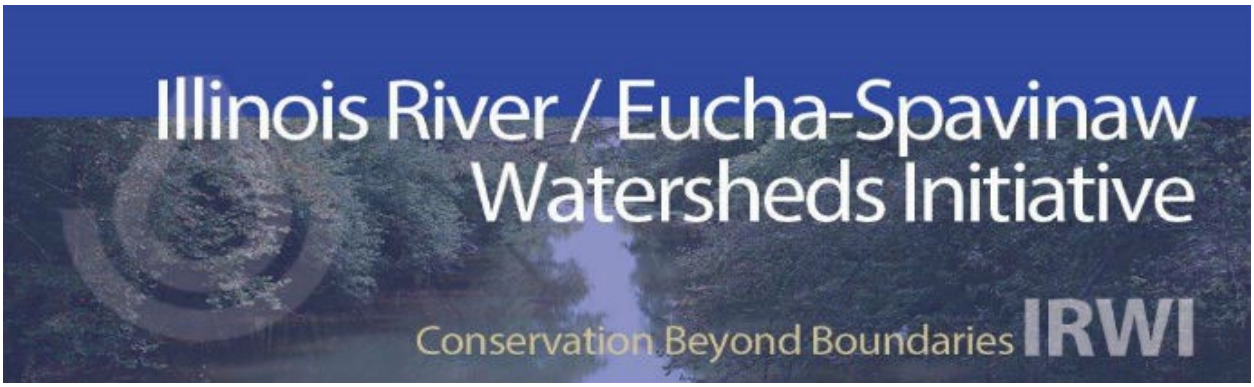
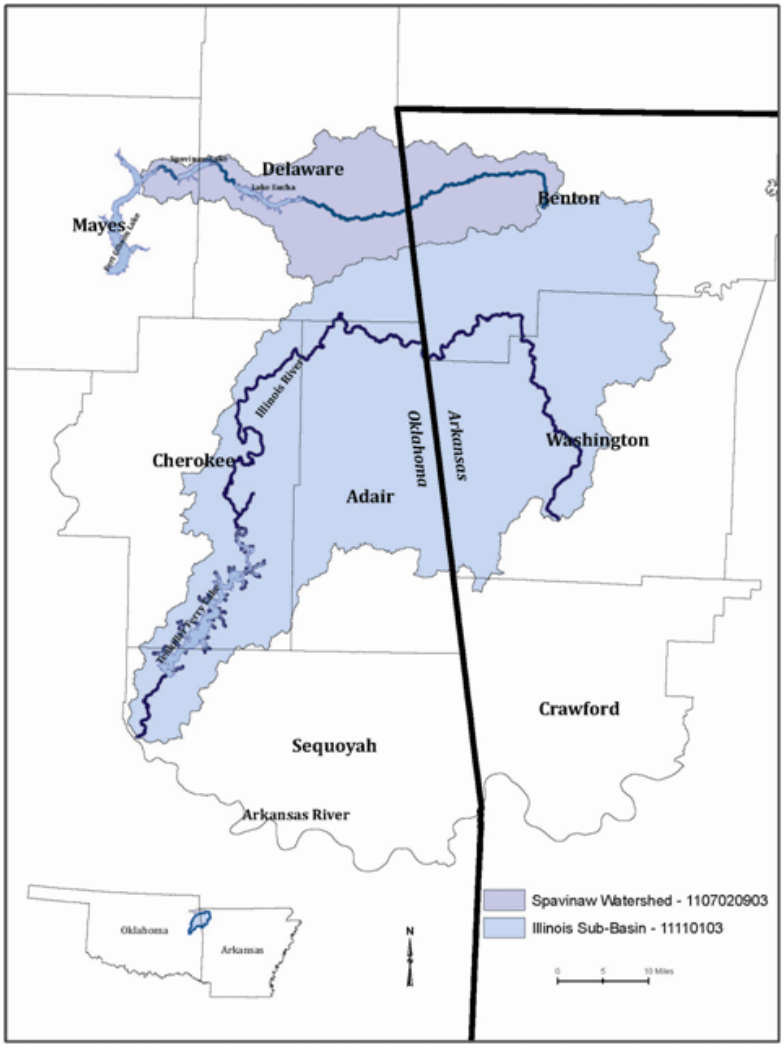


