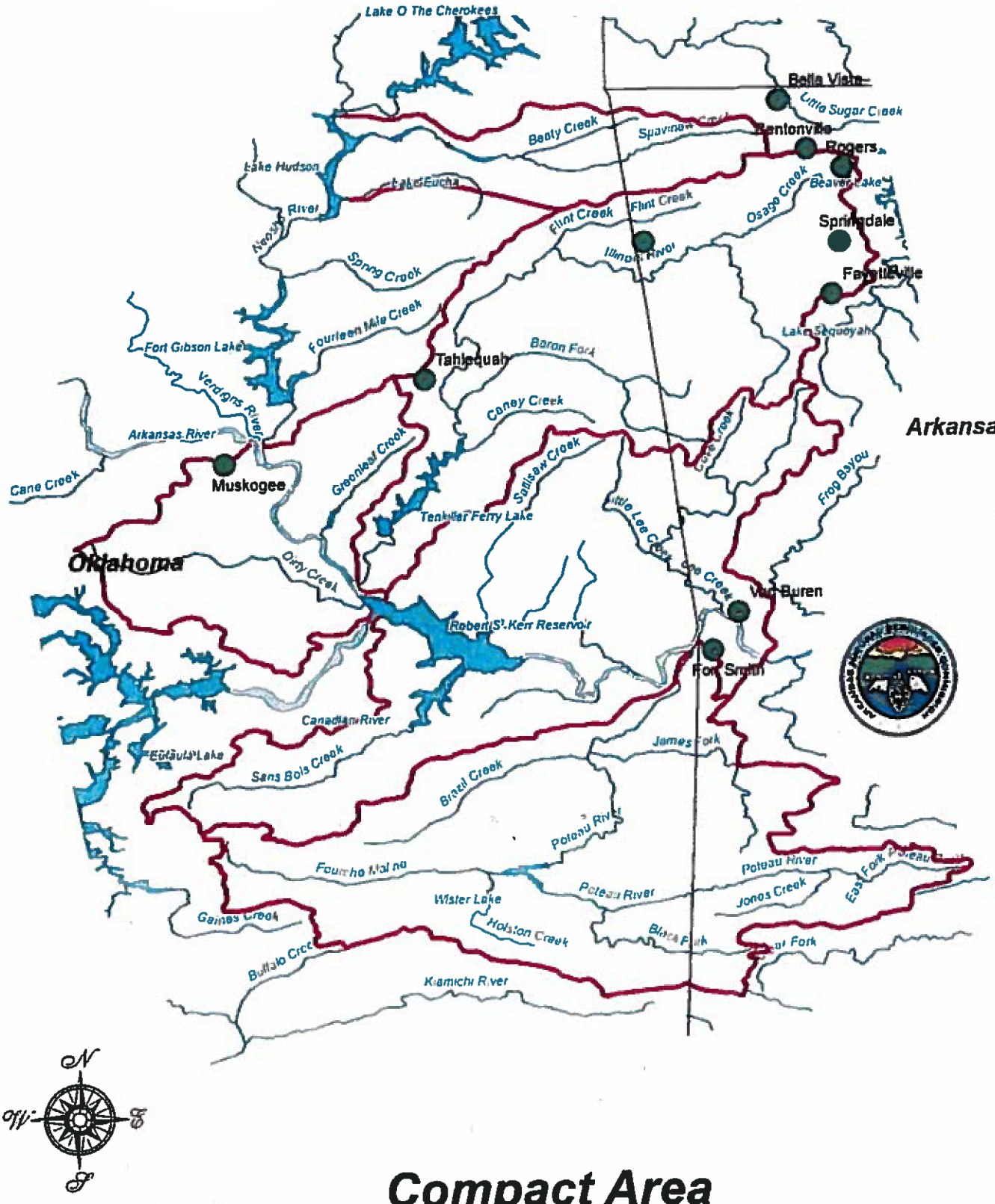
Arkansas River Compact Commission 2017 Report



Compact Area

Published in 2019

Arkansas River Compact Commission

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March 29, 2019

The President
United States of America

The Honorable J. Kevin Stitt
Governor, State of Oklahoma

The Honorable Asa Hutchinson
Governor, State of Arkansas

Dear Mr. President and Governors:

Pursuant to Article 9B(6) of the Arkansas-Oklahoma Arkansas River Compact (AOARC), submitted herewith is a copy of the report covering the activities of the Commission for 2017. A budget covering the anticipated expenses of the Commission for July 1, 2017 – June 30, 2018 is included in the report.

The State of Oklahoma hosted the 2017 Annual Meeting at Langley, Oklahoma, on September 28, 2017. Reports of the Budget, Engineering, Environmental and Natural Resources, and Legal Committees were presented, and the Commission approved committee assignments and appointments.

Respectfully submitted,

Delia Haak, Ed.D.

Delia Haak, Ed.D.
Federal Commissioner and Chairman
Arkansas-Oklahoma Arkansas River Compact Commission

DH/mls

Arkansas Oklahoma Arkansas River Compact Commission

2017 Annual Report

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Updated 9/2017

2017 MEETING
AGENDA

AGENDA

ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION ANNUAL MEETING

September 28, 2017

Grand River Dam Authority Ecosystems and Education Center, Grand Hall
420 E. Highway 28, Langley, Oklahoma 74350
9:00 a.m.

A. **Call to Order** – Chairman Delia Haak, Federal Commissioner

B. **Introductions and Announcements**

C. **Special Recognition of J.D. Strong, Derek Smithee, and Tyler Powell**

D. **Approval of Agenda**

E. **Consideration and Approval of Meeting Minutes of 2016 Annual Meeting**

F. **Report of the Chairman** – Chairman Delia Haak, Federal Commissioner

G. **Report of the Treasurer** – Ed Swaim, Arkansas

H. **Report of the Commissioners**
   1. Arkansas
   2. Oklahoma

I. **Committee Reports**
   1. Budget Committee, Yohanes Sugeng, Chair
   2. Engineering Committee, Yohanes Sugeng, Chair
   3. Environmental and Natural Resources, Julie Chambers, Chair
   4. Legal Committee, Sara Gibson, Chair

J. **Unfinished Business**

K. **New Business**
   1. Appointments/Assignments to Committees and Selection of Chairs
      a. Budget Committee
      b. Engineering Committee
      c. Environmental and Natural Resources Committee
      d. Legal Committee
   2. Election of Officers (Secretary and Treasurer)
   3. 2018 Annual Meeting

L. **Federal and State Government Representative Reports**
   1. Nicole Hardiman, Illinois River Watershed Partnership
   2. Other

M. **Public Comment**

N. **Adjournment.** Commissioners, staff and guests will tour Pensacola Dam following the meeting.

Attachment C.

2017 MEETING ATTENDANCE

PLEASE WRITE CLEARLY AND FURNISH COMPLETE MAILING ADDRESS

ATTENDANCE

MEETING: **ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION**

LOCATION: **Grand River Dam Authority Ecosystems and Education Center. Grand Hall 420 E. Highway 28, Langley, OK**

DATE: **September 28, 2017** **TIME: 9:00 a.m.**

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Mike Bender	mbender@bentonvillear.com	City of Bentonville
Bruce Holland	Bruce.holland@arkansas.gov	ANRC
jennifer sheehan	2 Natural Resources Dr 72205 jennifer.sheehan@agfc.ar.gov	AR Game & Fish Commission
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Crystal Phelps	crystal.phelps@arkansas.gov	ANRC
Rob Smith	NWA Council	
Bob Bledsoe	ADEQ	ADEQ

Attachment A.

PLEASE WRITE CLEARLY AND FURNISH COMPLETE MAILING ADDRESS

ATTENDANCE

MEETING: **ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION**

LOCATION: **Grand River Dam Authority Ecosystems and Education Center. Grand Hall 420 E. Highway 28, Langley, OK**

DATE: **September 28, 2017** **TIME: 9:00 a.m.**

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Nicole Hardiman	Post Box 205, Cave Springs, AR 72718	IRNP
Yohanes Sugeng	3800 N. Classen Blvd. OKC 73118	OWRB
Brad Stewart	Po Box 768 Springdale, AR	SCC
Greg Weeks	1400 N Fox Hunter Fayetteville AR 72701	Chzm / Fayetteville
Laura Brown		ANRC
TIM NYDNDER	113 W MOUNTAIN FAYETTEVILLE AR 72701	CITY OF FAYETTEVILLE
Jimmy Mendis	61 Champions BLVD Rogers AR	Commission
Shawn Jackson		ANRC

PLEASE WRITE CLEARLY AND FURNISH COMPLETE MAILING ADDRESS

ATTENDANCE

MEETING: **ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION**

LOCATION: **Grand River Dam Authority Ecosystems and Education Center. Grand Hall 420 E. Highway 28, Langley, OK**

DATE: **September 28, 2017** **TIME: 9:00 a.m.**

NAME	MAILING ADDRESS/Email address	REPRESENTING
Ryan Berenfield		
Ed Swaim		
Bill Cauthron		
Julie Chambers		
Carly Cordell		
Scott Thompson		
Mary Schwabe		
Jerrett Williams		
Delia Haak		
Roy Reams		

RESOLUTIONS OF SPECIAL RECOGNITION

RESOLUTION OF
THE ARKANSAS-OKLAHOMA
ARKANSAS RIVER COMPACT COMMISSION

WHEREAS, *J.D. Strong provided six years of valuable service to the Arkansas-Oklahoma Arkansas River Compact Commission; and*

WHEREAS, *Mr. Strong worked successfully to promote the interests of the Compact region; and*

WHEREAS, *Mr. Strong demonstrated a keen knowledge of the issues related to the Compact and provided invaluable guidance.*

NOW, THEREFORE, BE IT RESOLVED *that the Arkansas-Oklahoma Arkansas River Compact Commission extends its best wishes to Mr. Strong for a prosperous and enjoyable future.*

Presented at its September 28, 2017, annual meeting in Langley, Oklahoma.

Delia Haak

Delia Haak
Federal Commissioner and Chairman
Arkansas-Oklahoma Arkansas River Compact Commission

9-28-17

Date

B Holland

Bruce Holland
Commissioner for Arkansas

James H. Mardis

James Mardis
Commissioner for Arkansas

Roy Reaves

Roy Reaves
Commissioner for Arkansas

Scott Thompson
Commissioner for Oklahoma

Carly Cordell

Carly Cordell
Commissioner for Oklahoma

Absent

Julie Cunningham
Commissioner for Oklahoma

Attachment B.

RESOLUTION OF
THE ARKANSAS-OKLAHOMA
ARKANSAS RIVER COMPACT COMMISSION

WHEREAS, *Derek Smithee provided more than 21 years of valuable service for Oklahoma to the Arkansas-Oklahoma Arkansas River Compact Commission; and*

WHEREAS, *Mr. Smithee worked successfully on numerous projects and initiatives to promote the interests of the Compact, serving for many years on the Environmental and Natural Resources Committee, including service as the Committee Chair, and more recently Co-chairing the Scenic Rivers Joint Study Committee; and*

WHEREAS, *Mr. Smithee demonstrated expert knowledge of environmental and water quality issues related to the Compact and provided invaluable support to the Commission.*

NOW, THEREFORE, BE IT RESOLVED *that the Arkansas-Oklahoma Arkansas River Compact Commission extends its best wishes to Mr. Smithee for a prosperous and enjoyable future.*

Presented at its September 28, 2017, annual meeting in Langley, Oklahoma.

Delia Haak — 9-28-17

Delia Haak
Federal Commissioner and Chairman
Arkansas-Oklahoma Arkansas River Compact Commission

Date

Bruce Holland
Commissioner for Arkansas

James Mardis
Commissioner for Arkansas

Roy Reaves
Commissioner for Arkansas

Scott Thompson
Commissioner for Oklahoma

Carly Cordell
Commissioner for Oklahoma

Absent

Julie Cunningham
Commissioner for Oklahoma

RESOLUTION OF
THE ARKANSAS-OKLAHOMA
ARKANSAS RIVER COMPACT COMMISSION

WHEREAS, *Tyler Powell provided four years of valuable service to the Arkansas-Oklahoma Arkansas River Compact Commission; and*

WHEREAS, *Mr. Powell worked successfully to promote the interests of the Compact region; and*

WHEREAS, *Mr. Powell demonstrated a keen knowledge of the issues related to the Compact and provided invaluable guidance.*

NOW, THEREFORE, BE IT RESOLVED *that the Arkansas-Oklahoma Arkansas River Compact Commission extends its best wishes to Mr. Powell for a prosperous and enjoyable future.*

Presented at its September 28, 2017, annual meeting in Langley, Oklahoma.

Delia Haak
Delia Haak
Federal Commissioner and Chairman
Arkansas-Oklahoma Arkansas River Compact Commission

9-28-17
Date

Bruce Holland
Commissioner for Arkansas

James H. Mardis
James Mardis
Commissioner for Arkansas

Roy Reaves
Roy Reaves
Commissioner for Arkansas

Scott Thompson
Commissioner for Oklahoma

Carly Cordell
Carly Cordell
Commissioner for Oklahoma

Absent
Julie Cunningham
Commissioner for Oklahoma

2017 MEETING
MINUTES

Minutes of the
ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION
Annual Meeting

September 28, 2017
9:00 a.m.
Grand River Dam Authority Ecosystems and Education Center
420 E. Highway 28, Langley, Oklahoma

A. CALL TO ORDER

Chairman and Federal Commissioner Delia Haak called the Annual Meeting of the Arkansas-Oklahoma Arkansas River Compact Commission (AOARCC) to order at 9:00 a.m. on September 28, 2017, in the Grand Hall meeting room of the Grand River Dam Authority Ecosystems and Education Center, located at 420 E. Highway 28, Langley, Oklahoma.

Chairman Haak thanked Mr. Ed Fite and the GRDA for hosting the group for the meeting.

B. INTRODUCTIONS and ANNOUNCEMENTS

Commission members in attendance were: Federal Commissioner and Chairman Delia Haak; Federal Vice Chairman Joel West Williams; Oklahoma Commissioners Scott Thompson and Carly Cordell; Arkansas Commissioners Bruce Holland, Jimmy Mardis, and Roy Reaves. Oklahoma Commissioner Julie Cunningham was absent. Chairman Haak asked for those in attendance to make self-introductions. (Attachment A.)

Chairman Haak stated the Compact Committees had conducted successful meetings the day before and new commissioners had attended to learn in more detail the work of the compact. The Committees will report to the Commission today.

