annual	\$6.67		Total annual	\$96.53

Net Present Value Table: Vegetative Buffer (per acre)					
Year	One Time Costs	Annual Costs	One Time Payments	Annual Payments	Net Property Tax Impact
0	\$187.28	\$0.00	\$268.55	\$0.00	\$0.00
1	\$0.00	\$6.67	\$0.00	\$96.53	\$0.00
2	\$0.00	\$6.94	\$0.00	\$96.53	\$0.00
3	\$0.00	\$7.21	\$0.00	\$96.53	\$0.00
4	\$0.00	\$7.50	\$0.00	\$96.53	\$0.00
5	\$0.00	\$7.80	\$0.00	\$96.53	\$0.00
6	\$0.00	\$8.12	\$0.00	\$96.53	\$0.00
7	\$0.00	\$8.44	\$0.00	\$96.53	\$0.00
8	\$0.00	\$8.78	\$0.00	\$96.53	\$0.00
9	\$0.00	\$9.13	\$0.00	\$96.53	\$0.00
10	\$0.00	\$9.49	\$0.00	\$96.53	\$0.00
11	\$0.00	-	\$0.00	-	\$0.00
12	\$0.00	-	\$0.00	-	\$0.00
13	\$0.00	-	\$0.00	-	\$0.00
14	\$0.00	-	\$0.00	-	\$0.00
15	\$0.00	-	\$0.00	-	\$0.00
Sum totals	\$187.28	\$80.08	\$268.55	\$965.30	\$0.00
Present Value	\$187.28	\$60.87	\$268.55	\$745.38	\$0.00
Net Present Value	\$765.78				
Annualized Value	\$99.17				

NPV Table: Cropland Rent (per acre)	
Year	Rent
0	\$0.00
1	\$37.53
2	\$38.68
3	\$39.87
4	\$41.09
5	\$42.36
6	\$43.66
7	\$45.00
8	\$46.38
9	\$47.80
10	\$49.27
11	-
12	-
13	-
14	-
15	-
Sum totals	\$431.63
Present Value	\$329.27
Net Present Value	\$329.27
Annualized Value	\$42.64

Net Present Value Table: Vegetative Buffer (total project area)					
Year	One Time Costs	Annual Costs	One Time Payments	Annual Payments	Net Property Tax Impact
0	\$187.28	\$0.00	\$268.55	\$96.53	\$0.00
1	\$0.00	\$6.67	\$0.00	\$96.53	\$0.00
2	\$0.00	\$6.94	\$0.00	\$96.53	\$0.00
3	\$0.00	\$7.21	\$0.00	\$96.53	\$0.00
4	\$0.00	\$7.50	\$0.00	\$96.53	\$0.00
5	\$0.00	\$7.80	\$0.00	\$96.53	\$0.00
6	\$0.00	\$8.12	\$0.00	\$96.53	\$0.00
7	\$0.00	\$8.44	\$0.00	\$96.53	\$0.00
8	\$0.00	\$8.78	\$0.00	\$96.53	\$0.00
9	\$0.00	\$9.13	\$0.00	\$96.53	\$0.00
10	\$0.00	\$9.49	\$0.00	\$96.53	\$0.00
11	\$0.00	-	\$0.00	-	\$0.00
12	\$0.00	-	\$0.00	-	\$0.00
13	\$0.00	-	\$0.00	-	\$0.00
14	\$0.00	-	\$0.00	-	\$0.00
15	\$0.00	-	\$0.00	-	\$0.00
Sum totals	\$187.28	\$80.08	\$268.55	\$965.30	\$0.00
Present Value	\$187.28	\$60.87	\$268.55	\$745.38	\$0.00
Net Present Value	765.78				
Annualized Value	\$99.17				

NPV Table: Cropland Rental Rate (total project area)	
Year	Rent
0	\$0.00
1	\$37.53
2	\$38.68
3	\$39.87
4	\$41.09
5	\$42.36
6	\$43.66
7	\$45.00
8	\$46.38
9	\$47.80
10	\$49.27
11	-
12	-
13	-
14	-
15	-
Sum totals	\$431.63
Present Value	\$329.27
Net Present Value	\$329.27
Annualized Value	\$42.64

7.6.2 Streambank Stabilization: Economic Analysis

Your project area is located in Bourbon County, Kansas on a 80 acre field. Your project area is: 4.55 acres in size.

The results are based upon the following assumptions:

One time Costs: **\$18,495.60** One time Cost-Share Payments: **\$9,702.30** Time Period Selected: **10 years**
Annual Costs: **\$30.32** Annual Incentive Payments: **\$367.05** Opportunity Cost of Your Money: **5.00%**

The first year out-of-pocket costs of the streambank project would be **\$8,793.30**. This accounts for any cost-share payments you may receive.
Based on the information you have provided, a streambank stabilization project could potentially save **2.00** acres annually.

Take Home Message:

If you consider the asset value of the land that is preserved by the streambank stabilization project, then the take-home message is:

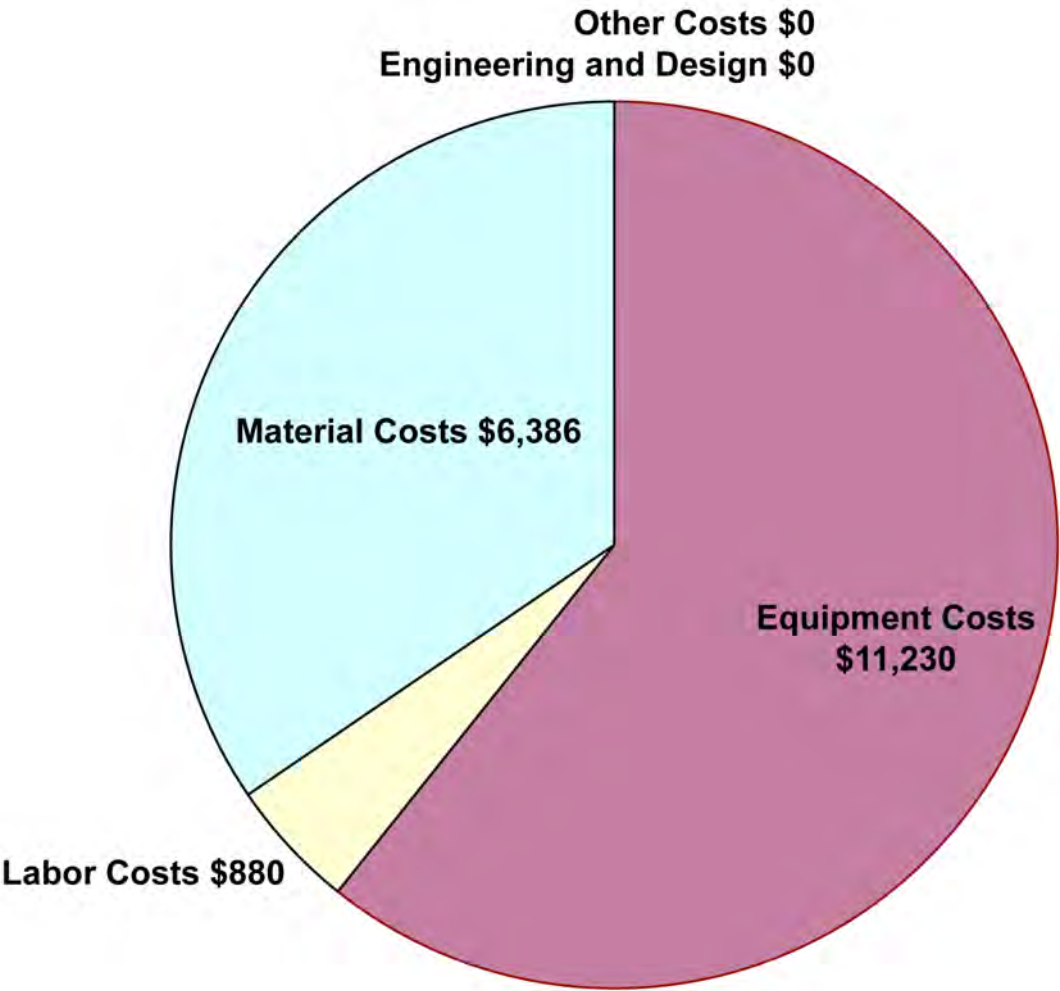
You would be **\$1,996.74** per year **better off** by stabilizing this streambank versus doing nothing.
A streambank project would **return** **\$15,418.29** in total over the 10 year time period you have selected.