CLOSE-OUT REPORT

Executive Summary

- The Illinois River Sub-Basin and Eucha-Spavinaw Lake Watershed in northwestern Arkansas and northeastern Oklahoma (which includes Lake Tenkiller, Lake Eucha and Lake Spavinaw in Oklahoma) provides drinking water for the urban center of Tulsa, Okla., as well as many smaller nearby municipalities.
- Water quality issues, including elevated concentrations of nitrogen and phosphorous, sediment and bacteria, have been identified in the watershed. Potential non-point sources of these pollutants are runoff from land surfaces after application of animal manure/litter as fertilizer on pastures, soil erosion, re-suspension of streambed sediments, and nutrients from poultry production, as well as other livestock farming operations within the area.



- Based on 2010 information from the Arkansas Natural Resources Commission (ANRC) and the Oklahoma Department of Agriculture, Food, and Forestry, there is a high density of livestock and poultry producers in the watersheds. Therefore, emphasis was placed on conservation practices to address livestock operations. Key conservation practices include waste storage facilities, animal mortality facilities, amendments for the treatment of agricultural waste, prescribed grazing, and forage and biomass planting.
- From 2011 through 2018, NRCS invested over $20 million in Environmental Quality Incentive Program funding through the Illinois River/Eucha-Spavinaw Watersheds Initiative (IRWI) that assisted local farmers and ranchers to implement conservation systems that included key water quality conservation practices to address sediment, nutrients and pathogens in surface waters.

Positive outcomes have resulted from the combined conservation efforts ongoing in the IRWI watershed to address agricultural sources of pollutants, as well as point source treatments:

- Due in part through the voluntary conservation efforts of landowners in the watersheds, several surface water segments were removed from the states' lists of impaired waters:
    - A 2.5 mile reach of the Illinois River in Arkansas was delisted for turbidity in 2014,
    - In 2016, Oklahoma recommended delisting an additional 2 segments on the Illinois River and 3 tributary segments (Flint Creek, Baron Fork, Sager Creek) within the watershed for pathogens (Escherichia coli and/or Enterococcus).
- Paired watershed studies conducted by the Oklahoma Conservation Commission to determine conservation effects have shown reductions in total phosphorus, nitrates and pathogens in tributary streams in watersheds where conservation practices have been implemented. Greatest reductions were noted for nitrates, soluble phosphorus and e coli.
- Based on trend analysis done for the Arkansas River Compact Commission in 2016, monitoring results showed a **highly significant downward trend** in total phosphorus in the Illinois River since 1999.

Introduction

The Illinois River Sub-Basin and Eucha-Spavinaw Lakes watershed in Arkansas and Oklahoma include 1.32 million acres of agricultural land, supply drinking water to more than one million people and provide fishing, recreation and tourism opportunities.

The U.S. Geological Survey has identified significant water quality problems in these watersheds, including high concentrations of nitrogen, phosphorus, sediments and bacteria. Water quality enhancement is crucial to ensuring an adequate supply of clean water for the urban center of Tulsa, Okla., as well as the many smaller municipalities and individuals who rely on these water resources for their water supply. Improving water quality will also benefit recreational activities within the Illinois River, a state-designated scenic river.