C. SPECIAL RECOGNITION OF J.D. STRONG, DEREK SMITHEE, AND TYLER POWELL

Chairman Haak stated the Commission wished to recognize the contributions of J.D. Strong (former Oklahoma Commissioner), Derek Smithee (retired Chief, OWRB Water Quality Division and AOARCC Environmental and Natural Resources Committee Member), and Tyler Powell (former Oklahoma Commissioner). She said Oklahoma had three resolutions of appreciation for the Commission's consideration today.

Oklahoma Commissioner Scott Thompson read the resolutions for Mr. Strong, Mr. Smithee, and Mr. Powell. Chairman Haak accepted Commissioner Thompson's motion to approve the resolutions; Commissioner Holland seconded. The motion was approved unanimously. Chairman Haak said the Commission is happy to recognize the contributions as stated in the resolutions. (Attachment B.)

D. APPROVAL OF AGENDA

Chairman Haak stated she would accept a motion to approve the agenda. There were no additions or deletions to the agenda. Commissioner Scott Thompson moved that the agenda be approved. Ms. Sara Gibson, Legal Committee Chair, asked if the Commission wanted to add Resolution 2017-1 that was discussed at the Legal Committee on September 27 regarding the remaining funds from the Joint Study. Chairman Haak asked the resolution be presented as part of the Legal Committee report to the Commission.

Commissioner Holland seconded the motion to approve the agenda. The motion carried unanimously. (Attachment C.)

D. Consideration and Approval of Meeting Minutes of the 2016, Annual Meeting.

Chairman Haak asked if there were any changes to the minutes of the 2016 Annual Meeting. She asked if website links could be added in the document when a report or other attachment is referenced; she recognized that website links may change. She asked if anyone had an objection, and that if not, she would accept a motion to approve the minutes of the 2016 Annual Meeting with that addition.

Commissioner Holland moved to approve the minutes of the 2016 Annual Meeting of the Arkansas-Oklahoma Arkansas River Compact Commission, and Commissioner Thompson seconded. There was no discussion, and Chairman Haak called for the vote. The motion carried unanimously.

E. REPORT OF THE CHAIRMAN

Chairman Haak thanked everyone in attendance representing the State of Arkansas and the State of Oklahoma, as well as federal agencies, cities and counties, and others in public service in the area. She said she had traveled to 13 states during the summer visiting several rivers and while appreciating the beauty of the western United States, she appreciated coming home to this beautiful region. She said we want to do all we can to be productive stewards of our water and land resources and she appreciates everyone from both states working together. She shared the original engineering report when the compact was formed in 1969, noting its example of how states can work together to find solutions and to continue to be a model for other parts of the country that face many challenges.

Chairman Haak concluded her report stating she is happy to be a part of the Compact mission and she thanked everyone for attending, and the Commissioners for their service.

F. REPORT OF THE TREASURER

Mr. Ed Swaim, Arkansas Natural Resources Commission and Commission Treasurer, presented the report of the Treasurer. He distributed a written report, noting the bank balance at the beginning of the fiscal year, July 1, 2016, at $258,006.64. He said all funds for the Stressor Study had been collected and spent by the end of the fiscal year, and there is $30,192.86 remaining in the bank account. He said there is also in the bank account a certificate of deposit in the amount of $11,111.31, with a balance of $41,306.73, less meeting expenses. Mr. Swaim concluded his report

saying the accounts are audited periodically at an expense of $275.00. He entertained questions; there were none.

There being no comments or questions, Commissioner Holland moved to accept the Report of the Treasurer, and Commissioner Cordell seconded. Chairman Haak called for the vote to approve the report, and the motion was unanimously approved.

Commissioner Reaves asked if the expenditures are in line with the budget, so when looking at the budget the expenditures are known. Mr. Swaim answered, yes; although what is spent is significantly less that what is budgeted in a typical year. (Attachment D.)

G. REPORT OF THE COMMISSIONERS

Chairman Haak invited Oklahoma as host to present the state report of the Commissioners.

1. Oklahoma

Oklahoma Commissioner Scott Thompson presented the report for the State of Oklahoma. Commissioner Thompson stated that according to today's agenda and based on reports of yesterday's committee meetings, the hard discussions have occurred and the details for implementation are being worked out, which he viewed as being very positive. Commissioner Thompson said the challenge is about how to work out the details; there is interest in getting the Environmental Protection Agency to develop the TMDL for the stream and he recommended it be approached through an economic development perspective for communities and to answer such questions as, will they have to meet the discharge, and how will the State and the companies have to operate so that everyone knows the rules and boundaries to move forward be known soon so each State's economy can continue. Uncertainty delays business decisions and he supported motivating EPA and to work out the details.

Chairman Haak asked if there is a status report on the Joint Study Commission. Mr. Bill Cauthron, Oklahoma, added the Joint Study had been completed and the results are available on line. He said the States would meet for further discussions about implementation and monitoring. Mr. Ryan Benefield, Arkansas, stated the report and recommendations can be found on the Oklahoma Conservation Commission website. https://www.ok.gov/conservation/Agency_Divisions/Water_Quality_Division/IR_Joint_Study_Committee.html).

There were no other questions or comments, and Commissioner Thompson concluded the State of Oklahoma Report. A written report of activities in the basin had been distributed. (Attachment E.)

2. Arkansas

Arkansas Commissioner Bruce Holland presented the report for the State of Arkansas and said a written report had been distributed. He said the ANRC continues to work on several reuse projects in the State converting the use of groundwater to surface water. He said staff is also working on a watershed-based management plan of the Buffalo River, and in November, the Governor had called together a working committee to determine contributing pollution sources to the Buffalo River. He has also served on a task force regarding the feral hog situation in the State as

they are causing streambank damage as well as to agriculture and the economy. Commissioner Holland talked about the natural beauty of Arkansas; he said he is proud of the State, and the work that both Arkansas and Oklahoma are doing to protect the States' natural resources. He thanked the staff for the work conducted in the committees, and he is encouraged to move forward.

There were no questions or comments, and Commissioner Holland concluded the State of Arkansas Report. (Attachment F.)

H. COMMITTEE REPORTS

1. Budget Committee

Mr. Ed Swaim, Arkansas Natural Resources Commission, presented the report of the Budget Committee. Mr. Swaim stated that because the meeting falls at an odd time of the fiscal year, there are three different fiscal years represented on the budget. He said the proposal, and report from the Budget Committee for recommendation and approval, is the far right column, proposed FY-2019, and the status of the budget is also shown for FY-2016 and FY-2017. Currently, the compact is operating under FY-2018, and FY-2019 will begin in July of 2018. Mr. Swaim stated the major budget item in the last two years has been the Stressor Response Study, with $600,000.00 in FY2016 total funding; $233,568 remaining for FY2017, and a small amount remaining with $5,000 budgeted for FY-2018 for one of the recommendations made in the report. He said the proposed budget has the same issues as previous years and there are no recommended changes in those amounts except for the computation of the annual water yield, which expense hasn't been needed in a couple of years. He said the stream gaging item of $6,300.00 has been in the budget the past few years which had been paid by Oklahoma in error and reimbursed. The payment for the gage is contracted between the USGS and Oklahoma so the Compact doesn't enter a separate contract with the USGS.

Mr. Swaim said the recommendation of the Budget Committee is a total budget of $10,248.00 as shown. There were no questions.

Commissioner Mardis moved to approve the budget, and Commissioner Thompson seconded. Chairman Haak called for the vote, and the budget was approved unanimously. (Attachment G.)

2. Engineering Committee

Mr. Yohanes Sugeng, Oklahoma Water Resources Board, distributed the written Engineering Committee Annual Compact Compliance Report and presented the report findings. He referred to page two of the written report and a table containing the 2016 computations summary which indicated both states complied with compact requirements. He said there was a discussion at the Engineering Committee meeting regarding water use from Oklahoma to Arkansas through Lake Frances and the water rights utilized by the City of Siloam Springs, and the states will work together to reflect the additional flow of 9,000 acre-feet in next year's report.

Mr. Sugeng concluded the report. There were no questions from Commissioners. Commissioner Holland moved to approve the Engineering Committee Report, and Commissioner Cordell seconded. Chairman Haak called for the vote, and report was approved unanimously. (Attachment H.)

3. Environmental and Natural Resources Committee

Ms. Julie Chambers, Oklahoma Water Resources Board, presented the report of the Environmental and Natural Resources Committee. She distributed a written Water Quality Monitoring Report of the Illinois River Basin and said it is in the same format as previous years; the first section contains the comparison of geometric means to the Oklahoma Scenic River total phosphorus criterion, waters listed on Oklahoma's 2014 303(d) list, and other notable impaired water in the Compact area. She said Table 1. contains stream gage data reported indicating the 5-year rolling average of phosphorus loading and the geometric mean for the long period of record 1999-2016, and excludes high flow information, indicating discharges still exceed the .037 standard. The next section concerned data regarding lakes and streams in the Compact area and illustrates how much area the Compact encompasses. Ms. Chambers said the next section concerned the 303(d) list still awaiting EPA Region 6 approval. She referred to the summary of activities of the upcoming revision of the Oklahoma Water Quality Standards which include the addition of an updated antidegradation policy for groundwater, aquifer storage and recovery and implementation policies for groundwater quality standards. The next section is the TMDL's in the Compact area provided by the Oklahoma Department of Environmental Quality, followed by the section on phosphorous loading. She said the monitoring report bar charts depict flow changes over the years and the 5-year rolling average indicating the 40% reduction goal from the baseline 1983 concentrations; all stations are below the 40% reduction goal, there have been fluctuations over the years, but the trend is moving downward. The graphs show movement toward the .037, trending downward i.e., the Flint Creek wastewater treatment plant went online 2010-2011, which is evident in the chart. She noted the report information on water and wastewater projects funded by the OWRB Financial Assistance Division in the Compact area, and there were two water use permits issued for either surface water or groundwater use since 2012. The last section is the update from the Oklahoma Conservation Commission on activities in the Illinois River Watershed, including a partnership with the Oklahoma Department of Transportation on a stabilization project, 319 funding projects, and Blue Thumb monitoring and education.

Commissioner Jimmy Mardis asked what the effect of the recent wet year will have on the results. Ms. Chambers stated the concentrations are affected by flow, and there is no way of knowing whether the numbers will be up or down; the flow information for this year is not available. Commissioner Reaves said it might be assumed there will be a spike in the phosphorous levels from the surface runoff. Chairman Haak noted the report had been brought up to date from 1999-2016, and that upon analysis all stations show a downward trend for use assessment geometric mean, and that it is good to see the hard work between the States has had an effect.

Ms. Shawn Jackson, Arkansas Natural Resources Commission, presented the Arkansas Report, she said the report is in the similar format. In response to Commissioner Mardis's question, she said that last year she didn't know that Oklahoma excluded the high flows and Arkansas numbers were not adjusted for high flows the past three years so she reviewed USGS data and has adjusted this year's report to exclude high flows. She reviewed the report noting the rolling average at the front, and the four station's data that mirror Oklahoma's report. Flint Creek is showing right at 40% reduction and making progress, and the trend line shows a slightly downward trend. Sager Creek is well below the 40% with a downward trend. She said the end of the report includes the 303(d) list for 2016 that has been accepted, with Spring Creek and segments of Osage Creek moved to category 4(b) according to requirements by EPA and nutrient application rates. She read the justification statement regarding the regulations to move the creeks off the category 5 list. Chairman Haak asked that the reports be available on line.

There were no questions, and Chairman Haak asked if there was a motion to approve the report. Commissioner Holland moved to approve the Environmental and Natural Resources Committee Report, and Commissioner Thompson seconded. The motion was approved unanimously. (Attachment I.)

4. Legal Committee

Ms. Sara Gibson, Oklahoma Water Resources Board, said to the Commissioners there was no assignment from the previous year, but there are two new items for the Commission to consider. First, $3,788.12 is remaining from the $600,000.00 Joint Study Stressor project and the Legal Committee determined that it was not necessary to return the funds. The Legal Committee recommended the funds be donated to the Illinois River Watershed Partnership for monitoring and education work which Ms. Hardiman will explain in her presentation. Ms. Gibson stated the Commission would need to approve donating the $3,788 dollars to the Illinois River Watershed Partnership for monitoring and education.

Commissioner Holland so moved, and Commissioner Cordell seconded.

The second matter concerned Resolution 2017-4 which Ms. Gibson asked Mr. Benefield to present. She stated the Committee recommended the Commission adopt the resolution. Mr. Ryan Benefield, Arkansas Natural Resources Commission, stated the distributed copy contained the small revision as discussed at the Committee meeting the previous day. He said the resolution regarded the Joint Study and thanked the Committee members and the members of the Baylor University research team for their work. He suggested the resolution number be 2017-4 following the three resolutions of appreciation presented earlier. Mr. Benefield read the resolution (attached). He said the Committee members didn't think they would ever reach the end, but they were able to come together and for his knowledge, it is the first time the States have agreed on the standard.

Commissioner Thompson asked to amend Ms. Chard's name, deleting McClary. There were no questions.

Commissioner Reaves moved to approve Resolution 2017-4, and Commissioner Cordell seconded.

Chairman Haak shared her observations on the committee's deliberations and progress; she regarded the work as a "watershed report," and expressed her appreciation to the team members for the work performed.

There were no other comments, and Chairman Haak called for the vote. The motion passed unanimously. Chairman Haak said the study is an example to the Nation of how states can come together. (Attachment J.)

Chairman Haak called for the vote on the recommendation to donate the remainder of funds to the IRWP, and the motion passed unanimously.

I. UNFINISHED BUSINESS

There were no items of unfinished business brought before the Commission for consideration.

J. NEW BUSINESS

1. Appointments/Assignments to Committee and Selection of Chairs

Chairman Haak said the Committee Chairs will move to Arkansas. The Committees will be as they are currently comprised, and the officers for 2018 are:

a. Budget Committee - Ed Swaim
b. Engineering Committee – Shawn Jackson
c. Environmental and Natural Resources Committee - Ryan Benefield
d. Legal Committee - Crystal Phelps

Commissioner Thompson moved and Commissioner Holland seconded. Chairman Haak called for the vote, and the motion carried unanimously.