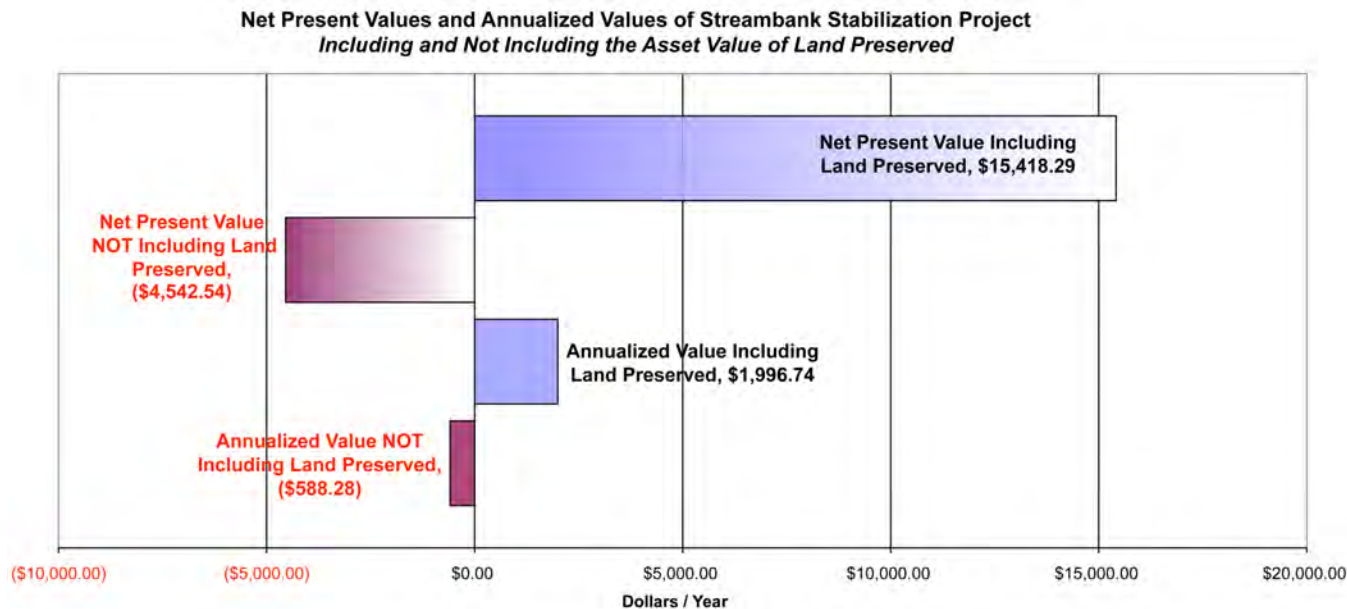
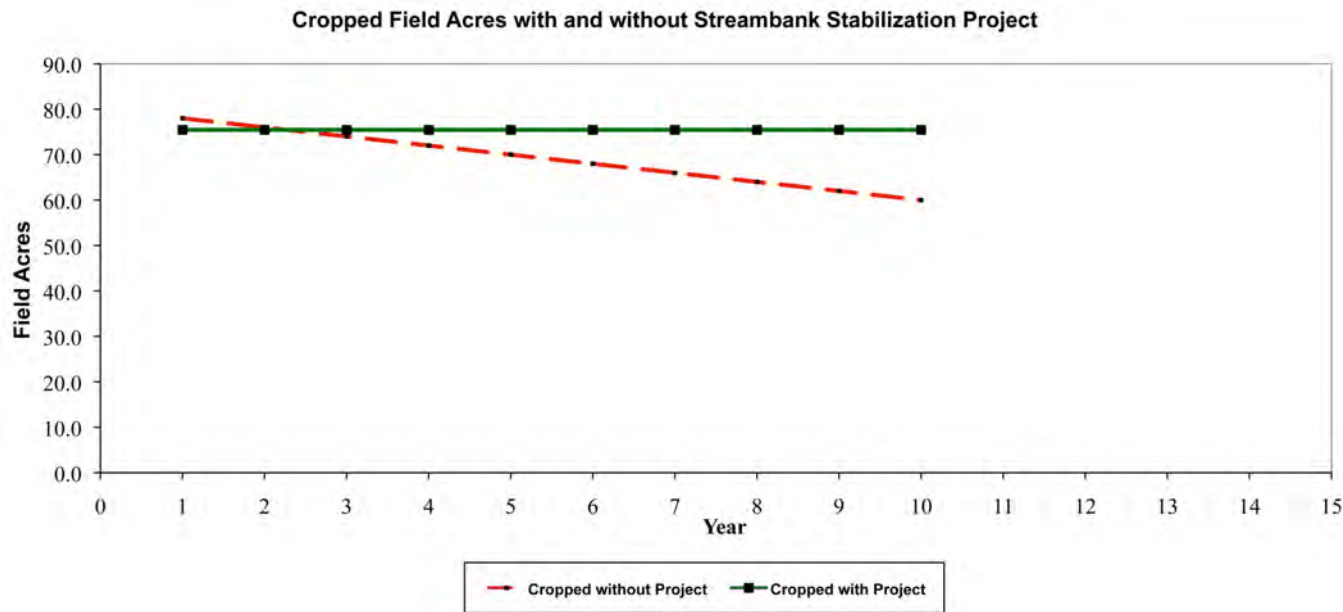
If you DO NOT consider the asset value of the land that is preserved by the streambank stabilization project, then the take-home message is:

You would be **(\$588.28)** per year **worse off** by stabilizing this streambank versus doing nothing.
A streambank project would **lose** **(\$4,542.54)** in total over the 10 year time period you have selected.

The asset value of the land that is preserved by the project is a real value that should probably be considered in your decision-making. It is, however, a value that would not be realized as cash until the property is sold.

