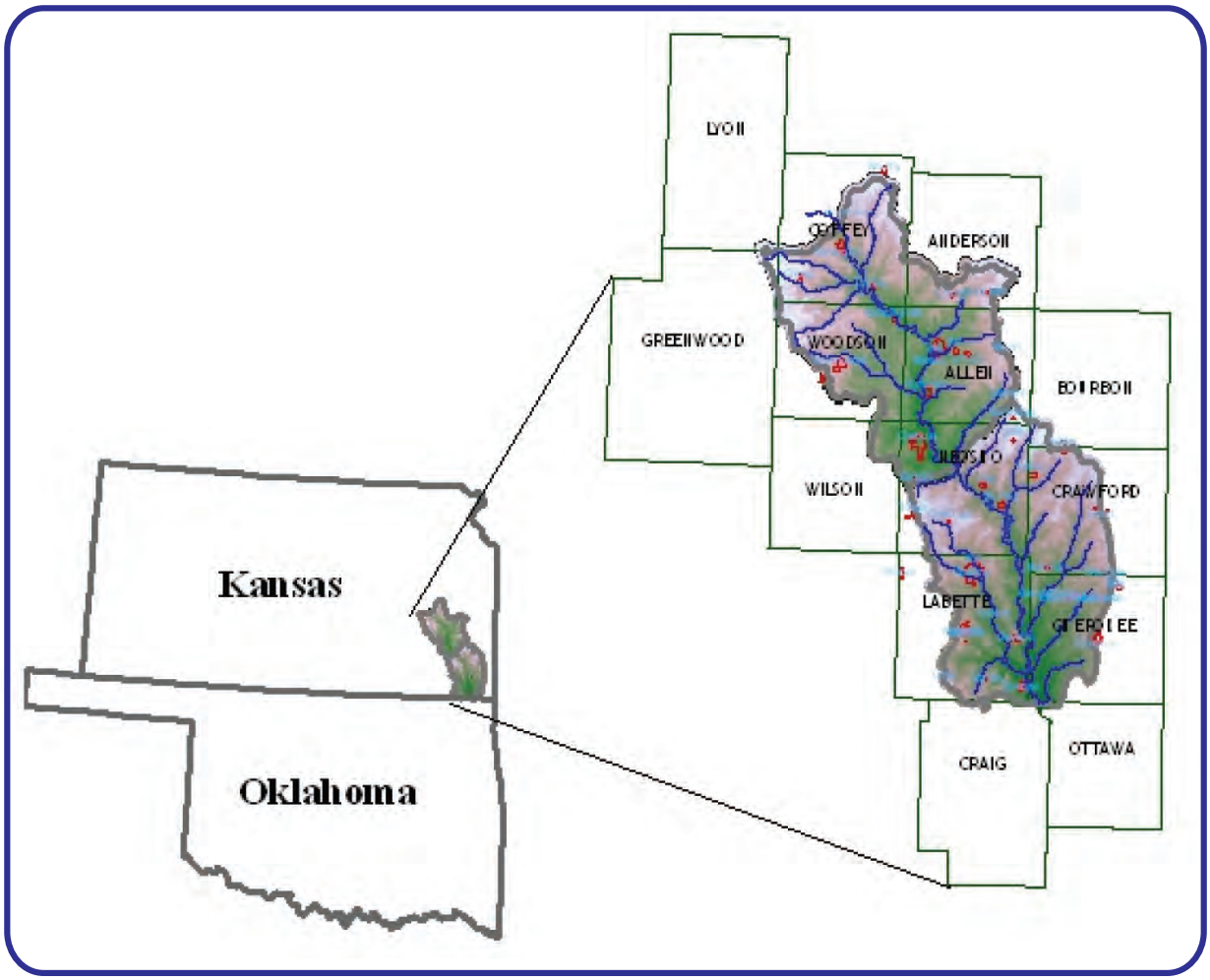
Upper and Middle Neosho Watersheds Assessment: Preliminary Report



2009
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Publication # EP-135

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

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1.0 Upper and Middle Neosho Watershed Assessment

1.1 Watershed Summary

The Upper Neosho Watershed is located primarily in Coffey, Anderson, Woodson, Allen, Wilson and Neosho counties in southeast Kansas, with small drainage areas originating from Lyon and Greenwood counties. The Middle Neosho Watershed is located primarily in Neosho, Crawford, Labette, and Cherokee counties in southeast Kansas, with small drainage areas originating from Allen and Bourbon counties. These watersheds contain the Neosho River and its tributaries beginning at the dam of John Redmond Lake and ending at the Oklahoma border. The Upper and Middle Neosho Watersheds have a Category I designation indicating the watershed is in need of restoration and protection to sustain water quality.

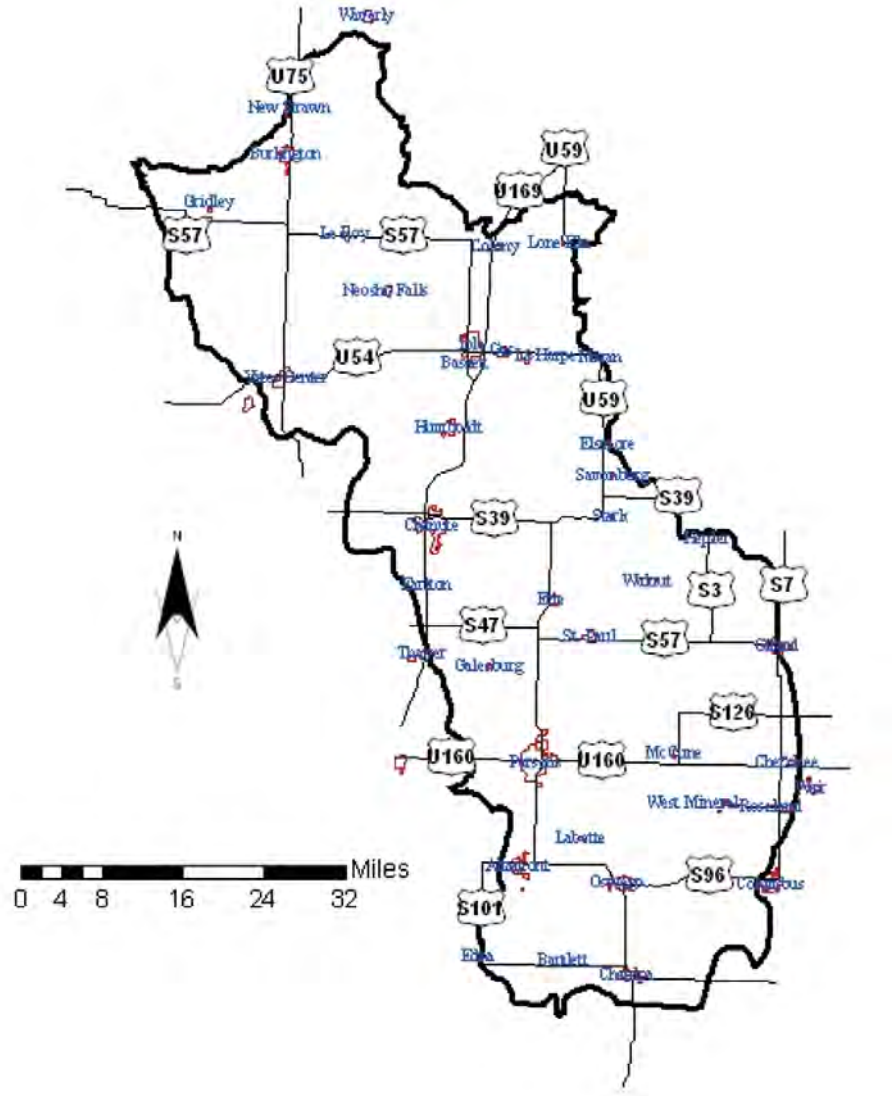

Figure 1. Major roads and cities – Upper and Middle Neosho Watersheds

Crop production is the predominant land usage (72.4 percent) for the watershed. Grassland is the second largest land usage at 11.3 percent. Woodland, water, and urban areas constitute the remaining 16.3 percent of land cover[1].

1.2 Overview of Water Quality Issues and Potential Pollution Sources

When river segments or lakes that are monitored by Kansas Department of Health and Environment (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.

Fecal coliform bacteria is listed as a TMDL in Owl Creek, Big Creek, Turkey Creek, and Deer Creek. Fecal coliform are present in human and animal waste. Potential sources of fecal coliform bacteria include feedlots, wastewater treatment plants, failing septic systems, and wildlife. Target TMDL endpoint is less than 200 colony forming units per 100 ml water for swimming, and less than 2,000 colony forming units per 100ml water for boating and fishing.

Low dissolved oxygen is impairment in numerous creeks and lakes throughout the watersheds. This has resulted in a TMDL 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.

Eutrophication is a primary result of excess nutrients entering a waterway. Excess nutrient loading from the watershed creates conditions favorable for algae blooms and plant growth resulting in 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.

The Neosho River has a TMDL for pH. Excursions above pH 8.5 in the Neosho River have been dominated by releases from John Redmond Lake. Nutrients released in the lake water cause photosynthesis by phytoplankton thereby raising the pH of the river water. Activities to reduce nutrient loading in John Redmond Lake should improve pH in the river.

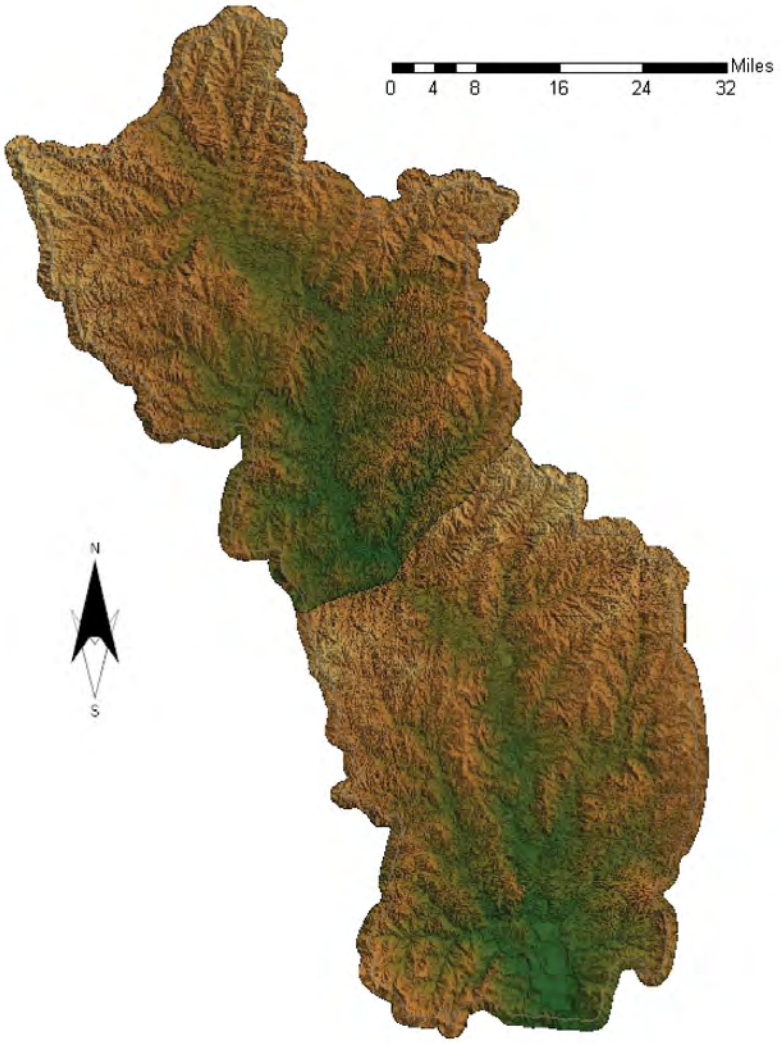

Figure 2. Relief Maps – Upper and Middle Neosho Watersheds [3]

Parsons Lake, Mined Land and Neosho Wildlife Management Areas, and three of the Mined Land Lakes are impaired by siltation. Silt or sediment accumulation in lakes and wetlands reduces reservoir volume and limits access to the lakes. In addition to the problem of sediment loading in lakes, copper and lead can be attached to the suspended soil particles in the water column causing higher than normal concentrations. Reducing erosion is necessary for a reduction in sediment. Agricultural best management practices, such as conservation tillage, grass buffer strips around cropland, and reducing activities within the riparian areas will reduce erosion and improve water quality.

The Mined Land Wildlife Area and Lakes have a TMDL for Sulfate. High sulfate concentrations are derived from exposed sulfur containing bedrock that leaches sulfate into the water. Since no further mining is present and the land has been converted to a wildlife area, reassessment will be made in 2007.

Copper impairs water quality in Owl Creek, Big Creek and the Neosho River at Chanute. The majority of copper loading appears to originate from eroding soil particles that wash into the waterways. The particles contain copper from natural as well as agricultural sources. Implementing BMPs will decrease erosion thereby reducing the amount of copper in the water.

Gridley City Lake has a low priority TMDL for beryllium. Possible sources of beryllium are air emissions and geology. One exceedance above water quality standards was reported in 1997. Because this exceedance occurred only once, monitoring will be continued and if beryllium is detected again, source assessment will be conducted and implementation activities will follow[2].

2.0 Climate Mapping System

2.1 Precipitation Map[4]

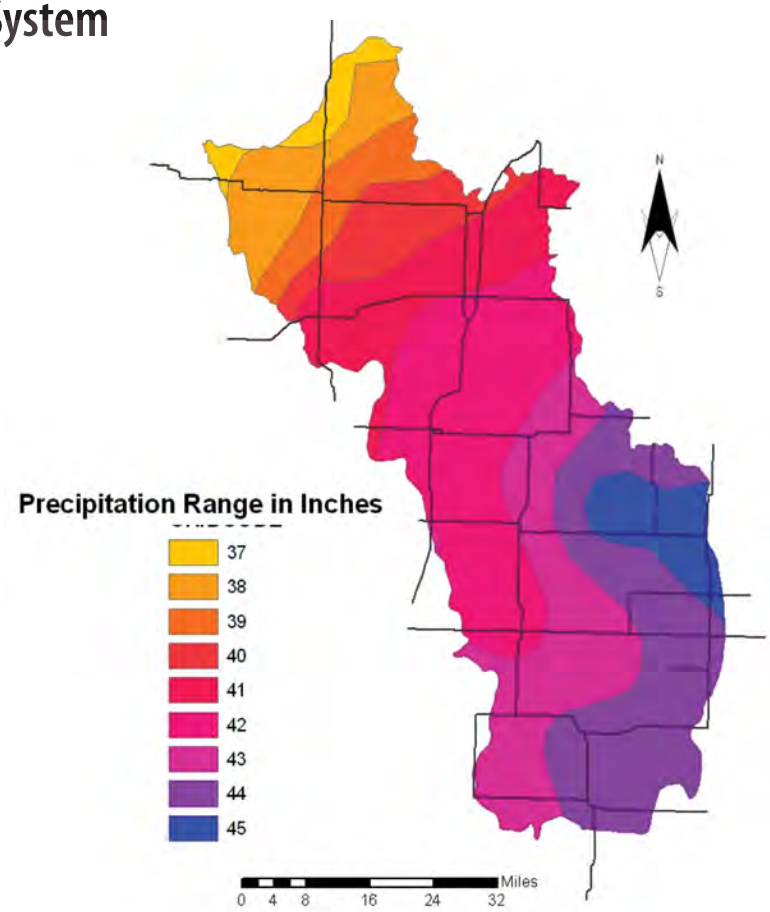

Figure 3. 30-year average annual precipitation in inches, 1971 – 2000

2.2 30-Year Average Daily Temperature Map[5]

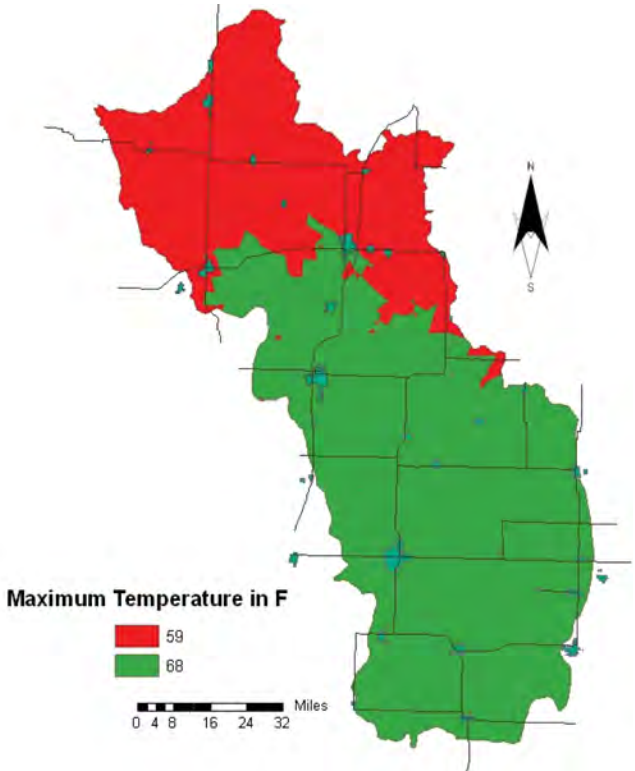

Figure 4. 30-year average daily maximum temperature in degrees Fahrenheit, 1971 – 2000

2.3 30-Year Average Daily Minimum Temperature Map [6]

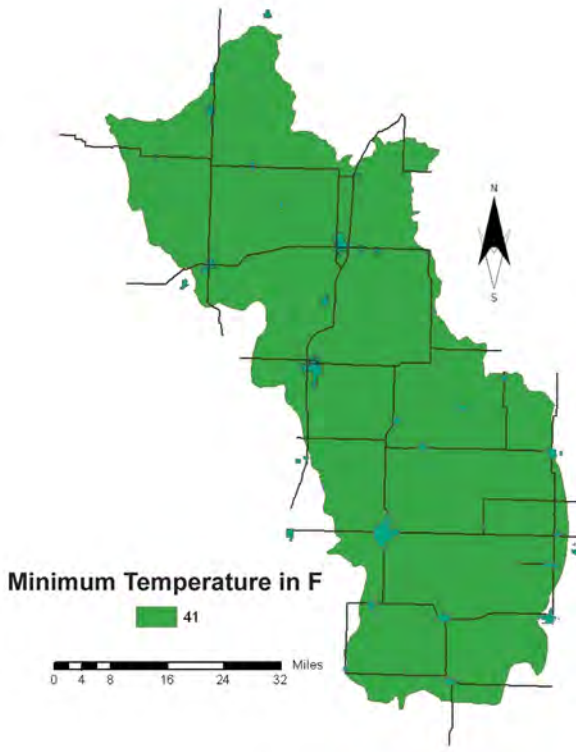

Figure 5. 30-year average daily minimum temperature in degrees Fahrenheit, 1971 – 2000

3.0 Land Use/Land Cover

3.1 Land Use (GIRAS 1980s)[7]

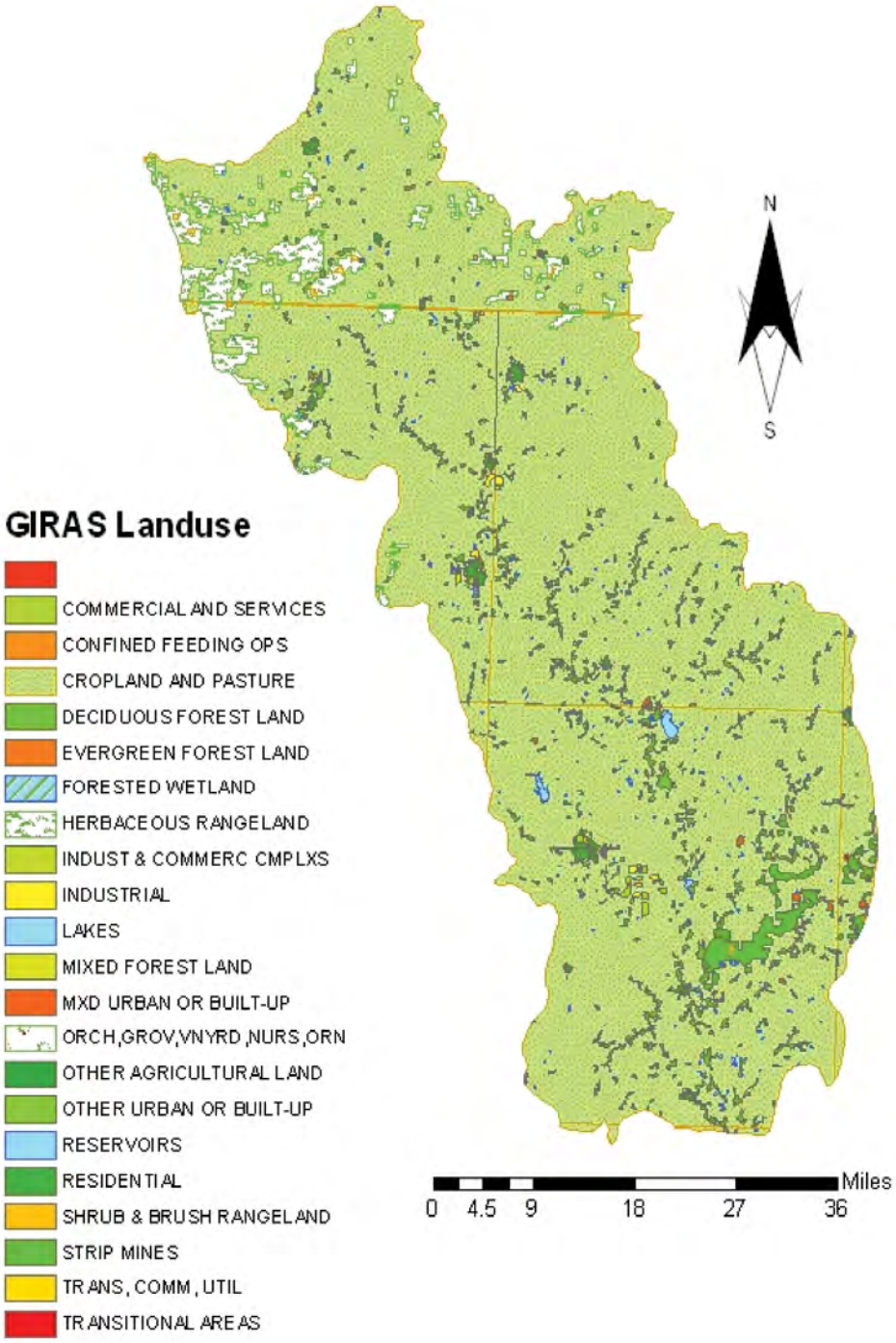

Figure 6. GIRAS 1980s land use classification.