2. Election of Officers (Secretary and Treasurer)

Chairman Haak asked if there were recommendations for Secretary and Treasurer for 2018. Commissioner Holland moved that Ms. Laura Brown serve as Secretary and Mr. Ed Swaim serve as Treasurer. Commissioner Thompson seconded the motion. There was no discussion and Chairman Haak called for the vote. The motion was approved unanimously.

3. 2018 Annual Meeting

Chairman Haak said the legislation states the meeting shall be held the last Thursday of September. She recognized it is a busy time of year but asked that the meeting be held at the designated time, if possible, which is September 27, 2018. The meeting will be hosted by the State of Arkansas, likely at Siloam Springs and a tour of Lake Frances.

There were no other New Business items for the Commission's consideration.

K. FEDERAL AND STATE GOVERNMENT REPRESENTATIVE REPORTS

1. Nicole Hardiman, Illinois River Watershed Partnership. Chairman Haak introduced Dr. Nicole Hardiman who gave a slide presentation about the creation and purpose of the IRWP, and spoke to the projects by the organization that has led to the downward trend in phosphorous loads in the Illinois River Watershed. She said the IRWP was created in 2005 and sought stakeholder collaboration with the "Big 4" cities in the Illinois River Watershed to address water quality through wastewater treatment and storm water management by utilizing detention basins which EPA recommends as the most effective way to reduce pollutants. She discussed that IRWP works with the Watershed Conservation Resources Center on streambank ecological restoration projects and described the work performed at Osage Creek east of Siloam Springs reducing 1,400 tons of sediment and 750 pounds of phosphorus per year. The IRWP also works with the Center on a streambank inventory identifying locations with a high rate of erosion, particularly focusing on Clear Creek currently. The IRWP also partners with the Northwest Arkansas Land Trust to conserve and preserve easements using voluntary measures in alignment with the vision of the landowner. Another conservation initiative is open space planning to conserve these spaces by ranking high value green areas in Northwest Arkansas according to conservation, cultural, historical, and

agricultural value along with economic development. Through the projects, the Arkansas Water Resources Center data depicts a downward trend and she illustrated on a slide the 30-day geometric mean from December 11—May 17 (2017), the 6-month average phosphorus load, and the standard, which conclusion illustrates is close to meeting the standard. She expressed her belief it could be achieved by organized partnerships working through voluntary conservation via nonpoint source projects.

Dr. Hardiman said the mission of the organization is to improve the integrity of the IRWP via education and outreach, monitoring, and implementation of conservation and restoration projects structured through seven stakeholder groups with varying levels of expertise and approaches. She discussed the local stakeholder sectors that work with the IRWP such as agriculture, conservation, business, construction, and government, etc., and the funding sources of one-third corporate, one-third state, and one-third private. She discussed the Priority Subwatershed Strategy of the Illinois River watershed which are Clear Creek, Sager Creek, Lower Muddy Fork, Moore's Creek, and the main stem of the Illinois River. All of these watersheds are listed as impaired in 2016 by ADEQ and are high priority for phosphorus, sediment, and nitrogen in ANRC's Non-Point Source Management Plan. Dr. Hardiman explained all the tools, time, money, and effort of the IRWP and its partners will be utilized in these areas to develop a priority subwatershed strategy, and she described the stream bank erosion inventory of 891 locations identifying areas for conservation and protection projects through long- term monitoring and modeling.

Dr. Hardiman spoke to the organization's education program focusing on the streambank erosion of the four priority watersheds with 5th grade and older students attending summer camps and school year field trips at Cave Springs. She described how the ECO assessment of priority subwatersheds teaches children scientific method, volunteerism and leadership, and technology skills through involvement in restoration programs and landowner outreach in priority subwatersheds. The IRWP will produce educational packets specific to residential, commercial, and agricultural properties to design erosion and conservation tours and onsite visits to implement the conservation practices and provide a toolbox with voluntary solutions to make preserving streams cost effective. She talked about implementation of open space plans, and described the feasibility study that will be conducted by the Trust for Public Lands in Northwest Arkansas to determine whether they will pay for land conservation, first time conducted across the region. She said the IRWP advocates prevention rather than reaction.

Dr. Hardiman concluded her presentation stating the IRWP message is one of connecting with landowners and finding solutions through a watershed approach and she thanked the Compact Commissioners for their support.

There were no questions. Chairman Haak thanked Dr. Hardiman for her presentation and proposal to use the funds for educational efforts. She commented that the Partnership seeks to work with Oklahoma, and to have Board members from both states, as well as the Cherokee Nation, and she complimented the work of the Oklahoma Conservation Commission and the Arkansas Natural Resources Commission.

2. Other

Mike Abate, U.S. Army Corps of Engineers (COE) Chief of Civil Works, presented a Power Point Presentation as the COE report of activities and funding for the compact area. The COE districts are governed by watershed and the Tulsa District includes the Arkansas River in the north and Red River in the south, and three states--southern one-half of Kansas, all of Oklahoma, and

Northern Texas. He described the multi-purpose projects of flood risk management, navigation, and hydroelectric uses, and the main mission is flood risk management of which there are over 30 projects in the District. He spoke about the 18-lock navigation system, the eight hydroelectric power facilities, that Tulsa District has 50% of the COE's water supply contracts serving over 2.2 million customers, and that COE lakes have more visitors than the National Park Service. Mr. Abate detailed several of the 2016 Accomplishments in the Arkansas Basin, Planning Assistance to the States, and Scheduled Commitments including replacing leaking water lines at Skiatook Lake, building a water tower and water lines for the City of Yukon, rehabilitation of the Webbers Falls Dam, dredging at John Redmond Dam in Kansas, work at Canton Lake Dam, and assistance with the GRDA watershed study workplan. Mr. Abate explained the 3-year budget, breakout of non-routine maintenance in the Arkansas Basin including, investigation and regulatory activities, and support of EPA and FEMA i.e., flood control and local emergencies. He explained work plan funding from Congress which has replaced earmarking and is a method of providing funding to the districts to distribute based upon need. He anticipated the budget will increase for Operation and Maintenance, and the District planned to obligate $44 million to infrastructure, including a bridge over the spillway at Eufaula and projects for the MKARNS navigation system.

Mr. Abate also reported on the Tulsa District Water Management Plan involving management of the pools in each lake – conservation, water supply, flood control, and hydropower. He noted progress of the Arkansas River Corridor Feasibility Study for a masterplan to develop the eco system through the proposed construction of a low water structure to catch release from Lake Keystone allowing a constant 1,000 cfs for power generation, and rock ripple along Prattville Creek that creates habitat for a Least Turn Island at Broken Bow. He said $50 million has already been authorized and Tulsa County will partner in the project. He updated the Commission on Canton Lake Dam safety construction adding a new spillway and fence gates to increase the dam safety rating, and finally, he reviewed the WIN Act support for the levee project involving a land transfer with the Creek Nation for improvements (no casino authorized), and management of the flowage easements with the Grand River Dam Authority.

Mr. Abate concluded his report. There were no questions by the Commissioners.

Chairman Haak invited other state and federal agency representatives to speak to the Commission.

Mr. Jason Lewis, Oklahoma USGS thanked the Commission for its support, and noted the distributed report.

Mr. Jason Funkhauser, Arkansas USGS, thanked Mr. Abate for the COE work and that he appreciated the opportunity to interact with the Compact group.

Ms. Jennifer Sheehan, with the Arkansas Game & Fish Commission said the agency desired to become more active in the Commission.

Ms. Shanon Phillips with the Oklahoma Conservation Commission expressed interest in the IRWP projects. She said the Oklahoma Conservation Commission is re-evaluating and re-prioritizing site selection for watershed restoration projects following the April flooding and is re-envisioning the agency's streambank protection program in partnership with GRDA. Additionally, the agency will conduct sampling and monitoring in the basin next year and has added seven sites within the Poteau Valley, Wister watershed and Poteau River Basin.

There were no other federal or state reports. There were no questions by the Commissioners. Chairman Haak thanked the agencies for seeking funding opportunities supporting interactive collaborations to improve the Arkansas River Basin.

L. PUBLIC COMMENT

There was no public comment.

M. ADJOURNMENT

Chairman Haak thanked the Commissioners for taking the time to participate, and thanked Vice Chairman Joel West Williams for attending from Washington, D.C.

There being no further business, Federal Commissioner and Chairman Delia Haak thanked everyone for their attendance. The GRDA staff and Mr. Ed Fite hosted a tour of the Pensacola Dam for those interested.

Commissioner Cordell moved to adjourn and Commissioner Reaves seconded. Chairman Delia Haak adjourned the 2017 Annual Meeting of the Arkansas-Oklahoma Arkansas River Compact Commission at 11:06 a.m., September 28, 2017.

Delia Haak

Delia Haak
Federal Commissioner and Chairman

9-27-18

Date

Mary Schooley

Mary Schooley, Oklahoma Water Resources Board
2017 Commission Secretary

Arkansas Oklahoma Arkansas River Compact Commission

2017 Annual Report

Minutes Attachments

Attachment A.	Attendee List
Attachment B.	Resolutions of Special Recognition
Attachment C.	Agenda
Attachment D.	Report of the Treasurer
Attachment E.	Report of the Oklahoma Commissioners
Attachment F.	Report of the Arkansas Commissioners
Attachment G.	Budget Committee Report
Attachment H.	Engineering Committee Report
Attachment I.	Environmental and Natural Resources Committee Report
Attachment J.	Legal Committee Report Resolution 2017-4

2017 REPORT OF THE TREASURER

Report of the Treasurer

Arkansas Oklahoma Arkansas River Compact Commission

September 28, 2017

The 2017 Year-end Financial Report covering July 1, 2016 through June 30, 2017 details income and expenses.

Regions Bank Balance on July 1, 2016	$ 258,006.64
Total Income	$ 7,057.89
Total Expenses	$ 234,871.67
NET TOTAL	$-227,813.78

Regions Bank Balance June 30, 2017	$ 30,192.86
Certificate of Deposit Balance June 30, 2017	$ 11,111.13

Account Balances as of August 31, 2017

Regions Bank Balance	$ 30,195.42
Certificate of Deposit Balance	$ 11,111.31
TOTAL	**$ 41,306.73**

Assessments for both states are current.

Note: We will continue to see our expenses exceed revenue until all the $600,000 Stressor Response Study Funds are spent/utilized.

Attachment D.

2017 REPORT OF THE COMMISSIONERS

OKLAHOMA COMMISSIONERS' REPORT

Arkansas-Oklahoma
Arkansas River Compact Commission
Langley, Oklahoma
September 28, 2017

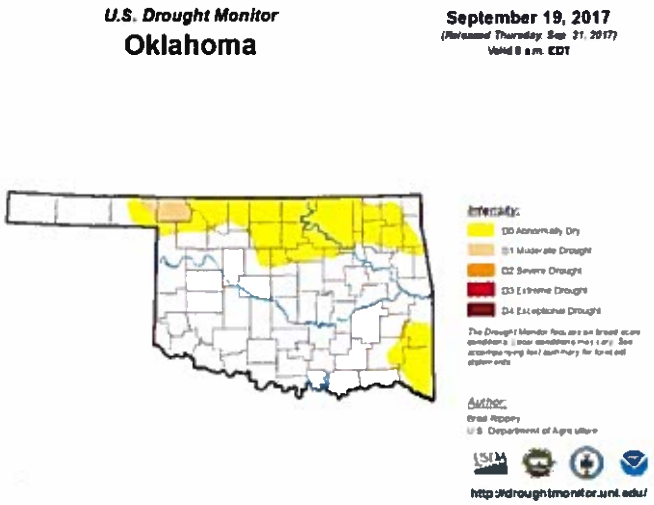
OVERVIEW & GOALS

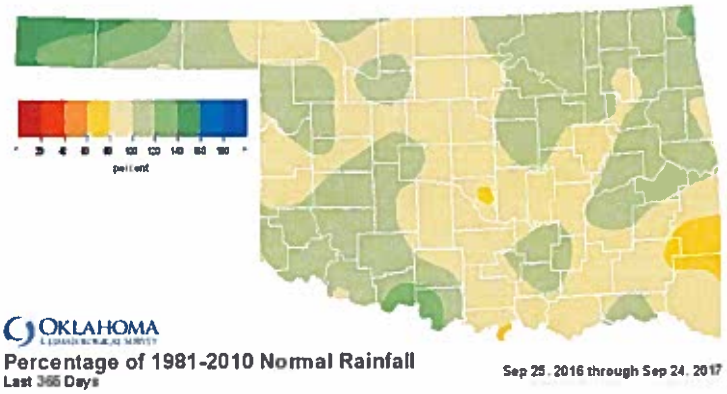
The OWRB continues to focus on implementation of the 2012 Update of the Oklahoma Comprehensive Water Plan (OCWP) and the recommendations of the Water for 2060 Final Report:

- Promoting more widespread adoption of water conservation, reuse and recycling— the cheapest, most feasible alternatives for resolving future water shortages—by seeking adoption of the Water for 2060 Advisory Council's final recommendations and through other efforts;
- Tackling Oklahoma's $82 billion future water and wastewater infrastructure needs through agency Financial Assistance loan programs, providing below-market interest rates to communities by leveraging federal grants and Oklahoma's new Water Infrastructure Credit Enhancement Reserve Fund;
- Allocating and managing water resources more accurately by creating stream water allocation models and reducing the backlog of statutorily required groundwater basin studies and 20-year updates;
- Detecting and assessing threats to Oklahoma's water resources by efficiently operating the state's most comprehensive surface and groundwater monitoring program;
- Considering M&I, tourism, recreation, and ecological water needs within Oklahoma's overall water management framework through lessons learned from the Illinois River Instream Flow Pilot Study;
- Encouraging and working closely with local and regional stakeholders to develop and execute long-range water plans to prevent future water shortages; including actively assisting in the facilitation of the Grand River Comprehensive Water Plan. Currently working on a regional water-budget and water permitting system
- Supporting the Governor and Legislature in working to resolve the water rights and needs of Oklahoma-based tribal nations;
- Finding solutions with Oklahoma's produced water quandary by facilitating the Governor's Produced Water Working Group and its initiatives.

CLIMATE

Oklahoma enjoyed one of its most mild and wet Augusts on record. According to preliminary data from the Oklahoma Mesonet, the statewide average precipitation total was 6.42 inches, 3.47 inches above normal and the second wettest August since records began in 1895. August 1915 holds the top spot with 6.48 inches. The Oklahoma City East site led the Mesonet with 13.04 inches, but there were plenty of hefty totals during the month. Ten Mesonet sites recorded at least 10 inches, and 79 received between 5 and 10 inches. Buffalo had the lowest total with 1.55 inches. Climatological summer (June 1-Aug. 31) was the 29th wettest on record with a statewide average of 12.24 inches, 1.89 inches above normal. The January-August average of 30.59 inches was 5.73 inches above normal to rank as the eighth wettest such period on record.