One Time Costs of the Streambank Stabilization Project





Discussion

In general, the **benefits** of a streambank stabilization project come in the form of: value of acres not lost to erosion, income from being able to crop the preserved acres not in CCRP acres, cost-share and incentive payments, and tax breaks from the reclassification of ag land.

The **costs** of a streambank stabilization project come in the form of: one time installation costs, annual maintenance costs, and the initial loss of cropping income from cropland being taken out of production and enrolled into CCRP.

In order to effectively compare scenarios which occur over multiple years (10 to 15 years), we must convert all costs and returns to today's dollars (e.g., 2008 dollars).

Net Present Value calculations convert future values into today's dollars. The net present value analysis uses a discount factor to equate a series of future cash flows into an equivalent amount of cash today. For example, if you are considering enrolling land into a 15 year Continuous Conservation Reserve Program (CRP) program, the projected net income in years 2 through 15 is discounted back to its equivalent value in today's dollars. Because a dollar today can earn interest until next year, it will be valued more highly than a dollar received in the future

For streambank stabilization assistance, be sure to contact your local county conservation district. A Kansas Conservation District Directory can be found at: http://scc.ks.gov/index.php?option=com_content&task=view&id=779&Itemid=178

If you have any questions regarding this Decision-Making Tool, please contact:
 Craig Smith
 Ph.D. Graduate Student Kansas State University
craigsmith@agecon.ksu.edu

Budget information for the streambank stabilization project

General Data For Streambank Stabilization										
Discount Rate		5.00%		per acre						
Cropland Value		\$1,063.00								
Annual Cropland Value Growth Rate		4.34%								
Cropland Rental Rate - not CCRP rental rate		\$37.53		per acre / year						
Annual Cropland Rental Growth Rate		3.07%								
Total Annual Costs		\$6.67		per acre / year						
Inflation Rate of Annual Costs		4.00%								
Project Length (feet)								1,980		
Project Width (feet)								100		
Acres (length x width/43,560)								4.55		
Estimated acreage lost over time period								20.00		
Value of estimated acreage lost				20	acres	@	\$1,063.00	per acre	\$21,260.00	
Estimated average annual acreage lost over period of				10	yr.	2.00				
Estimated acreage preserved over				10	yr.	20.00				
Value of estimated acres preserved				20.00	acres	@	\$1,625.70	per acre	\$32,514.09	
Cropland Property Tax (\$/acre)								\$9.88		
Tame Grass Property Tax (\$/acre)								\$9.88		
Costs				Payments						
Total one-time		\$18,495.60		Total one-time		\$9,702.30				
Total annual		\$30.32		Total annual		\$438.77				

Land Effects

							With Project			Without Project							
Year	Net Acres for Income	Rental Rate \$/ Ac	Rental Rate Effect	Total Acres Preserved	Land Value \$/Ac	Total Additional Value	Property Tax Cropland \$/Ac	Property Tax Tame Grass \$/Ac	CCRP Acres	Crop Acres	Property Tax	Crop Acres	Property Tax	Net Property Tax Impact	CCRP Acres	Net Cropland Preserved	Total Saved
0	(4.55)	\$37.53	(\$170.59)	-	\$1,063.00		\$9.88	\$9.88	4.55	15.45	\$197.60	20.00	\$197.60	\$0.00	4.55	-	4.55
1	(2.55)	\$38.68	(\$98.46)	2.00	\$1,109.13	\$0.00	\$10.18	\$10.18	4.55	15.45	\$203.67	20.00	\$203.67	\$0.00	4.55	-	4.55
2	(0.55)	\$39.87	(\$21.75)	4.00	\$1,157.27	\$0.00	\$10.50	\$10.50	4.55	15.45	\$209.92	18.00	\$188.93	\$20.99	4.55	-	4.55
3	1.45	\$41.09	\$59.77	6.00	\$1,207.50	\$0.00	\$10.82	\$10.82	4.55	15.45	\$216.36	16.00	\$173.09	\$43.27	4.55	1.45	6.00
4	3.45	\$42.36	\$146.32	8.00	\$1,259.90	\$0.00	\$11.15	\$11.15	4.55	15.45	\$223.01	14.00	\$156.10	\$66.90	4.55	3.45	8.00
5	5.45	\$43.66	\$238.12	10.00	\$1,314.58	\$0.00	\$11.49	\$11.49	4.55	15.45	\$229.85	12.00	\$137.91	\$91.94	4.55	5.45	10.00
6	7.45	\$45.00	\$335.42	12.00	\$1,371.63	\$0.00	\$11.85	\$11.85	4.55	15.45	\$236.91	10.00	\$118.45	\$118.45	4.55	7.45	12.00
7	9.45	\$46.38	\$438.48	14.00	\$1,431.16	\$0.00	\$12.21	\$12.21	4.55	15.45	\$244.18	8.00	\$97.67	\$146.51	4.55	9.45	14.00
8	11.45	\$47.80	\$547.54	16.00	\$1,493.28	\$0.00	\$12.58	\$12.58	4.55	15.45	\$251.68	6.00	\$75.50	\$176.17	4.55	11.45	16.00
9	13.45	\$49.27	\$662.88	18.00	\$1,558.08	\$0.00	\$12.97	\$12.97	4.55	15.45	\$259.40	4.00	\$51.88	\$207.52	4.55	13.45	18.00
10	15.45	\$50.78	\$784.80	20.00	\$1,625.70	\$32,514.26	\$13.37	\$13.37	4.55	15.45	\$267.37	2.00	\$26.74	\$240.63	4.55	15.45	20.00
11	-	-	-	-	-	\$0.00	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	\$0.00	-	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	\$0.00	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	\$0.00	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	\$0.00	-	-	-	-	-	-	-	-	-	-	-