During the past decade, ongoing lawsuits between Oklahoma and Arkansas have focused attention on water quality impairment by upstream wastewater treatment facility discharges and the application of poultry litter as a fertilizer. The main concerns center on phosphorus (P) levels in streams in Northwest Arkansas that flow into Eastern Oklahoma. The lawsuit settlement in the Eucha-Spavinaw Watershed, adjacent to the Illinois River Watershed, requires users of poultry litter to have a nutrient management plan that determines appropriate rates of application based on the potential for P loss in runoff. The application of poultry litter to pastures is now regulated by the States of Arkansas and Oklahoma and requires that litter be applied by a state-certified applicator and according to a P-based nutrient management plan. There are also programs that promote transport of litter outside of watershed boundaries.

<u>NRCS and the Illinois River Sub-Basin and Eucha-Spavinaw Watershed Initiative</u>
In 2011, NRCS launched the Illinois River/Eucha-Spavinaw Watersheds Initiative (IRWI), to reduce nutrient, sediment and pathogen impacts from agricultural land in Arkansas (576,517 acres) and Oklahoma (739,156 acres). The project is located in portions of Benton and Washington counties in Arkansas and parts of Adair, Cherokee, Delaware, Mayes and Sequoyah counties in Oklahoma. Primary land uses in the watersheds are forest, pasture, and hay, with significant poultry production, as well as beef cattle, dairy and hog production.

Many landowners have successfully completed land treatment and structural practices in the IRWI region using Environmental Quality Incentives Program (EQIP) assistance. NRCS offers conservation planning and recommends conservation practices combined in a systems approach to avoid, trap, and control excess nutrients and sediment before they reach the local streams. Core practices for the initiative include nutrient management, waste utilization and manure storage and transfer along with prescribed grazing and associated fencing. High priority is given to participants implementing a suite of complimentary conservation practices to address agriculture--related excess phosphorous and nitrogen runoff.

Through the Environmental Quality Incentives Program, NRCS has provided technical and financial assistance to agricultural producers to implement practices that avoid, control, and trap nutrients, pathogens and sediments to keep them out of surface waters. These practices include prescribed grazing, animal manure storage and treatment, access control, forage and biomass planting, and watering facilities, which enable landowners to improve water quality in the area and increase farm profitability.

2011-2018 Financial Assistance (EQIP FA) – Active and Completed Contracts (Source: READ Oct 2018)			
EQIP FA (Active and Completed Contracts	**# Contracts**	**Total Treated Acres**	**NRCS Investment**
Arkansas	586	45,388	$18,291,011
Oklahoma	122	39,885	$4,772,550
TOTAL	708	85,273	$23,063,561

Voluntary Conservation in Action

The initiative brings together conservation partners to accelerate conservation treatment and expand their capacity to improve water quality and maintain productivity throughout the basin and watershed. Among the benefits to the region, better water quality will improve fishing, recreation and tourism on the Illinois the river and save taxpayer dollars by decreasing public water treatment costs.

The initiative has also been very successful in assisting a diverse group of producers. From FY 2011-2018, 14% of active/completed contracts in the basin were with American Indian natives and 16% were with producers of Asian descent. Arkansas Association of Conservation Districts hired a bi-lingual translator and conservation district technician to work with the Hmong/Laotian land users in the Illinois River Sub--Basin and Eucha--Spavinaw Lake Watershed. The translator worked throughout the IRWI region to provide bilingual assistance with NRCS conservation practices and programs.

In addition, 20% of landowners were Beginning Farmers, 7% were Limited Resource landowners, 36% were considered Socially Disadvantaged; 1% were Veterans.