WATER FOR 2060

Since completion of the Water for 2060 Final Report in November 2015, the OWRB already has shifted focus to an implementation phase in relation to several of the recommendations found within the report. This work includes laying the necessary legislative and regulatory framework for the growth of water reuse in Oklahoma. The OWRB and ODEQ continue to work on rules for potable reuse in both surface and groundwater. Rules for potable reuse in sensitive water supplies (SWS-Reuse) became state law in September 2015 and should receive federal approval by the middle of March 2017. More information on Water for 2060, including a PDF of the Final Report, can be found here: www.owrb.ok.gov/2060 .

In addition to policy related work, the OWRB's Planning & Management Division has continued efforts to foster increased regional water planning in portions of Oklahoma who have yet to establish Regional Water Plans or similar guiding documents. The initiative was also featured at the March 2016 White House Water Summit for World Water Day, where the Oklahoma's Water for 2060 initiative was one of only a few projects to be highlighted at the White House event. Finally, the Governor's Water for 2060 Produced Water Working Group (PWWG) has continued its efforts in support of the Governor's goal of reducing the amount of produced water injection through the establishment of other economically viable solutions. The PWWG has completed a high level study to determine the nexus between produced water generation and potential large-scale end users, as well as any related produced water transportation hurdles. Findings from this study that may be relevant to the Compact Area revealed the feasibility of transporting the enormous volumes of extremely salty PW in the Mississippi-Lime play away from the area to serve as frac water for the nearby water-poor STACK play. Such a move would both reduce the current injection volumes, potentially saving billions of gallons of fresh water reserves annually in counties located in the STACK play. A more in depth look at this idea as well as evaporation technologies will begin in mid-September. More information on the PWWG, including the latest Study, can be found here: www.owrb.ok.gov/pwwg .

AQUIFER STORAGE AND RECOVERY

In 2016, the Oklahoma Legislature and Governor Mary Fallin approved Senate Bill 1219 to authorize the OWRB and ODEQ to establish a process for citizens or communities to construct ASR projects. The 2012 Update of the Oklahoma Comprehensive Water Plan included a review of potential ASR sites. A working group, consisting of state regulators, consulting engineers, scientists, and community leaders, has studied the issue since the summer of 2015 while holding informal public meetings on recommendations for groundwater quality standards.

At the February 2017 board meeting, the OWRB took the first step toward fulfilling the goal of SB 1219 by voting to approve a proposed package of rule amendments to Oklahoma's Water Quality Standards (WQS). The rule provisions were ultimately approved by the Governor in June 2017.

The rule amendments to Oklahoma's WQS provide distinct protection for domestic use of untreated groundwater supplies, provide both narrative criteria to be applied to all uses and numeric criteria (primary and secondary MCLs from Safe Drinking Water Act and other human health criteria) specifically applicable to water supply groundwater that will utilize ASR. A new statute allowing for Limited Scale Pilot studies passed this past session. OWRB and ODEQ are expected to go through rulemaking this fall for permitting of ASR facilities. This innovative water-management tool will help Oklahomans secure reliable water supplies for decades to come.

WATER RIGHTS PERMITTING

In 2016, as the state's designated water management agency, the OWRB issued 76 regular permits (51 groundwater & 25 surface water) for a total of 43,478.8 acre-feet (35,878.1 groundwater & 7,600.7 surface water). In addition, the OWRB has issued 1,068 Provisional Temporary (90-Day) permits (212 groundwater & 856 surface water) for a total of 88,277.6 acre-feet (8,278.5 groundwater & 79,999.1 surface water). So far in 2017, OWRB issued 58 regular permits (31 groundwater & 27 surface water) for a total of 86,215.6 acre-feet (13,420.2 groundwater & 72,795.4 surface water). In addition, the OWRB has issued 874 Provisional Temporary (90-Day) permits (188 groundwater & 686 surface water) for a total of 28,818.2 acre-feet (5,043.1 groundwater & 23,775.1 surface water). OWRB staff currently track water use and maintain more than 12,500 permits for approximately 2.7 million acre-feet of surface water per year and 3.8 million acre-feet of groundwater per year.

WELL DRILLER AND PUMP INSTALLER PROGRAM

In cooperation with the Well Driller's Advisory Council, changes have been made to the ODEQ's minor public water well rules to better streamline regulations between our two agencies affording better protection of groundwater, and better service to our well drillers and the public. In cooperation with Oklahoma Real Estate Commission (OREC), several workshops were conducted for more than 300 real estate agents regarding dam safety, floodplain, and well driller program. Finally, in 2017 the WDPI program conducted a series of continuing education courses across the state of Oklahoma, in partnership with Oklahoma Ground Water Association, to assist operators with their licensing requirements. OWRB staff responded to more than 72 public and industry generated complaints, and conducted several hundred routine well inspections and firm visits. License renewals were issued for 137 firms, 22 new firms licensed and 37 new operators licensed. Program staff also completed a system to address incomplete and inaccurate written well logs that have been filed.

FLOODPLAIN MANAGEMENT

Floodplain staff continues to conduct Community Assistance Visits, Community Assistance Contacts, and public outreach through various field visits, conferences, technical assistance, and workshops. Floodplain staff also developed new course material for Oklahoma's Floodplain Administrator Accreditation Program. OWRB staff coordinated with the Oklahoma Floodplain Managers Association (OFMA) and NOAA to provide Low Water Crossing mapping of over 400 Turn Around Don't Drown Sign locations to be synchronized with NOAA Weather Prediction system and the Oklahoma Public Alert System enabling emergency alerts to Oklahoma residents. Furthermore, OWRB partnered with OFMA to distribute an additional 110 new Turn Around Don't Drown Signs across 15 Oklahoma communities. OWRB delivered mapping products in three watersheds as part of FEMA's RiskMAP, bringing critical protection and planning tools to a total of eight

Priority Watersheds through the Cooperative Technical Partners Program. Floodplain staff leveraged GIS technology to develop mobile data collection surveys to facilitate field work and automate reporting, and published a new and improved interactive flood hazard map for the agency website.

DAM SAFETY PROGRAM

In 2016, OWRB staff completed 25 low hazard-potential dam inspections and provided inspection reports with breach inundation maps to dam owners at no cost. Staff is conducting more detailed analyses for several dams that have potential to be reclassified. A detailed breach inundation map of one high hazard-potential dam was developed, and provided to the dam owner at no cost, and integrated into the site-specific Emergency Action Plan to assist emergency managers in the event of dam failure. OWRB Dam Safety program hosted a series of dam safety workshops in multiple locations throughout 2016 and 2017 for the licensed realtors to provided information to their clients about the responsibilities of owning a dam. Also in November, the Dam Safety program, in cooperation with Freese and Nichols, Inc., hosted a seismicity workshop attended by 48 individuals representing municipalities across Oklahoma along with state and federal government officials. Evaluating safety of existing municipal infrastructure, designing new infrastructure to withstand earthquakes and communicating safety efforts to the public were discussed during this workshop, followed by an interactive panel discussion involving audience participation. In April 2017, the Dam Safety Program hosted a HEC-RAS 2D modeling workshop in Oklahoma City. The 3 day class which was instructed by experts from Freese and Nichols, Inc. was attended by more than 50 engineers and dam safety officials representing several states, cities and private entities.

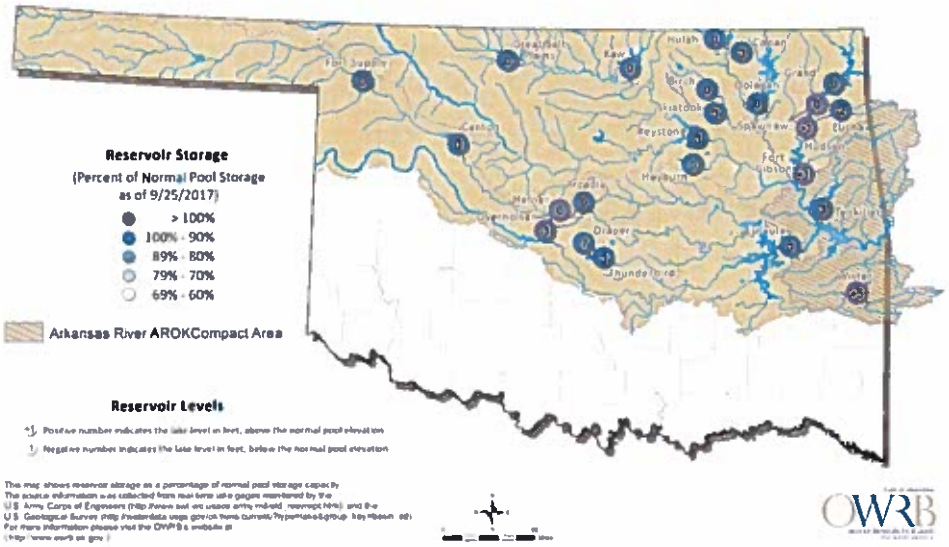
TECHNICAL STUDIES

Consistent with state law, the OWRB continues to focus on several ongoing hydrologic studies to withdrawal rates from Oklahoma's groundwater basins by permitted water users. Several projects slated to begin in fiscal year 2017 include the Boone/Roubidoux aquifer system in northeastern Oklahoma and the Salt Fork of the Arkansas River (see next section).

The OWRB, in partnership with the US Geological Survey (USGS), is currently conducting groundwater hydrologic investigations on the North Fork of the Red River and the Salt Fork of the Red River. The North Fork study was completed in 2016 and the South Fork study is slated to be completed in September 2017. The OWRB and USGS have already completed stream

Surface Water Resources - Arkansas-Oklahoma Arkansas River Compact Area

Reservoir Levels and Storage as of 9/25/2017

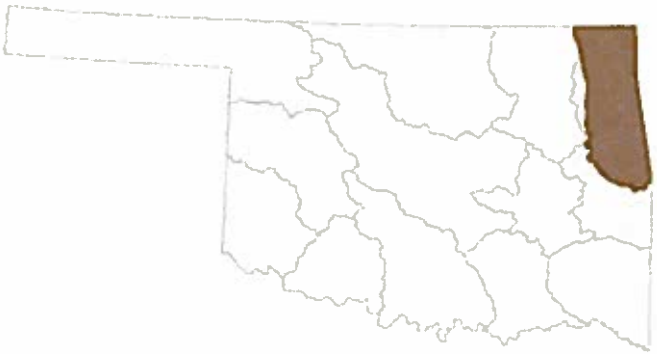


allocation for the North Fork, Salt Fork, and Elm Fork of the Red River basins. Additionally, the OWRB and the US Bureau of Reclamation have completed the first of a three-year study of the entire Upper Red River Basin. The Upper Red River Basin study will build upon existing OWRB/USGS investigations while also updating information on groundwater and surface water demands and supplies, assessing risks to the long-term reliability of reservoirs during drought periods, and evaluating adaptation strategies that address water supply challenges.

The Rush Springs aquifer study, initiated in 2011 in support of the Upper Washita River Basin project, is scheduled to be completed by the Summer 2017. The OWRB continued its work during 2016 on the Upper Washita Basin Study, an ongoing project conducted in collaboration with the Bureau of Reclamation, Foss Reservoir Master Conservancy District, and Fort Cobb Master Conservancy District. The OWRB is also working on groundwater hydrologic investigations in-house as well as contractually with the US Geological Survey.

HYDROLOGIC INVESTIGATION: BOONE/ROUBIDOUX AQUIFER SYSTEM

A hydrologic investigation of the Boone-Roubidoux aquifer, a freshwater resource spanning northeastern Oklahoma, is set to begin in 2017. It is a major component of a larger hydrologic system called the Ozark Plateaus aquifer system. The Boone-Roubidoux aquifer supplies domestic, industrial, irrigation, and municipal wells, with large-volume wells primarily completed in the Roubidoux Formation. Water quality analyses reveal a wide range in water types produced from the Boone and Roubidoux Formations due to changes in lithology and mineral content.



INSTREAM FLOW WORKGROUP

The concept of "instream flow" has evolved over the years, but generally describes the amount of water in a stream or river necessary to ensure that environmental, social and economic benefits are met. In 2016, the OWRB hosted two public forums in Tahlequah to present updates and obtain public feedback on the Illinois River Instream Flow Pilot Study being conducted on the Barron Fork and Flint Creeks above Lake Tenkiller in eastern Oklahoma. The field portion of the pilot study is now complete. The next step is an investigation of how these various flow scenarios would socially and economically affect the region and with guidance from local stakeholders, and weigh those costs/benefits through feedback from stakeholder workshops. This pilot study on a state-designated Scenic River was initiated in 2014 in response to the recommendations of a 25-member Instream Flow Advisory Group. The ultimate goal of this pilot is to develop a methodology for Oklahoma to use in other basins if the state wants to include instream flow as part of watershed's permitting calculations.

WATER QUALITY PROJECTS & MONITORING

OWRB staff continue to work cooperatively with the Central Oklahoma Master Conservancy District (COMCD) to monitor water quality in Lake Thunderbird. This is a long-term monitoring project to address Thunderbird water quality impairments, including high turbidity, algae, and low dissolved oxygen. Along with the work for the COMCD, the OWRB has also entered into a contract with the City of Norman to conduct

ambient and storm water monitoring within the Lake Thunderbird Basin as part of the cities TMDL requirements.

Staff completed the bathymetric mapping of the Clinton, Crowder and Fairfax City lakes. This work was completed as part of an agreement with the Oklahoma Department of Environmental Quality (ODEQ) to map reservoirs currently impaired for the Fish and Wildlife propagation beneficial use due to dissolved oxygen. Additionally, staff completed mapping of Langston lake and firm yield monitoring as part of the Comprehensive Water Plan.

The OWRB has completed work on the 2017 National Lakes Assessment Study. Sampling on numerous lakes across Oklahoma provides data to assess environmental integrity of the waters of the nation. Work will begin this year on the "next round" of the National Rivers and Streams Assessment Study collecting data to assess wadeable and non-wadeable streams over a two year time frame beginning in the summer of 2018.