7.7 Census Data¹⁸

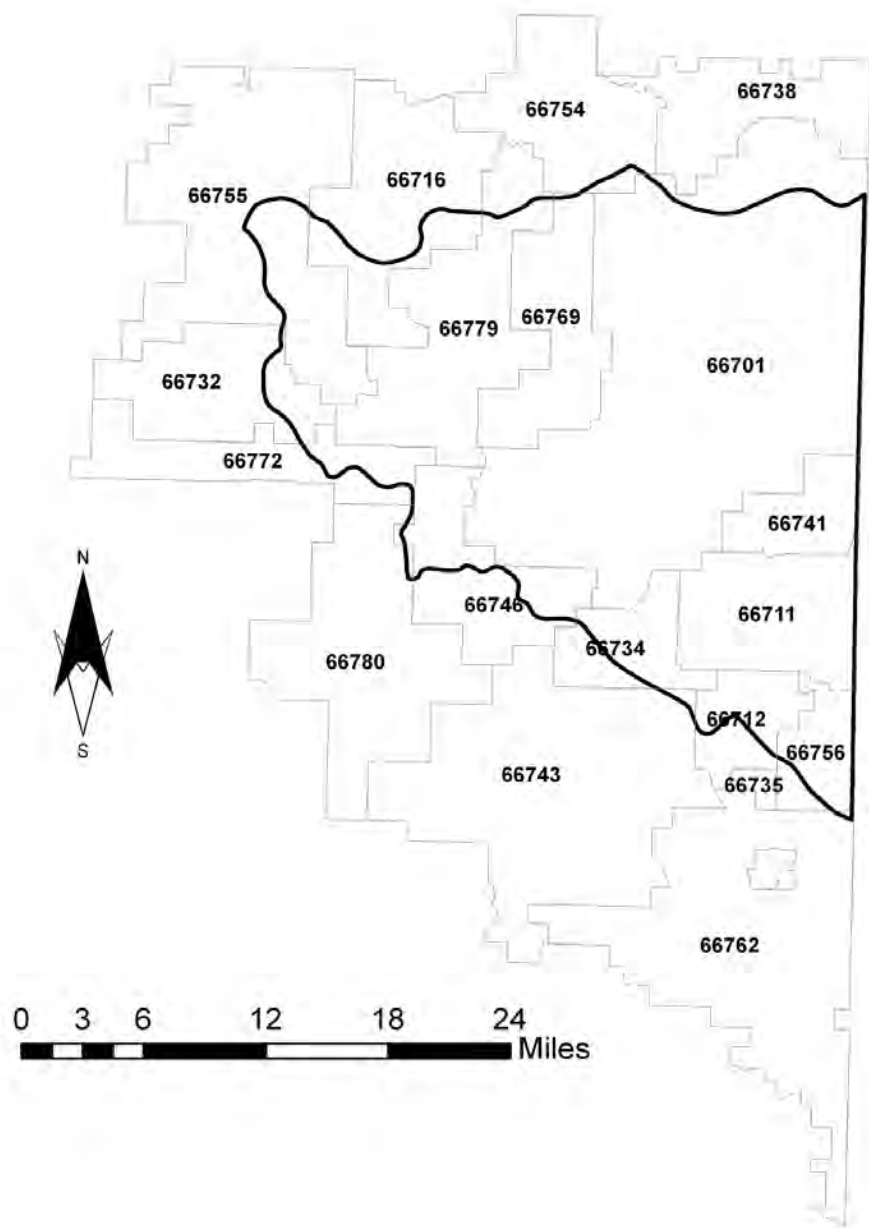


Figure 17. Zip Code Boundary Map.

