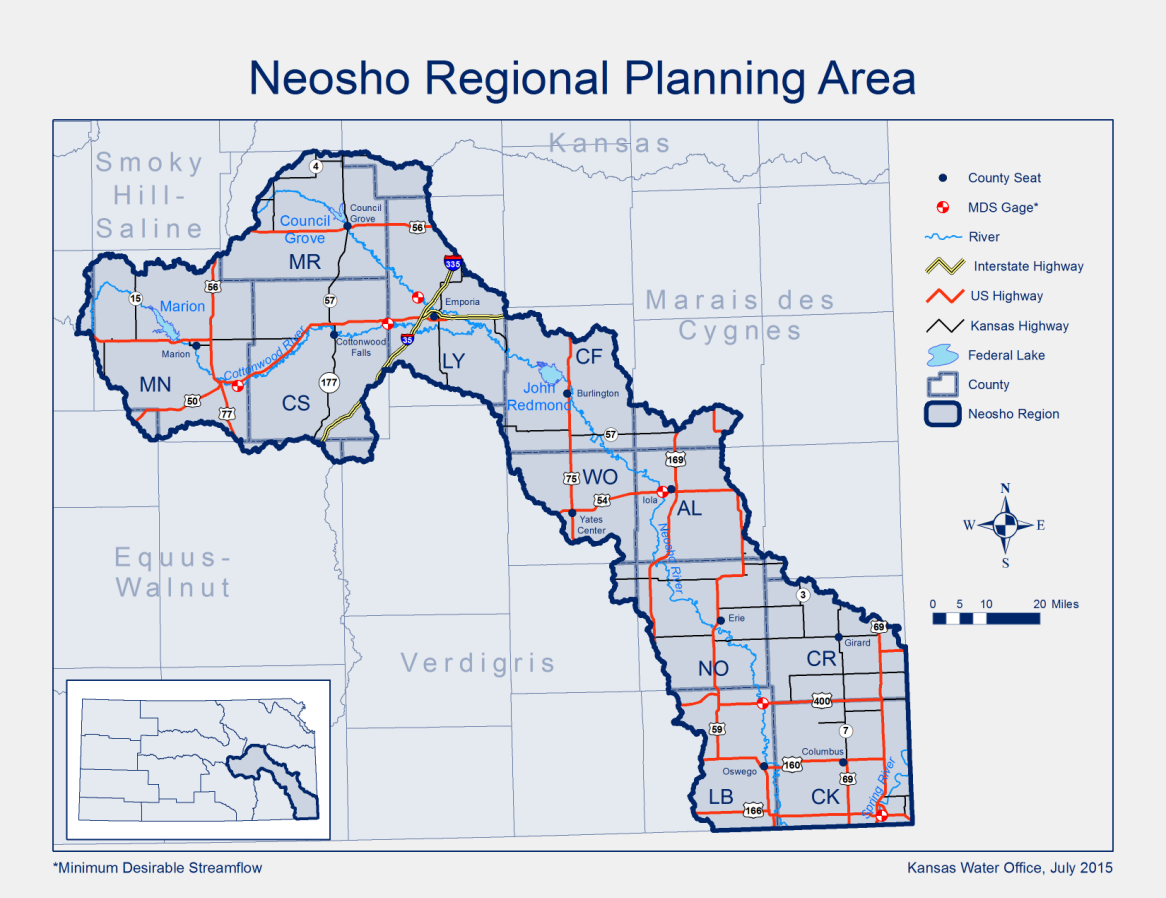


Regional Description

The Neosho region covers over 6,243 square miles and encompasses all or part of 18 counties in southeastern Kansas. The Neosho, Cottonwood, and Spring are the major rivers within the region. There are three major federal reservoirs in the region: John Redmond, Council Grove, and Marion Reservoirs. Each reservoir supplies the region's municipalities and industries with water through the Water Marketing Program or Water Assurance District.