Through an ongoing successful partnership with the Grand River Dam Authority, the OWRB continued dissolved oxygen monitoring on both Grand and Hudson Lakes to support Federal Energy Regulatory Commission (FERC) relicensing, and began work on W.R. Holway Reservoir to support its relicensing.

The OWRB's groundwater monitoring team assessed Swine Licensed Managed Feeding Operations compliance in an additional 550 wells through a continuing partnership with the Oklahoma Department of Agriculture, Food and Forestry (ODAFF).

Additional OWRB water quality projects include:

- Probabilistic biological monitoring to assess stream ecosystem integrity throughout Oklahoma;
- Confirmatory stream and reservoir monitoring to assess Water Quality Standards beneficial use attainment status;
- Monitoring for the Grand River Dam Authority to assist GRDA in management of their reservoirs for ecosystem support;
- Pre-TMDL monitoring on Lake Arcadia and its watershed for the ODEQ;

BUMP REPORTS PROVIDE WATER QUALITY DATA FOR 2016

The Oklahoma Water Resources Board (OWRB) water monitoring staff announced the release of the agency's 2016 Beneficial Use Monitoring Program (BUMP) reports providing detailed physical, chemical, and biological water data from approximately 1,300 stream, lake, and groundwater well sites across Oklahoma. Created in 1998, BUMP provides data necessary for water quality management decisions by identifying impairments to the "beneficial uses" of Oklahoma's water resources, as well as determining causes for those water quality impairments. The water data contained in the OWRB's annual BUMP report is collected from about 130 lakes and 100 stream segments at approximately 600 sites throughout Oklahoma.

The Groundwater Monitoring and Assessment Program (GMAP), added to BUMP in 2012, consists of a network of approximately 750 wells in Oklahoma's 21 major aquifers, where the OWRB monitors both water levels and water quality. Assessing Oklahoma's groundwater is achieved through both a baseline monitoring network and a long-term (trend) monitoring network within each of the state's 21 major aquifers. This provides information on individual aquifer characteristics as well as a more general assessment of the Oklahoma's groundwater.

The lakes monitoring network consists of 130 lakes across the state. In general, a minimum of three to five stations per lake are sampled depending on the size of the reservoir. Sampling stations are located to represent multiple zones of the lake with additional sites on many reservoirs as necessary.

The stream monitoring network consists of permanent sampling stations in each of the state's 82 water planning basins, as outlined by the Oklahoma Comprehensive Water Plan, and a smaller network of additional reference sites.

The 2016 lakes, streams, and groundwater BUMP reports are available on the OWRB website. Each stream, lake, and well site featured in the report include a detailed fact sheet and map of data collection sites. For additional information, visit the OWRB's Monitoring & Assessment page: www.owrb.ok.gov/bump .

OKLAHOMA WATER QUALITY STANDARDS

Revision topics for the 2017-2018 Interim Rulemaking will include changes to Oklahoma's antidegradation policy and implementation rules (785:45-5; 785:46-13), implementation rules for Sensitive Water Supply—Reuse Waters (785:46-13), implementation policies for the Oklahoma Groundwater Quality Standards (OGWQS) (OAC 785:45-7), site specific copper criteria for Mud Creek in southeastern Oklahoma, and an updated methyl-mercury criterion. For information on the draft rule revisions and to view revised language, please visit the OWRB website at http://www.owrb.ok.gov/util/rules/wqs_revisions.php. Also, standards changes proposed in the most recent interim revision were recently approved and became state rule in September. Changes relevant to the Ark/Ok compact area included:

- Revisions and updates to the Oklahoma Groundwater Quality Standards (OGWQS) (OAC 785:45-7). The revision included the addition of an updated antidegradation policy for groundwaters, revisions to classifications of fresh groundwater, development of a new Domestic Untreated Water Supply beneficial use, and promulgation of numeric and narrative criteria for recharge projects to groundwaters.

WATER INFRASTRUCTURE FINANCING

The OWRB administers the State Financial Assistance Program (FAP), backed by the Statewide Water Development Revolving Fund, which awards loans and grants for the construction and improvement of water and sewer facilities. In all, through the OWRB's five loan and grant programs, more than $3.6 billion in financing has been provided for water and sewer projects in Oklahoma with a total estimated savings of more than $1.2 billion to Oklahoma communities. In 2016, 18 loans were funded totaling $224,528,000, and 17 grants totaling $1,480,790.86 were approved by the Board. As of September 2017, 19 loans totaling $146,917,807.60 were funded and 14 grants totaling $1,332,610.79 have been approved by the Board this year.

PROGRAM	NUMBER AND AMOUNT
FAP Loans	380 for $1,022,310,000
CWSRF Loans	306 for $1,431,655,200
DWSRF Loans	190 for $1,166,748,300
REAP Grants	672 for $59,561,641
Emergency Grants	575 for $34,178,455
Drought Response Grants	6 for $418,848
Water for 2060	8 for $2,625,000
TOTAL (as of 05/31/17)	2,137 for $3, 717,497,443

The new Water Infrastructure Credit Enhancement Reserve Fund—a $300 million pledge of credit from the state enabled through an OCWP priority recommendation and subsequent passage of State Question 764—was instrumental in Standard and Poor's rating upgrade to AAA of the State Revenue Bond Loan Program. The

upgrade allows municipalities and rural water/sewer districts to receive loans from the program at lower interest rates than what they could receive through conventional financing.

OWRB LOAN PROGRAM RECEIVES AAA RATING

In 2016, the OWRB sold $16,435,000 in revenue bonds for its Financial Assistance Loan Program (FAP). The OWRB's bonds received an "AAA" rating from Standard & Poor's Rating Service. Citing a number of program and oversight strengths, the report stated, "The long-term rating reflects the strengths of the program...". The report also highlighted the OWRB's management of Oklahoma's Water Infrastructure Credit Enhancement Reserve Fund (WICERF), a fund created by Oklahoma citizens' through passage of SQ 764 in November 2012. State Question 764 authorized the OWRB to issue up to $300 million of state general obligation bonds to help meet the projected multi-billion dollar need of Oklahoma's water-related infrastructure. The FAP is the OWRB's longest-running, and one of the most cost-effective, financial programs available to municipalities and other water systems. Since the FAP's inception in 1985, the OWRB has approved 379 loans totaling over $1 billion to assist communities and other water systems in providing safe and reliable water resources to their customers.

HISTORIC WATER RIGHTS AGREEMENT

In August 2016, the State of Oklahoma, City of Oklahoma City, and Choctaw and Chickasaw nations announced a historic water rights settlement agreement that settles longstanding lawsuits involving water rights in south central and southeastern Oklahoma.

The settlement, which is being considered by Congress for final approval, will resolve long-standing questions over water rights ownership and regulatory authority over the waters of the Choctaw and Chickasaw nations' historic treaty territories, an area that spans approximately 22 counties in south-central and southeastern Oklahoma. Under the agreement, the state will continue to exercise its authority to manage and protect water resources in Oklahoma. This way, existing uses of water remain secure, and it provides certainty for future development.

The agreement also gives the Choctaw and Chickasaw nations a voice in specific proceedings addressing water resources within their treaty territories. It also fully resolves the state's debt to the federal government for the construction of Sardis Lake, ensuring Oklahoma City has a reliable water supply while providing a standard to protect lake levels in Sardis, which all agreed is very important. A mechanism is in place to collaboratively address any possible out-of-state water use if out-of-state water use is ever authorized by the Legislature. It will provide protections for the source basin and region while ensuring the entire state benefits.

With this agreement, the rural communities and recreational and ecological values of south-central and southeastern Oklahoma are preserved and protected. And Oklahoma City has a path to obtain access to sufficient water to secure the economic posterity of central Oklahoma for generations to come. Without this agreement, existing water rights – for urban, agricultural, industrial uses – and development for future uses and needs would remain uncertain.

When finalized, the agreement will protect existing rights and provide certainty for the development of future uses both in and outside southeastern Oklahoma. After the agreement is signed by all parties, it must be approved by federal legislation and executed by the Secretary of the U.S. Department of the Interior. More information about the agreement can be found by visiting www.waterunityok.com

OTHER LEGAL MATTERS

The District Court of Oklahoma County affirmed an order of the Oklahoma Water Resources Board (OWRB) which embodied the state's first implementation of Senate Bill 288, enacted in 2003. Senate Bill 288 prohibited the OWRB from issuing groundwater permits which would reduce the "natural flow" of springs and streams draining "sensitive sole source groundwater basins." Senate Bill 288 was the first act of the Oklahoma Legislature which addressed a connection between groundwater and stream water in Oklahoma's system for administration of rights to the use of groundwater. The Oklahoma Supreme Court had previously rejected a facial challenge to Senate Bill 288 in Jacobs Ranch, L.L.C. v. Smith.

The OWRB's order set the maximum amount of groundwater which may be withdrawn annually under permits from the Arbuckle-Simpson, a sensitive sole source groundwater basin as defined in 82 O.S. §1020.9A. Where temporary permits had previously authorized the withdrawal of up to 2 acre-feet per acre of land overlying the aquifer, the OWRB's order limited that amount to 0.2 acre-feet per acre. Those challenging the order argued that such a restriction on the use of groundwater, a private property right in Oklahoma, was a de facto "taking" that required compensation under the Oklahoma and US constitutions. The District Court disagreed. Appeal has been taken to the Oklahoma Supreme Court.

Administrative Rule Defining "Fresh Water" for Drinking Water Wells Upheld. - In Sharp Drilling Co. v. Oklahoma Water Resources Board, a water well drilling company challenged an administrative rule defining "fresh water" in the context of groundwater as water containing less than 5000 parts per million total dissolved solids (TDS). The drilling company challenged the rule after the OWRB directed it to abandon and plug a newly-drilled drinking water well which tested at more than 8000 parts per million TDS. The drilling company argued that fresh groundwater was defined elsewhere in state regulations, including in the OWRB's Groundwater Quality Standards, as water containing less than 10,000 parts per million total dissolved solids.

The OWRB argued that its authority to regulate commercial drilling of groundwater wells was derived from Oklahoma Groundwater Law, which also defined fresh groundwater as that water containing less than 5000 parts per million TDS. The OWRB further argued that the regulations cited by the drilling company were intended to govern different commercial activities, such as oil and gas drilling and power plant operation, and did not permit groundwater with more than 5000 parts per million TDS to be used for drinking water supply. The District Court of Oklahoma County upheld the OWRB's rule. The decision was not appealed.

Arkansas Commissioners' Report

Arkansas-Oklahoma
Arkansas River Compact Commission
Vinita, Oklahoma
September 27-28, 2017

NONPOINT SOURCE MANAGEMENT PROGRAM

The Arkansas Natural Resources Commission continues to use the Clean Water Act section 319(h) program to help finance water quality projects in the Illinois and Upper White River watersheds. Projects of interest to the Compact Commission include:

NPS Management Plan

Work continues to progress on the update and development of the 2017-2022 Arkansas NPS Management Plan. The Plan will incorporate an additional watershed (Lower Little) as a NPS priority. Priority watersheds identified in the 2017-2022 NPS Management Plan are:

- Bayou Bartholomew (HUC 8040205) *
- Cache River (HUC 8020302) *
- Illinois River (11110103) *
- L'Anguille River (HUC 8020205) *
- Lake Conway-Point Remove (HUC 11110203)
- Lower Little (HUC 111409109) *
- Lower Ouachita – Smackover Creek (HUC 8040201)
- Poteau River (HUC 11110105)
- Strawberry River (HUC 11010012) *
- Upper Saline (HUC 8040203)
- Upper White (HUC 11010001) *

*indicates 9 element plan WMP has be developed and accepted by EPA

Illinois River Watershed Partnership

The Illinois River Watershed Partnership (IRWP) is using a 9-element Watershed Based Plan to reduce non-point source sediment and nutrient loads through the implementation and demonstration of green infrastructure elements. Water quality improvements will be achieved through institutionalizing green infrastructure as a voluntarily implemented Best Management Practice (BMP). IRWP works collaboratively with communities in the Watershed to help protect water quality while helping communities realize the greatest possible benefits of conservation efforts and investments. Conservation, restoration and enhancement of natural areas and green spaces in the watershed are continuing to be realized by incorporating trees and native grasses in riparian areas, installing rain gardens, vegetated roofs, and incorporating rain water harvesting to mimic natural systems in

developed areas, revitalize downtown areas, and make neighborhood streets and greenways safe for walking and biking while reinforcing a sense of place.

Washington County Cooperative Extension
The Washington County Cooperative Extension Service has a project to communicate the connection between best management practices and streams that receive stormwater and other runoff. This project builds upon previous EPA 319 projects. Education and engagement efforts are being broadened and refined to address resident activities that have the potential to increase NPS pollutant loads. Potential activities of stakeholders such as disposal of yard waste, excess chemicals, soaps and detergents from car maintenance and cleaning products into storm drains are being highlighted with the use of a GoPro camera. The camera follows "pollutants" as they travel to the storm drain inlet, down the drain and through underground conduits to receiving waters without going through any treatment processes. The project is utilizing social media, video and direct engagement at NPS pollution prevention events to educate stakeholders about the effect of these types of activities and how they diminish water quality. The increased awareness and knowledge of select best management practices (BMPs) is instrumental to improve the water quality of the Beaver Reservoir and Illinois River Watersheds. The project is also installing two unique storm drain inlets and LID BMP demonstrations. These implementations and demonstrations are being coordinated with the participation of the cities of Fayetteville and Springdale.

The techniques, challenges, and successes learned from this project will be shared with conservation organizations, LID professionals, jurisdictions, and agencies across Arkansas.

The project period is October 1, 2015 – June 30, 2018

Watershed Management Plans
Most recently ANRC and its contractor have developed nine-element watershed management plans (WMP) in the Cache, Strawberry River and Lower Little watersheds that were accepted by EPA. Additionally, a WMP is being developed in the Buffalo River watershed is to be completed by March 2018. The WMPs are developed cooperatively with the input from stakeholders, the use of available and applicable QA/QC data and information from other state and federal agencies.

♦♦♦

GROUNDWATER
USGS and NRCS, continue to monitor approximately 1,500 groundwater wells around Arkansas annually. The ANRC also has installed 55 monitoring wells designated to measure groundwater levels. The water level and water use data collected is analyzed, and an annual Groundwater Protection and Management Report is produced. The data ANRC groundwater staff collects is also used in USGS aquifer reports as well as

groundwater flow models. Annual reports back to 2004 are available on the ANRC website.