3.2 Land Use (NLCD 1992) [8]

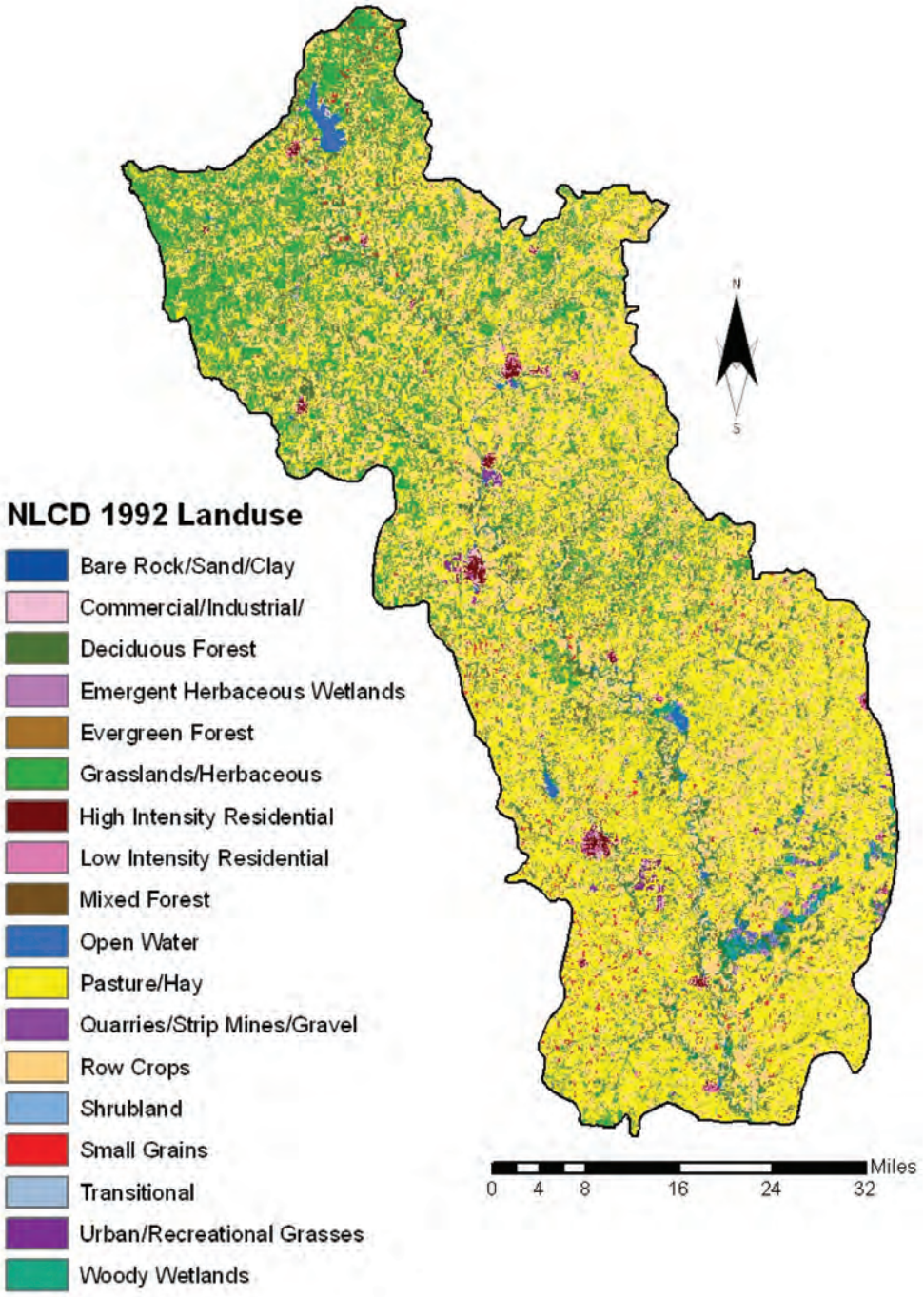

Figure 7. NLCD 1992 land use classification.

3.2.1 NLCD 1992 Land Cover Class Definitions[28]

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.
12. **Perennial Ice/Snow –** all areas characterized by year-long surface cover of ice and/or snow.
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 to100 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.

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]

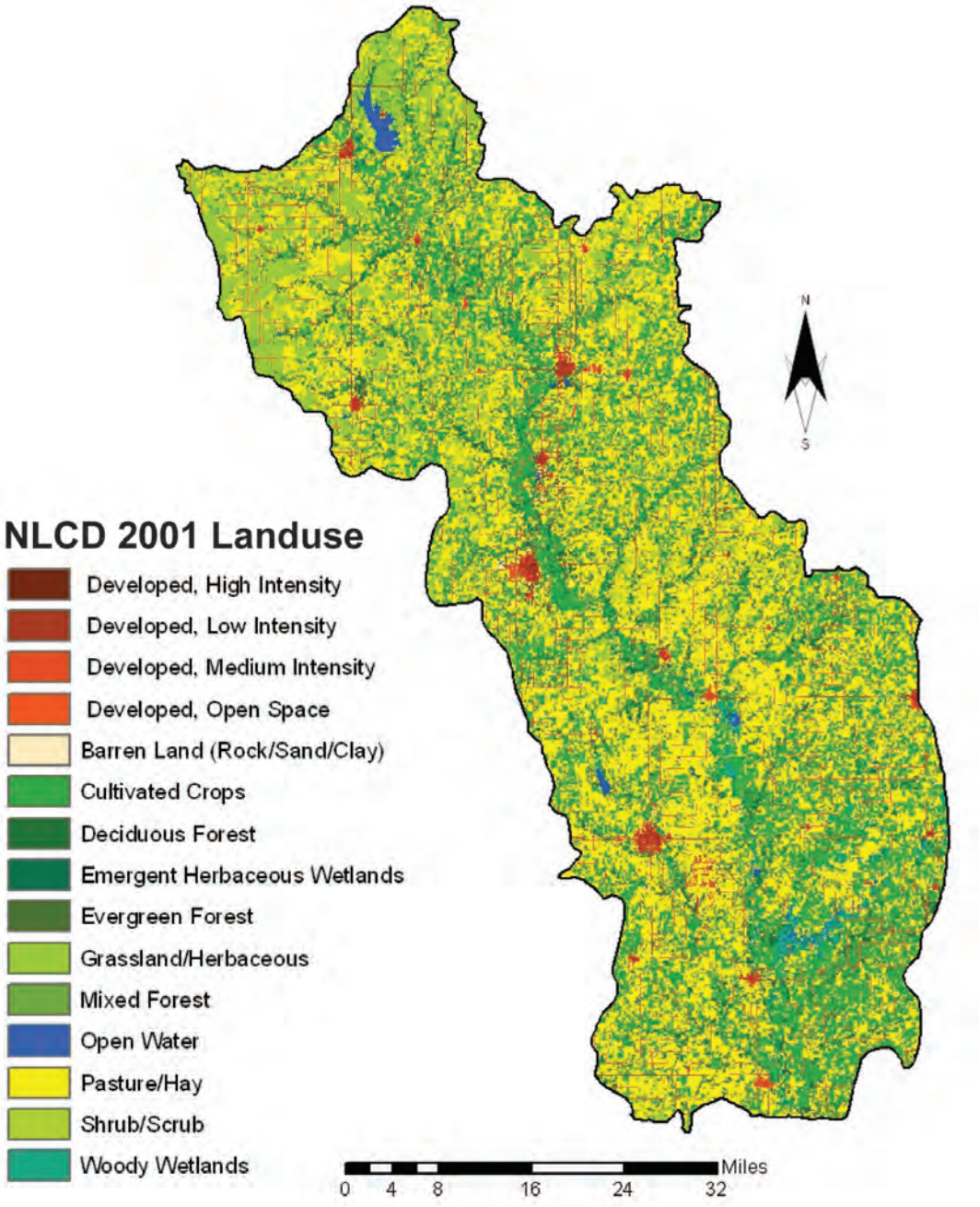

Figure 8. NLCD 2001 land use classification.

3.3.1 NLCD 2001 Land Cover Class Definitions[29]

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.

24. Developed, High Intensity – Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to100 percent of the total cover.

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.

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.

52. Shrub/Scrub – Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20 percent of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.

71. Grassland/Herbaceous – Areas dominated by grammanoid or herbaceous vegetation, generally greater than 80 percent 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.

90. Woody Wetlands – Areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

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 1980	1613719		1613719	23392	52360	71122	21712	5796	0	1788101
NLCD 1992	564487	704981	1269468	2233	108711	283946	20090	91935	18045	1794428
NLCD 2001	498051	793740	1291791	1868	127955	201653	102084	59051	538	1784940

4.0 River Network[9]

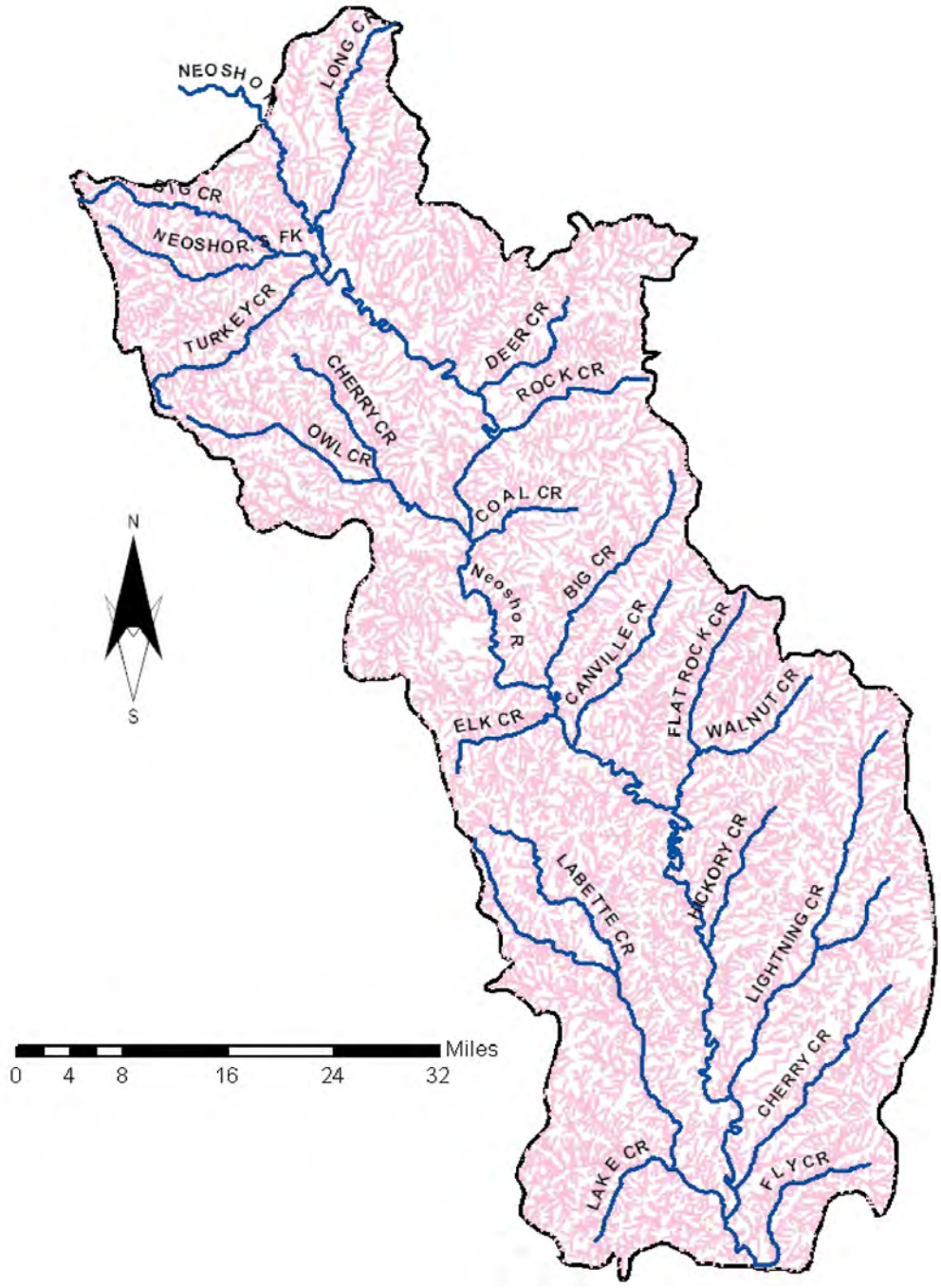

Figure 9. River network – Upper and Middle Neosho Watersheds.

5.0 Hydrologic Soil Groups[10]

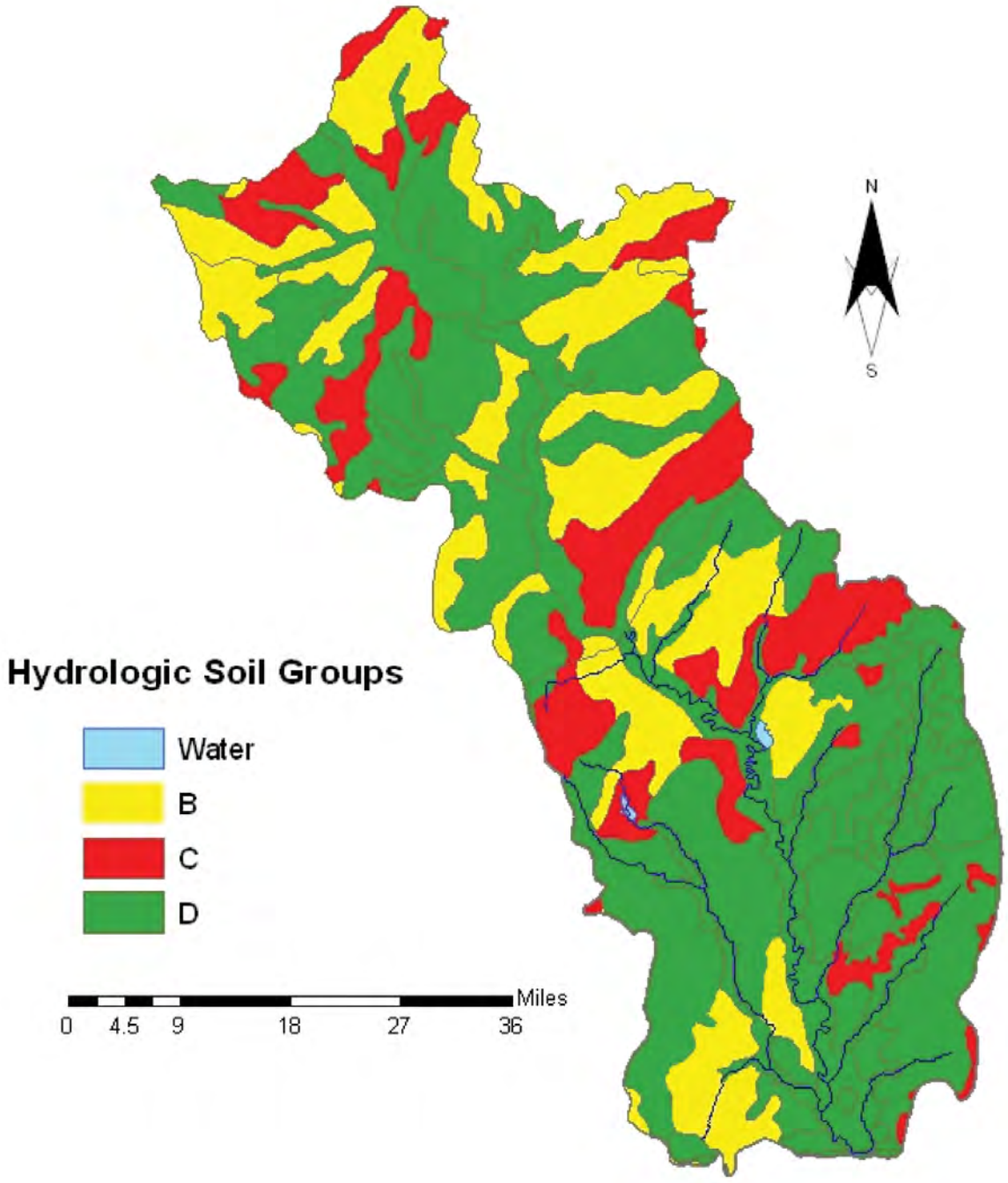

Figure 10. Hydrologic Soil Groups – STASTGO Database – Upper and Middle Neosho Watershed.

6.0 Water Quality Conditions

6.1 The 303d List of Impaired Waterbodies[2]

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.

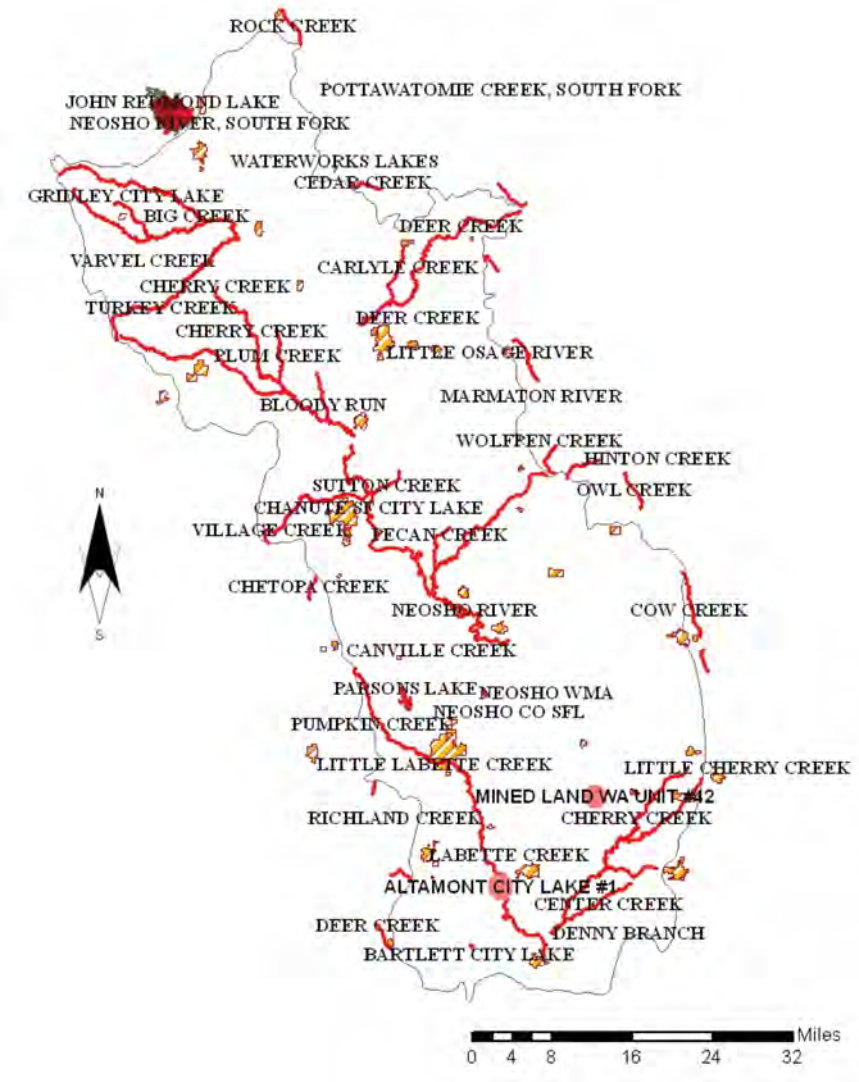

Figure 11. Impaired Waterbodies based on the 303d list – Upper and Middle Neosho Watersheds.