Hydrology

The Neosho River begins in Morris County and flows southeast to join the Arkansas River near Muskogee, Oklahoma. The Cottonwood River originates in Marion County and joins the Neosho River in Lyon County east of Emporia. The Spring River, in the southeast part of the state, starts out in Missouri and drains about 500 square miles in Kansas. It enters Cherokee County in the east, flows across the southeastern corner of that county, and joins the Neosho River in Oklahoma a short distance below the Kansas state line.

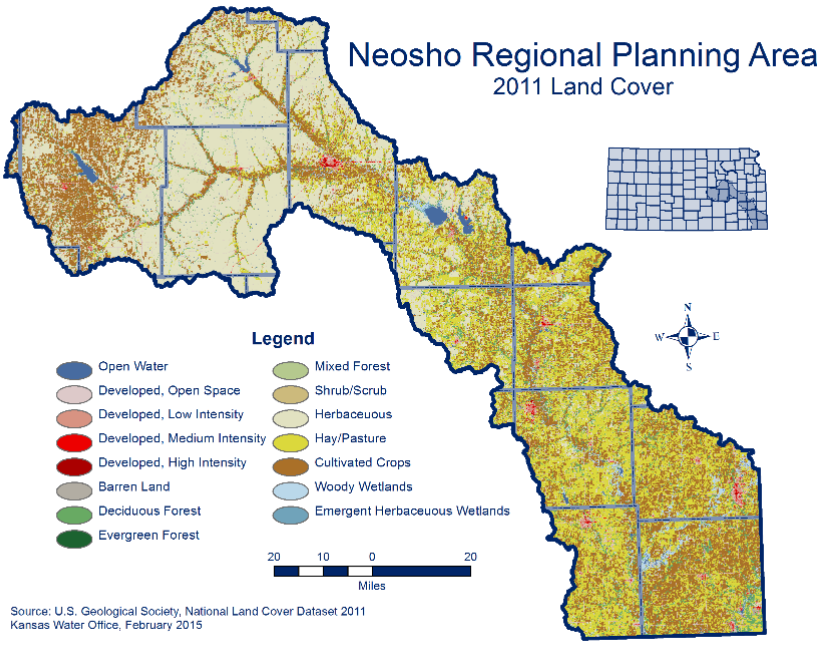
The larger tributaries of the Cottonwood River are South Cottonwood River, Mud Creek, Clear Creek, Doyle Creek, Cedar Creek, Middle Creek, Diamond Creek, and South Fork Cottonwood River. Tributaries to the Neosho with drainage areas greater than 70 square miles are Rock and Allen Creeks above Emporia, and Eagle Creek, Long Creek, Big Creek, Turkey Creek, Deer Creek, Elm Creek, Owl Creek, another Big Creek, Flat Rock Creek, Lightning Creek, Cherry Creek, and Labette Creek below Emporia. Elevations in

the region range from 1,320 feet in Marion County at the top of the region to 826 feet in Cherokee County at the bottom of the region in Kansas. Eighty percent of the streams in the region are intermittent and 20% are perennial for a total of 16,696 stream miles. Average stream density is 2.7 stream miles/square mile of land area, the second highest density of the 12 regions in the state.

Climate & Land Use

The climate of the region is characterized as humid in the southeastern half and sub-humid in the northwestern half. The annual precipitation in the region varies from approximately 30 inches in the western-most part of the region to almost 42 inches in the southeast. Approximately 70% of this precipitation falls between April and September. Ten to 18 inches of snow falls in an average winter.

The predominant features in the region are the grasslands of the Flint Hills in the northwestern part of the region; crop land in the Neosho River and other flood plains, in the Marion Reservoir watershed, and in the Cherokee County area; and urbanized areas. Plant communities in the study area include Oak-Hickory Forest, floodplain Forest, Cross Timbers, Cedar Glades, Bluestem Prairie, and Bluestem-Grama Prairie. Grassland (56%) and row crops (38%) are the most widespread land cover classes covering about 3.7 million acres of the region.