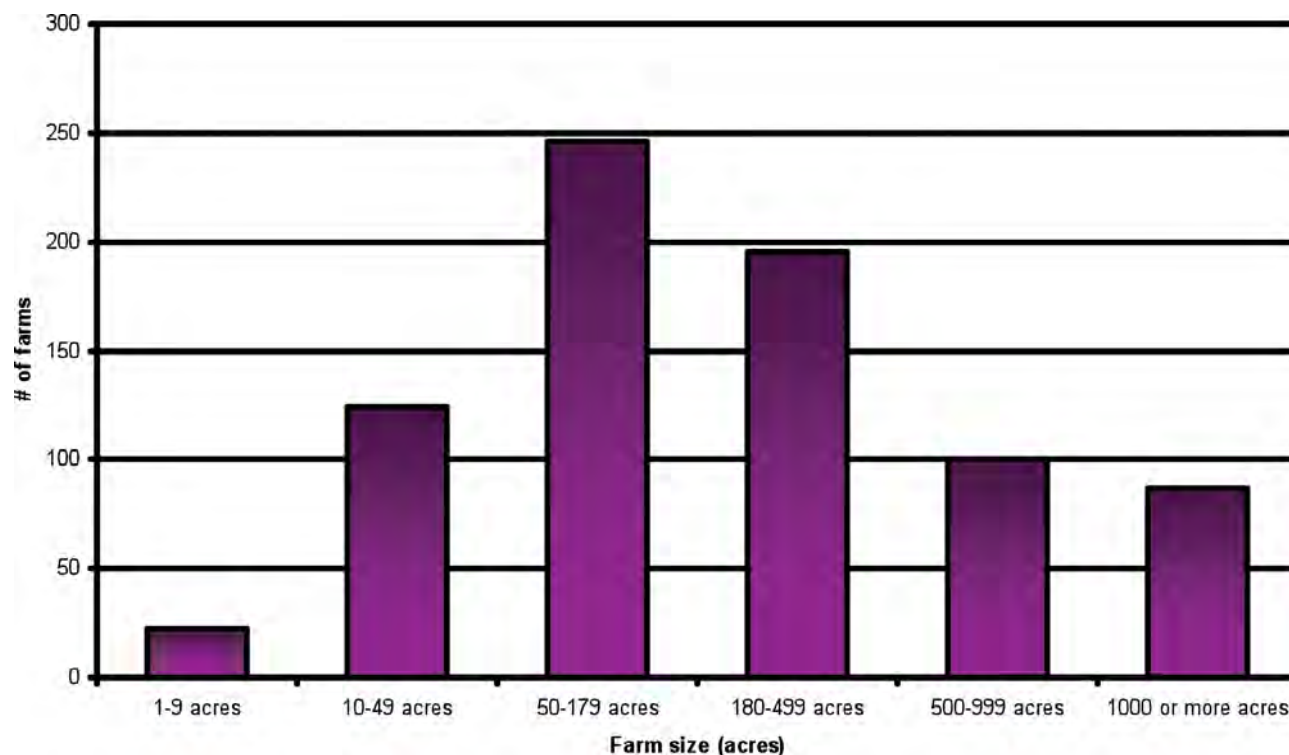


Figure 18. Size Distribution of Farms in Marmaton Watershed, 2002¹⁸

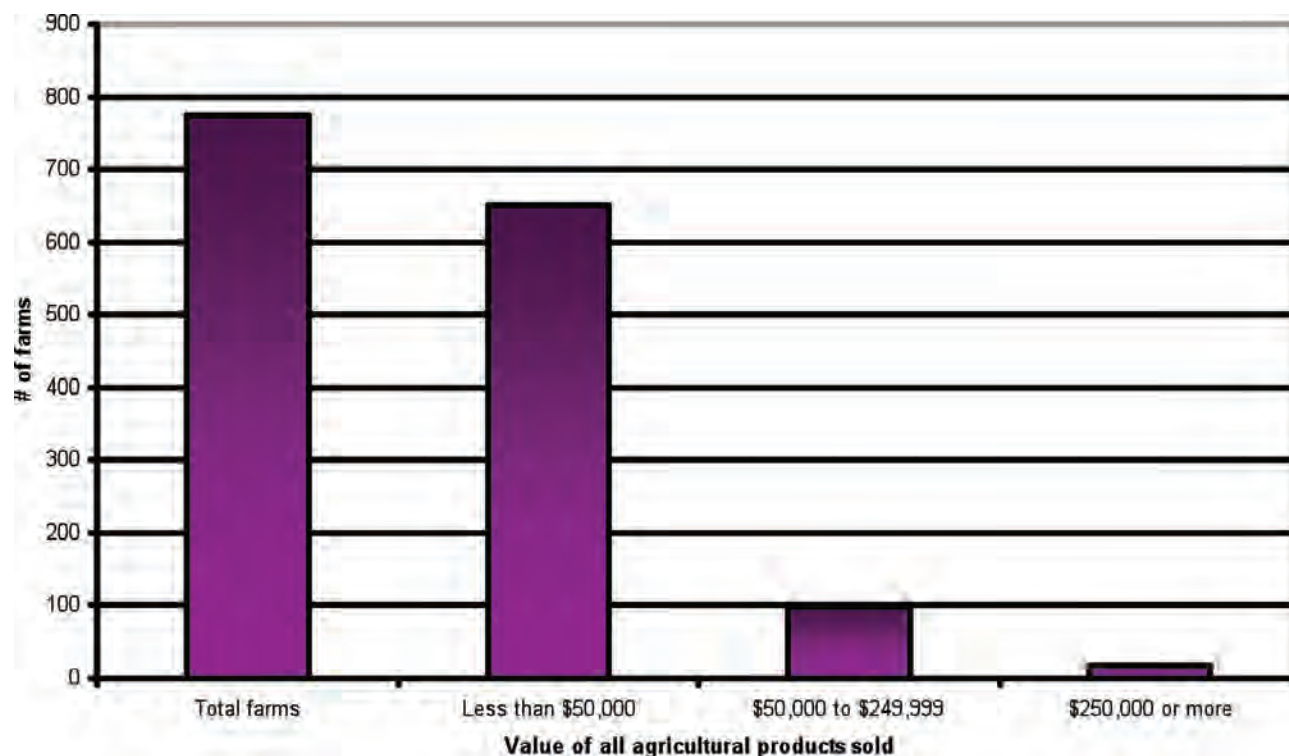


Figure 19. Sales Distribution of Farms in Marmaton Watershed, 2002¹⁸

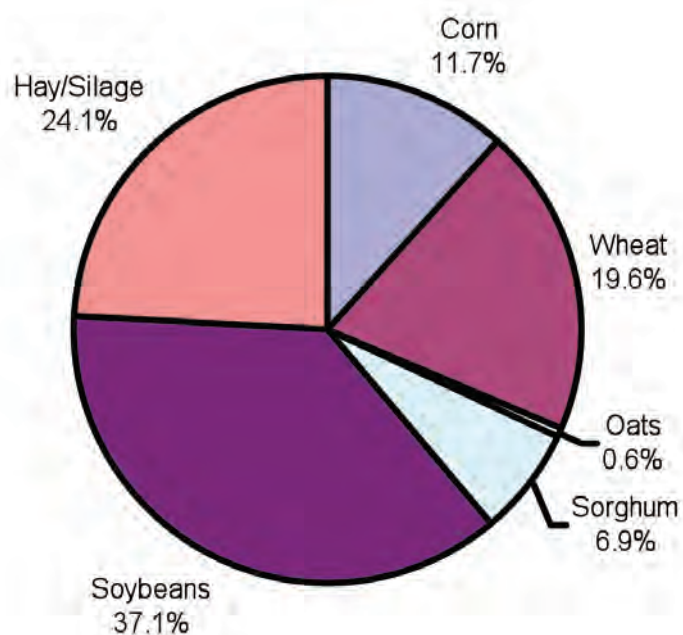


Figure 20. Harvested Crop Acreage in Marmaton Watershed, 2002¹⁸

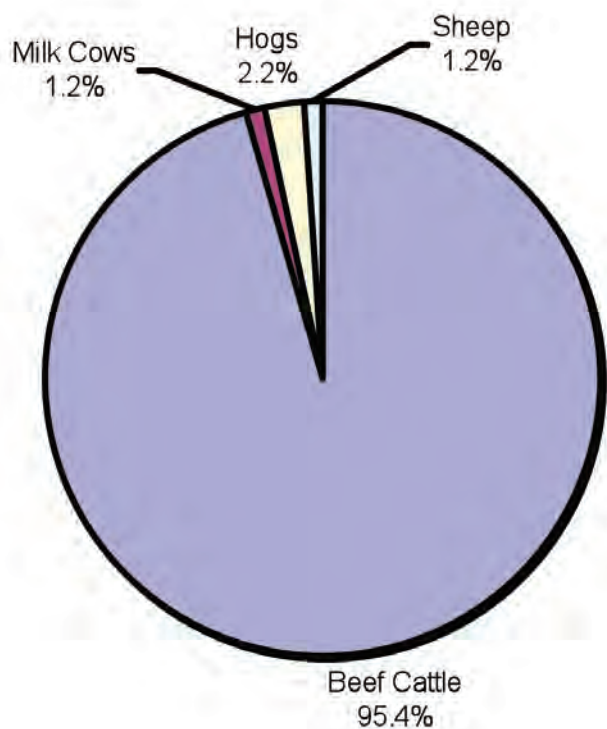


Figure 21. Livestock Number Distribution in Marmaton Watershed, 2002¹⁸

8.0 Modeling

8.1 Subbasin Map¹⁹

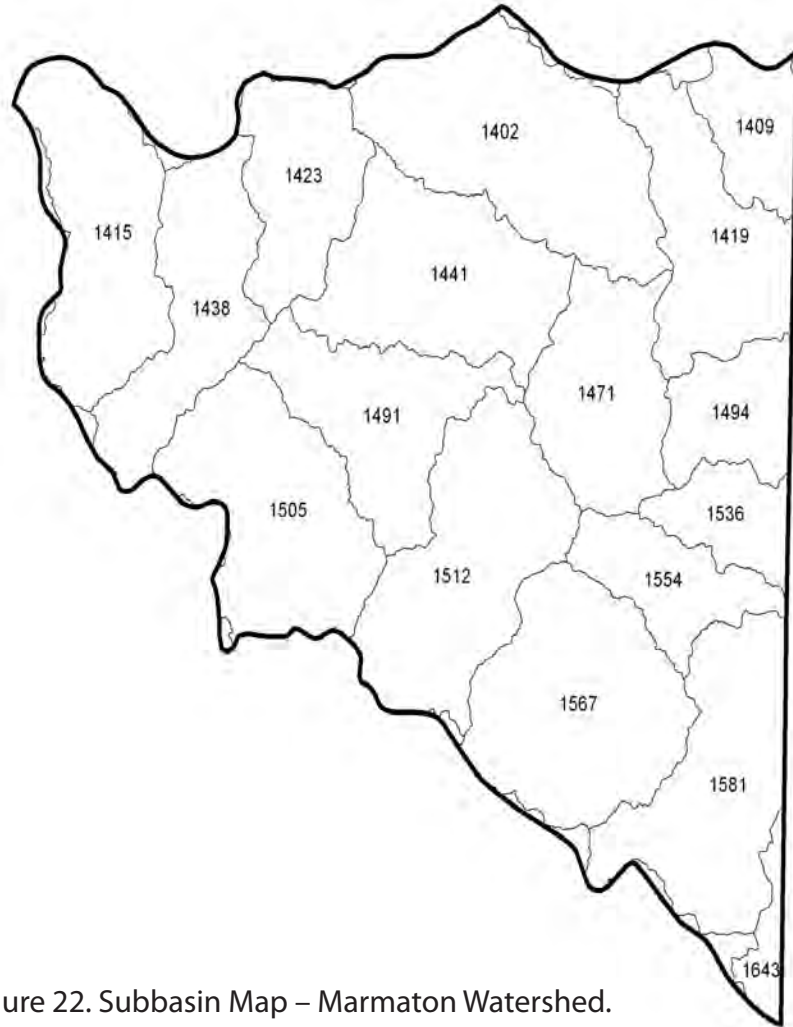


Figure 22. Subbasin Map – Marmaton Watershed.