Table 2. The 303d List of Impaired Waterbodies[2]

State	Water Body Name	Impairment
KS	Mined Land Wa Unit #42	Pathogens, Organic Enrichment/low Do
KS	Altamont City Lake #1	Organic Enrichment/low Do
KS	Wolfpen Creek	Organic Enrichment/low Do
KS	Hinton Creek	Organic Enrichment/low Do
KS	Owl Creek	Organic Enrichment/low Do
KS	Hinton Creek	Organic Enrichment/low Do
KS	Chetopa Creek	Pathogens, Organic Enrichment/low Do
KS	Pumpkin Creek	Organic Enrichment/low Do
KS	Richland Creek	Organic Enrichment/low Do
KS	Deer Creek	Organic Enrichment/low Do
KS	Neosho River	Ph
KS	Cherry Creek	Organic Enrichment/low Do
KS	Center Creek	Metals
KS	Labette Creek	Organic Enrichment/low Do
KS	Labette Creek	Pathogens, Unionized Ammonia, Organic Enrichment/low Do
KS	Little Labette Creek	Organic Enrichment/low Do
KS	Pecan Creek	Organic Enrichment/low Do
KS	Canville Creek	Organic Enrichment/low Do
KS	Denny Branch	Organic Enrichment/low Do
KS	Little Cherry Creek	Organic Enrichment/low Do
KS	Neosho Wma	Organic Enrichment/low Do, Other Cause, Sediment/siltation
KS	Neosho Co Sfl	Ph, Pathogens, Organic Enrichment/low Do
KS	Cow Creek	Pesticides, Pathogens
KS	Bartlett City Lake	Organic Enrichment/low Do
KS	Parsons Lake	Organic Enrichment/low Do, Sediment/siltation
KS	Cedar Creek	Organic Enrichment/low Do
KS	Pottawatomie Creek, South Fork	Pathogens, Organic Enrichment/low Do
KS	Rock Creek	Metals
KS	Little Osage River	Pathogens
KS	Marmaton River	Organic Enrichment/low Do
KS	Chetopa Creek	Pathogens, Organic Enrichment/low Do
KS	John Redmond Lake	Organic Enrichment/low Do, Sediment/siltation
KS	Big Creek	Pathogens
KS	Deer Creek	Ph, Pathogens
KS	Neosho River, South Fork	Pathogens
KS	Turkey Creek	Pathogens, Organic Enrichment/low Do
KS	Owl Creek	Ph, Pathogens
KS	Cherry Creek	Ph, Pathogens
KS	Owl Creek	Metals, Ph, Pathogens, Unionized Ammonia
KS	Plum Creek	Ph, Pathogens
KS	Carlyle Creek	Ph, Pathogens
KS	Sutton Creek	Ph
KS	Gridley City Lake	Organic Enrichment/low Do
KS	Village Creek	Ph
KS	Varvel Creek	Pathogens
KS	Bloody Run	Ph, Pathogens
KS	Chanute/sf City Lake	Ph, Organic Enrichment/low Do

6.2 Water Quality Obersvation Stations[11]

USEPA Observation-level water quality monitoring data is useful for identifying the location of water quality data in a given watershed.

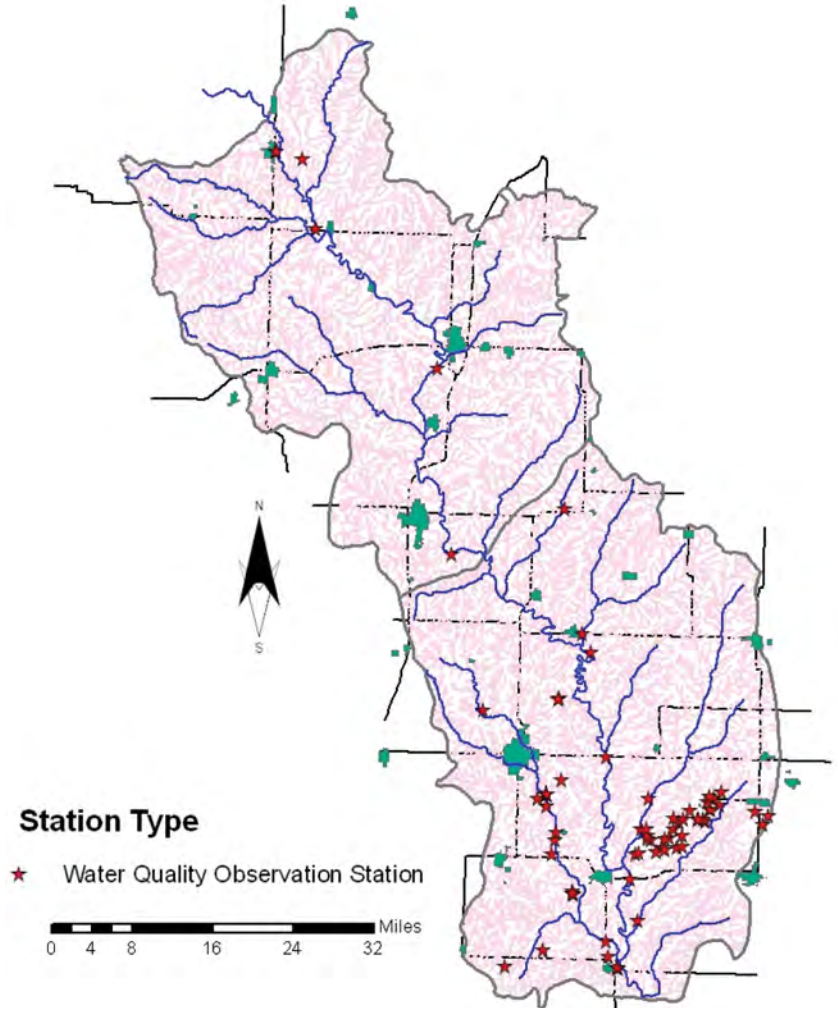

Figure 12. Lakes and Streams Water Quality Observation Stations – Upper and Middle Neosho Watersheds.

Table 3. Water Quality Observation Stations

State	Agency	Station ID	Station Name
KS	USGS	7183500	Neosho R Nr Parsons, Ks
KS	USGS	07184000	Lightning C Nr Mccune, Ks
KS	KDHE	000214	Neosho R. Nr Chetopa
KS	USGS	07182510	Neosho R At Burlington, Ks
KS	USGS	07183000	Neosho R Nr Iola, Ks
KS	KDHE	000098	Neosho River At Leroy Kansas
KS	KDHE	000107	Wolf Creek Near Burlington
KS	KDHE	000271	Neosho R. Near Chanute, Ks.
KS	KDHE	000272	Neosho R. At Burlington, Ks.
KS	KDHE	000565	Lightining Creek Near Oswego / Arkansas River /
KS	KDHE	000566	Neosho River Near Oswego / Arkansas River / Neos
KS	KDHE	000605	Cherry Creek Near Faulkner / Arkansas River / Ne
KS	KDHE	035801	Mined Land Lake No. 11, Sta. No. 1 / Arkansas Ri
KS	KDHE	035901	Mined Land Lake No. 12, Sta. No. 1 / Arkansas Ri

State	Agency	Station ID	Station Name
KS	KDHE	036101	Mined Land Lake No. 14, Sta. No. 1 / Arkansas Ri
KS	KDHE	036401	Mined Land Lake No. 18, Sta. No. 1 / Arkansas Ri
KS	KDHE	036501	Mined Land Lake No. 19, Sta. No. 1 / Arkansas Ri
KS	KDHE	036601	Mined Land Lake No. 20, Sta. No. 1 / Arkansas Ri
KS	KDHE	036701	Mined Land Lake No. 21, Sta. No. 1 / Arkansas Ri
KS	KDHE	036801	Mined Land Lake No. 22, Sta. No. 1 / Arkansas Ri
KS	KDHE	036901	Mined Land Lake No. 23, Sta. No. 1 / Arkansas Ri
KS	KDHE	037001	Mined Land Lake No.24, Sta. No. 1 / Arkansas Riv
KS	KDHE	037101	Mined Land Lake No. 25, Sta. No. 1 / Arkansas Ri
KS	KDHE	037301	Mined Land Lake No. 27, Sta. No. 1 / Arkansas Ri
KS	KDHE	037401	Mined Land Lake No. 28, Sta. No. 1 / Arkansas Ri
KS	KDHE	037501	Mined Land Lake No. 29, Sta. No. 1 / Arkansas Ri
KS	KDHE	037601	Mined Land Lake No. 30, Sta. No. 1 / Arkansas Ri
KS	KDHE	037701	Mined Land Lake No. 31, Sta. No. 1 / Arkansas Ri
KS	KDHE	037801	Mined Land Lake No. 32, Sta. No. 1 / Arkansas Ri
KS	KDHE	037901	Mined Land Lake No. 33, Sta. No. 1 / Arkansas Ri
KS	KDHE	038001	Mined Land Lake No. 34, Sta. No. 1 / Arkansas Ri
KS	KDHE	038101	Mined Land Lake No. 35, Sta. No. 1 / Arkansas Ri
KS	KDHE	038201	Mined Land Lake No. 36, Sta. No. 1 / Arkansas Ri
KS	KDHE	038301	Mined Land Lake No. 37, Sta. No. 1 / Arkansas Ri
KS	KDHE	038401	Mined Land Lake No. 38, Sta. No. 1 / Arkansas Ri
KS	KDHE	038501	Mined Land Lake No. 39, Sta. No. 1 / Arkansas Ri
KS	KDHE	038601	Mined Land Lake No. 40, Sta. No. 1 / Arkansas Ri
KS	KDHE	038701	Mined Land Lake No. 41, Sta. No. 1 / Arkansas Ri
KS	KDHE	038801	Mined Land Lake No. 42, Sta. No. 1 / Arkansas Ri
KS	KDHE	038841	Mined Land Lake No. 42 Wetland Sta. No. 41 / Sou
KS	KDHE	038901	Mined Land Lake No. 43, Sta. No. 1 / Arkansas Ri
KS	KDHE	039001	Mined Land Lake No. 45, Sta. No. 1 / Arkansas Ri
KS	KDHE	048201	Mined Land Lake No. 17 Sta. No. 1 / Arkansas Riv
KS	KDHE	048401	Mined Land Lake No. 44 Sta. No. 1 / Arkansas Riv
KS	KDHE	SID00004996	West Mineral #1 / Arkansas /
KS	US EPA Region 7	002147	Kaap Npdes Station #002 Burning / Lower Mississi
KS	US EPA Region 7	002148	Kaap Npdes Station #001 / Lower Mississippi / Ne
KS	US EPA Region 7	002149	Labette Creek Downstream Station / Lower Mississ
KS	US EPA Region 7	002150	Process Control Point M / Lower Mississippi / La
KS	US EPA Region 7	002153	Effluent Tnt System 1000 Area / Lower Mississipp
KS	US EPA Region 7	002156	Surface Stream At 700 Area Kf / Lower Mississipp
KS	US EPA Region 7	002157	Surface Stream At 700 Area Kd / Lower Mississipp
KS	US EPA Region 7	002158	Surface Stream At 700 Road 2 Ke / Lower Mississi
KS	US EPA Region 7	002159	Kill Tank Effluent K Kill Area / Lower Mississip
KS	US EPA Region 7	002160	Upstream Station Kaap Wastes 006 / Lower Mississ
KS	US EPA Region 7	002161	Effluent Laundry Discharge / Lower Mississippi /
KS	US EPA Region 7	005195	Neosho River East Of Chetopa, Kansas. / Arkansas
KS	US EPA Region 7	005933	Kaap Sewage Treatment Plant Eff / South Central
KS	US EPA Region 7	007873	Labette Creek Sw Of Labette, Kansas. / /
KS	US EPA Region 7	008459	Outfall 007(A), Kansas A.a.p., Parsons, Kansas.
KS	KDHE	000214	Neosho R. Nr Chetopa / Arkansas R. Basin / Neosh
KS	KDHE	000564	Labette Creek Near Labette / Arkansas River / Ne
KS	KDHE	000571	Labette Creek Near Chetopa / Arkansas River / Ne

State	Agency	Station ID	Station Name
KS	KDHE	000698	Bachelor Creek Near Labette / Southwestern Lower
KS	KDHE	002703	Neosho River Near Chetopa / Arkansas / Neosho Ba
KS	KDHE	002704	Labette Creek Near Labette / Arkansas / Neosho B
KS	KDHE	045401	Bartlett City Lake / Arkansas River / Neosho Riv
KS	KDHE	068001	Altamont City Main Lake Sta. No. 1 / Arkansas R
KS	KDHE	068101	Altamont City North Lake Sta. No. 1 / Arkansas
KS	KDHE	068201	Altamont City West Lake Sta. No. 1 / Arkansas R
KS	KDHE	071701	Edna City Lake Sta. No. 1 / Arkansas River / Ve
KS	US EPA Region 7	009645	Canville Creek / /
KS	US EPA Region 7	009650	Neosha State Fishing Lake / /
KS	KDHE	000613	Flat Rock Creek Near St. Paul / Arkansas River /
KS	KDHE	041401	Parsons Lake / Arkansas R. / Neosho R.
KS	KDHE	044601	Neosho County State Lake / Arkansas River / Neos
KS	KDHE	053401	Neosho Wa Sta. No. 1 / Arkansas River / Neosho
KS	USGS	7183500	Neosho R Nr Parsons, Ks
KS	USGS	07184000	Lightning C Nr Mccune, Ks
KS	KDHE	000214	Neosho R. Nr Chetopa
KS	USGS	07182510	Neosho R At Burlington, Ks
KS	USGS	07183000	Neosho R Nr Iola, Ks
KS	KDHE	000098	Neosho River At Leroy Kansas
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KS	KDHE	000566	Neosho River Near Oswego / Arkansas River / Neos
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KS	KDHE	035801	Mined Land Lake No. 11, Sta. No. 1 / Arkansas Ri
KS	KDHE	035901	Mined Land Lake No. 12, Sta. No. 1 / Arkansas Ri
KS	KDHE	036101	Mined Land Lake No. 14, Sta. No. 1 / Arkansas Ri
KS	KDHE	036401	Mined Land Lake No. 18, Sta. No. 1 / Arkansas Ri
KS	KDHE	036501	Mined Land Lake No. 19, Sta. No. 1 / Arkansas Ri
KS	KDHE	036601	Mined Land Lake No. 20, Sta. No. 1 / Arkansas Ri
KS	KDHE	036701	Mined Land Lake No. 21, Sta. No. 1 / Arkansas Ri
KS	KDHE	036801	Mined Land Lake No. 22, Sta. No. 1 / Arkansas Ri
KS	KDHE	036901	Mined Land Lake No. 23, Sta. No. 1 / Arkansas Ri
KS	KDHE	037001	Mined Land Lake No.24, Sta. No. 1 / Arkansas Riv
KS	KDHE	037101	Mined Land Lake No. 25, Sta. No. 1 / Arkansas Ri
KS	KDHE	037301	Mined Land Lake No. 27, Sta. No. 1 / Arkansas Ri
KS	KDHE	037401	Mined Land Lake No. 28, Sta. No. 1 / Arkansas Ri
KS	KDHE	037501	Mined Land Lake No. 29, Sta. No. 1 / Arkansas Ri
KS	KDHE	037601	Mined Land Lake No. 30, Sta. No. 1 / Arkansas Ri
KS	KDHE	037701	Mined Land Lake No. 31, Sta. No. 1 / Arkansas Ri
KS	KDHE	037801	Mined Land Lake No. 32, Sta. No. 1 / Arkansas Ri
KS	KDHE	037901	Mined Land Lake No. 33, Sta. No. 1 / Arkansas Ri
KS	KDHE	038001	Mined Land Lake No. 34, Sta. No. 1 / Arkansas Ri
KS	KDHE	038101	Mined Land Lake No. 35, Sta. No. 1 / Arkansas Ri
KS	KDHE	038201	Mined Land Lake No. 36, Sta. No. 1 / Arkansas Ri
KS	KDHE	038301	Mined Land Lake No. 37, Sta. No. 1 / Arkansas Ri
KS	KDHE	038401	Mined Land Lake No. 38, Sta. No. 1 / Arkansas Ri

State	Agency	Station ID	Station Name
KS	KDHE	038501	Mined Land Lake No. 39, Sta. No. 1 / Arkansas Ri
KS	KDHE	038601	Mined Land Lake No. 40, Sta. No. 1 / Arkansas Ri
KS	KDHE	038701	Mined Land Lake No. 41, Sta. No. 1 / Arkansas Ri
KS	KDHE	038801	Mined Land Lake No. 42, Sta. No. 1 / Arkansas Ri
KS	KDHE	038841	Mined Land Lake No. 42 Wetland Sta. No. 41 / Sou
KS	KDHE	038901	Mined Land Lake No. 43, Sta. No. 1 / Arkansas Ri
KS	KDHE	039001	Mined Land Lake No. 45, Sta. No. 1 / Arkansas Ri
KS	KDHE	048201	Mined Land Lake No. 17 Sta. No. 1 / Arkansas Riv
KS	KDHE	048401	Mined Land Lake No. 44 Sta. No. 1 / Arkansas Riv
KS	KDHE	SID00004996	West Mineral #1 / Arkansas /
KS	US EPA Region 7	002147	Kaap Npdes Station #002 Burning / Lower Mississi
KS	US EPA Region 7	002148	Kaap Npdes Station #001 / Lower Mississippi / Ne
KS	US EPA Region 7	002149	Labette Creek Downstream Station / Lower Mississ
KS	US EPA Region 7	002150	Process Control Point M / Lower Mississippi / La
KS	US EPA Region 7	002153	Effluent Tnt System 1000 Area / Lower Mississipp
KS	US EPA Region 7	002156	Surface Stream At 700 Area Kf / Lower Mississipp
KS	US EPA Region 7	002157	Surface Stream At 700 Area Kd / Lower Mississipp
KS	US EPA Region 7	002158	Surface Stream At 700 Road 2 Ke / Lower Mississi
KS	US EPA Region 7	002159	Kill Tank Effluent K Kill Area / Lower Mississip
KS	US EPA Region 7	002160	Upstream Station Kaap Wastes 006 / Lower Mississ
KS	US EPA Region 7	002161	Effluent Laundry Discharge / Lower Mississippi /
KS	US EPA Region 7	005195	Neosho River East Of Chetopa, Kansas. / Arkansas
KS	US EPA Region 7	005933	Kaap Sewage Treatment Plant Eff / South Central
KS	US EPA Region 7	007873	Labette Creek Sw Of Labette, Kansas. / /
KS	US EPA Region 7	008459	Outfall 007(A), Kansas A.a.p., Parsons, Kansas.
KS	KDHE	000214	Neosho R. Nr Chetopa / Arkansas R. Basin / Neosh
KS	KDHE	000564	Labette Creek Near Labette / Arkansas River / Ne
KS	KDHE	000571	Labette Creek Near Chetopa / Arkansas River / Ne
KS	KDHE	000698	Bachelor Creek Near Labette / Southwestern Lower
KS	KDHE	002703	Neosho River Near Chetopa / Arkansas / Neosho Ba
KS	KDHE	002704	Labette Creek Near Labette / Arkansas / Neosho B
KS	KDHE	045401	Bartlett City Lake / Arkansas River / Neosho Riv
KS	KDHE	068001	Altamont City Main Lake Sta. No. 1 / Arkansas R
KS	KDHE	068101	Altamont City North Lake Sta. No. 1 / Arkansas
KS	KDHE	068201	Altamont City West Lake Sta. No. 1 / Arkansas R
KS	KDHE	071701	Edna City Lake Sta. No. 1 / Arkansas River / Ve
KS	US EPA Region 7	009645	Canville Creek / /
KS	US EPA Region 7	009650	Neosha State Fishing Lake / /
KS	KDHE	000613	Flat Rock Creek Near St. Paul / Arkansas River /
KS	KDHE	041401	Parsons Lake / Arkansas R. / Neosho R.
KS	KDHE	044601	Neosho County State Lake / Arkansas River / Neos
KS	KDHE	053401	Neosho Wa Sta. No. 1 / Arkansas River / Neosho
KS	USGS	7183500	Neosho R Nr Parsons, Ks
KS	USGS	07184000	Lightning C Nr Mccune, Ks
KS	KDHE	000214	Neosho R. Nr Chetopa
KS	USGS	07182510	Neosho R At Burlington, Ks
KS	USGS	07183000	Neosho R Nr Iola, Ks
KS	KDHE	000098	Neosho River At Leroy Kansas
KS	KDHE	000107	Wolf Creek Near Burlington