Of the 37,257 bank miles of riparian area in the Neosho region the dominant riparian cover is pasture/grassland (31%), within a 100 foot corridor along each bank in the region. The second most common cover is forest land (25%), and third most common cover is a mixture of pasture and trees (20%). The remaining riparian cover types, in descending order of dominance, are cropland, crop land/tree mix, shrubland, urban, urban/tree mix, and barren land.

Population & Economy

There were an estimated 168,300 residents in the region in 2010. In 2020 there were an estimated XXXXX residents in the region, a decrease of about four percent. No counties in the region are expected to gain population through 2040, but the more rural counties are projected to lose proportionally more population than the counties having regional urban centers.

Local economies are based primarily on agriculture, general manufacturing, and retail trades. The major crops grown in the region include wheat, grain sorghum and soybeans. The production of beef cattle remains an important part of the area's agricultural economy.

Natural resources of economic importance are oil, gas, cement, ceramic materials, coal, lead, zinc, stone, and sand and gravel. The Neosho region has a greater variety of minerals than any other area in Kansas. The production of oil and gas is a relatively small but important component of the economy. A significant amount of coal, lead and zinc mining occurred historically in the southeastern portion of the region. Strip mining of coal is the only one of these mining activities which continues today. Lead and zinc mining peaked in 1926 and by 1958, mining of these minerals had all but ceased.

There are additional components of the local economy throughout the region. These components include the Wolf Creek Nuclear Generating Plant (WCNGP) located near Burlington, KS, which is the only nuclear powered generating plant in Kansas. Emporia State, Pittsburg State, Tabor College, and numerous community colleges including Ft. Scott, Labette County and Neosho County Community Colleges provide opportunities for higher education and employment. There is also a wide variety of water based recreation that includes boating, fishing, hunting, wildlife watching, etc. These recreational opportunities are included at all three federal reservoirs, state fishing lakes in each county, community lakes, and the numerous private hunting establishments utilizing wetland resources, as well as the USFWS and KDWPT refuges in the region.

Water Supply and Quality

There are three federal reservoirs in the region: Marion, Council Grove, and John Redmond. Coffey County State Fishing Lake provides cooling water for WCNGP and depends on John Redmond Reservoir for supplemental water during dry conditions. All counties in the Neosho Region have state fishing lakes. Council Grove City Lake serves as a water supply for the city of Council Grove. Other localized resources are utilized to provide water supply sources for others in the region. The Ozark Plateau aquifer system and Spring River are water resources shared by Arkansas, Kansas, Missouri, and Oklahoma. Demand for water in the region is growing and concerns about water level declines and potential water quality degradation have prompted long-term management actions and cooperation among the states.

Water quality and related water resource issues are addressed through a combination of watershed restoration and protection efforts utilizing voluntary, incentive-based approaches, as well as regulatory programs. Watershed Restoration and Protection efforts are needed to address a variety of water quality and water resource concerns such as achieving Total Maximum Daily Loads (TMDL), Nutrient Reduction

goals, development of Source Water Protection Plans, reduction of sedimentation in reservoirs and lakes, and protection or restoration of wetland and riparian habitats.

With a large part of the watershed draining into Oklahoma, specifically Grand Lake O' the Cherokees (Grand Lake), interstate cooperation with Grand River Dam Authority (GRDA) has been critical. GRDA has supported Kansas' Watershed Restoration and Protection Strategy (WRAPS) efforts in the Neosho and has also partnered with Grand Lake Watershed Alliance Foundation (GLWAF) to protect water quality.

Spring River and its tributaries in the far southeastern part of the region, including Shoal Creek, Short Creek, Shawnee Creek, Turkey Creek and Center Creek in Cherokee County, are a valuable biological resource in the region, providing habitat for many unique and some Threatened and Endangered species. Of particular concern are mussel populations that have been in decline since the start of heavy metal mining. Due to historic mining activities in the area, these waters are contaminated by lead, zinc, copper and cadmium. TMDLs for these contaminants have been developed for these streams.