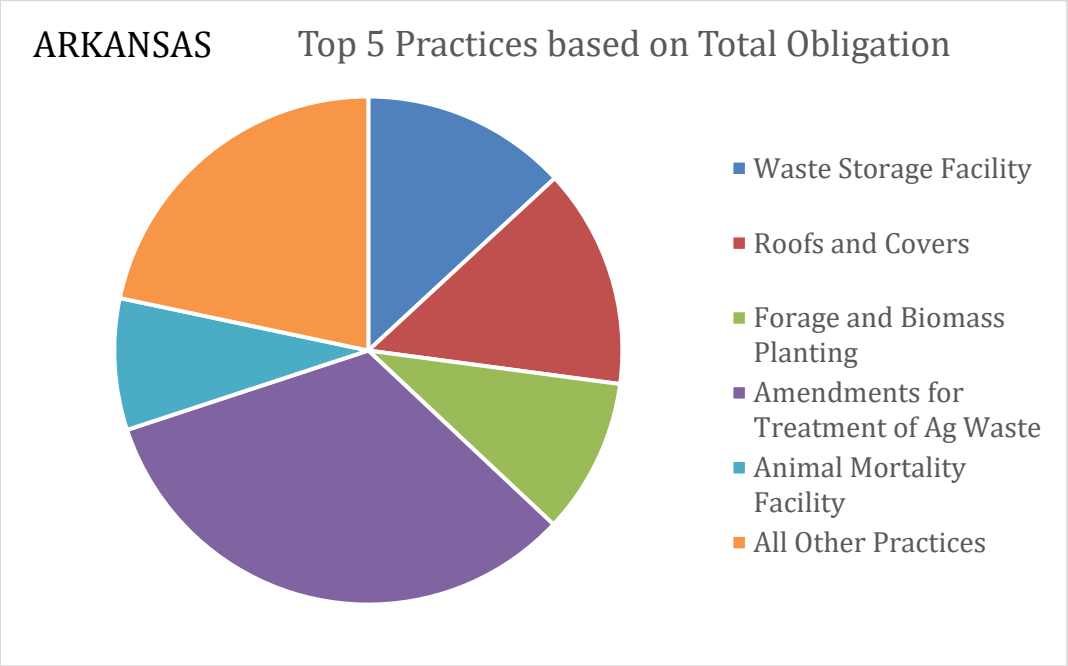
Key Livestock Conservation Practices Implemented FY11-18:

Animal Mortality Facilities	98
Waste Storage Facilities	132
Amendments for Treatment of Ag Waste	1,225,679 Animal Units
Prescribed Grazing	11,983 acres
Forage and Biomass Planting	19,771 acres

Primary practices implemented in the IRWI are practices to address management of animal waste and animal mortality, and to implement prescribed grazing plans.

Arkansas

The top five practices by total obligation amount for Arkansas are shown in the graph below.



These practices are part of conservation systems that have been installed and adopted by producers in the watershed to address phosphorus, sediment and pathogens in surface waters. The following are examples of the types of conservation practices implemented to improve water quality and to achieve producer objectives (photos and excerpts from producer stories developed by Creston Shrum, Arkansas NRCS).

- *Tim Crawley is a fourth-generation dairy farmer in Benton County, Ark. Crawley's Valley View Farms is one of the largest dairy farms in the county and one of the top milk producers. With grain prices steadily increasing, Crawley turned to USDA Natural Resources Conservation Service and the Environmental Quality Incentives Program (EQIP) to convert his 300-head dairy herd from a confined operation to a prescribed grazing system. Crawley planted 750 acres of forage to pasture, instaledl electric fencing, underground pipelines and watering facilities. Converting to a well-managed grazed operation significantly reduces the risks of nutrient and pathogen loss compared to a concentrated feeding operation. He also planted a cover crop on 75 acres to decrease soil erosion and nutrient runoff. Two waste storage ponds were incorporated into his system to ensure sufficient for manure and wastewater, and to capture runoff from his dairy barn and feed stalls. "These practices will not only help keep my operation financially viable but also improve the environment," Crawley said.*