State	Agency	Station ID	Station Name
KS	KDHE	000271	Neosho R. Near Chanute, Ks.
KS	KDHE	000272	Neosho R. At Burlington, Ks.
KS	KDHE	000565	Lightining Creek Near Oswego / Arkansas River /
KS	KDHE	000566	Neosho River Near Oswego / Arkansas River / Neos
KS	KDHE	000605	Cherry Creek Near Faulkner / Arkansas River / Ne
KS	KDHE	035801	Mined Land Lake No. 11, Sta. No. 1 / Arkansas Ri
KS	KDHE	035901	Mined Land Lake No. 12, Sta. No. 1 / Arkansas Ri
KS	KDHE	036101	Mined Land Lake No. 14, Sta. No. 1 / Arkansas Ri
KS	KDHE	036401	Mined Land Lake No. 18, Sta. No. 1 / Arkansas Ri
KS	KDHE	036501	Mined Land Lake No. 19, Sta. No. 1 / Arkansas Ri
KS	KDHE	036601	Mined Land Lake No. 20, Sta. No. 1 / Arkansas Ri
KS	KDHE	036701	Mined Land Lake No. 21, Sta. No. 1 / Arkansas Ri
KS	KDHE	036801	Mined Land Lake No. 22, Sta. No. 1 / Arkansas Ri
KS	KDHE	036901	Mined Land Lake No. 23, Sta. No. 1 / Arkansas Ri
KS	KDHE	037001	Mined Land Lake No.24, Sta. No. 1 / Arkansas Riv
KS	KDHE	037101	Mined Land Lake No. 25, Sta. No. 1 / Arkansas Ri
KS	KDHE	037301	Mined Land Lake No. 27, Sta. No. 1 / Arkansas Ri
KS	KDHE	037401	Mined Land Lake No. 28, Sta. No. 1 / Arkansas Ri
KS	KDHE	037501	Mined Land Lake No. 29, Sta. No. 1 / Arkansas Ri
KS	KDHE	037601	Mined Land Lake No. 30, Sta. No. 1 / Arkansas Ri
KS	KDHE	037701	Mined Land Lake No. 31, Sta. No. 1 / Arkansas Ri
KS	KDHE	037801	Mined Land Lake No. 32, Sta. No. 1 / Arkansas Ri
KS	KDHE	037901	Mined Land Lake No. 33, Sta. No. 1 / Arkansas Ri
KS	KDHE	038001	Mined Land Lake No. 34, Sta. No. 1 / Arkansas Ri
KS	KDHE	038101	Mined Land Lake No. 35, Sta. No. 1 / Arkansas Ri
KS	KDHE	038201	Mined Land Lake No. 36, Sta. No. 1 / Arkansas Ri
KS	KDHE	038301	Mined Land Lake No. 37, Sta. No. 1 / Arkansas Ri
KS	KDHE	038401	Mined Land Lake No. 38, Sta. No. 1 / Arkansas Ri
KS	KDHE	038501	Mined Land Lake No. 39, Sta. No. 1 / Arkansas Ri
KS	KDHE	038601	Mined Land Lake No. 40, Sta. No. 1 / Arkansas Ri
KS	KDHE	038701	Mined Land Lake No. 41, Sta. No. 1 / Arkansas Ri
KS	KDHE	038801	Mined Land Lake No. 42, Sta. No. 1 / Arkansas Ri
KS	KDHE	038841	Mined Land Lake No. 42 Wetland Sta. No. 41 / Sou
KS	KDHE	038901	Mined Land Lake No. 43, Sta. No. 1 / Arkansas Ri

6.3 USGS Gage Stations[12]

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

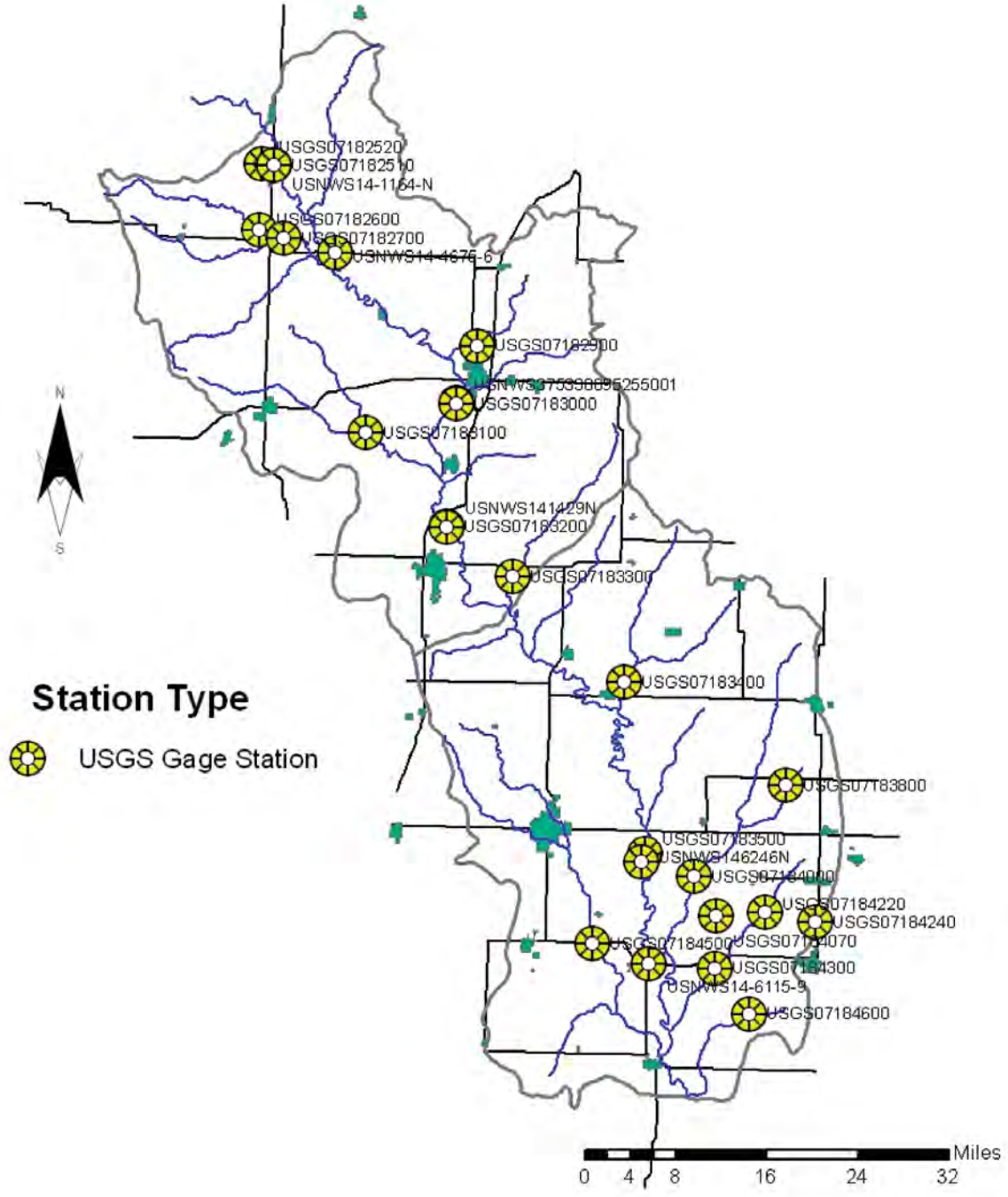


Figure 13. USGS Gage Stations – Upper and Middle Neosho Watersheds.

Table 4. USGS Gage Station[12]

Gage ID	Stream Flow (cfs)												
	Mean	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
USGS07182520	-	-	-	-	-	-	-	-	-	-	-	-	-
USNWS14-1164-N	-	-	-	-	-	-	-	-	-	-	-	-	-
USGS07182510	1520.8	784.9	877.9	1545.5	1830.5	1987.9	3545.4	2464.1	452.0	1101.1	1487.1	1209.1	829.9
USGS07182600	-	-	-	-	-	-	-	-	-	-	-	-	-
USGS07182700	-	-	-	-	-	-	-	-	-	-	-	-	-
USNWS14-4675-6	-	-	-	-	-	-	-	-	-	-	-	-	-
USGS07182900	-	-	-	-	-	-	-	-	-	-	-	-	-
USNWS375330095255001	-	-	-	-	-	-	-	-	-	-	-	-	-
USGS07183000	1789.8	809.0	886.9	1717.4	2630.5	2833.7	3592.7	2745.8	995.8	1512.5	1546.7	1274.8	798.2
USGS07183100	111.7	30.4	24.4	102.4	138.0	152.5	198.4	82.0	32.7	244.2	152.6	125.3	57.7
USNWS141429N	-	-	-	-	-	-	-	-	-	-	-	-	-
USGS07183200	2392.7	1600.5	1367.4	2543.9	3063.9	2756.8	5224.0	3417.7	694.6	1608.6	2889.1	2001.4	1529.8
USGS07183300	-	-	-	-	-	-	-	-	-	-	-	-	-
USGS07183400	-	-	-	-	-	-	-	-	-	-	-	-	-
USGS07183800	-	-	-	-	-	-	-	-	-	-	-	-	-
USGS07183500	2564.2	1246.1	1408.6	2469.6	4023.9	4034.1	5074.4	3841.4	1142.3	2069.6	2202.7	2020.4	1147.1
USNWS146246N	-	-	-	-	-	-	-	-	-	-	-	-	-
USGS07184000	146.2	102.1	84.3	189.2	234.5	263.1	296.5	58.3	23.9	120.2	133.1	140.7	101.1
USGS07184500	229.2	47.3	66.3	204.0	466.5	440.3	375.0	86.6	77.3	346.1	404.3	77.7	89.3
USNWS14-6115-9	-	-	-	-	-	-	-	-	-	-	-	-	-
USGS07184300	-	-	-	-	-	-	-	-	-	-	-	-	-
USGS07184600	-	-	-	-	-	-	-	-	-	-	-	-	-

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 Kansas [13]

USGS ID	Sation 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
7182520	Rock Creek at Burlington	8.27	1020	2370	3660	5760	7690	9960	12600
7182600	North Big Creek near Burlington	46	3210	4850	6000	7500	8660	9830	11000
7183000	Neosho River near Iola	3820	23700	48300	70700	107000	140000	180000	226000
7183100	Owl Creek near Piqua	177	6940	14400	20900	31200	40200	50500	62200
7183500	Neosho River near Parsons	4910	28700	50800	69300	97300	122000	149000	181000
7183800	Limestone Creek near Beulah	12	3140	6540	9400	13600	17200	21100	25300
7184000	Lightning Creek near McCune	197	7520	16800	26300	42600	58300	77600	101000
7184500	Labette Creek near Oswego	211	8330	13200	16600	21200	24700	28300	32000

[mi^2, square miles; ft^3/s, cubic feet per second]

Table 6. USGS gaging stations period of record for Upper and Middle Neosho[12]

USGS ID	Drainage Area (mi^2)	Period of record	
		Begin	End
7182510	3042	6/30/1961	Present
7183000	3723	9/30/1985	Present
7183100	177	6/30/1959	10/7/1970
7183200	4195	9/30/1962	10/1/1974
7183500	4905	9/30/1921	Present
7184000	197	9/30/1938	Present
7184500	211	90/30/1938	9/30/1945
7184300	90	9/1/1979	9/30/1982
7184070	7	10/18/1976	5/30/1979
7184220	27	10/19/1976	5/16/1979
7184240	34	3/14/1977	8/17/1977

6.4 Permitted Point Source Facilities[14]

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.

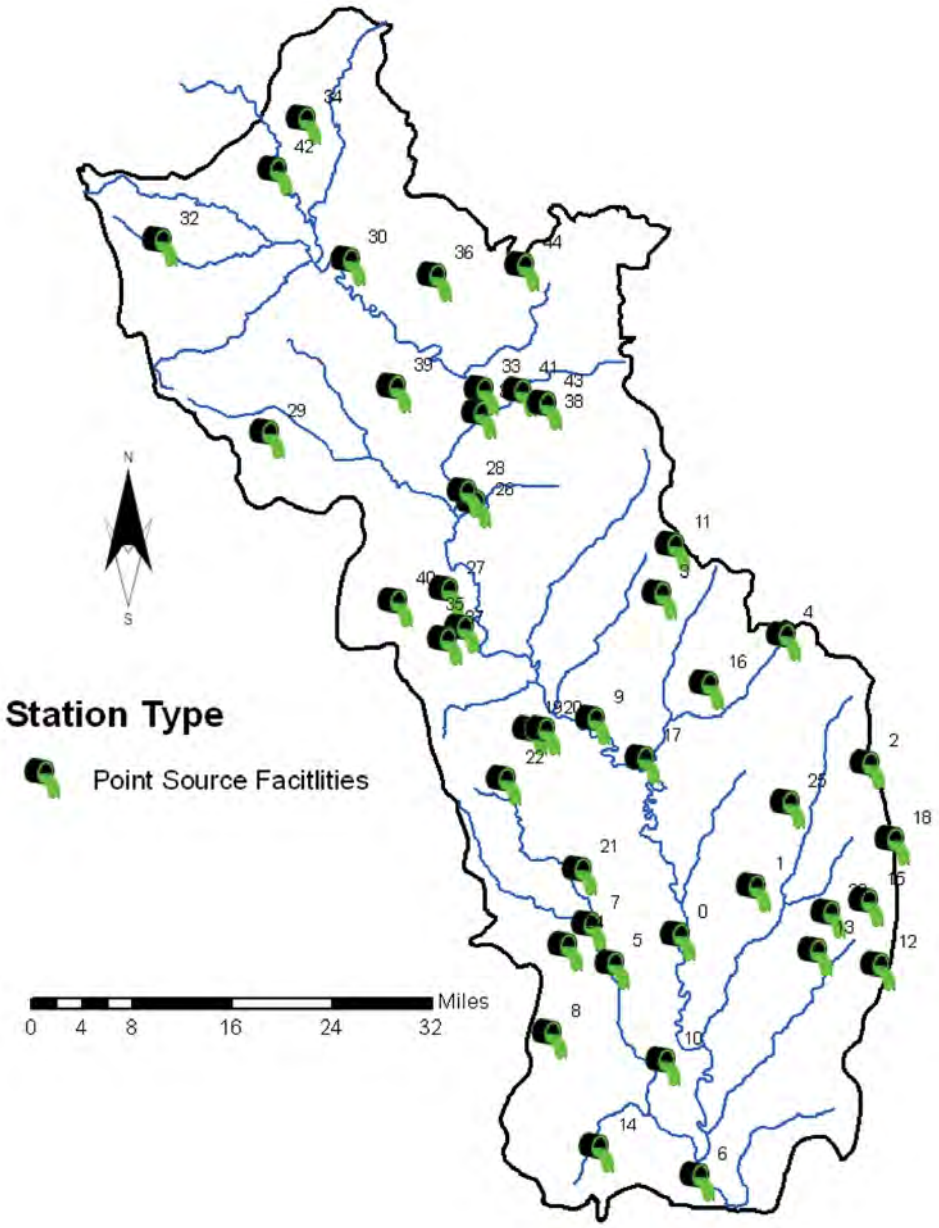


Figure 14. NPDES permit-holding facilities – Upper and Middle Neosho Watersheds.

Table 7. Permitted Point Source Facilities[14]

ID	NPDES	Facility Name	Ownership	Description	Industrial Classification	City	County	Flow Rate (Million gallons/day)
0	KS0000612	Kansas Gas & Elect Co Parsons	Pub Pri	Electrical Services	Primary O	Parsons	Labette	0.00000
1	KS0021393	Mccune City Of Stp	Public	Sewerage Systems	Municipal	Mccune	Crawford	0.00000
2	KS0022551	Girard City Of Wwtp	Public	Sewerage Systems	Municipal	Girard	Crawford	0.00000
3	KS0025526	Stark City Of Wwtp	Public	Sewerage Systems	Municipal	Stark	Neosho	0.01000
4	KS0028533	Hepler City Of Stp	Public	Sewerage Systems	Municipal	Hepler	Crawford	0.00000
5	KS0029360	Us Army-Kansas Army Ammunition	Federal	National Security	Not On El	Parsons	Labette	30.00000
6	KS0031135	Chetopa City Of Wwtp	Public	Sewerage Systems	Municipal	Chetopa	Labette	0.00000
7	KS0036722	Parsons Water & Sewer Dept	Public	Sewerage Systems	Municipal	Parsons	Labette	3.50000
8	KS0045918	Altamont City Of Stp	Public	Sewerage Systems	Municipal	Altamont	Labette	0.00000
9	KS0045977	Erie City Of Wwtp	Public	Sewerage Systems	Municipal	Erie	Neosho	0.00000
10	KS0047554	Oswego City Of Stp	Public	Sewerage Systems	Municipal	Oswego	Labette	0.30000
11	KS0079952	Savonburg City Of Wwtp	Public	Sewerage Systems	Municipal	Savonburg	Allen	0.00000
12	KS0080357	Scammon Wastewater Treatment F	Public	Sewerage Systems	Municipal	Scammon	Cherokee	0.00000
13	KS0080861	West Mineral City Of Wwtp	Public	Sewerage Systems	Municipal	West Mineral	Cherokee	0.00000
14	KS0080900	Bartlett City Of Wwtp	Public	Sewerage Systems	Municipal	Bartlett	Labette	0.00000
15	KS0081230	Cherokee Wwtp	Public	Sewerage Systems	Municipal	Cherokee	Crawford	0.00000
16	KS0083887	Walnut City Of Wwtp	Public	Sewerage Systems	Municipal	Walnut	Crawford	0.00000
17	KS0084174	St. Paul City Of Munic Wwtp	Public	Sewerage Systems	Municipal	Saint Paul	Neosho	0.12000
18	KS0087190	Nelson Quarries Inc.-pittsburg	Private	Crushed And Broken Limestone	On Elg	Pittsburg	Crawford	0.00000
19	KS0088889	Nidwest Minerals, Inc. Quarry7	Private	Meat Packing Plants	On Elg	Neosho County	Neosho	0.00000
20	KS0089931	Nelson Quarry - Erie/ beachner	Pub Pri			Erie	Neosho	0.00000
21	KS0090298	Individual Mausoleum Company	Pub Pri			Parsons	Labette	0.00000
22	KS0092193	Galesburg	Pub Pri			Galesburg	Neosho	0.00000
23	KS0115479	Midwest Minerals Inc Quarry 21	Private	Crushed And Broken Limestone	On Elg	Cherokee	Crawford	
24	KS0115525	Midwest Minerals Inc Quarry 3	Private	Crushed And Broken Limestone	On Elg	Parsons	Labette	0.00000
25	KS0000701	Monarch Cement Co.	Private	Cement, Hydraulic	On Elg	Allen	Lyon	0.00000

ID	NPDES	Facility Name	Ownership	Description	Industrial Classification	City	County	Flow Rate (Million gallons/day)
26	KS0001201	Ash Grove Cement Co Chanute P	Private	Cement, Hydraulic	On Elg	Chanute	Neosho	0.00000
27	KS0022632	Humboldt Wwtf	Public	Sewerage Systems	Municipal	Humboldt	Allen	0.00000
28	KS0024732	Yates Center City Of Stp	Public	Sewerage Systems	Municipal	Yates Center	Woodson	0.30000
29	KS0030813	Leroy City Of Stp	Public	Sewerage Systems	Municipal	Le Roy	Coffey	0.00000
30	KS0032123	Iola City Of Stp	Public	Sewerage Systems	Municipal	Iola	Allen	3.00000
31	KS0045993	Gridley City Of Stp	Public	Sewerage Systems	Municipal	Gridley	Coffey	0.00000
32	KS0078905	Iola City Of Munic Power Plant	Pub Pri	Electrical Services	Primary O	Iola	Allen	0.00000
33	KS0079057	Wolf Creek Generating Station	Pub Pri	Electrical Services	Primary O	Burlington	Coffey	0.10000
34	KS0080837	Chanute Wwtp (New Plant)	Public	Sewerage Systems	Municipal	Chanute	Neosho	2.20000
35	KS0081434	Settlemyer Quarry #24	Private	Crushed And Broken Limestone	On Elg	Ottawa	Franklin	0.00000
36	KS0082597	Chanute, City Of Power Plnt 3	Public	Electrical Services	On Elg	Chanute	Neosho	0.00000
37	KS0082686	Nelson Quarry-stokes Quarry	Private	Crushed And Broken Limestone	On Elg	La Harpe	Allen	0.00000
38	KS0084085	Woodson Co. Im-provemetn Dist.	Public	Sewerage Systems	Municipal	Piqua	Woodson	0.01000
39	KS0084476	Wilson Cnty Sd#1 (Tu-lakes) Wwt	Public	Sewerage Systems	Municipal	Wilson County	Wilson	0.01000
40	KS0085201	Allen County Sewer Dist 1 Wwtp	Public	Sewerage Systems	Municipal	Iola	Allen	0.01000
41	KS0090417	Burlington - Municipal Plt	Pub Pri			Burlington	Coffey	0.00000
42	KS0115991	Laharpe Mwwtf	Public	Sewerage Systems	Municipal	La Harpe	Allen	0.00000
43	KS0116122	Colony Mun Wwtf	Public	Sewerage Systems	Municipal	Colony	Anderson	4.50000

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 Upper and Middle Neosho Watersheds.