Water use from the Mississippi River alluvial aquifer in 2015 totaled 7,636 million gallons per day. Sustainable yield from the aquifer is 3,375 million gallons per day. Therefore, *56 percent of reported use was unsustainable.*

♦♦♦

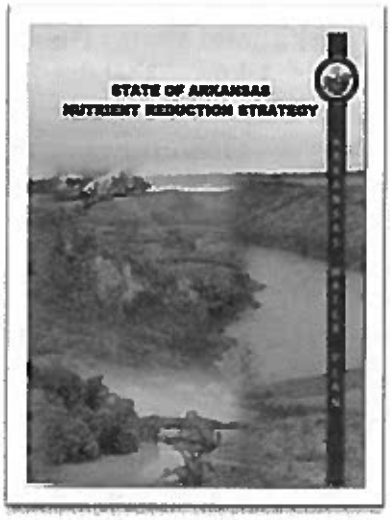
Water Well Construction Commission

The ANRC Groundwater Section staffs this commission which licenses approximately 200 water well contractors and registers over 500 drillers and pump installers through apprenticeship and testing programs. The commission meets six times per year to carry out normal functions as well as administrative hearings on improper well construction, or licensing violations. A database of all water wells drilled in the state is maintained which collects the required water well construction reports provided by contractors within 90 days of construction.

♦♦♦

Nutrient Reduction Strategy

Initiated by the 2014 Arkansas Water Plan update and Arkansas's participation in the Gulf of Mexico Hypoxia Task Force, the Arkansas Nutrient Reduction Strategy (ANRS) is a strategic framework that outlines opportunities, both regulatory and voluntary, which are available to improve overall aquatic health and viability in Arkansas waters for recreational, economic, environmental, and human health benefits. The ANRS is not a regulatory document and does not supersede existing water laws governing water quality issues in Arkansas. Rather, it focuses on outreach and "grass-roots" implementation of nutrient reduction activities. Arkansas has invested significant effort to address point and non-point source nutrient loading through state, federal, and private partnerships. Partnerships with local, county, state, federal, non-profit, academic, and for-profit private sector entities are necessary for: a) mobilization and coordination of available resources, b) consistent interpretation and implementation of water management policies, c) long-term support at the national, state, and local levels, and d) advancement of science-based technologies, methods, and new nutrient reduction techniques. The Water Plan update directed that ANRC facilitate public review of the Strategy and coordinate implementation of nutrient reduction activities with public and private entities. That process has begun.



♦♦♦

DAM SAFETY

ANRC manages the Dam Safety Program for the State of Arkansas. At present ANRC has 409 active permitted dams that it inspects on a routine basis. Of the 409 active permitted dams, 114 are high hazard, 92 are significant hazard, and 203 are low hazard. We are cooperating with NRCS, who assists with the maintenance of dams constructed under the federal watershed dam program decades ago. Through a cooperative agreement, we have been able to hire an additional dam inspector and have assembled a trailer with equipment aboard to be used to lower lake levels to perform repairs or to respond to emergencies. NRCS has also lent ANRC survey equipment to work on these dams.

♦♦♦

FLOODPLAIN MANAGEMENT

Our floodplain management program continues to train, accredit, and assist community floodplain managers around the state. They also assist with damage assessments following floods.

Arkansas Water Plan

The Arkansas Water Plan is being implemented. Some highlights include:

Drought planning

Arkansas recently moved from "no drought plan" to "in progress" in the National Drought Mitigation Center's (NDMC) inventory of state drought plans. The Water Plan update recommended that the state plan for drought. With NDMC's support and help from the Southern Climate Impacts Planning Program, ANRC kicked off the planning effort by engaging agencies and organizations last year. We are now working with a contractor this fall to convene the workgroups and build capacity for drought planning and response.

Stream gauging and monitoring

The Water Plan recommends a coordinated effort to continue support for gauging and monitoring. Work with federal, state, and local agencies, water utilities, academic institutions, and interested groups to coordinate our network of gauges and monitoring sites will continue.

Water use data improvements

Participants in the Water Plan update expressed concern about the accuracy of water use information, specifically, the method of estimating agricultural water use. Eighty percent of Arkansas's water use is for crop irrigation, so this issue is central to water planning.

Separate projects are being carried out to address this concern:

- ANRC just completed a project contract with an engineering firm to work with irrigators and irrigation experts to review water use collection and data and to recommend changes to the commission. We are addressing the concerns with USGS, the agency that manages the electronic database. Additional money from USGS is being put into improvements to the server and software.
- Arkansas has over 50,000 irrigation wells and over 10,000 surface water relifts. It is impossible to install and maintain meters on all of them, so estimated water use is reported by farmers. To improve water use estimates, the USGS is conducting a study of groundwater use from the alluvial aquifer by installing 65 meters to be monitored over a multi-year period. Several of the meters will be located near real-time groundwater level measurement sites, and approximately 20% of the wells will have real-time telemetry.

- NRCS and ANRC are conducting a joint project to cost share meter installation with farmers on alluvial wells in designated Critical Groundwater Areas. A team of irrigation specialists, also financed through an NRCS grant and ANRC, is working with farmers to place the meters and to monitor them on a regular basis. Through cost-share and tax incentives, ANRC hopes to increase the number and distribution of metered withdrawals, so county-by-county estimate tables can be improved.

Groundwater Conservation

Unsustainable groundwater use for crop irrigation can be reduced by approximately 25% with widespread adoption of water-saving irrigation techniques and technology. NRCS and ANRC have worked together to hire a team of irrigation technicians to work with farmers to conserve water. Educational efforts have been stepped up to communicate the message of irrigation conservation. Several practices are starting to be adopted widely, including computerized irrigation pipe layout software, surge valves, alternate wetting and drying, and cover crops. We have moved from debate over whether there is a groundwater problem to finding solutions.

The updated Arkansas Water Plan and supporting documents can be viewed in detail at arkansaswaterplan.org.

2017 COMMITTEE REPORTS

2017 BUDGET
COMMITTEE

Arkansas Natural Resources Commission

Bruce Holland
Executive Director

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Little Rock, Arkansas 72201
http://www.anrc.arkansas.gov/

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Fax: (501) 682-3991
E-mail: anrc@arkansas.gov

Asa Hutchinson
Governor

MEMORANDUM

TO: Yohanes Sugeng

FROM: Edward Swaim, Treasurer

DATE: August 30, 2017

SUBJECT: Budget

As a member of the Budget Committee, please find enclosed the 2017 Meeting Budget for the Arkansas-Oklahoma Arkansas River Compact Commission. Expenses for the 2016-2017 fiscal years are displayed under Expenses FY 2017.

The next audit will be completed June 30, 2018 at which time a copy of the Cash Receipts and Disbursements will be forwarded to you.

ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION

2017 Meeting
BUDGET

ITEM	Total EXPENSES FY - 2017 7/1/2016 6/30/2017	(BUDGET) FY - 2017 7/1/2016 6/30/2017	To date EXPENSES FY - 2018 7/1/2017 6/30/2018	(BUDGET) FY - 2018 7/1/2017 6/30/2018	(PROPOSED) FY - 2019 7/1/2018 6/30/2019
Chairman Hosts		$ 500.00		$ 500.00	$ 500.00
Postage		$ 60.00		$ 60.00	$ 60.00
Stationery		$ 75.00		$ 75.00	$ 75.00
Printing & Reproduction		$ 1,000.00		$ 1,000.00	$ 1,000.00
Personnel Service & Office Expenses		$ 120.00		$ 120.00	$ 120.00
Biennial Audit	$ 275.00	$ 275.00			$ 275.00
Meeting Place	$ 581.13	$800.00		$ 800.00	$ 800.00
Security Bond	$ 411.00	$ 688.00		$ 698.00	$ 698.00
Contingency	$ 36.00	$ 420.00		$ 420.00	$ 420.00
Computation of Annual Water Yield		$ 2,000.00		$ 2,000.00	
Stressor Response Study -Illinois River	$ 233,568.54	$ 600,000.00 *		$ 5,000.00 **	
Stream Gaging		$ 6,300.00		$ 6,300.00	$6,300.00
TOTALS:	**$ 234,871.67** 6/30/2017	**$ 612,238.00**		**$ 16,973.00**	**$ 10,248.00**
1/2 Annual budget to be paid by each state		$3,500.00		$3,500.00	$3,500.00

*** This is total study cost.**
**** To allow spending remainder**

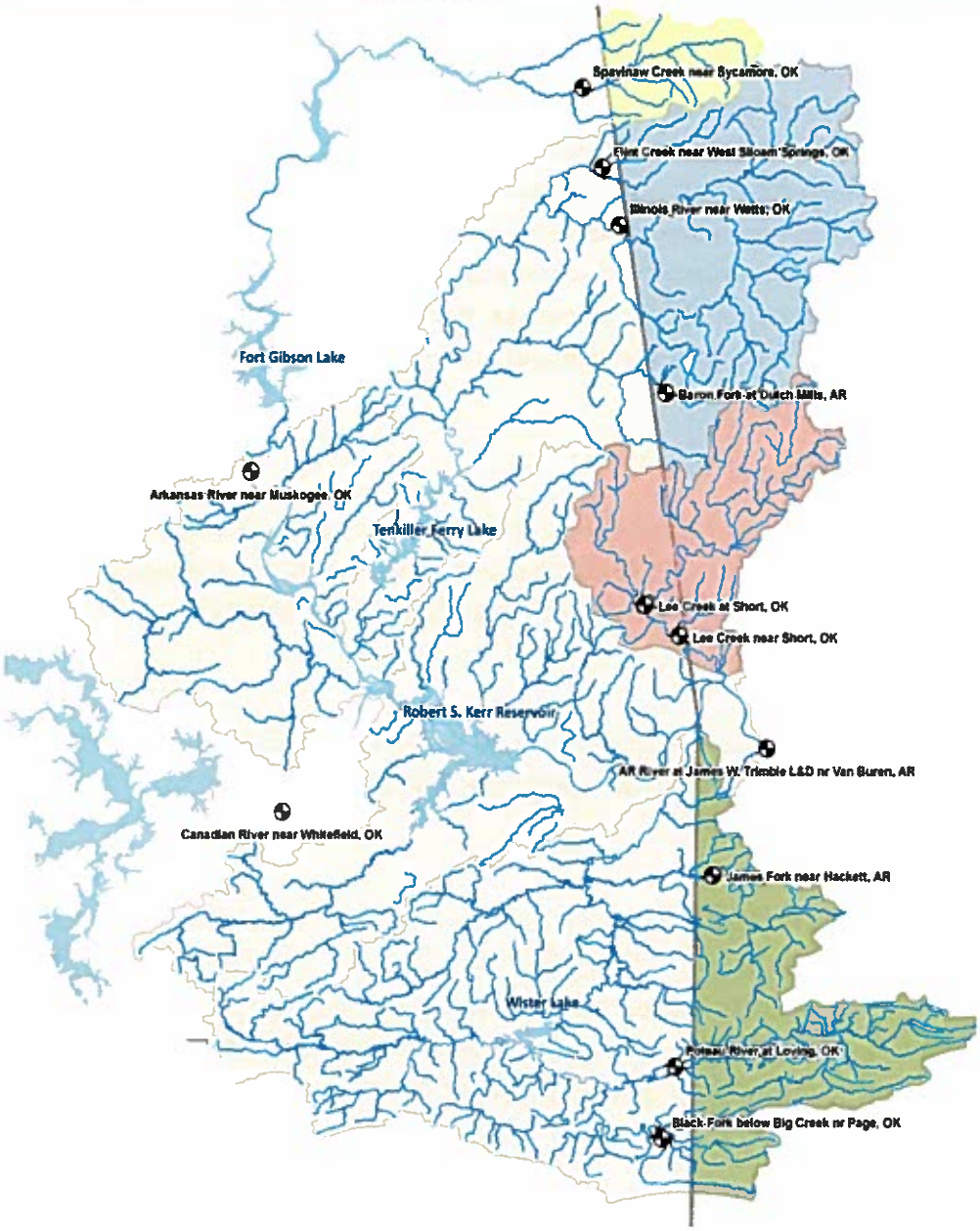
Attachment G.

August 21, 2017

2017 ENGINEERING COMMITTEE REPORT

Arkansas River Basin Compact

Annual Compliance Report



September 2017

Submitted to the Arkansas-Oklahoma Arkansas River Basin Compact Commission

Attachment H.

ARKANSAS RIVER BASIN COMPACT

ANNUAL REPORT

The Arkansas River Basin Interstate Compact (Compact) exists to promote interstate comity between the states of Arkansas and Oklahoma and provide for an equitable apportionment of the waters of the Arkansas River between the States of Arkansas and Oklahoma. Provisions in the Compact specify apportionment requirements for the Illinois River, Lee Creek and Spavinaw Creeks, Poteau River, and Arkansas River subbasins based on computation of annual runoff, yield, and depletion/accretions. In an effort to streamline computations and verify Compact compliance, an Excel-based data entry and analyses tool has been developed to standardize computation methods and annual reporting. The new report summary includes compilation of reservoir depletions and subbasin yields in single page, tabular formats. A description of computation methods and procedures is included as Appendix A.

COMPACT COMPLIANCE

For the water year 2014, annual yields in the Illinois River, Lee Creek, Spavinaw Creek, Poteau River, and Arkansas River subbasins exceeded apportionment requirements (no computed deficits) Results from compliance computations are summarized in Tables #1 and #2 on page 2.

Note:

- *Nutrient loading and water quality data for the Illinois River subbasin is reported in a separate publication entitled Water Quality Monitoring Report Illinois River Basin.*

USGS STREAM GAGE CALIBRATION

The following describes United States Geological Survey stream gage calibration as noted in Geological Survey Water-Supply Paper 2175: *Measurement and Computation of Streamflow: Volume 1, Measurement of Stage and Discharge, S. E. Rantz and others.*

> "Each gage will be equipped with data collection platforms that record stage (water-level) at 15-minute intervals and transmit these data to the USGS National Water Information System (NWIS) database and displayed in near real-time on the USGS web page (http://ar.water.usgs.gov). Water-level information from the gages will be used to develop discharge rating curves for calculation of instantaneous and daily discharge in accordance with methods as described by Rantz and others (1982)."