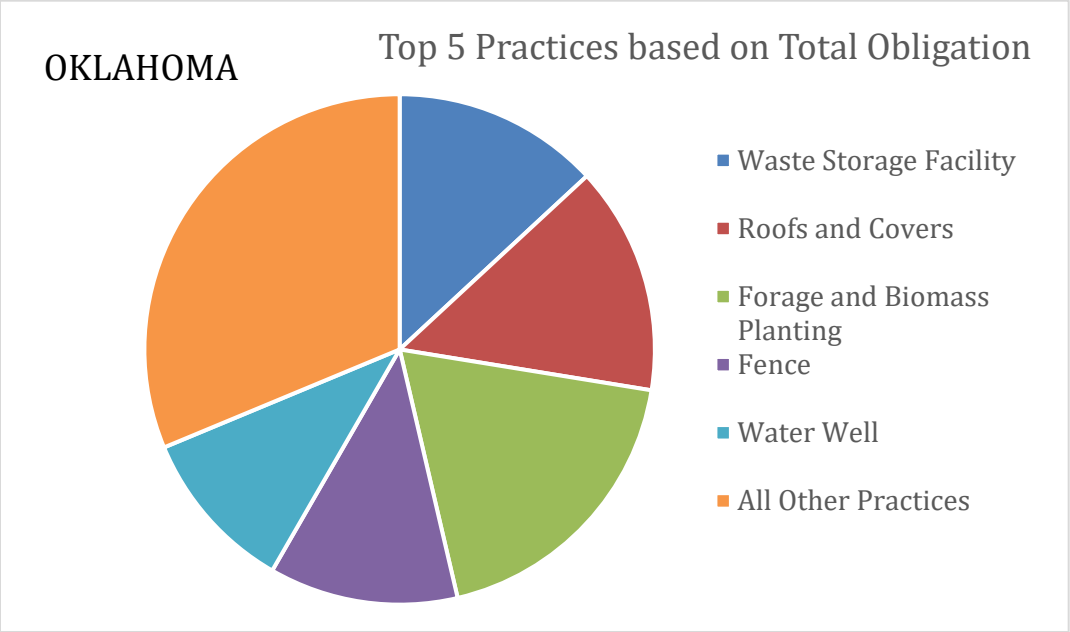
- *Gary Harral farms 141 acres, producing green beans and hay, and 80 spring calving cows. His operation is located on the Anderson Branch of the Little Osage Creek. Harral was concerned with streambank instability on his farm. Streambank reshaping and armoring has significantly reduced streambank erosion and pasture loss. Estimated soil loss from streambank erosion along the 2,400-foot section of the Anderson Branch on Gary Harral's farm was 800 tons, the equivalent of 1,600 pickup truck loads. This reduction in soil loss should provide positive water quality benefits. In addition, the stream was fenced off from livestock access on both sides. Harral installed several armored livestock crossings at his own expense. Limiting livestock access will help prevent further bank instability and significantly reduce direct deposition of manure and urine into the creek. Cross fencing will be used to better rotate cattle through the pastures, which will result in increased forage production and better utilization. Better pasture condition will also help reduce the potential for surface and subsurface loss of nutrients to the creek.*
- *Bill Haak operates a dairy farm along Flint Creek in Benton County near Gentry, Arkansas. To improve the water quality of the creek, Haak installed a fence on each side to keep the cattle out and planted trees through the Conservation Reserve Enhancement Program. Instead of his 70 dairy cattle spending the day drinking and cooling off in the creek, a pump and pipeline were installed to fill four watering facilities spread throughout his pastures. Haak installed a waste storage facility, and protected a heavy use area. He also improved his pastures using forage plantings. "The waste storage facility and paving the heavy use area will cut down on the amount of nutrients that run into Flint Creek. This in turn, will help improve the water quality of the entire watershed," said Mike Whitis, Benton County district conservationist. "The key to making a program like this work is the district conservationist building a relationship with landowners," Haak said. "That relationship is what allowed me to trust what Mike was saying was going to work on my farm.".*

- *For Bruce Norindr moved from Florida to become a poultry producer. He didn't have a farming background, so the transition to poultry production 2 ½ years ago has had a pretty steep learning curve. His sought out NRCS for technical assistance. "Mr. Norindr needed a way to dispose of dead chickens," said Rhonda Foster, the Washington County district conservationist. "When he purchased the farm, the previous owner didn't tell him he couldn't use the existing stacking shed (used to store chicken litter) as a composter for dead chickens." The solution – a 2,641-square-foot composting facility. The facility uses a mixture of raw organic by-products and chicken litter to dispose of chicken carcasses in an environmentally friendly way. "This is great and will defiantly help my operation. Norindr also uses alum treatment in his eight chicken houses three times a year. The alum treatment binds and reduces soluble phosphorous in chicken litter by up to 25 percent,*

preventing the loss of soluble phosphorus in runoff. Norindr raises six flocks a year with 125,000 chickens in a flock.