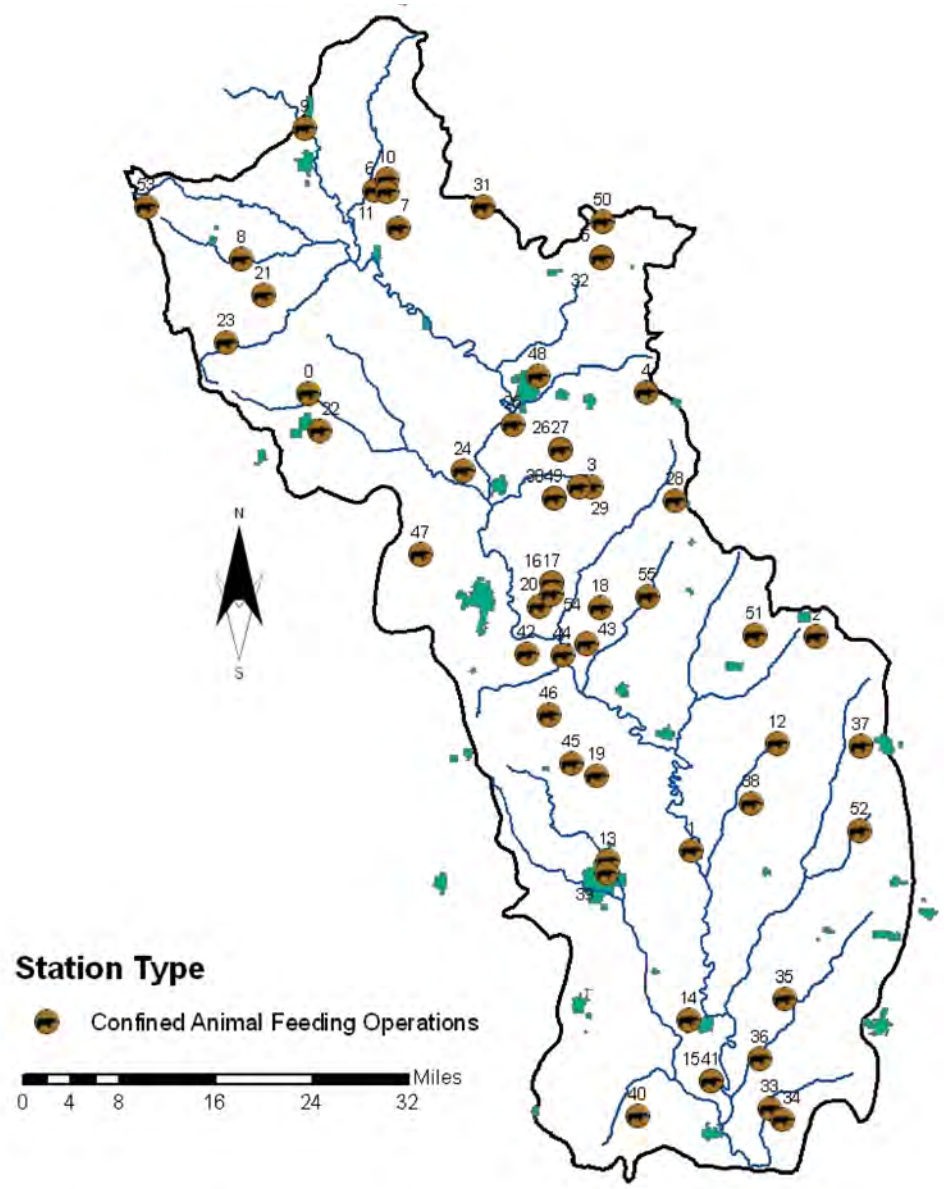


Figure 15. Confined Animal Feeding Operations facilities – Upper and Middle Neosho Watersheds.

Table 8. Confined Animal Feeding Operations[15]

ID	Permit No.	Total Head	Kansas Animal Unit System	Federal Animal Unit System	Animal Type
0	A-NEWO-C001	3500	3500	3500	Beef
1	A-NELB-C001	18000	18000	18000	Beef
2	A-NECR-B003	1400	700	1400	Beef
3	A-NEAL-MA24	40	56	56	Dairy
4	A-NEAL-BA01	900	900	900	Beef
5	A-NEAN-BA01	600	300	600	Beef
6	A-NECF-BA11	150	75	150	Beef
7	A-NECF-BA03	150	150	150	Beef

ID	Permit No.	Total Head	Kansas Animal Unit System	Federal Animal Unit System	Animal Type
8	A-NECF-BA01	168	168	168	Beef
9	A-NECF-BA02	100	100	100	Beef
10	A-NECF-BA04	80	40	80	Beef
11	A-NECF-BA12	125	63	125	Beef
12	A-NECR-BA01	500	500	500	Beef
13	A-NELB-BA01	600	600	600	Beef
14	A-NELB-MA02	100	140	140	Dairy
15	A-NELB-MA04	75	105	105	Dairy
16	A-NENO-BA05	400	400	400	Beef
17	A-NENO-BA04	300	300	300	Beef
18	A-NENO-BA02	150	150	150	Beef
19	A-NENO-MA01	75	105	105	Dairy
20	A-NENO-BA03	600	600	600	Beef
21	A-NEWO-BA02	400	200	400	Beef
22	A-NEWO-SA01	200	80	80	Swine
23	A-NEWO-BA01	150	150	150	Beef
24	A-NEAL-S012	350	80	60	Swine
25	A-NEAL-M014	50	70	70	Dairy
26	A-NEAL-M011	124	152	164	Dairy
27	A-NEAL-M015	100	140	140	Dairy
28	A-NEAL-M016	80	86	96	Dairy
29	A-NEAL-B001	300	200	300	Beef
30	A-NEAL-S011	600	240	240	Swine
31	A-MCAN-S028	300	120	120	Swine
32	A-NEAN-M001	100	122	132	Dairy
33	A-NECK-F025	54000	972	0	Turkeys
34	A-NECK-F011	33000	594	0	Turkeys
35	A-NECK-F024	33000	594	0	Turkeys
36	A-NECK-F012	33000	594	0	Turkeys
37	A-NECR-M004	130	182	182	Dairy
38	A-NECR-M002	290	280	350	Dairy
39	A-NELB-B001	189	189	189	Beef
40	A-NELB-S008	540	144	120	Swine
41	A-NELB-M011	38	53	53	Dairy
42	A-NENO-S020	850	265	240	Swine
43	A-NENO-M005	70	98	98	Dairy
44	A-NENO-S002	600	240	240	Swine
45	A-NENO-M010	335	410	435	Dairy
46	A-NENO-S005	550	220	220	Swine
47	A-NEWL-S001	1150	340	300	Swine
48	A-NEAL-M003	530	640	690	Dairy, Beef
49	A-NEAL-M012	120	168	168	Dairy
50	A-NEAN-B001	250	250	250	Beef
51	A-NECR-M006	68	95	95	Dairy
52	A-NECR-F001	54000	972	0	Turkeys
53	A-NEGW-M002	400	560	560	Dairy
54	A-NENO-M012	65	91	91	Dairy
55	A-NENO-S001	1392	482	457	Swine

6.6 1990 Population and Sewerage by Census Tract [16]

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.

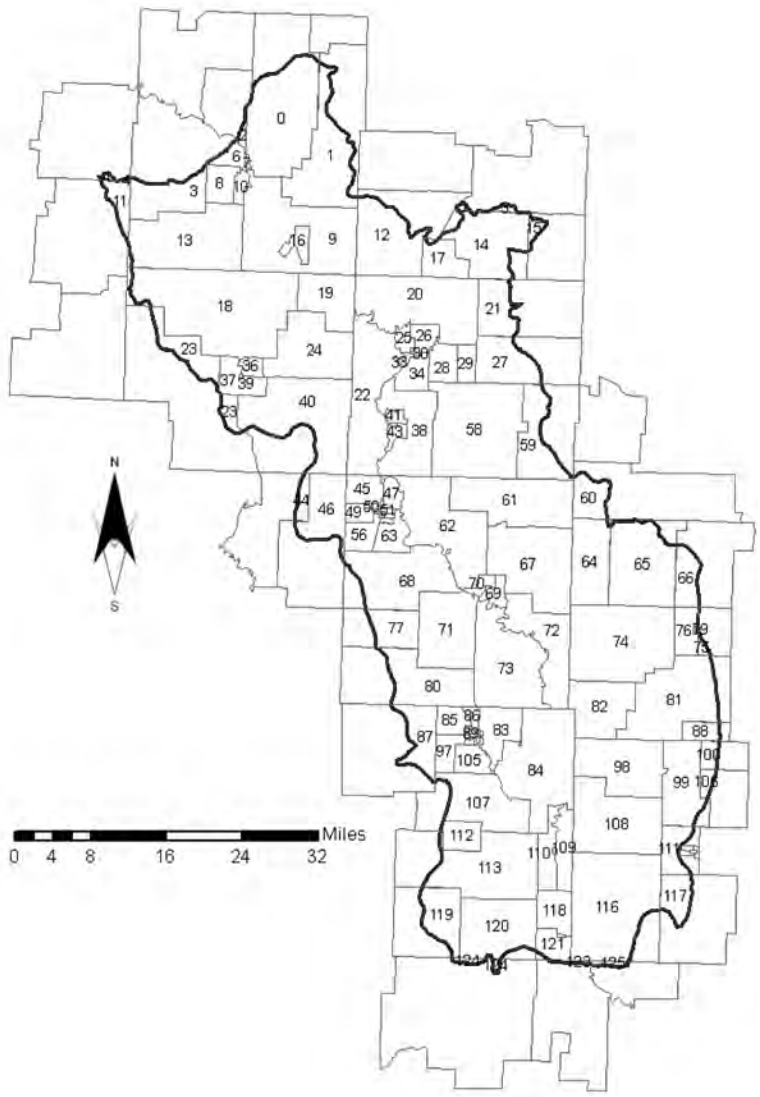


Figure 16. Population and Sewerage by Census – Upper and Middle Neosho Watersheds.

Table 9. 1990 Population and Sewerage by Census Tract[16]

ID	TRACT	Population	House Units	Sewer Public	Sewer Septic	Sewer Other
0	996100	455	179	19	160	0
1	996100	412	184	0	157	27
2	996200	642	248	167	71	10
3	996200	332	187	0	162	25
4	800	979	359	184	150	25
5	953700	521	274	7	259	8
6	996300	854	301	283	18	0
7	996300	582	319	313	6	0
8	996300	856	372	306	56	10
9	996100	318	129	5	110	14
10	996300	729	333	319	14	0
11	995600	347	141	0	120	21
12	953700	256	104	7	97	0
13	996200	630	295	180	98	17
14	953700	283	121	0	103	18

ID	TRACT	Population	House Units	Sewer Public	Sewer Septic	Sewer Other
15	953700	364	203	111	92	0
16	996100	580	288	270	13	5
17	953700	508	233	211	22	0
18	996600	281	120	0	120	0
19	996600	219	118	0	118	0
20	952700	435	187	0	187	0
21	952600	379	173	7	152	14
22	953000	501	206	41	160	5
23	996600	319	145	0	138	7
24	996600	324	133	42	85	6
25	952800	1354	546	517	29	0
26	952800	1301	457	429	28	0
27	952600	847	378	260	109	9
28	952700	969	414	302	110	2
29	952700	744	315	279	35	1
30	952800	879	394	394	0	0
31	952800	514	264	264	0	0
32	952900	606	380	380	0	0
33	952900	747	381	360	21	0
34	952900	947	413	259	154	0
35	952900	785	353	353	0	0
36	996700	646	310	282	28	0
37	996700	963	504	456	48	0
38	953000	407	156	0	156	0
39	996700	419	231	231	0	0
40	996600	350	153	0	139	14
41	953000	817	346	324	22	0
42	953000	603	309	309	0	0
43	953000	842	373	352	21	0
44	997100	411	201	3	185	13
45	951700	643	303	202	101	0
46	997100	468	204	23	175	6
47	951700	457	210	202	8	0
48	951700	908	428	428	0	0
49	951800	1102	454	403	51	0
50	951700	923	442	411	31	0
51	951900	820	433	433	0	0
52	951800	949	451	442	9	0
53	951800	559	313	307	6	0
54	951900	1025	481	481	0	0
55	951900	590	279	273	6	0
56	951800	1185	445	394	51	0
57	951900	694	301	301	0	0
58	952600	442	197	0	191	6
59	952600	519	212	93	117	2
60	955700	388	180	0	155	25
61	951600	426	203	42	156	5
62	951600	920	405	9	396	0
63	951900	334	159	68	91	0

ID	TRACT	Population	House Units	Sewer Public	Sewer Septic	Sewer Other
64	956700	368	186	121	65	0
65	956700	470	210	70	138	2
66	956700	423	233	6	221	6
67	951600	514	232	5	227	0
68	952000	467	206	4	190	12
69	951600	610	279	258	21	0
70	951600	772	332	318	14	0
71	952000	544	241	72	169	0
72	951600	887	327	267	60	0
73	952000	541	268	0	261	7
74	956700	434	157	0	157	0
75	956800	1033	452	315	137	0
76	956800	926	345	284	61	0
77	952000	690	314	221	93	0
78	956800	560	293	288	5	0
79	956800	745	367	360	7	0
80	952000	475	220	0	214	6
81	956700	646	258	0	246	12
82	956700	711	357	213	144	0
83	950100	1195	475	303	172	0
84	950500	488	200	0	181	19
85	950300	1033	456	344	112	0
86	950100	643	285	238	47	0
87	950500	916	368	19	340	9
88	956700	803	375	322	53	0
89	950300	979	467	467	0	0
90	950300	376	45	36	9	0
91	950200	690	272	270	2	0
92	950300	906	350	350	0	0
93	950100	726	384	377	7	0
94	950200	589	422	422	0	0
95	950200	451	253	253	0	0
96	950400	894	426	426	0	0
97	950400	1000	378	257	117	4
98	958200	429	193	112	77	4
99	958100	591	302	8	268	26
100	958100	1025	450	327	108	15
101	950200	483	283	283	0	0
102	950200	617	268	261	7	0
103	950100	1178	509	509	0	0
104	950400	1230	581	581	0	0
105	950400	620	237	117	120	0
106	958100	606	277	227	50	0
107	950500	657	262	4	240	18
108	958200	422	202	5	197	0
109	950700	635	347	270	74	3
110	950700	1028	474	358	96	20
111	958300	470	226	87	132	7
112	950500	1181	495	431	64	0

ID	TRACT	Population	House Units	Sewer Public	Sewer Septic	Sewer Other
113	950600	475	215	0	211	4
114	958300	856	359	359	0	0
115	950700	577	277	277	0	0
116	958200	485	235	0	192	43
117	958200	933	366	76	283	7
118	950800	475	232	182	44	6
119	950600	850	380	212	161	7
120	950600	404	183	73	110	0
121	950800	666	307	266	36	5
122	950800	544	295	292	0	3
123	973100	601	265	0	265	0
124	973100	466	233	3	186	44
125	974100	198	93	0	93	0

7.0. Agricultural Economy

7.1 Corn Cost-Return Budget[17]

Table 10. Cost-return projections for corn crops in the Upper and Middle Neosho 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 Non-irrigated 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 Budget [17]

Table 12. Cost-return projections for soybean crops in the Upper and Middle Neosho 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 and 2006 Non-irrigated 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 Budget [17]

Table 14. Cost-return projections for wheat crops in the Upper and Middle Neosho 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 and 2006 Non-irrigated 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 Budget [17]

Table 16. Cost-return projections for grain sorghum crops in the Upper and Middle Neosho 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 and 2006 Non-irrigated 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 Budget [17]

Table 18. Cost-return projections for alfalfa crops in the Upper and Middle Neosho 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 Non-irrigated 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.

7.6 Common Cropland BMPs in Upper and Middle Neosho 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 Upper and Middle Neosho watershed.

Contour farming[24] 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 is erosion reduced. Crop yields are increased in arid areas.

Grassed waterways[25] 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 buffers[25] 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-till[25] 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.

Terraces[25] 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 stabilization[25] 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 Upper and Middle Neosho Watershed. These reports were generated using the KSU-Vegetative Buffer and KSU-Streambank Stabilization Decision-Making Tools[27].

7.6.1 Vegetative Buffer: Economic Analysis

Your project area is located in Neosho 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:*	**$82.86**	*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** **$85.50** per acre annually.

Based on the information you have provided, a vegetative buffer on the project area would **return** **$85.50** annually.

Based on the information you have provided, cropland on the project area would return **$46.19** per acre annually.

Based on the information you have provided, cropland on the project area would return **$46.19** annually.

Take Home Message:

You would be **$39.31** per year **better off** installing this area to a vegetative buffer versus using it for crop production.

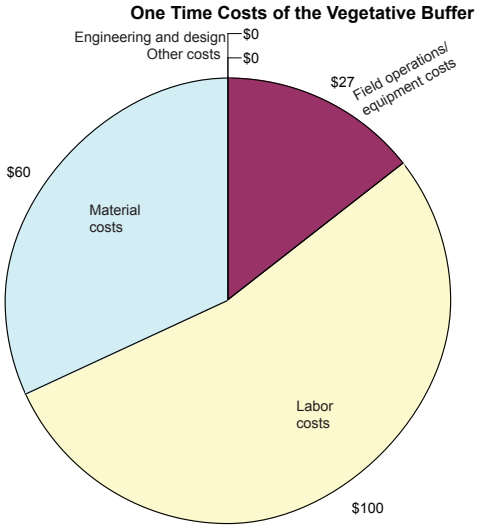
Discussion

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).