Table 20. Marmaton Watershed Subbasin Area

Subbasin	State	HUC ID	Area (acres)
1402	KS	10290104020010	39029
1409	KS	10290104020030	10482
1419	KS	10290104020020	23886
1415	KS	10290104010010	28638
1423	KS	10290104010030	18745
1441	KS	10290104010070	30419
1438	KS	10290104010020	23241
1471	KS	10290104010080	22274
1494	KS	10290104030070	12251
1491	KS	10290104010060	23595
1505	KS	10290104010040	31146
1512	KS	10290104010050	33516
1536	KS	10290104030060	9612
1554	KS	10290104030050	13417
1567	KS	10290104030045	34751
1581	KS	10290104030040	29832
1643	KS	10290104030020	4171
Total			389005

8.2 Input Data

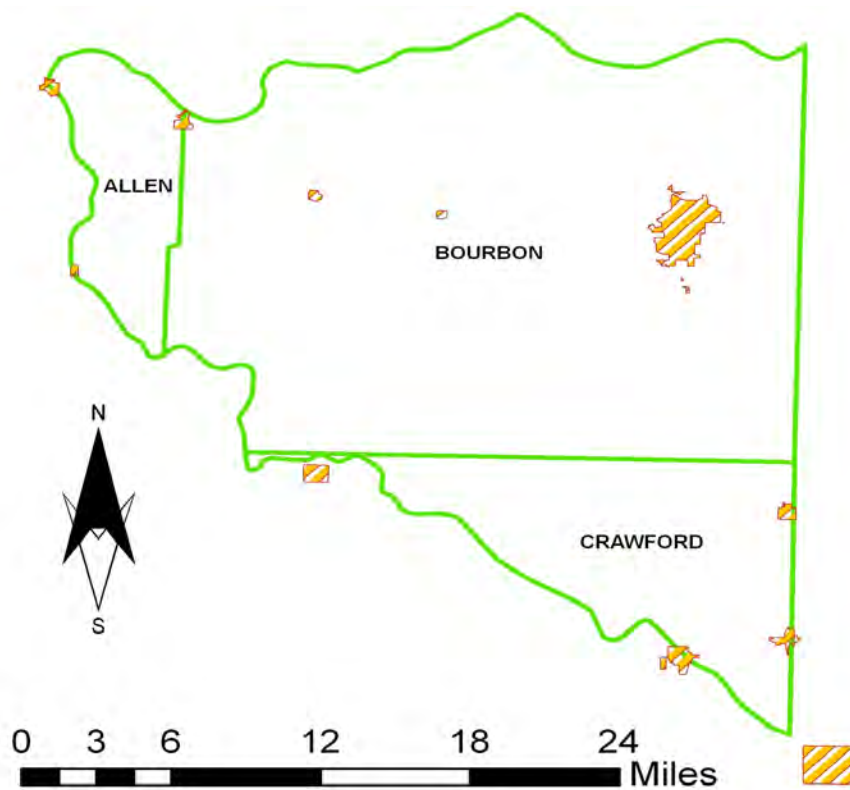


Figure 23. County Map – Marmaton Watershed.

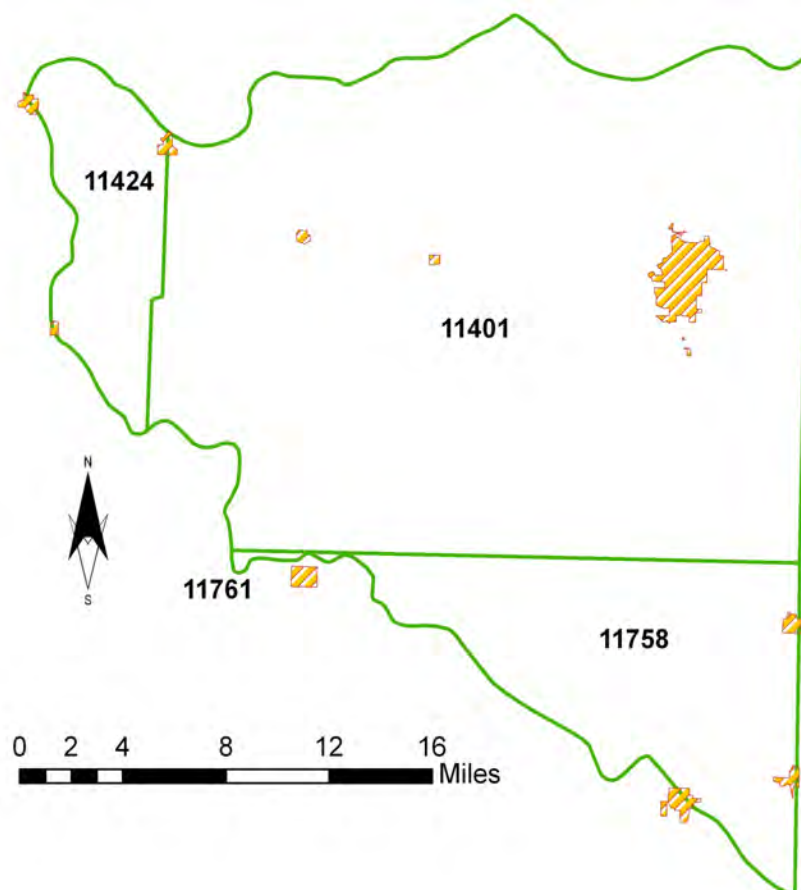


Figure 24. HUCO Map (overlay of county and 8-digit hydrologic unit boundary) – Marmaton Watershed²³

Table 21. Marmaton Watershed Summary²³

Polygon ID	County Name	State	HUC	Area (acre)	% in County	% in HUC
11401	Bourbon	KS	10290104	285486	73.19	39.89
11424	Allen	KS	10290104	29333	9.07	4.10
11758	Crawford	KS	10290104	68808	17.84	9.61
11761	Crawford	KS	10290104	570	0.15	0.08

Table 22. Landuse Area (acre)²⁰

Polygon ID	Urban/Transportation	Cropland	Pasture/Rangeland	Forest	Feedlots	Water	Others
11401	13900	59400	169100	49900	12	3800	5400
11424	600	3600	19300	3300	1	400	2400
11758	2975	14182	14281	14876	3	2380	24001
11761	25	118	118	123	0	20	199
Total	17500	77300	202799	68199	16	6600	32000

Table 23. Agricultural Animals¹⁸

Polygon ID	Beef Cattle	Dairy Cattle	Swine (Hog)	Sheep	Horse	Chicken	Turkey	Duck
11401	18704	218	D	239	851	551	30	19
11424	1563	70	100	22	52	30	0	0
11758	4021	63	208	172	115	93	D	1
11761	33	0	1	1	0	0	D	0
Total	24321	351	309	434	1018	674	30	20

D = data withheld to avoid disclosing information for individual farms

Table 24. Septic System²¹

Polygon ID	No. of Septic Systems	Population per Septic System	Septic Failure Rate,%
11401	1771	2.16	0.93
11424	135	2.27	0.93
11758	691	2.15	0.93
11761	5	2.15	0.93
Total	2602		