Arkansas River Basin Compact
2016 Computations Summary

Summary of Results for Water Year 2016

Table 1. Annual Depletion by Major Reservoirs in the Compact Area

ANNUAL DEPLETIONS BY MAJOR RESERVOIRS IN ACRE-FEET (AF)

RESERVOIR	CHANGE IN STORAGE	PRECIPITATION (P)	RUNOFF (p)	EVAPORATION (E)	PERMITTED DIVERSIONS (D)	RELEASES (O)	INFLOW (I)	DEPLETIONS (X)
Webber Falls	10,005	51,833	9,330	44,383	-	11,140,018	11,151,903	11,885
Tenkiller Ferry	(50,441)	46,644	8,396	48,785	8,162	1,831,368	1,799,625	(31,743)
Robert S. Kerr	(35,815)	169,416	30,495	171,361	1,149	31,391,171	31,388,944	(2,226)
Wister	4,455	39,925	7,186	26,384	9,617	1,193,208	1,200,926	7,718
						ANNUAL DEPLETIONS:		**(14,366)**

Table 2. Annual Yield from Sub-basins in the Compact Area

ANNUAL YIELD FROM SUB-BASINS IN ACRE-FEET (AF)

SUB-BASIN	RUNOFF	DEPLETIONS (+) ACCRETIONS (-)	ANNUAL YIELD[1]	STATE OBLIGATED	FLOW REQUIRED TO DELIVER		ACTUAL FLOW DELIVERED
					Percentage	Amount	
Spavinaw Creek	107,352	1	**107,353**	AR	50	53,677	**107,352**
Illinois River	813,596	(18,264)	**795,332**	AR	40	318,133	**813,596**
Lee Creek	308,518	1,797	**310,315**	AR	0	-	**308,518**
Poteau River	579,793	696	**580,489**	AR	40	232,196	**579,793**
Arkansas River	4,296,752	829	**4,297,581**	OK	40	1,719,032	**4,296,752**

[1] *Runoff which would occur from any specified area under unaltered conditions*

Arkansas River Basin Compact
2016 Reservoir Summary

WATER BALANCE FOR LARGE RESERVOIRS IN THE COMPACT AREA															
	Normal Storage	Surface Area	Month	Storage	Precipitation (P)		Runoff (p)	Evaporation (E)			Diversions (D)	Releases (O)		Inflow (I)	Depletions (X)
	AF	Acres		AF	in	AF	AF	in	in*	AF	AF	Total (DSF)	Total AF	AF	AF
Webbers Falls	170,100	11,600	Oct	163,740	3.01	2,910		4.62	3.23	3,126		63,788	126,523		
			Nov		8.44	8,159		2.46	1.72	1,665		417,474	828,060		
			Dec		13.05	12,615		2.18	1.53	1,475		2,505,485	4,969,629		
			Jan		0.67	648		2.28	1.60	1,543		2,004,305	3,975,539		
			Feb		1.16	1,121		4.21	2.95	2,849		274,420	544,312		
			Mar		3.74	3,615		5.28	3.70	3,573		283,878	563,072		
			Apr		5.34	5,162		6.68	4.68	4,520		721,181	1,430,463		
			May		3.62	3,499		6.27	4.39	4,243		1,529,038	3,032,847		
			Jun		1.82	1,759		8.96	6.27	6,063		997,467	1,978,476		
			Jul		5.94	5,742		8.70	6.09	5,887		756,811	1,501,135		
			Aug		3.74	3,615		7.70	5.39	5,210		548,290	1,087,533		
			Sep	173,745	3.09	2,987		6.25	4.38	4,229		1,037,881	2,058,637		
			TOTAL	10,005	53.62	51,833	9,330	65.59	45.91	44,383	-		11,148,918	11,151,903	11,885
Tenkiller Ferry	627,467	12,900	Oct	682,894	2.8	2,989		4.06	2.84	3,055		17,672	35,052		
			Nov		7.9	8,450		2.55	1.79	1,919		34,670	68,768		
			Dec		11.9	12,750		2.77	1.94	2,084		235,747	467,604		
			Jan		0.7	763		2.47	1.73	1,859		337,817	670,060		
			Feb		0.7	785		3.88	2.72	2,920		38,233	75,835		
			Mar		3.4	3,612		5.24	3.67	3,943		57,519	114,089		
			Apr		4.5	4,870		6.65	4.66	5,004		19,183	38,049		
			May		3.4	3,612		6.15	4.31	4,628		66,767	132,432		
			Jun		0.9	946		8.57	6.00	6,449		53,917	106,944		
			Jul		4.5	4,816		8.45	5.92	6,359		21,637	42,917		
			Aug		0.8	828		7.59	5.31	5,711		22,984	45,589		
			Sep	632,453	2.1	2,225		6.45	4.52	4,854		17,155	34,027		
			TOTAL	(50,441)	43.39	46,644	8,396	64.83	45.38	48,785	8,162		1,831,368	1,799,625	(31,743)
Robert S. Kerr	525,700	41,900	Oct	555,468	1.96	6,844		4.87	3.41	11,903		107,674	213,571		
			Nov		8.50	29,679		2.43	1.70	5,939		582,145	1,154,685		
			Dec		12.12	42,319		2.26	1.58	5,524		3,632,164	7,204,397		
			Jan		0.37	1,292		2.32	1.62	5,670		3,478,573	6,899,750		
			Feb		1.24	4,330		4.48	3.14	10,950		434,782	862,390		
			Mar		3.89	13,583		5.30	3.71	12,954		779,521	1,546,180		
			Apr		4.64	16,201		6.95	4.87	16,987		1,096,851	2,175,604		
			May		2.75	9,602		7.00	4.90	17,109		2,102,290	4,169,092		
			Jun		2.25	7,856		9.66	6.76	23,611		1,244,562	2,468,589		
			Jul		4.47	15,608		9.85	6.90	24,075		737,429	1,462,690		
			Aug		3.78	13,199		7.78	5.45	19,016		552,700	1,096,280		
			Sep	519,653	2.55	8,904		7.21	5.05	17,622		1,077,460	2,137,142		
			TOTAL	(35,815)	48.52	169,416	30,495	70.11	49.08	171,361	1,149		31,391,171	31,388,944	(2,226)
Wister	48,850	7,700	Oct	45,880	1.30	834		3.92	2.74	1,761		2	4		
			Nov		11.83	7,591		1.84	1.29	826		9,524	18,891		
			Dec		12.96	8,316		1.75	1.23	786		160,548	318,447		
			Jan		0.32	205		1.84	1.29	826		197,039	390,827		
			Feb		1.73	1,110		3.66	2.56	1,644		45,694	90,634		
			Mar		8.39	5,384		4.43	3.10	1,990		87,554	173,663		
			Apr		8.05	5,165		5.72	4.00	2,569		30,165	59,832		
			May		2.14	1,373		5.93	4.15	2,664		64,734	128,400		
			Jun		0.86	552		8.41	5.89	3,777		-	-		
			Jul		7.97	5,114		8.31	5.82	3,733		2,022	4,011		
			Aug		4.12	2,644		6.63	4.64	2,978		2,210	4,384		
			Sep	50,335	2.55	1,636		6.30	4.41	2,830		2,075	4,116		
			TOTAL	4,455	62.22	39,925	7,186	58.74	41.12	26,384	9,617		1,193,208	1,208,926	7,718

*A coefficient of 0.7 is applied to convert pan evaporation data to lake evaporation

Arkansas River Basin Compact

Sub-basin Drainage Areas

Water Year 2016 - Additional Tables (refer to Drainage Areas for adjustment of flows)

USGS 07191220		
Spavinaw Creek near Sycamore, OK		
Drainage area:	133	sq.mi
Measured	59,324	cfs
	117,668	acre-feet
Adjusted to State Line		
Drainage Area:	121.34	sq.mi
Estimated	54,123	cfs
	107,352	**acre-feet**

USGS 07195855		
Flint Creek near West Siloam Springs		
Drainage area:	60	sq.mi
Measured	26,462	cfs
	52,487	acre-feet
Adjusted to StateLine		
Drainage Area:	55	sq.mi
Estimated	24,147	cfs
	47,896	acre-feet

USGS 07195500		
Illinois River near Watts, OK		
Drainage area:	635	sq.mi
Measured	355,768	cfs
	705,666	acre-feet
Adjusted to StateLine		
Drainage Area:	630	sq.mi
Estimated	352,720	cfs
	699,620	**acre-feet**

USGS 07196900		
Baron Fork at Dutch Mills, AR		
Drainage area:	41	sq.mi
Measured	21,456	cfs
	42,558	acre-feet
Adjusted to StateLine		
Drainage Area:	63	sq.mi
Estimated	33,315	cfs
	66,079	acre-feet

USGS 07249985		
Lee Creek near Short, OK		
Drainage area:	420	sq.mi
Measured	267,080	cfs
	529,754	acre-feet
Adjusted to StateLine		
Drainage Area:	245	sq.mi
Estimated	155,542	cfs
	308,518	acre-feet

USGS 07247015		
Poteau River at Loving, OK		
Drainage area:	269	sq.mi
Measured	184,947	cfs
	366,842	acre-feet
Adjusted to StateLine		
Drainage Area:	262	sq.mi
Estimated	179,859	cfs
	356,751	**acre-feet**

USGS 07247250		
Black Fork below Big Creek nr Page, OK		
Drainage area:	74	sq.mi
Measured	95,348	cfs
	189,123	acre-feet
Adjusted to StateLine		
Drainage Area:	18	sq.mi
Estimated	22,594	cfs
	44,815	**acre-feet**

USGS 07247250		
James Fork near Hackett, AR		
Drainage area:	147	sq.mi
Measured	84,541	cfs
	167,687	acre-feet
Adjusted to StateLine		
Drainage Area:	156	sq.mi
Estimated	89,855	cfs
	178,227	**acre-feet**

USGS 07250550		
AR River at James W Trimble L&D nr Van Buren		
Drainage area:	151,000	sq.mi
Measured	16,966,766	cfs
	33,653,580	acre-feet
Adjusted to StateLine		
Drainage Area:	149,954	sq.mi
Estimated	16,849,266	cfs
	33,420,519	**acre-feet**

USGS 07194500		
Arkansas River near Muskogee, OK		
Drainage area:	84,133	sq.mi
Measured	10,389,380	cfs
	20,607,335	**acre-feet**

USGS 07245000		
Askansas River near Whitefield, OK		
Drainage area:	37,876	sq.mi
Measured	3,435,606	cfs
	6,814,525	**acre-feet**

Arkansas River Basin Compact

Appendix A

Guidelines for the Computation of Annual Yields

This document provides details on the data sources and methods required for computation of the annual yields for the Spavinaw Creek, Illinois River, Lee Creek, Poteau River and Arkansas River Sub-basins of the Oklahoma-Arkansas River Compact.

Computation of Annual Yields

The Oklahoma-Arkansas River Compact states the required determinations for computation of annual yields (Appendix I, page 116), as follows:

1. **Measurement or computation of actual runoff from each Sub-basin**
2. **Computation of total depletions or accretions in each of the respective Sub-basins**
3. Sum of items (1) and (2) to obtain the "annual yield" for each basin
4. Multiply item (3) by 100 minus the percent depletion allowed in Article IV of the Compact
5. Compute deficiency, if any, by comparing item (4) to (1)

Items 1 and 2 are explained in this document, as these involve interpretation of the Compact, data collection and application of appropriate methods for computation of runoff, accretions, and depletions. Items 3 to 5 are not included herein as these are self-explanatory.

1. Measurement or Computation of Actual Runoff from each Sub-basin

- Runoff from the Sub-basins should be computed using the areas defined by the Compact in Article II (page 93), and further comments of the Committee presented in Appendix I, Item 1 (page 117-118). Active USGS streamflow gauges should be used to retrieve measured runoff as available. Since most gauges are not located right on the Oklahoma-Arkansas state border, estimates of runoff should account for the ungauged flows generated in the drainage area above or below the selected gauge.

  In the case of the Spavinaw Creek, Illinois River, Lee Creek and Poteau River Sub-basins, the runoff measured at the gauges needs to be adjusted using simple linear interpolation, as follows:

$$R = R_M * \left[\frac{A_T}{A_G}\right] \qquad \textbf{(Eq. 1)}$$

Where,

***R** = Actual runoff at the OK-ARK state line*

***R_M** = Measured runoff at the gauge*

***A_G** = Contributing area at the gauge*

***A_U** = Area ungauged above or below gauge*

***A_T** = Total area including ungauged portion. Because water from these Sub-basins originates in the state of Arkansas, then:*

- *If gauge is located on the Oklahoma side: $A_T = A_G - A_U$*
- *If gauge is located on Arkansas side: $A_T = A_G + A_U$*

The report should include a brief description of the procedure used to compute actual runoff (R) in these Sub-basins, and should also include the measured ungauged drainage areas used for such computation.

In the case of the Arkansas River Sub-basin, the Compact specifies that the following formula be applied (Appendix I, Item 1, page 117):

$$Q_A = Q_V - [Q_M + Q_W + Q_2 + Q_3 + Q_4] \quad \textbf{(Eq. 2)}$$

Where,

Q_A = *Total annual discharge originating from the Arkansas River Sub-basin.*
Q_V = *Total annual discharge of the Arkansas River immediately below the mouth of Lee Creek presently measured at the Van Buren gaging station.*
Q_M = *Total annual discharge of the Arkansas River immediately below the mouth of the Grand Neosho River, presently measured at the Muskogee gaging station.*
Q_W = *Total annual discharge of the Canadian River at Eufaula Dam, presently measured at Whitefield gaging station.*
Q_2 = *Total annual outflow from the Illinois River Sub-basin.*
Q_3 = *Total annual outflow from the Lee Creek Sub-basin.*
Q_4 = *Total annual outflow from the Poteau River Sub-basin.*

Measured runoff should be retrieved from the USGS website (http://waterdata.usgs.gov/nwis) for the following gauges (Figure 1), as available:

Table 1. Current USGS gauges used for Computation of Runoff at Sub-basins in the Compact Area

Sub-basin	USGS Gauges Required	Drainage Area (mi^2)
Spavinaw Creek	07191220 - Spavinaw Creek near Sycamore, OK	133
Illinois River	07195855 - Flint Creek near West Siloam Springs, OK	59.8
	07195500 - Illinois River near Watts, OK	635
	07196900 - Baron Fork at Dutch Mills, AR	41
Lee Creek	07249985 - Lee Creek near Short OK	420
Poteau River	07247015 - Poteau River at Loving, OK	269[a]
	07247250 - Black Fork below Big Creek nr Page, OK	74.4[b]
	07247250 – James Fork near Hackett, AR	147[c]
Arkansas River	07194500 - Arkansas River near Muskogee, OK	84,133
	07245000 - Canadian River near Whitefield, OK	37,876
	07250550 - AR River at J. W. Trimble L&D nr Van Buren, AR	151,000[d]

[a] Does not include 25.1 sq. miles of ungauged drainage.
[b] Does not include 13.0 sq. miles of ungauged drainage.
[c] Does not include 35.2 sq. miles of ungauged drainage.
[d] Includes 22,200 sq. miles of drainage area in Kansas that "probably is noncontributing".