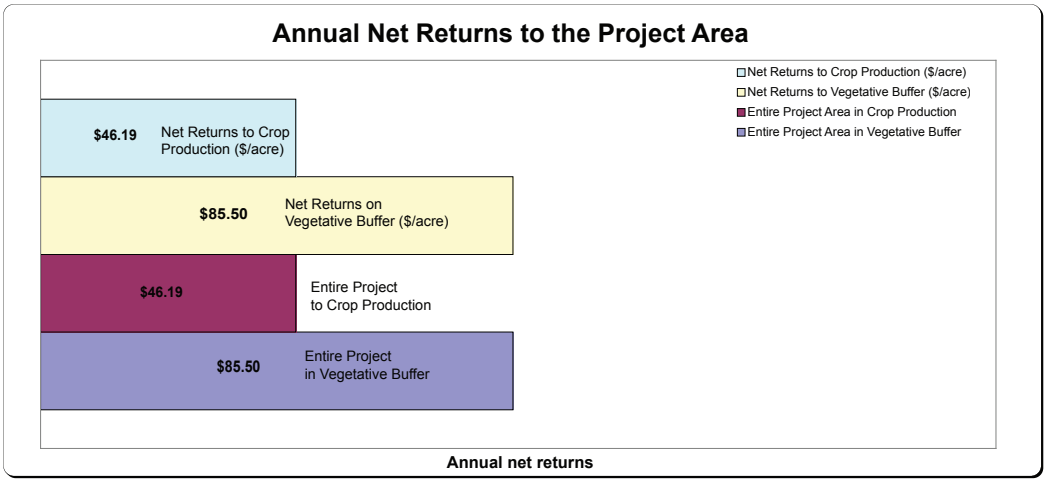
Net Present Value calculations convert future values into today's dollars. The net present value analysis uses a discount factor to equate a series of future cash flows into an equivalent amount of cash today. For example, if you are considering enrolling land into a 15 year Continuous Conservation Reserve 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



Budget information for the vegetative buffer project

General Data For Vegetative Buffer		
Discount Rate	5.00%	
Cropland Rental Rate - not CCRP rental rate	$40.65	per acre / year
Annual Cropland Rental Growth Rate	3.07%	
Total Annual Costs	$6.67	per acre / year
Inflation Rate of Annual Costs	4.00%	
Project Length (feet)	660	
Project Width (feet)	66	
Acres (length x width/43,560)	1.00	
Length of analysis (years)	10	
Cropland Property Tax ($/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	**$82.86**

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	$82.86	$0.00
2	$0.00	$6.94	$0.00	$82.86	$0.00
3	$0.00	$7.21	$0.00	$82.86	$0.00
4	$0.00	$7.50	$0.00	$82.86	$0.00
5	$0.00	$7.80	$0.00	$82.86	$0.00
6	$0.00	$8.12	$0.00	$82.86	$0.00
7	$0.00	$8.44	$0.00	$82.86	$0.00
8	$0.00	$8.78	$0.00	$82.86	$0.00
9	$0.00	$9.13	$0.00	$82.86	$0.00
10	$0.00	$9.49	$0.00	$82.86	$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	$828.58	$0.00
Present Value	$187.28	$60.87	$268.55	$639.81	$0.00
Net Present Value	**$660.21**				
Annualized Value	**$85.50**				

NPV Table: Cropland Rent (per acre)	
Year	**Rent**
0	$0.00
1	$40.65
2	$41.90
3	$43.18
4	$44.51
5	$45.88
6	$47.28
7	$48.74
8	$50.23
9	$51.77
10	$53.36
11	-
12	-
13	-
14	-
15	-
Sum totals	$467.51
Present Value	$356.64
Net Present Value	**$356.64**
Annualized Value	**$46.19**

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	$0.00	$0.00
1	$0.00	$6.67	$0.00	$82.86	$0.00
2	$0.00	$6.94	$0.00	$82.86	$0.00
3	$0.00	$7.21	$0.00	$82.86	$0.00
4	$0.00	$7.50	$0.00	$82.86	$0.00
5	$0.00	$7.80	$0.00	$82.86	$0.00
6	$0.00	$8.12	$0.00	$82.86	$0.00
7	$0.00	$8.44	$0.00	$82.86	$0.00
8	$0.00	$8.78	$0.00	$82.86	$0.00
9	$0.00	$9.13	$0.00	$82.86	$0.00
10	$0.00	$9.49	$0.00	$82.86	$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	$828.58	$0.00
Present Value	$187.28	$60.87	$268.55	$639.81	$0.00
Net Present Value	**$660.21**				
Annualized Value	**$85.50**				

NPV Table: Cropland Rental Rate (total project area)	
Year	**Rent**
0	$0.00
1	$40.65
2	$41.90
3	$43.18
4	$44.51
5	$45.88
6	$47.28
7	$48.74
8	$50.23
9	$51.77
10	$53.36
11	-
12	-
13	-
14	-
15	-
Sum totals	$467.51
Present Value	$356.64
Net Present Value	**$356.64**
Annualized Value	**$46.19**

7.6.2 Streambank Stabilization: Economic Analysis

Your project area is located in Neosho 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:	**$376.63**	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:

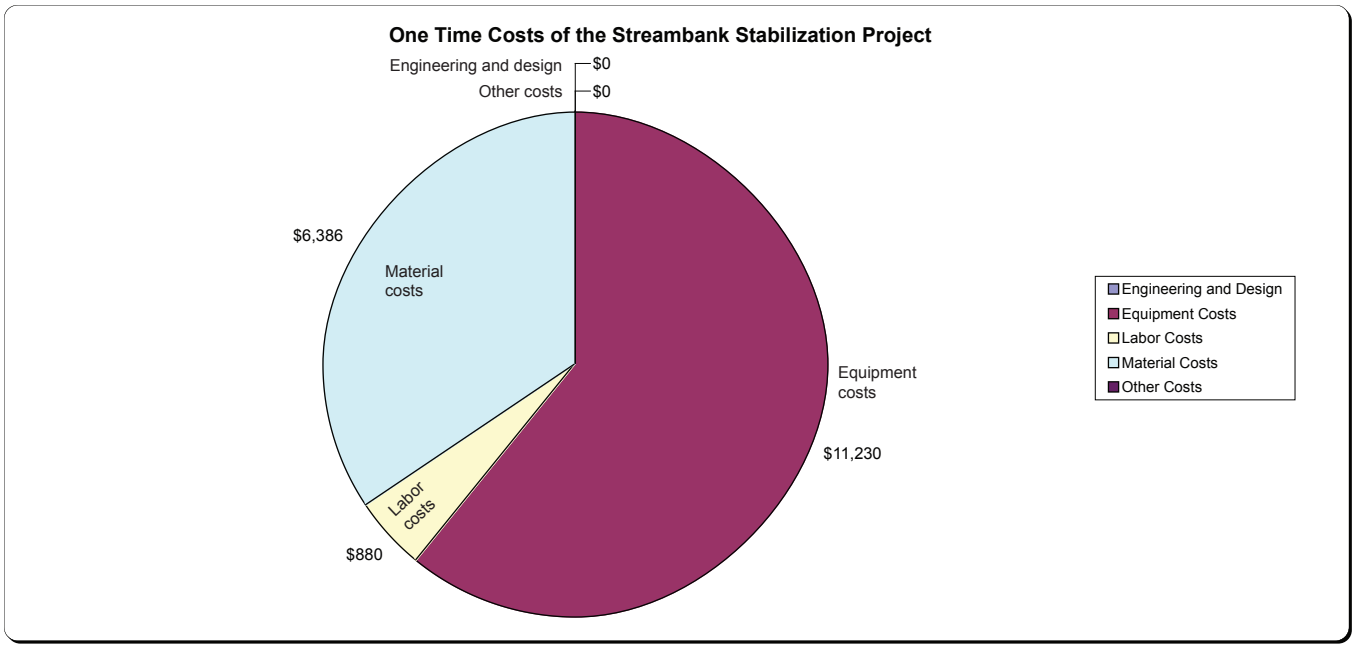
If you consider the asset value of the land that is preserved by the streambank stabilization project, then the take-home message is:

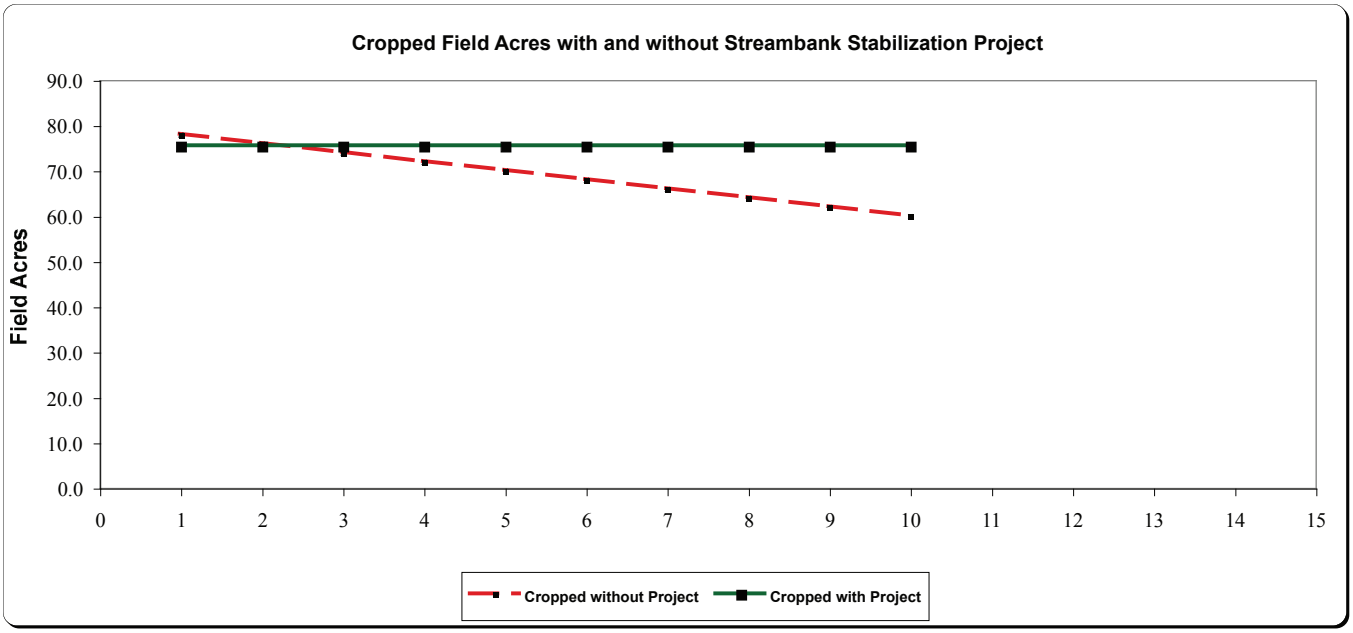
You would be	**$1,996.56**	per year	**better off**	by stabilizing this streambank versus doing nothing.
A streambank project would	**return**	**$15,416.93**		in total over the 10 year time period you have selected.

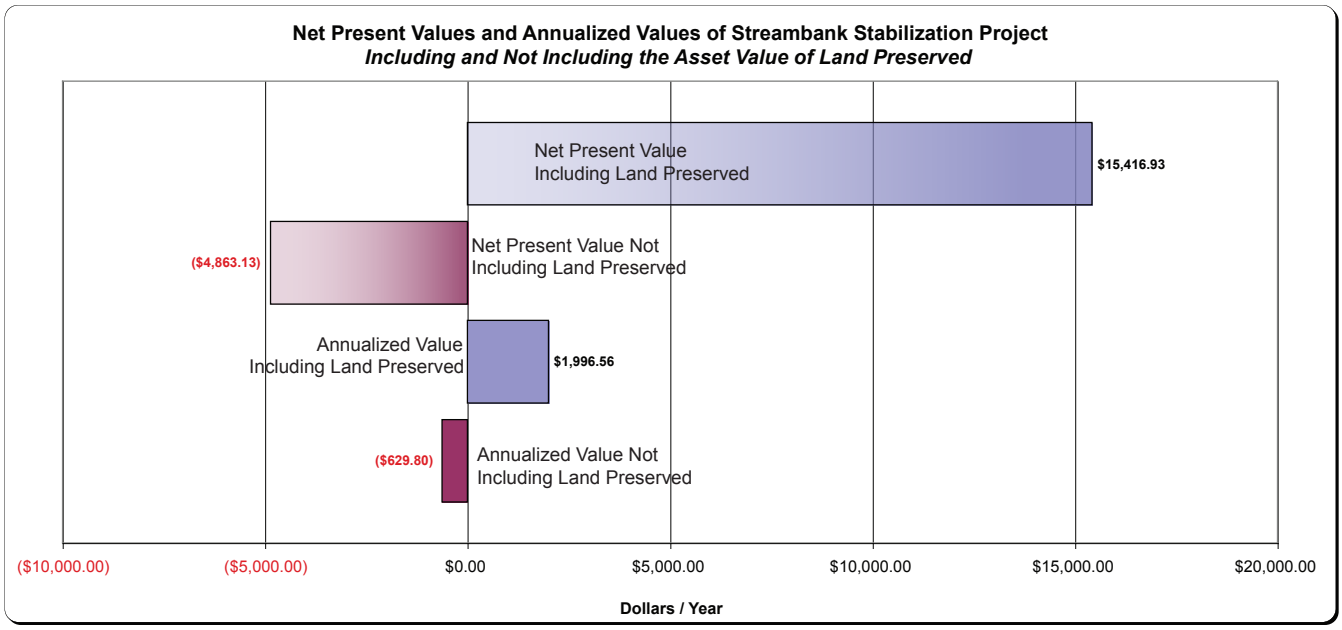
If you DO NOT consider the asset value of the land that is preserved by the streambank stabilization project, then the take-home message is:

You would be	($629.80)	per year	**worse off**	by stabilizing this streambank versus doing nothing.
A streambank project would	**lose**	($4,863.13)		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.







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%	
Cropland Value	$1,080.00	per acre
Annual Cropland Value Growth Rate	4.34%	
Cropland Rental Rate - not CCRP rental rate	$40.65	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	@	$1,080.00	per acre	**$21,600.00**
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	@	$1,651.70	per acre	**$33,034.07**
Cropland Property Tax ($/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	**$376.63**

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)	$40.65	($184.77)	-	$1,080.00		$9.88	$9.88	4.55	15.45	$197.60	20.00	$197.60	$0.00	4.55	-	4.55
1	(2.55)	$41.90	($106.65)	2.00	$1,126.87	$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)	$43.18	($23.56)	4.00	$1,175.78	$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	$44.51	$64.74	6.00	$1,226.81	$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	$45.88	$158.48	8.00	$1,280.05	$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	$47.28	$257.92	10.00	$1,335.60	$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	$48.74	$363.31	12.00	$1,393.57	$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	$50.23	$474.93	14.00	$1,454.05	$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	$51.77	$593.06	16.00	$1,517.16	$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	$53.36	$717.99	18.00	$1,583.00	$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	$55.00	$850.04	20.00	$1,651.70	$33,034.07	$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 Data[18]

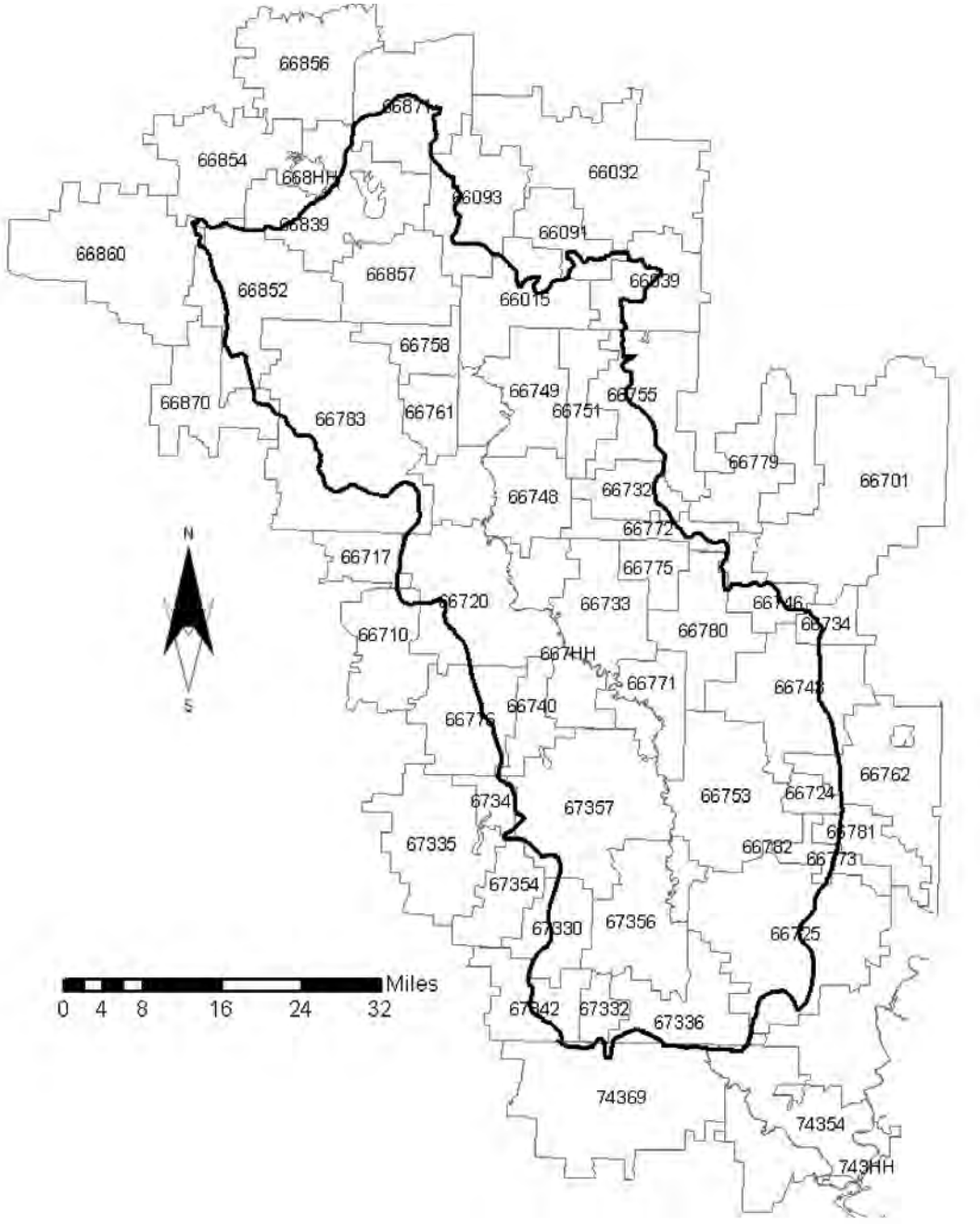


Figure 17. Zip Code Boundary Map.

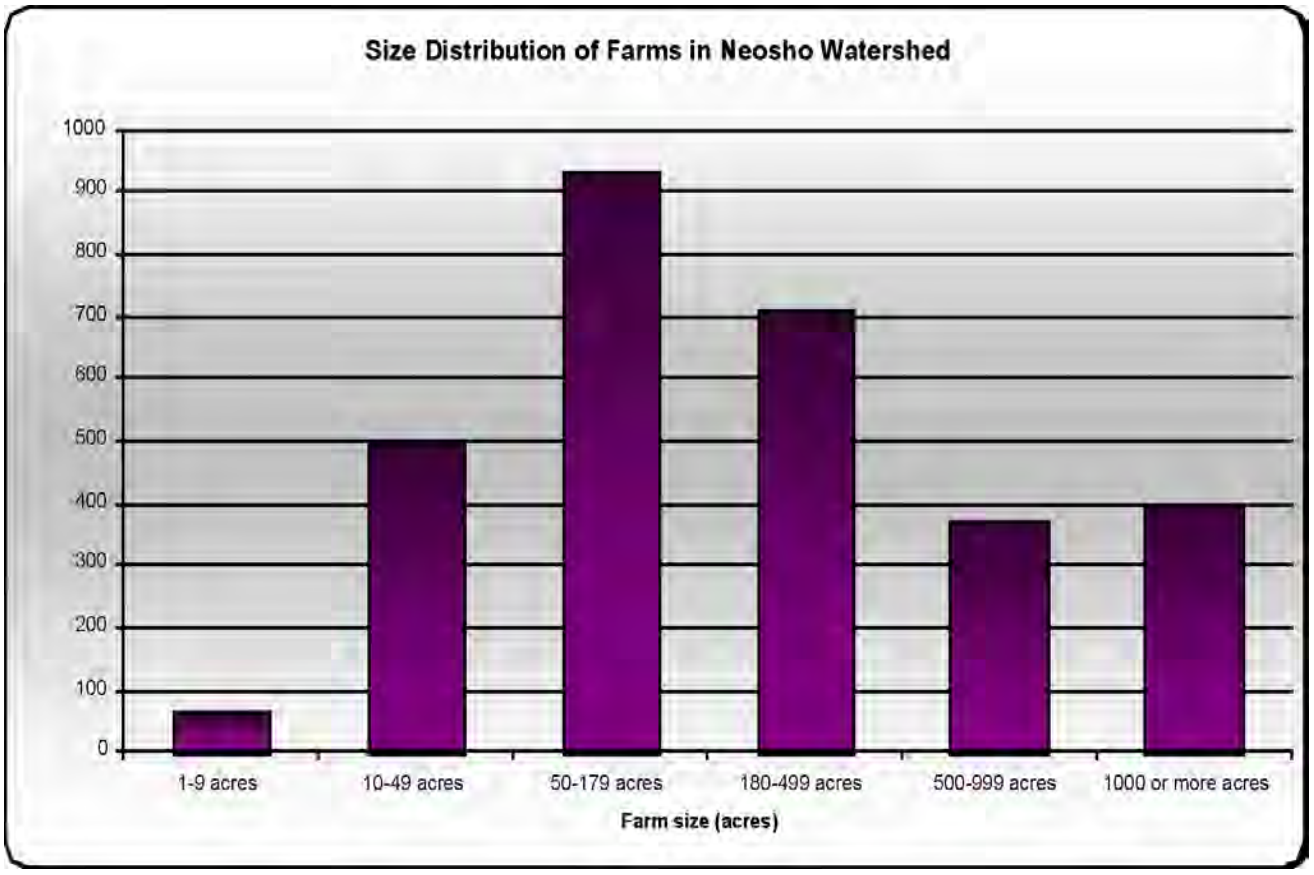


Figure 18. Size Distribution of Farms in Upper and Middle Neosho Watershed, 2002.[18]