Oklahoma

The top five practices by total obligation amount for Oklahoma are shown in the graph below.



These practices are part of conservation systems that have been installed and adopted by producers in the watershed to address phosphorus, sediment and pathogens in surface waters. The following are examples of the types of conservation practices implemented to improve water quality and to achieve producer objectives (photos and excerpts from producer stories developed by Oklahoma NRCS).

- *Keith Mitchell was expanding his Turkey operation located in the Lower Flint Creek watershed, a tributary to the Illinois River. Mitchell had an old composting facility that was inadequate to handle the amount of mortality loss and size of birds that he now produced. He worked with NRCS on the design for his composting facility to better handle the large birds, which included bins 10ft wide and 10ft long, the overall structure was approximately 4,160 square feet. The structure has been in nearly continuous use since completed in October 2012. "This composter is a great asset and has really helped manage my normal daily bird loss" says Mitchell. Proper disposal and management of animal carcasses can significantly reduce the risk of nutrient and pathogen loss and subsequent impacts to water quality.*

- *Robert Faddis raises cattle along Baron Fork Creek in Adair County, Oklahoma. He worked with NRCS to develop a rotational grazing system, which included cross fencing and energy--free watering facilities. Faddis also planted legumes as a way to meet his nitrogen requirements and minimize commercial fertilizer applications. To keep his cattle out of the creek, Faddis installed critical--area fencing. Additionally, he used the land adjacent to the tributary for hay production. These activities reduced the excessive amount of phosphorus in the soil left from the former dairy and poultry operations, helped to reduce direct deposition by cattle into the creek, and provided permanent planting adjacent to surface water to help capture runoff and nutrients from upland areas.*

Phosphorus Balance and Reduced Phosphorus Application within the Sub-Basins

A major source of phosphorus within the basin comes from animal production, especially poultry. Poultry litter production within the watershed is estimated at 75,574 tons/year in the Euchla-Spavinaw watershed and 194,673 tons/year in the Illinois River watershed. According to the University of Arkansas Extension, producers are implementing litter management practices to improve the quality of their bedding material. Nutrient management plans are reducing the maximum litter and therefore P application rates. This, combined with a successful litter export program, has resulted in a significant reduction in the amount of litter applied in the watershed.

According to Mittelstet and Storm (2016), over 340,000 and 60,000 Mg of phosphorous have been added to the two Basins since 1925, of which over 59% and 67% were attributed to poultry in the Illinois River and Eucha-Spavinaw basins, respectively. Due to 90% litter export, the decline in commercial fertilizer application and the reduction in swine and dairy cattle production as part of conservation practice implementation and a litter export program, the current net phosphorous to the basins has decreased significantly. Historically, over 80% of all phosphorous is currently being stored in the stream systems and soils and will continue to cause water quality issues in the basins for several decades.

Conservation practices installed along Spavinaw Creek are helping improve water quality in the Illinois River Sub-Basin.