Table 25. Hydrological Soil Group²²

Polygon ID	Hydrological Group
11401	C
11424	C
11758	C
11761	C

A = well to excessively drained soil
 B = moderately-well to well drained soil
 C = poorly drained soil
 D = very poorly drained soil

Table 26. Modify the Universal Soil Loss Equation (USLE) parameters²³

Polygon ID	Land Cover	R	K	LS	C	P
11401	Crop land	225.00	0.38	0.206	0.28	0.90
11424	Crop land	225.00	0.39	0.183	0.24	0.80
11758	Crop land	250.00	0.43	0.207	0.25	0.82
11761	Crop land	250.00	0.43	0.207	0.25	0.82
11401	Pasture Land	225.00	0.35	0.306	0.03	1.00
11424	Pasture Land	225.00	0.36	0.202	0.03	1.00
11758	Pasture Land	250.00	0.39	0.265	0.03	1.00
11761	Pasture Land	250.00	0.39	0.265	0.03	1.00
11401	Forest	225.00	0.30	0.290	0.003	1.000
11424	Forest	225.00	0.35	0.222	0.003	1.000
11758	Forest	250.00	0.30	0.481	0.003	1.000
11761	Forest	250.00	0.30	0.481	0.003	1.000

8.3 Model Outputs

Table 27. Total Pollution Load²³

Polygon ID	N Load (lb/year)	P Load (lb/year)	BOD Load (lb/year)	Sediment Load (t/year)
11401	2459351	261656	7444747	21516
11424	243797	22859	755665	1135
11758	306730	41276	863842	4545
11761	2437	321	7023	38
Total	3012315	326113	9071276	27234

Table 28. Total Load by Land Uses²³

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Urban	172426	26679	673984	3958
Cropland	565861	101592	1185611	16850
Pastureland	2175105	169275	7044326	6191
Forest	29136	14481	72463	235
Feedlots	69118	13824	92157	0
User Defined	0	0	0	0
Septic	670	262	2734	0
Gully	0	0	0	0
Streambank	0	0	0	0
Groundwater	0	0	0	0
Total	3012315	326113	9071276	27234

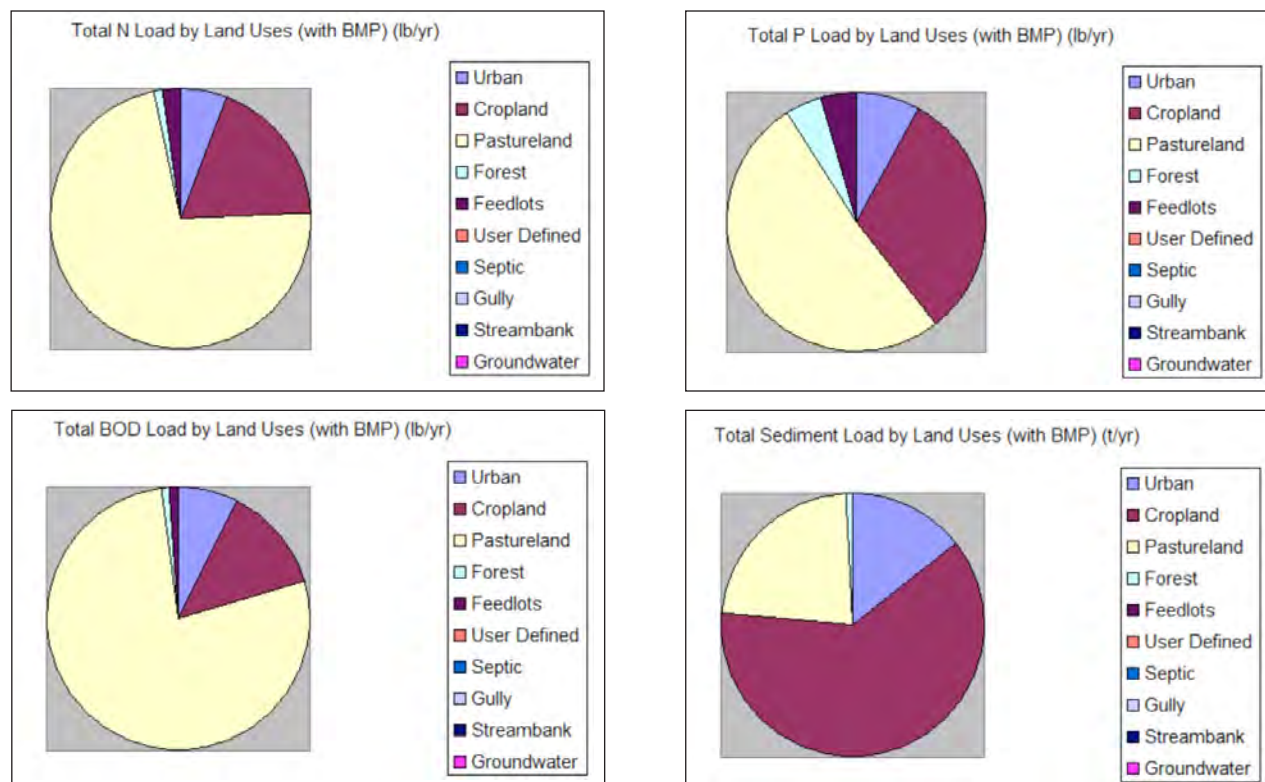


Figure 25. Total Load by Land Uses – Marmaton Watershed.

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The authors would like to acknowledge Dr. William Hargrove, Dr. Danny Rogers, Ms. Judy Willingham, and Mr. Don Snethen for their help and comments.

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10.0 Footnotes/Bibliography

1. *National Land Cover Database 2001 (NLCD 2001)*: “NLCD 2001 products include 21 classes of Land Cover, Percent Tree Canopy and Percent Urban Imperviousness at 30 m cell resolution.”

Online reference information available at: http://www.mrlc.gov/mrlc2k_nlcd.asp

2. *Marais des Cygnes Basin Total Maximum Daily Load*: “The Section 303(d) list submitted to and approved by EPA in 1998, identifies 86 river segments and 13 lakes in the Marais des Cygnes River Basin as water quality impaired. Among the streams, the greatest number of impairments were caused by excessive levels of fecal coliform bacteria and dissolved oxygen depletion. Among the lakes, eutrophic conditions indicative of excessive algae production was the predominant cause of impairment. Other pollutants limiting the use of the Marais des Cygnes River Basin streams include nutrients oxygen demand, selenium and ammonia. Additional lake impairments were caused by dissolved oxygen depletion, pH, excessive aquatic plants, atrazine, and siltation. Each parameter causing impairment requires a TMDL.”

Online reference information available at: <http://www.kdheks.gov/tmdl/marais.htm>

3. *National Elevation Dataset*: “The USGS National Elevation Dataset (NED) has been developed by merging the highest-resolution, best quality elevation data available across the United States into a seamless raster format. NED is the result of the maturation of the USGS effort to provide 1:24,000-scale Digital Elevation Model (DEM) data for the conterminous US.”