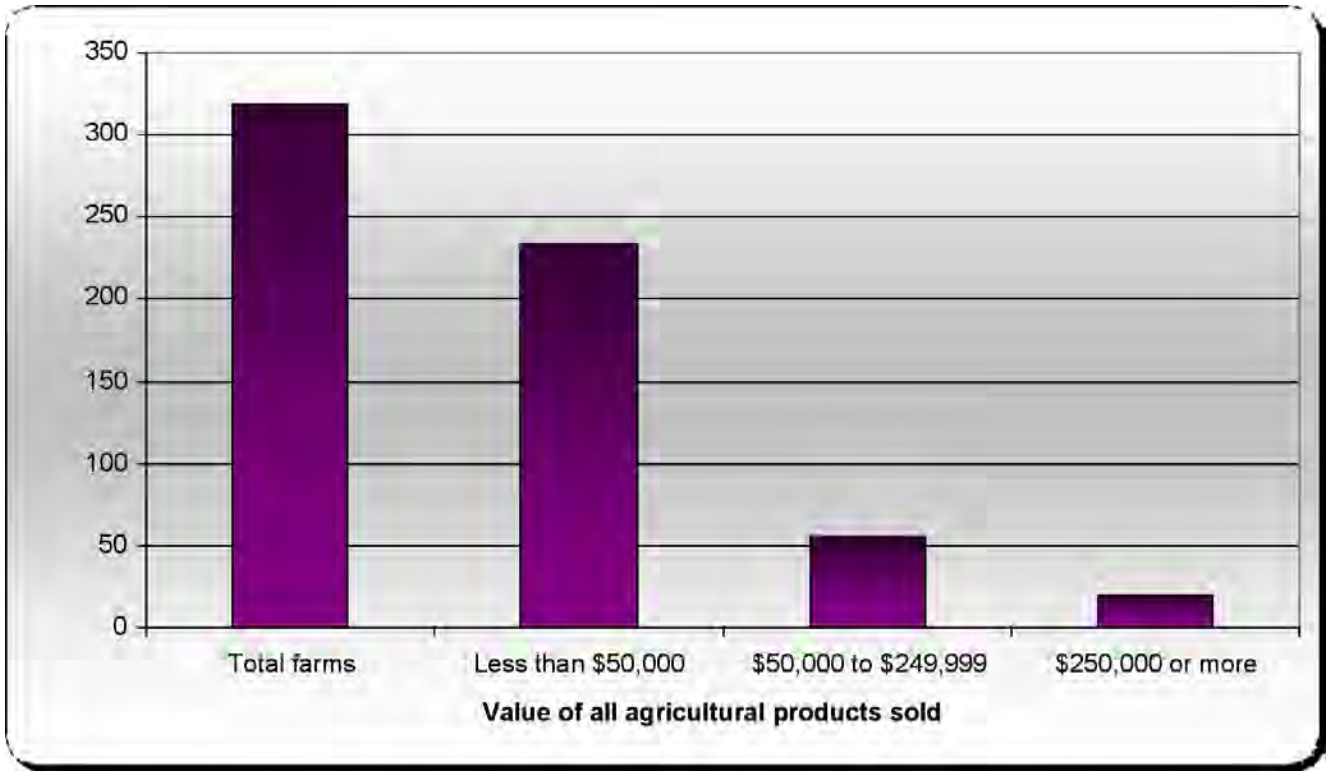


Figure 19. Sales Distribution of Farms in Upper and Middle Neosho Watershed, 2002.[18]

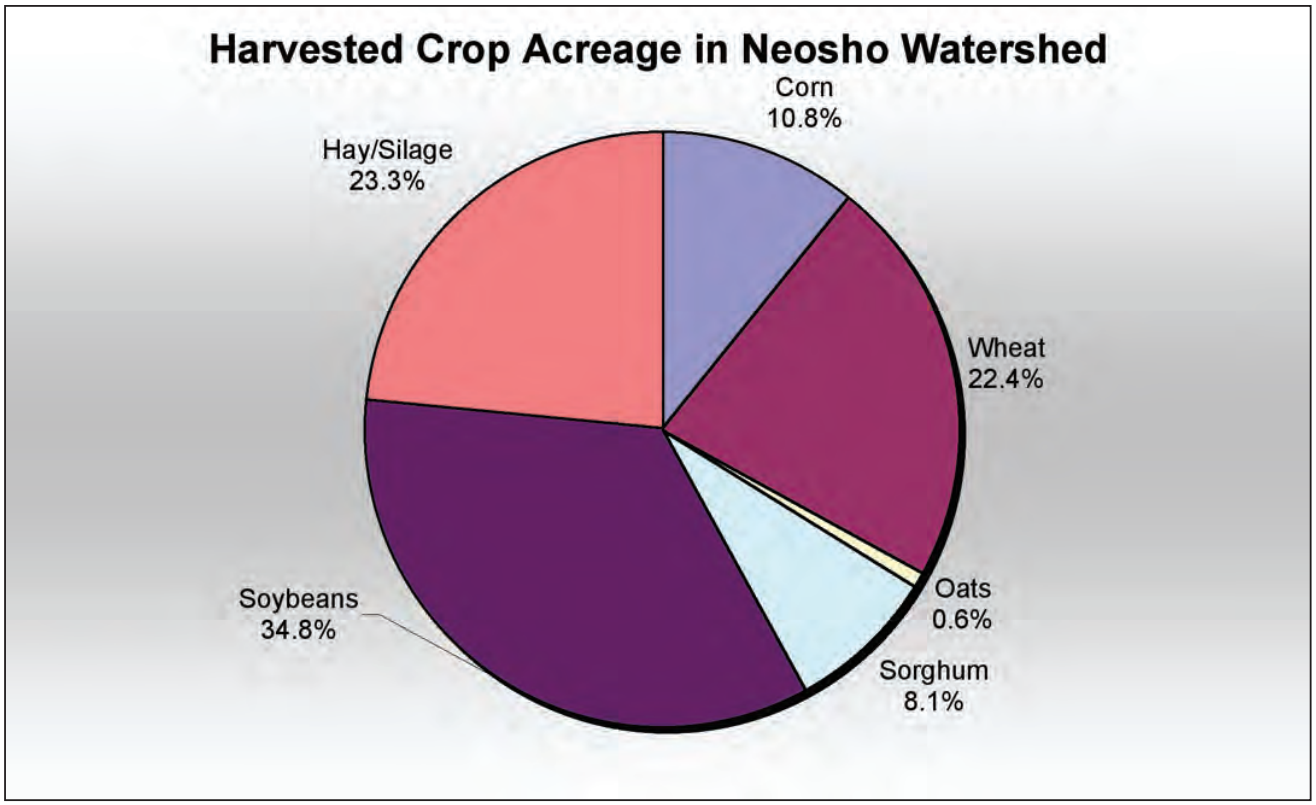


Figure 20. Harvested Crop Acreage in Upper and Middle Neosho Watershed, 2002.[18]

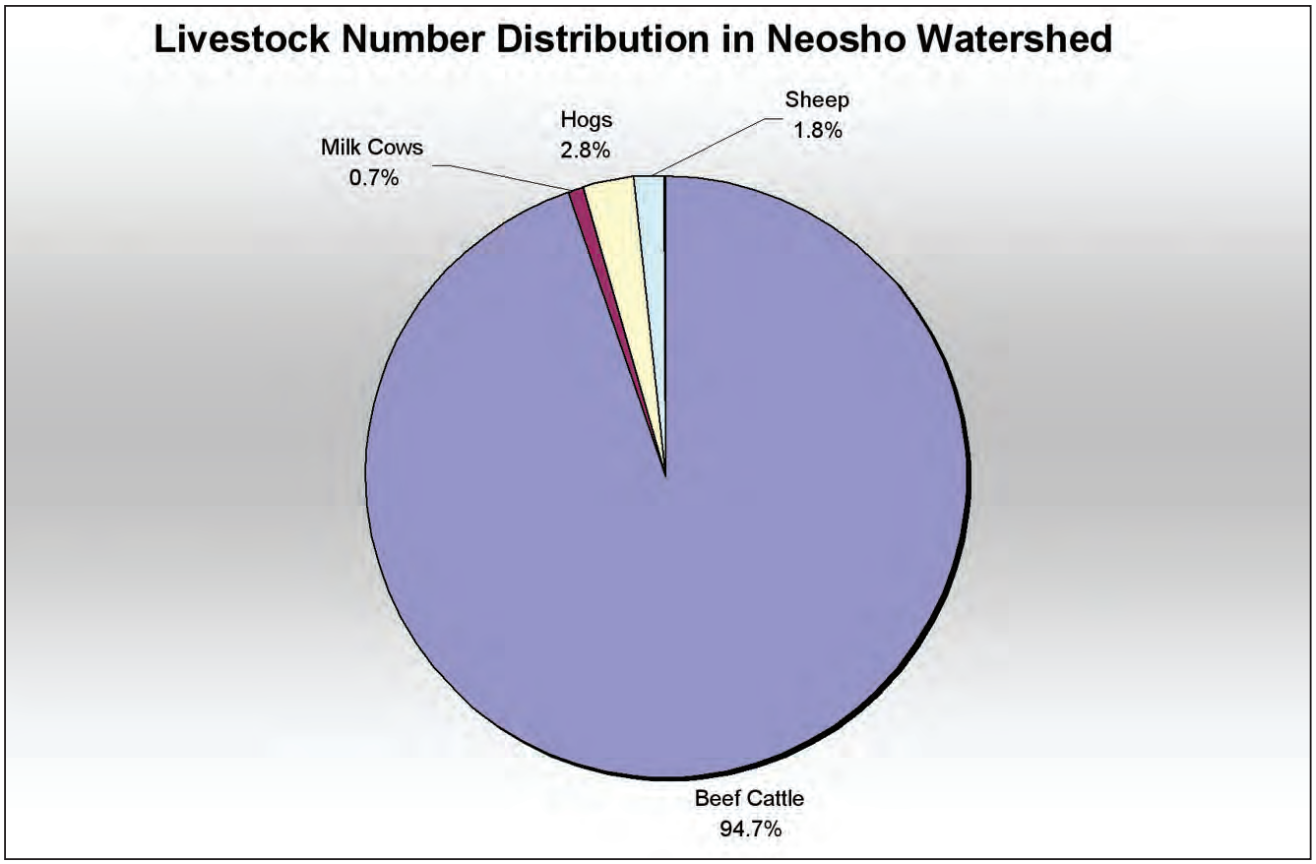


Figure 21. Livestock Number Distribution in Upper and Middle Neosho Watershed, 2002.[18]

8.0. Modeling

8.1 Subbasin Map[19]

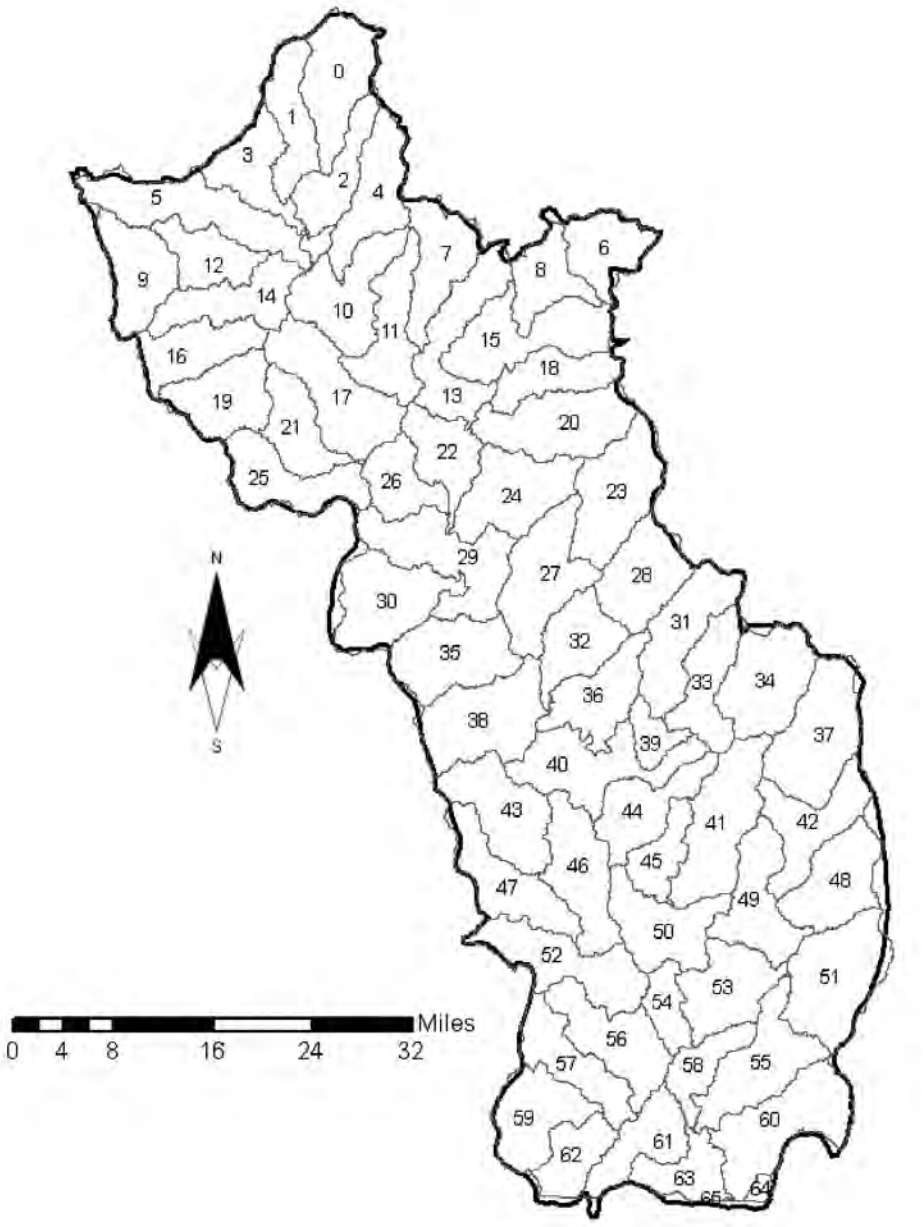


Figure 22. Subbasin Map – Upper and Middle Neosho Watersheds.

Table 20. Upper and Middle Neosho Watersheds Subbasin Area.

Subbasin	State	HUC ID	Area (acres)
0	KS	11070204010020	30940
1	KS	11070204010010	22037
2	KS	11070204010030	20085
3	KS	11070204010070	24476
4	KS	11070204020030	26877
5	KS	11070204010060	37956
6	KS	11070204030010	20844
7	KS	11070204020050	25523
8	KS	11070204030020	19306
9	KS	11070204010040	25995
10	KS	11070204020040	31670
11	KS	11070204020060	26882
12	KS	11070204010050	19284
13	KS	11070204030060	31047
14	KS	11070204020020	25278
15	KS	11070204030030	36045
16	KS	11070204020010	23182
17	KS	11070204040040	37930
18	KS	11070204030040	19987
19	KS	11070204040020	26326
20	KS	11070204030050	35221
21	KS	11070204040030	21227
22	KS	11070204040070	20841
23	KS	11070204050030	35280
24	KS	11070204040060	32359
25	KS	11070204040010	26764
26	KS	11070204040050	18256
27	KS	11070204050040	35255
28	KS	11070205010020	27978
29	KS	11070204050020	38409
30	KS	11070204050010	33028
31	KS	11070205010050	30802
32	KS	11070205010030	23367

Subbasin	State	HUC ID	Area (acres)
33	KS	11070205010070	23563
34	KS	11070205010060	33198
35	KS	11070204050050	33185
36	KS	11070205010040	25734
37	KS	11070205030010	37821
38	KS	11070205010010	37587
39	KS	11070205010080	9087
40	KS	11070205010090	35440
41	KS	11070205020030	38518
42	KS	11070205030020	27148
43	KS	11070205040010	31586
44	KS	11070205020010	24328
45	KS	11070205020020	14998
46	KS	11070205040030	30654
47	KS	11070205040020	27521
48	KS	11070205030030	28793
49	KS	11070205030040	28489
50	KS	11070205020040	29024
51	KS	11070205060020	38330
52	KS	11070205040040	32770
53	KS	11070205030050	27974
54	KS	11070205020050	11811
55	KS	11070205060030	32921
56	KS	11070205050010	30435
57	KS	11070205050040	24313
58	KS	11070205060010	15321
59	KS	11070205050030	26954
60	KS	11070205060040	38907
61	KS,OK	11070205050050	21497
62	KS,OK	11070205050020	17300
63	KS,OK	11070205060050	16982
64	KS,OK	11070206010020	2183
65	KS,OK	11070206010010	22
Total			**1764853**

8.2 Input Data

8.2.1 Upper Neosho

Figure 23. County Map – Upper Neosho Watershed.

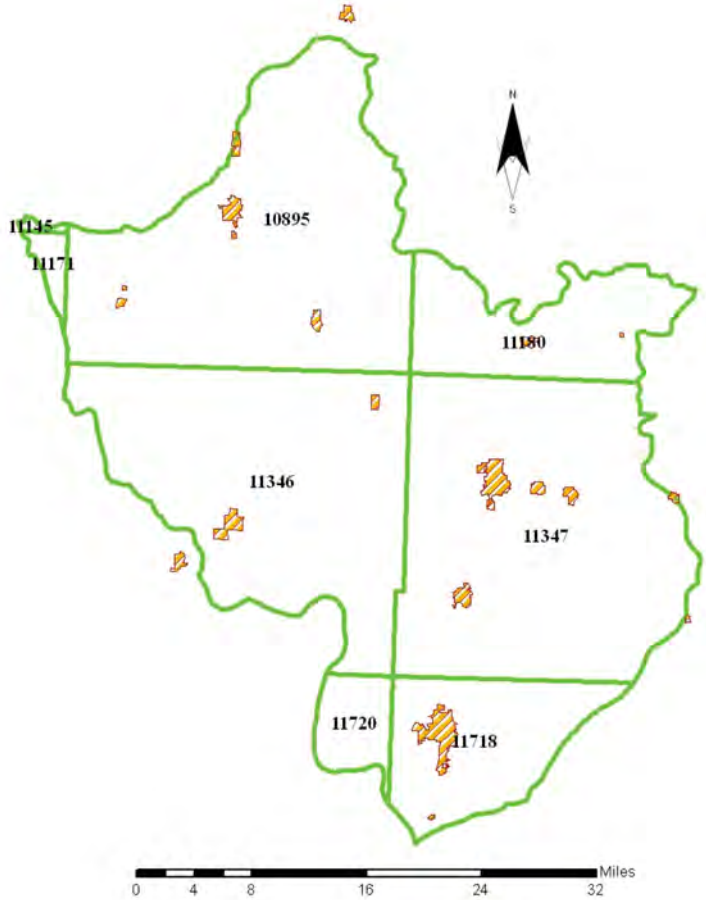


Figure 24. HUCO Map (overlay of county and 8-digit hydrologic unit boundary) – Upper Neosho Watershed.[23]

Table 21. Upper Neosho Watershed Summary[23]

Polygon ID	County Name	State	HUC	Area (acre)	% in County	% in HUC
10895	Coffey	KS	11070204	241222.66	57.39%	27.34%
11145	Lyon	KS	11070204	2603.96	0.47%	0.30%
11171	Greenwood	KS	11070204	6773.83	0.93%	0.77%
11180	Anderson	KS	11070204	78928.86	21.06%	8.95%
11346	Woodson	KS	11070204	207952.28	63.94%	23.57%
11347	Allen	KS	11070204	249916.48	77.26%	28.33%
11718	Neosho	KS	11070204	74655.41	20.08%	8.46%
11720	Wilson	KS	11070204	20154.94	5.54%	2.28%

Table 22. Upper Neosho - Landuse Area (acre)[20]

Polygon ID	Urban/ Transportation	Cropland	Pasture/ Rangeland	Forest	Feedlots	Water	Others
10895	4600	118000	72700	20100	3.93	7500	2000
11145	0	0	0	0	0.06	0	0
11171	200	2600	2600	2400	0.16	0	0
11180	1600	30400	40100	0	2.96	600	1900
11346	6500	114000	77000	7600	0.08	2700	5200
11347	14800	131400	72400	15300	8.99	4600	6900
11718	8000	37600	27200	9900	3.1	2800	3700
11720	600	15000	6800	0	0.67	100	500
Total	**36300**	**449000**	**298800**	**55300**	**19.95**	**18300**	**20200**

Table 23. Upper Neosho - Agricultural Animals[18]

Polygon ID	Beef Cattle	Dairy Cattle	Swine (Hog)	Sheep	Horse	Chicken	Tur-key	Duck
10895	5807	28	D	1045	363	62	0	1
11145	81	2	24	3	5	2	0	0
11171	243	4	15	3	8	4	D	0
11180	4076	167	777	150	167	151	D	2
11346	D	D	65	269	0	211	0	5
11347	13323	598	852	190	444	261	0	4
11718	4448	110	669	307	154	71	D	3
11720	953	15	308	D	0	34	D	0
Total	**28931**	**924**	**2710**	**1967**	**1141**	**796**	**D**	**15**

D = data withheld to avoid disclosing information for individual farms

Table 24. Upper Neosho - Septic System[21]