All three federal reservoirs, and many streams and tributaries that connect them, are experiencing water quality impairments. Water quality and related water resource issues are addressed through a combination of watershed restoration and protection efforts utilizing voluntary, incentive-based approaches, as well as regulatory programs.

Reservoir sedimentation is a major water quantity and quality concern, particularly in reservoirs where the state owns storage for the Water Marketing Program, or where a Water Assurance District owns storage. As sediment accumulates in a reservoir's multi-purpose pool, the capacity for water supply storage is reduced.

Loss of capacity in John Redmond Reservoir is the most pressing issue among the three federal reservoirs. Inventories and assessments have determined the sources of sediment and actions have been identified as the most likely to result in improvement in long term reservoir storage capacity. Implementation of these actions is underway.

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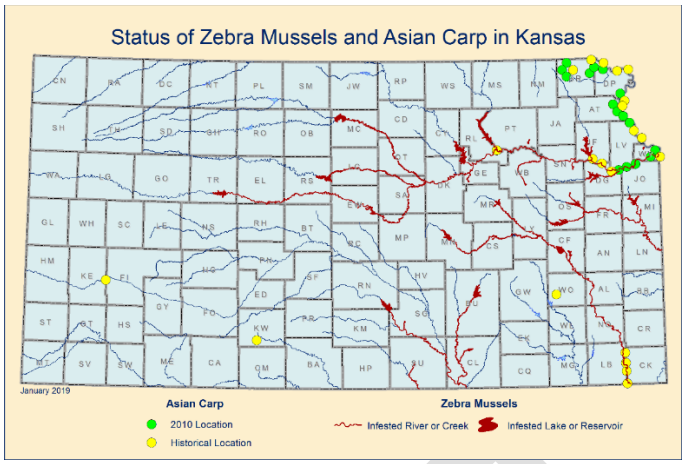
Zebra mussels, one of the Aquatic Nuisance Species (ANS) affecting Kansas waters, can cause various problems for water users. Zebra mussels are found in all the federal reservoirs within the Neosho Region, and smaller county and Public Water Supply (PWS) lakes are also infested. Unfortunately, ANS affect the quality of water and recreational opportunities within the state. The Kansas Department of Wildlife, Parks, and Tourism (KDWPT) has worked diligently on their ANS education and management plan in order to mitigate the ANS problem and work to slow the spread of them.



Addressing Regional

To address many of the Neosho Region's water related issues, there are agencies and programs that are in place to work on solving these issues. However, for issues that have not been fully addressed, the Neosho Regional Advisory Committee (RAC) has created Goals and Actions Plans to improve water quality and quantity in the region to secure and protect the Neosho's water resources.

While the Vision provided a framework for the management of the state's water supply overall, these regional goals were set to identify and address issues at the local level. The progress of the goals are evaluated each year in the State of the Resource.

A main problem, as noted before, is that the Neosho Region must contend with, along with many other regions, the sediment and nutrients coming from upstream in the watershed and filling up the water supply reservoirs and compromising water quality. Since sedimentation and securing reliable water supplies are concerns in the region, the Neosho RAC created goals that would reduce sedimentation, conserve soil, protect water supply, and improve water quality.

To accomplish these goals the following action items, projects, and initiatives have been undertaken. With a collaboration between the RAC, local producers, local WRAPS groups, local conservation districts, the Kansas Water Office (KWO), the Kansas Department of Health and Environment (KDHE), and the Kansas Department of Agriculture-Department of Conservation (KDA-DOC) funding can be secured and work to reduce sediment and nutrient runoff can be accomplished. These entities will also work towards an educational component to be implemented along with the reduction practices.