Illinois River Sub-basin Delistings in Arkansas and Oklahoma

In 2014, a portion of the Illinois River in Arkansas was removed from the state's Clean Water Act section 303(d) impaired waters list. Landowners in the watershed implemented a variety of conservation practices to address water quality, with assistance from NRCS and partners including Arkansas Natural Resources Commission (ANRC), Illinois River Watershed Partnership (IRWP) and the Washington and Benton county conservation districts. The delisting of one 2.5 mile reach of the Illinois River for turbidity was in part the result of landowners' conservation efforts. Six small watersheds (Goose Creek-Illinois River, Headwaters Illinois River, Lake Weddington-Illinois River, Lower Muddy Fork – Illinois River, Moores Creek-Muddy Fork, and Upper Muddy Fork-Illinois River) contribute to this 2.5 mile segment of the river that was delisted. Practices implemented by producers included waste storage facilities, forage and biomass planting, prescribed grazing, fencing, and amendments for the treatment of agricultural waste.

For 2016, the state of Oklahoma has recommended delisting an additional 2 segments on the Illinois River and 3 tributary segments (Flint Creek, Baron Fork, Sager Creek) within the sub-basin for pathogens (Escherichia coli and/or Enterococcus), since these segments have shown attainment of water quality standards. The monitoring from paired watersheds in Oklahoma (see section below) demonstrates these

positive trends in pathogen reduction and the contribution to this trend from conservation implementation in the watersheds, as well as from upstream of the state line.

NRCS works with poultry and livestock producers to implement conservation practices to improve water quality.

Positive Water Quality Response to Conservation Efforts

According to paired watershed monitoring by the Oklahoma Conservation Commission (OCC), the Eucha-Spavinaw and Illinois River watersheds are showing downward trends in pollutant loading over expected values, based on the relationship between paired watersheds.

<u>Illinois River Watershed (OCC 2012a)</u>

The calibration regression equations provided a baseline relationship for each parameter between Flint (treatment) and Saline (control) and Baron Fork Lower (treatment) and Baron Fork Upper (control). The paired watershed/site model was then used to assess implementation effectiveness based on one to three years of monitoring subsequent to the calibration period. The significance of the regression of paired observations between the treatment and controls was tested using an analysis of variance (ANOVA). At the end of the examined treatment period, the significance of the effect of the BMPs on each nutrient parameter was determined using analysis of covariance (ANCOVA).

In the Flint Creek watershed, data analysis indicated:

- Approximately 30% reduction in expected total phosphorus loading in Flint Creek relative to Saline Creek; significantly reduced TP concentrations and average weekly TP loads in treatment period versus calibration period

- 54% reduction in expected orthophosphorus loading in Flint Creek relative to Saline; significantly reduced oP concentrations and average weekly oP loads in treatment period versus calibration period
- 60% reduction in expected nitrate loading in Flint relative to Saline; significantly reduced nitrate concentrations and average weekly nitrate loads in treatment versus calibration period
- Approximately 41% reduction in expected instantaneous *E. coli* loading in Flint Creek
- Increased TKN and ammonia concentrations and loads in Flint Creek for treatment versus calibration period

A point source contributing to a tributary to Flint Creek made a facility improvement during the implementation period. However, comparison of load reduction at low and high flows suggest reduced loading over the implementation period is likely a result of both the point source improvement and conservation practices.

In the Baron Fork watershed, data analysis showed:

- 15% reduction in expected orthophosphorus loading at the Baron Fork Lower site relative to the Upper site
- 47% reduction in expected nitrate loading at Baron Fork Lower relative to Upper
- 20% reduction in expected ammonia loading at Baron Fork Lower relative to Upper
- Slightly increased TP, ammonia, and TKN concentrations and loads at Baron Fork Lower for treatment versus calibration period (only TKN was significantly increased)
- Significantly improved average bacteria levels at the Baron Fork Upper site, perhaps due to stormwater improvement efforts in Arkansas; this actually led to increased bacteria loading from what was expected at the Lower site using the upstream/downstream paired analysis.

Baron Fork is a much larger system compared to Flint Creek. However, it still showed some positive water quality trends within the short implementation period. A slight increase in TP over time was likely due primarily to a record storm in 2011. For Baron Fork, most nutrient data showed slight increase over time, for both control and implementation watersheds. Reductions in e-coli were noted, and both Flint and Upper Baron Creeks are meeting standards for e-coli at this time.