Online reference information available at: <http://ned.usgs.gov/>

4. *Precipitation Map*: “Point estimates of precipitation originated from some or all of the following sources: 1) National Weather Service (NWS) Cooperative (COOP) stations, 2) Natural Resources Conservation Service (NRCS) SNOTEL, 3) United States Forest Service (USFS) and Bureau of Land Management (BLM) RAWs Stations, 4) Bureau of Reclamation (AGRIMET) stations, 5) California Data Exchange Center (CDEC) stations, 6) Storage gauges, 7) NRCS Snowcourse stations, 8) Other State and local station networks, 9) Estimated station data, 0) Canadian stations, 10) Upper air stations, and 11) NWS/Federal Aviation Administration (FAA) Automated surface observation stations (ASOS). All COOP station data were subjected to quality control checks by the National Climatic Data Center (NCDC). All COOP, SNOTEL and other data were subjected to further quality control checks by the PRISM Group.”

Online reference information available at: http://prism.oregonstate.edu/docs/meta/ppt_30s_meta.htm#7

5. *Maximum Temperature Map*: “Point estimates of temperature originated from some or all of the following sources: 1) National Weather Service (NWS) Cooperative (COOP) stations, 2) Natural Resources Conservation Service (NRCS) SNOTEL, 3) United States Forest Service (USFS) and Bureau of Land Management (BLM) RAWs Stations, 4) Bureau of Reclamation (AGRIMET) stations, 5) California Data Exchange Center (CDEC) stations, 6) Storage gauges, 7) NRCS Snowcourse stations, 8) Other State and local station networks, 9) Estimated station data, 0) Canadian stations, 10) Upper air stations, and 11) NWS/Federal Aviation Administration (FAA) Automated surface observation stations (ASOS). All COOP station data were subjected to quality control checks by the National Climatic Data Center (NCDC). All COOP, SNOTEL and other data were subjected to further quality control checks by the PRISM Group.”

Online reference information available at: http://prism.oregonstate.edu/docs/meta/tmax_30s_meta.htm

6. *Minimum Temperature Map*: “Point estimates of temperature originated from some or all of the following sources: 1) National Weather Service (NWS) Cooperative (COOP) stations, 2) Natural Resources Conservation Service (NRCS) SNOTEL, 3) United States Forest Service (USFS) and Bureau of Land Management (BLM) RAWs Stations, 4) Bureau of Reclamation (AGRIMET) stations, 5) California Data Exchange Center (CDEC) stations, 6) Storage gauges, 7) NRCS Snowcourse stations, 8) Other State and local station networks, 9) Estimated station data, 10) Canadian stations, 11) Upper air stations, and 12) NWS/Federal Aviation Administration (FAA) Automated surface observation stations (ASOS). All COOP station data were subjected to quality control checks by the National Climatic Data Center (NCDC). All COOP, SNOTEL and other data were subjected to further quality control checks by the PRISM Group.”

Online reference information available at: http://prism.oregonstate.edu/docs/meta/tmin_30s_meta.htm

7. *Land Use (GIRAS 1980s)*: “This is land use/land cover digital data collected by USGS and converted to ARC/INFO by the EPA. This data which resides in EPA’s Spatial Data Library (ESDLS), is useful for environmental assessment of land use patterns with respect to water quality analysis, growth management, and other types of environmental impact assessment. GIRAS LU/LC is being used in EPA’s, Office of Water/OST BASINS water quality assessment model.”

Online reference information available at: <http://www.epa.gov/waterscience/basins/metadata/giras.htm>

8. *National Land Cover Database 1992 (NLCD 1992)*: “Derived from the early to mid-1990s Landsat Thematic Mapper satellite data, the National Land Cover Data (NLCD) is a 21-class land cover classification scheme applied consistently over the United States. The spatial resolution of the data is 30 meters and mapped in the Albers Conic Equal Area projection, NAD 83. The NLCD are provided on a state-by-state basis. The state data sets were cut out from larger “regional” data sets that are mosaics of Landsat TM scenes. At this time, all of the NLCD state files are available for free download as 8-bit binary files and some states are also available on CD-ROM as a Geo-TIFF.”

Online reference information available at: http://landcover.usgs.gov/us_map.php

9. *River Network*: “The National Hydrography Dataset (NHD) is a comprehensive set of digital spatial data that contains information about surface water features such as lakes, ponds, streams, rivers, springs and wells. The NHD is based upon the content of USGS Digital Line Graph (DLG) hydrography data integrated with reach-related information from the EPA Reach File Version 3 (RF3). The stream network was generated based on the USEPA Reach File, Version 1 and National Hydrography Dataset (NHD).”

Online reference information available at: <http://nhd.usgs.gov/>

USEPA Reach File, Version 1.0. Online reference information available at: <http://www.epa.gov/>

10. *Hydrologic Soil Groups*: “The Natural Resources Conservation Service (NRCS) - National Cartography and Geospatial Center (NCGC) previously archived and distributed the State Soil Geographic (STATSGO) Database. The STATSGO spatial and tabular data have been revised and updated. STATSGO has been renamed to the U.S. General Soil Map (STATSGO).”

Online reference information available at: <http://www.ncgc.nrcs.usda.gov/products/datasets/statsgo/>

11. *Water Quality Observations Stations*: “Observation-level water quality monitoring data for selected locations and parameters. Better Assessment Science Integrating Point & Nonpoint Sources (BASIN v. 4.0).”

Online reference information available at: <http://www.epa.gov/waterscience/basins/index.html>

12. *USGS Gage Stations*: “Inventory of surface water gaging station data including 7Q10 low and monthly mean stream flow. Better Assessment Science Integrating Point & Nonpoint Sources (BASIN v. 4.0).”

Online reference information available at: <http://www.epa.gov/waterscience/basins/index.html>

13. *Estimated Peak-Streamflow Frequencies*: “Estimated peak-streamflow frequencies for selected gaging stations with at least 10 years of annual peak-discharge data for unregulated, rural streams in Kansas.”

Online reference information available at: <http://ks.water.usgs.gov/Kansas/waterwatch/flood/flood-freq.html>

14. *Permitted Point Source Facilities*: “BASINS also includes information on pollutant loading from point source discharges. The location, type of facility, and estimated loading are provided. These loadings are also used to support evaluation of watershed-based loading summaries combining point and nonpoint sources.”

Online reference information available at: <http://www.epa.gov/waterscience/basins/index.html>

15. *Confined Animal Feeding Operations*: Obtained from Watershed Planning Section -Kansas Department of Health and Environment.
16. *The 1990 Population and Sewerage by Census Tract*: “Summarizes the selected area by census tract ID. For each census tract, the report lists the population, number of housing units, type of residential sewer system, and spatial percentage of that tract located within the subject watershed area.”
Online reference information available at: <http://www.epa.gov/waterscience/basins/index.html>
17. *Cost-Return Budget*: Data acquired from Sarah L. Fogleman and Stewart R. Duncan, for Different Crop Cost-Return Budget in Southeast Kansas, Kansas State University.
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19. *Subbasin Map*: This map was provided based on USGS Hydrologic Unit Level 14 Code Boundaries. United States Department of Agriculture/Natural Resources Conservation Service.
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