Reduce sediment by implementing watershed best management practices

Implementation of watershed best management practices (BMPs) reduces sediment and nutrient runoff to help protect water supply storage and improve water quality in the reservoirs that provide water to municipal and industrial customers. BMPs can be an individual practice or a combination of practices that are determined to be the most efficient means of controlling point and non-point sources of pollution at levels compatible with resource and economic goals.

Water storage is being diminished over time due to reservoir sedimentation and water quality is being impacted by nutrient runoff, potentially resulting in harmful algae blooms, taste and odor issues with drinking water, and impacts to recreation in the Neosho Region.

Using program such as the Kansas Reservoir Protection Initiative (KRPI) Program the KWO, the KDHE, and the KDA-DOC can partner with the RACs, the WRAPS program, and Conservation Districts to provide financial assistance to producers within targeted watersheds to implement conservation practices which reduce sediment runoff. Projects implemented with this funding will be designed to meet Natural Resources Conservation Service (NRCS) specifications and/or guidelines.
In FY2019 $900,000 was allocated and $700,000 in FY2020 targeting four reservoir watersheds, including The total needs for implementation to cover all targeted areas is $500,000,000 as noted within WRAPS Watershed Plans. The consequences of not funding this program are continued nutrient and sediment runoff and soil erosion at current or worse rates, resulting is accumulation of sediment in water supply reservoirs, and additional nutrient loading leading to harmful algal blooms, such as seen in Marion Reservoir.

Reduce sediment by stabilizing streambanks:

Streambank stabilization in its entirety as a project is overseen by the Streambank Stabilization Team consisting of the KWO, the KDHE, and the KDA-DOC. This Team manages the streambank stabilization efforts that are concentrated in the priority Kansas watersheds above Federal reservoirs, including the Neosho-Cottonwood Rivers above John Redmond Reservoir. Sites for implementation have been prioritized based on the highest estimated sediment yield and proximity to the downstream reservoir. Landowner agreements for construction and maintenance of the project, as well as the installation and maintenance of a riparian buffer are obtained as part of the project, as are contracts with the Kansas Forest Service to oversee the enrollment, planting and maintenance of adjacent crop field or pasture acres into a riparian forest buffer program is a requirement of a completed project.
In 2018, construction contracts for the stabilization of 13 streambank sites were awarded and designs for 12 new sites were initiated. The construction of approximately 13 streambank sites is anticipated to be completed in 2019.

While many sites have been completed or are currently being completed there are still many sites to address. Based on current assessment information, the following table indicates the total estimated streambank implementation needs within the Neosho Region.

Priority Watershed	Sites Previously Addressed	Total Sites Remaining to be Addressed		Total Estimated Need*
		Number	Est. Bank Length (linear feet)*	
John Redmond Reservoir Watershed	41	312	155,741	$15,574,100

*The estimated bank length is based on the assessment information. Actual project lengths and costs may vary from those included in the above table based on design plans and final site construction.

If these sites are not addressed, reservoir sedimentation at or above current rates will continue and there will be valuable water storage capacity lost in the federal reservoirs including John Redmond Reservoir. Therefore, stabilizing these streambank sites is critical, however there may be roadblocks in accomplishing this. One such issue, beyond lack of funding, is that of being able to hire enough contractors, engineers, etc. to design and construct these sites. Due to the fact that streambank stabilization design and construction can be a very specialized project, there may be issues in the future finding an adequate number of companies to take on these projects.

Measuring success:

To measure the success of sedimentation reduction practices, the RAC has directed the KWO to review the sedimentation rate of these three reservoirs in the Neosho Region. This will be done by conducting bathymetric surveys every 5 years to monitor the change in reservoir capacity due to sedimentation.

Additional measurement of success would include having at least 10 sites per year in some phase of the stabilization process. This would ensure that satisfactory progress was being made to reduce enough sediment to positively affect the available storage in the reservoirs.