Monitoring in Baron Fork watershed at the Arkansas/Oklahoma state line has indicated a reduction in pollutants not only from upstream to downstream, but also has shown significantly reduced bacteria at the state line. OCC indicated this suggests that treatments within the watershed on the Arkansas side are also having a positive impact.

<u>Euchla-Spavinaw Watershed (OCC 2012b)</u>

The excessive nutrient loading in the watershed, particularly phosphorus, and the resulting eutrophication of the Euchla and Spavinaw Lakes has impacted 10 municipalities, including Tulsa, and 11 Rural Water Districts which depend on the lakes to supply their populations with drinking water and recreation. It is estimated that 73,000 tons of litter is produced annually (Oklahoma side). The watershed report highlights the expansion of successful efforts that have been ongoing in the Beaty Creek and Spavinaw watersheds over the past decade. High phosphorus loss areas were identified using

the SWAT model. Littered and poor condition pastures were also identified based on land survey and GIS analysis. Efforts were focused in these critical source areas.

The calibration regression equations provided a baseline relationship for each parameter between Beaty Creek (treatment) and Little Saline (control) and Spavinaw Creek (treatment) and Saline (control). The paired watershed/site model was then used to assess implementation effectiveness based on one to three years of monitoring subsequent to the calibration period. The significance of the regression of paired observations between the treatment and controls was tested using an analysis of variance (ANOVA). At the end of the examined treatment period, the significance of the effect of the BMPs on each nutrient parameter was determined using analysis of covariance (ANCOVA).

Significant decreasing trends in nutrients have continued in the Beaty Creek watershed relative to the Little Saline control watershed, including:

- 37% reduction in expected total phosphorus loading over what was expected based on pre-implementation conditions
- 81% reduction in expected TKN loading, and significantly lower average TKN concentration in implementation period relative to calibration period.
- 55% reduction in expected nitrate loading over what was expected based on pre-implementation conditions.
- Significant reduction in ammonia concentrations in implementation period relative to calibration period.
- 72% reduction in expected instantaneous E. coli loading and 52% reduction in expected Enterococcus loading over what was predicted based on pre-implementation data.
- Maintained excellent biological community and instream habitat conditions.

Similar results were observed for Spavinaw Creek relative to the Saline Creek control watershed, including:

- 37% reduction in expected total phosphorus loading over what was expected based on pre-implementation conditions.
- 64% reduction in expected orthophosphorus loading, and significantly lower average oP concentrations and loads in the implementation period relative to calibration period.
- 46% reduction in expected nitrate loading over what was expected based on pre-implementation conditions, and significantly lower nitrate concentrations.
- 19% decrease in expected ammonia loading over what was predicted based on pre-implementation data.
- Reduced bacteria levels.
- Excellent, nonimpaired fish and macroinvertebrate communities.

The cooperative, cumulative efforts of all of the funding sources and groups within the Euchla-Spavinaw watershed are expected to further the progress toward the full attainment of all beneficial uses in the waterbodies of the Spavinaw Creek watershed.

Summary

For all watersheds in Euchla-Spavinaw and Illinois River watersheds where conservation efforts have been targeted, the potential for water quality load reductions and other positive impacts are expected to increase over time as conservation practices mature and as additional conservation practices and other measures are implemented within the watershed. It is anticipated that continued monitoring of these implementation efforts within the paired watersheds will capture additional benefits of conservation implementation, and will characterize the improvements that could be seen for the sub-basins as a whole.

According to Shannon Phillips with the Oklahoma Conservation Commission, "Although we still have more phosphorus in the river than a scenic river should have, according to Arkansas-Oklahoma Arkansas River Compact Commission reports, we've cut concentrations at the state line by at least half since the 1980s" (ODAFF 2016). The 2016 Arkansas-Oklahoma Arkansas River Compact Commission report noted a significant downward trend in total phosphorus in the Illinois River since 1999.

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