Polygon ID	No. of Septic Systems	Population per Septic System	Septic Failure Rate,%
10895	616	2.26	0.93
11145	9	2.42	0.93
11171	13	1.85	0.93
11180	330	2.22	0.93
11346	554	1.87	0.93
11347	1152	2.27	0.93
11718	432	2.2	0.93
11720	100	2.02	0.93
Total	**3206**	**2.18**	**0.93**

Table 25. Upper Neosho – Hydrological Soil Group[22]

Polygon ID	Hydrological Group
10895	C
11145	C
11171	C
11180	C
11346	B
11347	B
11718	C
11720	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. Upper Neosho – Modify the Universal Soil Loss Equation (USLE) parameters[23]

Polygon ID	Land Cover	R	K	LS	C	P
10895	Cropland	225.00	0.38	0.191	0.25	0.76
11145	Cropland	225.00	0.37	0.220	0.24	0.83
11171	Cropland	225.00	0.35	0.166	0.24	0.95
11180	Cropland	225.00	0.40	0.207	0.24	0.79
11346	Cropland	225.00	0.40	0.180	0.26	0.76
11347	Cropland	225.00	0.39	0.183	0.24	0.80
11718	Cropland	225.00	0.39	0.184	0.25	0.89
11720	Cropland	225.00	0.38	0.202	0.24	0.92
10895	Pastureland	225.00	0.38	0.268	0.01	1.00
11145	Pastureland	225.00	0.39	0.301	0.03	1.00
11171	Pastureland	225.00	0.36	0.341	0.02	1.00
11180	Pastureland	225.00	0.38	0.440	0.01	1.00
11346	Pastureland	225.00	0.37	0.237	0.01	1.00
11347	Pastureland	225.00	0.36	0.202	0.03	1.00
11718	Pastureland	250.00	0.36	0.352	0.03	1.00
11720	Pastureland	250.00	0.36	0.299	0.02	1.00
10895	Forest land	225.00	0.34	0.220	0.003	1.000
11145	Forest land	225.00	0.32	0.220	0.003	1.000
11171	Forest land	225.00	0.32	0.220	0.003	1.000
11180	Forest land	225.00	0.31	0.220	0.003	1.000
11346	Forest land	225.00	0.33	0.220	0.003	1.000
11347	Forest land	225.00	0.35	0.220	0.003	1.000
11718	Forest land	250.00	0.32	0.220	0.003	1.000
11720	Forest land	250.00	0.29	0.220	0.003	1.000

8.2.2 Middle Neosho

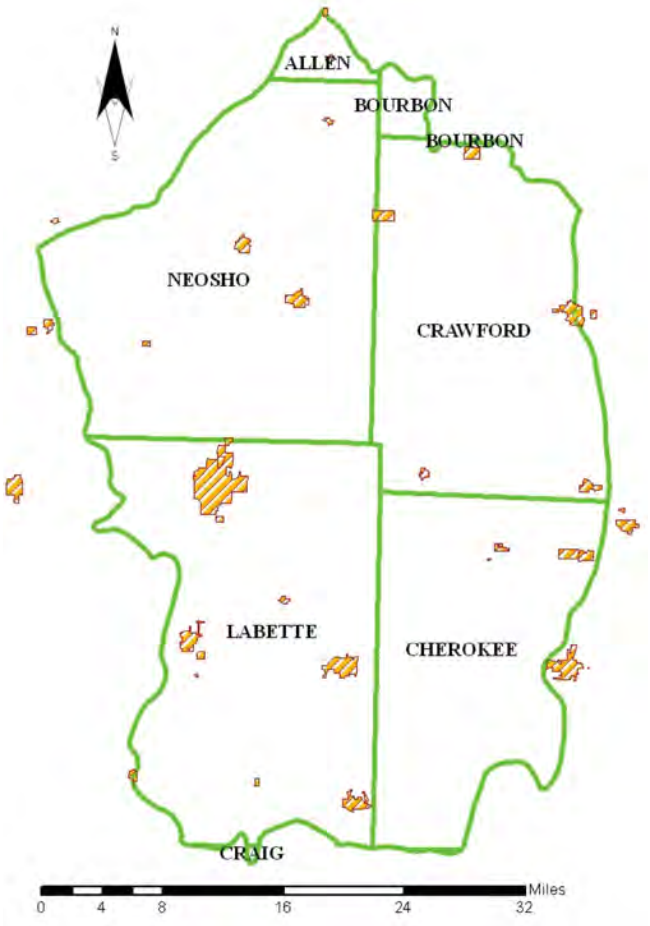


Figure 25. County Map – Middle Neosho Watershed.

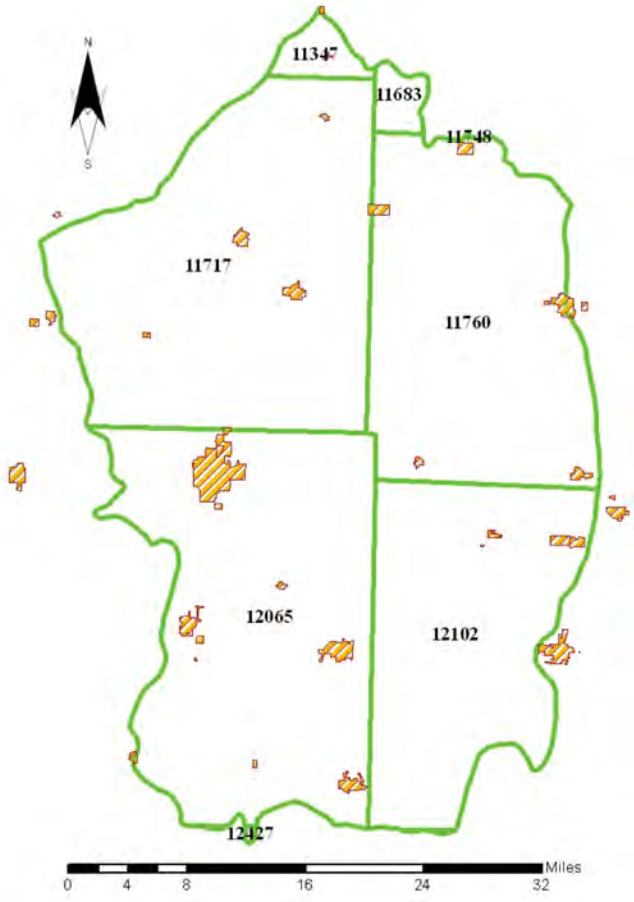


Figure 26. HUCO Map (overlay of county and 8-digit hydrologic unit boundary) – Middle Neosho Watershed[23]

Table 27. Middle Neosho Watershed Summary[23]

Polygon ID	County Name	State	HUC	Area (acre)	% in County	% in HUC
11638	Allen	KS	11070205	14559.51	4.50%	1.60%
11683	Bourbon	KS	11070205	10493.67	2.69%	1.16%
11717	Neosho	KS	11070205	260444.2	70.07%	28.70%
11748	Bourbon	KS	11070205	928.85	0.24%	0.10%
11760	Crawford	KS	11070205	203519	52.77%	22.42%
12065	Labette	KS	11070205	256808	60.83%	28.30%
12102	Cherokee	KS	11070205	160808.2	43.49%	17.72%
12427	Craig	OK	11070205	46.42	0.01%	0.01%

Table 28. Middle Neosho - Landuse Area (acre)[20]

Polygon ID	Urban/ Transportation	Cropland	Pasture/ Rangeland	Forest	Feedlots	Water	Others
11638	300	3300	11700	0	0.52	0	100
11683	0	0	0	0	0.44	0	0
11717	10300	86600	106400	19200	10.82	4900	13100
11748	0	0	0	0	0.04	0	0
11760	7300	128400	52500	3700	7.66	2700	5200
12065	15300	99200	80000	17300	10.91	4900	20800
12102	5400	111300	26700	19500	48.81	3700	11300
12427	0	0	0	0	0	0	0
Total	**38600**	**428800**	**277300**	**59700**	**79.2**	**16200**	**50500**

Table 29. Middle Neosho - Agricultural Animals[18]

Polygon ID	Beef Cattle	Dairy Cattle	Swine (Hog)	Sheep	Horse	Chicken	Turkey	Duck
11638	776	34	49	11	25	15	0	0
11683	687	8	D	8	31	20	1	0
11717	15518	385	2335	1073	538	248	D	12
11748	60	0	D	0	2	1	0	0
11760	11894	188	616	510	340	275	D	3
12065	17291	206	328	425	582	338	D	8
12102	6986	13	707	41	367	175	320548	6
12427	4	0	0	0	0	0	D	0
Total	**53216**	**834**	**4035**	**2068**	**1885**	**1072**	**320549**	**29**

D = data withheld to avoid disclosing information for individual farms

Table 30. Middle Neosho - Septic System[21]

Polygon ID	No. of Septic Systems	Population per Septic System	Septic Failure Rate,%
11638	67	2.27	0.93
11683	65	2.16	0.93
11717	1509	2.2	0.93
11748	5	2.16	0.93
11760	2043	2.15	0.93
12065	1505	2.23	0.93
12102	1449	2.27	0.93
12427	0	2.33	0
Total	**6643**	**2.21**	**0.93**

Table 31. Middle Neosho - Hydrological Soil Group[22]

Polygon ID	Hydrological Group
11638	B
11683	C
11717	C
11748	C
11760	C
12065	C
12102	C
12427	C

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

Table 32. Middle Neosho – Modify the Universal Soil Loss Equation (USLE) parameters[23]

Polygon ID	Land Cover	R	K	LS	C	P
11638	Crop land	225.00	0.39	0.183	0.24	0.80
11683	Crop land	225.00	0.38	0.206	0.28	0.90
11717	Crop land	250.00	0.39	0.184	0.25	0.89
11748	Crop land	225.00	0.38	0.206	0.28	0.90
11760	Crop land	250.00	0.43	0.207	0.25	0.82
12065	Crop land	250.00	0.39	0.188	0.25	0.92
12102	Crop land	250.00	0.43	0.179	0.26	0.92
12427	Crop land	260.00	0.42	0.149	0.29	1.00
11638	Pasture Land	225.00	0.36	0.202	0.03	1.00
11683	Pasture Land	225.00	0.35	0.306	0.03	1.00
11717	Pasture Land	250.00	0.36	0.352	0.03	1.00
11748	Pasture Land	225.00	0.35	0.306	0.03	1.00
11760	Pasture Land	250.00	0.39	0.265	0.03	1.00
12065	Pasture Land	250.00	0.37	0.272	0.03	1.00
12102	Pasture Land	250.00	0.37	0.397	0.03	1.00
12427	Pasture Land	260.00	0.38	0.193	0.01	1.00
11638	Forest	225.00	0.35	0.279	0.003	1.000
11683	Forest	225.00	0.30	0.279	0.003	1.000
11717	Forest	250.00	0.32	0.279	0.003	1.000
11748	Forest	225.00	0.30	0.279	0.003	1.000
11760	Forest	250.00	0.30	0.279	0.003	1.000
12065	Forest	250.00	0.33	0.279	0.003	1.000
12102	Forest	250.00	0.32	0.279	0.003	1.000
12427	Forest	260.00	0.31	0.279	0.003	1.000

8.3 Model Outputs

8.3.1 Upper Neosho

Table 33. Total Pollution Load – Upper Neosho Watershed [23]

Polygon ID	N Load (lb/year)	P Load (lb/year)	BOD Load (lb/year)	Sediment Load (t/year)
10895	1580571.4	200501.7	4234526.8	12995.3
11145	260.7	52.6	354.7	0.0
11171	47031.7	5801.1	132277.8	330.5
11180	637365.5	70343.7	1823197.4	4389.9
11346	1150394.4	146467.6	3117042.5	12818.2
11347	1310910.3	178263.2	3502245.9	16666.3
11718	618606.2	80512.3	1739497.1	7175.2
11720	177708.5	23951.3	460143.5	2196.3
Total	**5522848.6**	**705893.5**	**15009285.7**	**56571.6**

Table 34. Total Load by Land Uses - Upper Neosho Watershed[23]

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Urban	299333.35	46231.08	1166353.49	6866.96
Cropland	2554390.45	436512.14	5362281.79	45666.23
Pastureland	2563441.58	196175.75	8315388.23	3949.22
Forest	19038.92	9486.65	47454.64	89.17
Feedlots	85814.50	17162.90	114419.33	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	829.76	324.99	3388.21	0.00
Gully	0.00	0.00	0.00	0.00
Streambank	0.00	0.00	0.00	0.00
Groundwater	0.00	0.00	0.00	0.00
Total	**5522848.56**	**705893.50**	**15009285.70**	**56571.58**

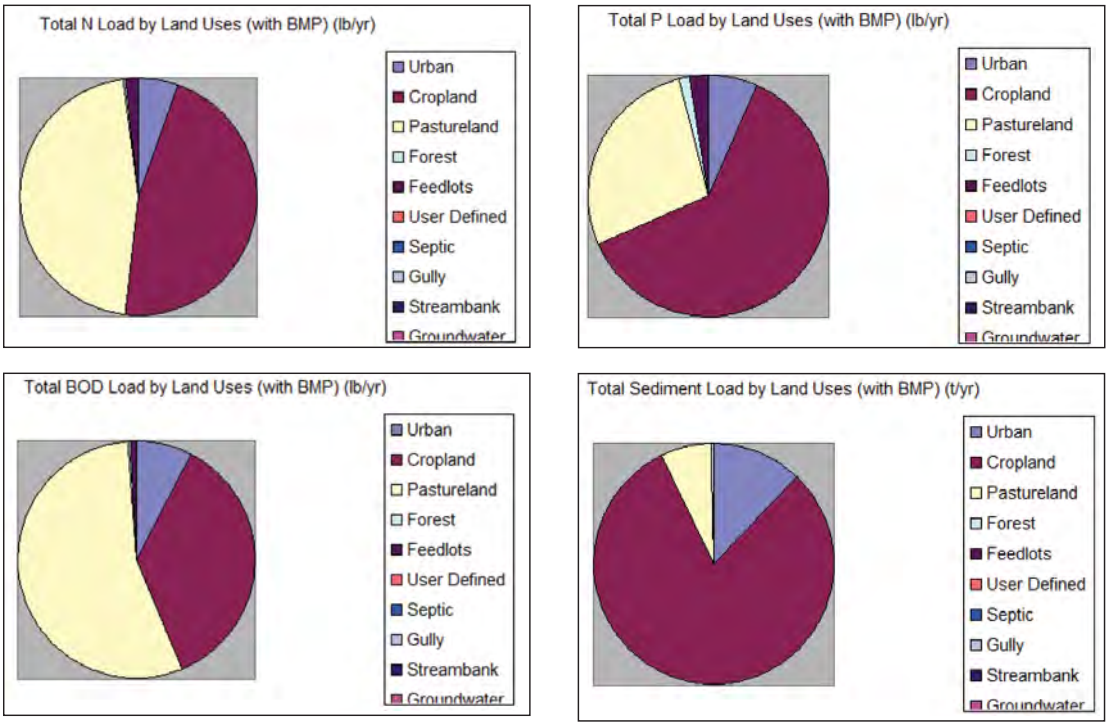


Figure 27. Total Load by Land Uses – Upper Neosho Watershed.

8.3.1 Middle Neosho

Table 35. Total Pollution Load – Middle Neosho Watershed [23]

Polygon ID	N Load (lb/year)	P Load (lb/year)	BOD Load (lb/year)	Sediment Load (t/year)
11638	109620.0	10585.6	332474.7	557.9
11683	2001.8	403.6	2715.0	0.0
11717	1966716.8	228802.6	5627095.8	16788.3
11748	181.7	36.6	245.9	0.0
11760	1626908.2	225527.8	4186250.7	21703.5
12065	1815785.6	229251.4	5067652.9	18867.5
12102	1391017.6	219882.0	3190786.4	18429.3
12427	0.0	0.0	0.0	0.0
Total	**6912231.7**	**914489.6**	**18407221.4**	**76346.6**

Table 36. Total Load by Land Uses - Middle Neosho Watershed[23]

Sources	N Load (lb/yr)	P Load (lb/yr)	BOD Load (lb/yr)	Sediment Load (t/yr)
Urban	389056.61	60209.46	1521375.70	8929.73
Cropland	3110354.69	534440.81	6528030.71	59625.67
Pastureland	3027625.64	234672.14	9809137.32	7661.50
Forest	26138.70	13021.64	65139.29	129.65
Feedlots	357311.70	71462.34	476415.60	0.00
User Defined	0.00	0.00	0.00	0.00
Septic	1744.35	683.20	7122.76	0.00
Gully	0.00	0.00	0.00	0.00
Streambank	0.00	0.00	0.00	0.00
Groundwater	0.00	0.00	0.00	0.00
Total	**6912231.70**	**914489.58**	**18407221.39**	**76346.56**

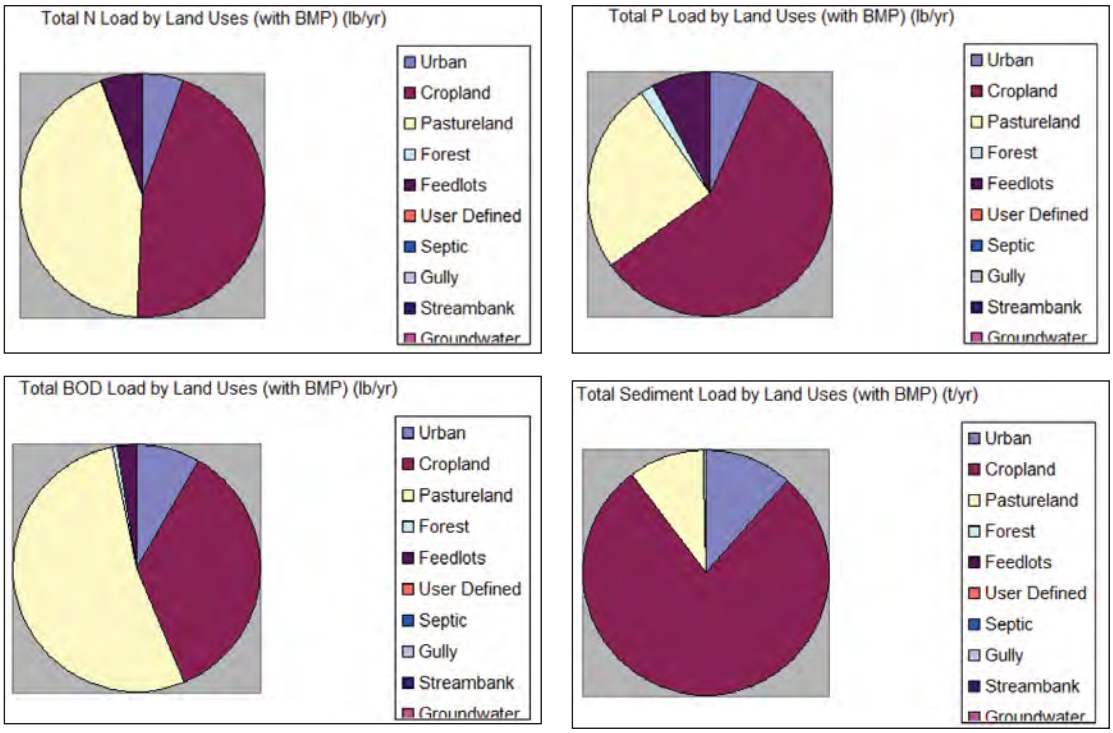


Figure 28. Total Load by Land Uses - Middle Neosho Watershed.

9.0 Acknowledgment:

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

Funding for this project was provided in part by Kansas Water Plan Funds, and EPA 319 funds through Kansas Department of Health and Environment, Watershed Management Section.

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. *Neosho Basin Total Maximum Daily Load*: "Twenty-six watershed and 16 lake TMDLs were developed. The high priority TMDLs were submitted to EPA on July 5, 2002. Twelve of the medium and low priority lake TMDLs were submitted on August 29, 2002. These submitted TMDLs have been approved by EPA. The medium and low priority stream TMDLs were submitted to EPA on November 7, 2002 and were approved on December 13, 2003. The John Redmond Lake TMDLs were approved on February 27, 2003. TMDLs done in 2004 were approved on January 5th and February 24th, 2005."
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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, 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/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/*

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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*

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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."
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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.

18. *Census Data*: Data was derived from the 2002 Census of Agriculture. The data presented here serves only as an estimate for agricultural activity in the Upper and Middle Neosho watershed. Since watersheds do not follow political boundaries, the estimates were made based on proportion assumptions of county and zip code census data. Online reference information available at:
http://www.nass.usda.gov/Census_of_Agriculture/index.asp

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. Online reference information available at: *http://www.kansasgis.org/catalog/catalog.cfm*

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Kansas State University Agricultural Experiment Station and Cooperative Extension Service

EP135 February 2009