Streambank Restoration (Photo Credit: The Watershed Institute)

Reducing vulnerability by securing water supply storage:

The three federal reservoirs in the region contain valuable water supply for municipal and industrial users in the upper part of the region. Reducing vulnerability to drought in the Neosho Region will work to ensure water supply is secured during times of significant drought. To reduce vulnerability, the KWO will continually work with the U.S. Army Corps of Engineers (USACE) on refining reservoir operations and developing Drought Contingency Plans. In doing this, response to drought will be done quickly and efficiently. Beyond coordinating with the USACE on reservoir operations and Drought Contingency Plans, the KWO will evaluate costs associated with conservation pool rises and the benefits of increased supply. If warranted, a reallocation study may be an option to pursue to increase water supply for times of drought.

Ensuring reliable and adequate supply for water users below John Redmond Reservoir is also an integral part of reducing vulnerability. In addition to the actions above, the KWO will begin to utilize Forecast Informed Reservoir Operations (FIRO) forecasting to control storage to increase water supply and reduce flooding by looking at climate variability and creating long-term forecasting. By managing storage this way releases can be altered to improve reliability of water supply for downstream users and reduce damage due to flooding.

Measuring Success:

Success can be measured by ensuring that water supply available from storage is managed and exceeds projected demand by at least 10% through the year 2050. This exceedance will allow the water users in the Neosho Region to have a reliable water supply even during times similar to the historical droughts of record.

Harmful Algal Blooms:

Harmful Algal Blooms (HABs) are common in bodies of water when nutrient loading is excessive and during periods of elevated temperatures. The lakes in Marion County historically experience HABs on a regular basis. Marion Reservoir has experienced HABs nearly every year since 2011, with Marion County State Fishing Lake experiencing HABs nearly every year since 2016.

Health effects of HABs are well documented from flu like symptoms in humans, to the death of pets. Water supplies are often shut down during the blooms and beaches are closed; contact by both humans and animals is discouraged. These blooms cause water quality issues, threats to public health, increased costs for water supply treatment, and economic loss in the region.

The KDHE may issue three different levels of public health protection notifications: a Public Health Watch, a Public Health Warning, or a Public Health Hazard. These notification levels are determined by the concentration of a harmful toxin(s) or the concentration of cyanobacteria cell counts.

The reduction of bloom frequencies is critical for water bodies, such a Marion Reservoir, to reduce the impact of economic loss for the local area and PWS, and to protect both human and animal health. In order to reduce bloom frequencies, the Neosho RAC and the KWO are working with KDHE to investigate

and demonstrate in-lake treatment options to reduce the frequency and duration of HABs and assess the effectiveness of in-lake treatment options at minimizing the impact of HABs.

HAB Reduction Strategies:

- Investigate and demonstrate in-lake treatment options to reduce the frequency and duration of HABs using the following possible methods:
- Algaecide treatment demonstrations in public lakes
- Collaborate with the RAC, the KWO, the KDHE, interested municipalities within the Neosho Region, and the Grand River Dam Authority to investigate nutrient crediting options for the entire Neosho Region Implement BMPs above Marion Reservoir
- Implementation of additional strategies such as:
    - Rough fish removal
    - Sonar
    - Superoxide
    - Phosphorus harvesting
    - Phosphorus binding
    - Targeted lake treatments

If HAB frequency and duration are not reduced, beaches and lakes will be closed, local revenue will be lost, extra costs for PWS will be incurred, and both human and animal heath could be adversely affected, even leading to possible hospitalizations and death.

Measuring Success:

Success in program initiatives to reduce HABs can measured by the number of in-lake treatment options that are implemented and assessed. Even if the actual initiative implemented is not 100% successful, allowing for the assessment of it is critical. Another measure of success is reducing the number of HABs per year and shortening the number of days HABs occur. Comparing HAB frequency and duration from historical data, to that of the HAB data after sediment and nutrient reduction practices and in-lake treatment options have been implemented, will allow for this measurement.