Data obtained from the eleven (11) above listed gauges is sufficient to accurately compute actual runoff from the Sub-basins but different gages could be used for the computation of runoff.

- Review of the Poteau River Sub-basin indicates that there are large portions of runoff that originates in Arkansas but is not included in the gaging. Calculations should be completed to estimate the runoff for these areas using the following equation.

$$R_U = R_M * \left[\frac{A_U}{A_G}\right] \quad \textbf{(Eq. 3)}$$

Where,

R_U= *Calculated runoff at the OK-AR state line from ungauged contributing streams*

R_M = *Measured runoff at the gauge*

A_G = *Contributing area at the gauge*

A_U = *Area contributing runoff for ungauged streams*

- Actual runoff should be computed on an annual basis, and monthly values should be included as appendices, instead of the daily time series that have been included in previous reports. Units should be consistent; preferably in Acre-feet (AF).Flows originated from outside the Compact area should not be included in the computation of actual runoff, unless specified in the Compact. Article II of the Compact defines the drainage areas for each Sub-basin as waters originating in the Compact area. In previous reports, return flows from the White River Basin have been removed from the flow originating in the Arkansas River Basin since the water is being transferred in from another basin. The return flow data is obtained from the water department/utilities for the Cities of Fayetteville, Rogers, and Springdale, AR.

2. Computation of Total Depletions or Accretions in each of the respective Sub-basins

In Supplement No. 1, Appendix I, Item 2, the Compact states that *"The total annual depletion in each sub-basin will be the sum of the following: **(a)** Total stream diversions minus return flows. **(b)** Depletions and/or accretions by major reservoirs. **(c)** Evaporation losses from other than major reservoirs. **(d)** Pumpage of ground water alluvium aquifers"*. Data sources and procedures suggested for computation of these items are described as follows:

a) Total stream diversions minus return flows

Diversions over the Oklahoma side of the Compact, i.e. the Arkansas Sub-basin and the Oklahoma portion of the Lee Creek Sub-basin, should be estimated using information from the OWRB. Likewise, diversions over the Arkansas side of the Compact should be obtained from ANRC. These agencies manage the surface water rights of their areas, and can provide information on the type of uses, allocated amounts, annual reported use, and estimates of return flows. Values of annual diversions for each sub-basin should be included in the report, along with a brief description of the methods and assumptions used in the calculation of return flows.

Depletions and/or accretions by major reservoirs

The Compact defines depletion as the difference between the inflow and outflow, using the following equation (Appendix I, item 2):

$$I - O = -P + p \pm \Delta S + E + D$$

in which

***I - O** = Depletion in the reservoir.*

***P** = Precipitation on reservoir surface.*

***p** = Runoff that would have occurred from area covered by reservoir, computed by a derived rainfall-runoff factor c times P, or cP.*

***ΔS** = Change in storage volume at beginning and end of period*

***E** = Evaporation from reservoir surface.*

***D** =Direct diversions from reservoir storage, not included in outflow; seepage from reservoir may also be a factor and, if not included in measured outflow as at gaging station below dam, should be estimated.*

Monthly data for the reservoirs of the Compact area should be obtained from the USACE web page, at http://www.swt-wc.usace.army.mil/. Available data includes reservoir contents, as well as evaporation and precipitation measured over the reservoir surface.

- **Precipitation on reservoir surface (P)**

  Monthly values of precipitation data measured over the lakes should be retrieved from the USACE webpage.

- **Runoff (p)**

  This component should be estimated as the product of precipitation (P) and a runoff coefficient as stated in the Compact, also known as the Rational Method. A runoff coefficient of 0.18 has been used since 1974 to determine the runoff quantity. It has been noted that the runoff coefficient value can vary depending on publications and that there is no way to know what existed in the area before the reservoirs were built. For these reasons it is agreed upon by the Engineering Committee to continue the use of 0.18 as the runoff coefficient since this is the value that has been used in all of the previous reports.

- **Change in Storage (ΔS)**

  Change in storage is defined in the compact as the *"Change in the storage volume at the beginning and end of a period"*, which for the water year would be computed as the difference between the contents at the end of the period (September 30th) minus the contents at the beginning of the period (September 30th, previous calendar year).

- **Evaporation from reservoir surface (E)**

  Monthly values of evaporation strictly measured over the lakes should be retrieved from the USACE webpage. Pan evaporation is used to estimate the evaporation from lakes. There is a correlation between lake evaporation and pan evaporation. Evaporation from a natural body

of water is usually at a lower rate because the body of water does not have metal sides that get hot with the sun, and while light penetration in a pan is essentially uniform, light penetration in natural bodies of water will decrease as depth increases. Pan coefficients can vary depending on a number of different variables, including ground cover, levels of relative humidity, and 24 hour wind speed. Previous reports have used a pan coefficient of 0.70 for correlation between reservoir evaporation and pan evaporation.

Further discussion as to the coefficient value that should be used is required by the engineering committee.

- **Direct Diversions from reservoir surface (D)**

  Direct diversions from reservoir storage, not included in the outflow, can be computed using information from the OWRB water rights database. Previous reports only used data from the USACE, but did not include description of details such as the type of use, the year of the data, and if any return flows had been included in the computation.

b) Evaporation losses from other than major reservoirs

This item has not been addressed in previous reports. The Compact states that *"Evaporation from small lakes, such as those not designed for water supply, including flood-detentions structures, farm ponds, and recreation lakes, may be estimated on basis of average water surface area and appropriate data from evaporation-pan records"* (Appendix I, Item 2, page 119).

Further discussion about the data sources and feasibility of including this item in the computation of depletions needs to be discussed by the Engineering Committee. Inclusion of this item in the computation of depletions will be determined by the Engineering Committee.

c) Pumpage of ground water from alluvium aquifers

This item has not been included in previous reports. The Compact states that *Pumpage from stream alluviums may cause appreciable depletions in the stream flow. This is not believed to be a factor at the present (1969) time, but could conceivably be in the future for some stream reaches"* (Appendix I, Item 2, page 119).

Inclusion of this item in the computation of depletions will be determined by the Engineering Committee.

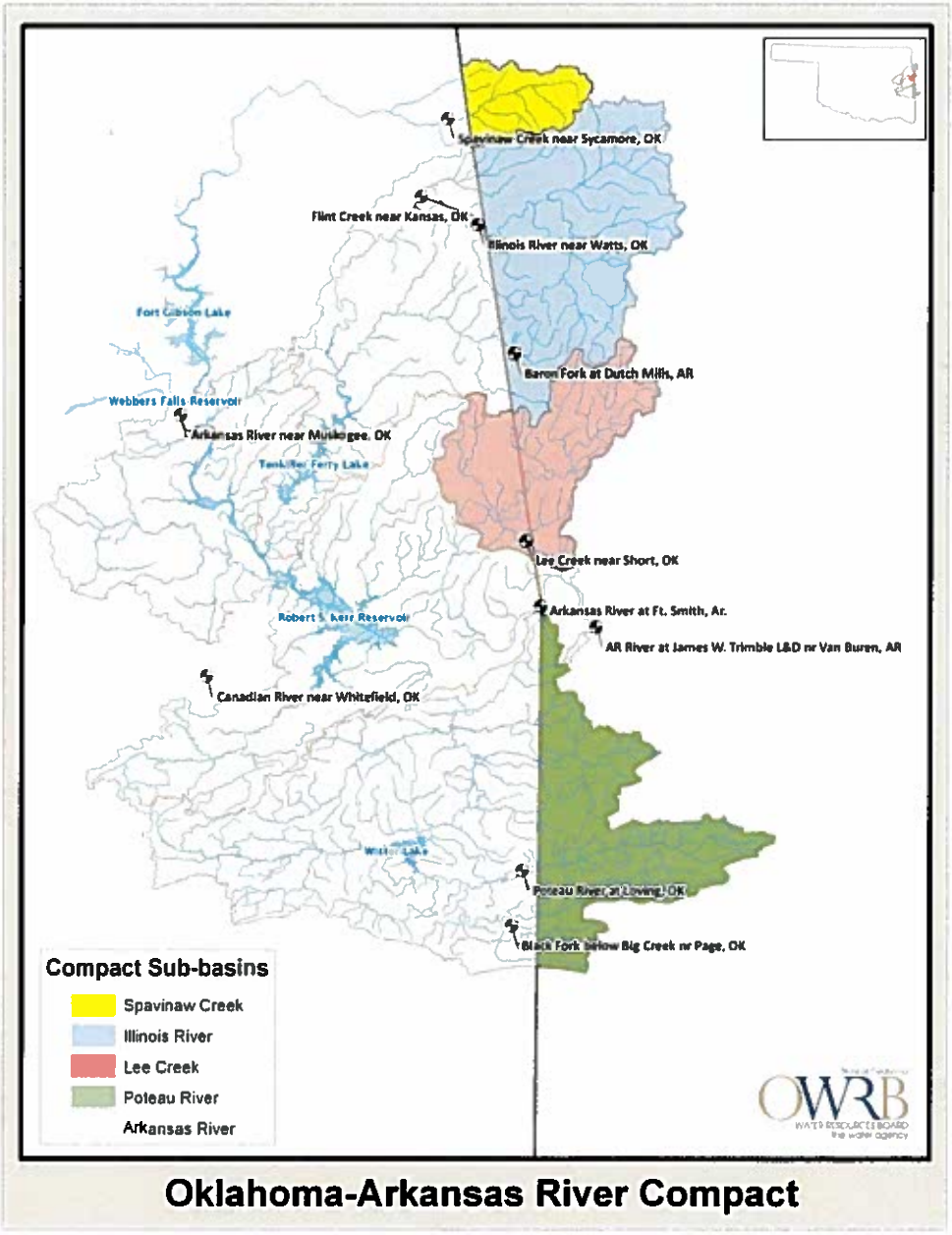
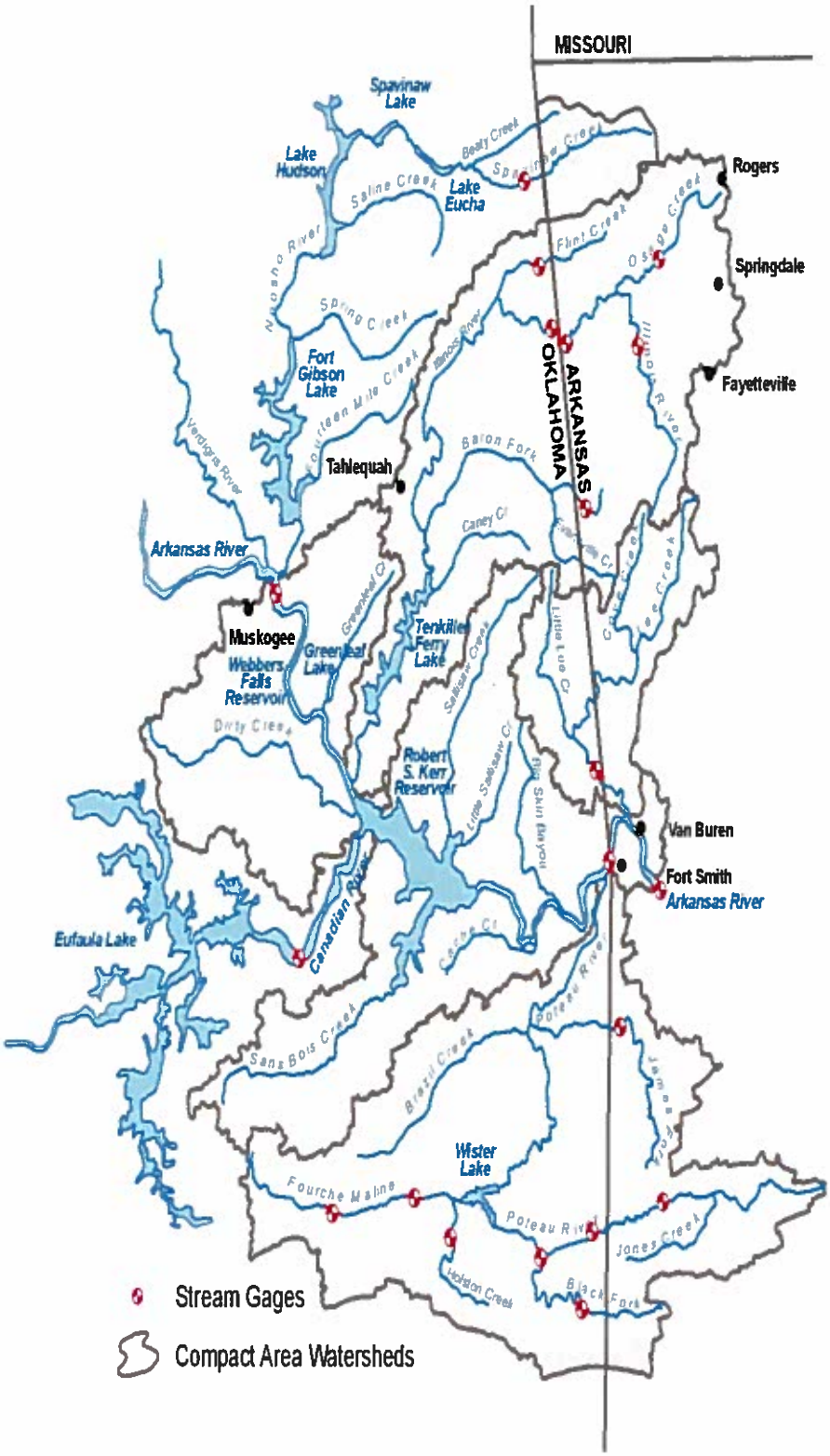


Figure 1. Map of the Oklahoma-Arkansas River Compact Area

2017 ENVIRONMENTAL NATURAL RESOURCES COMMITTEE REPORT

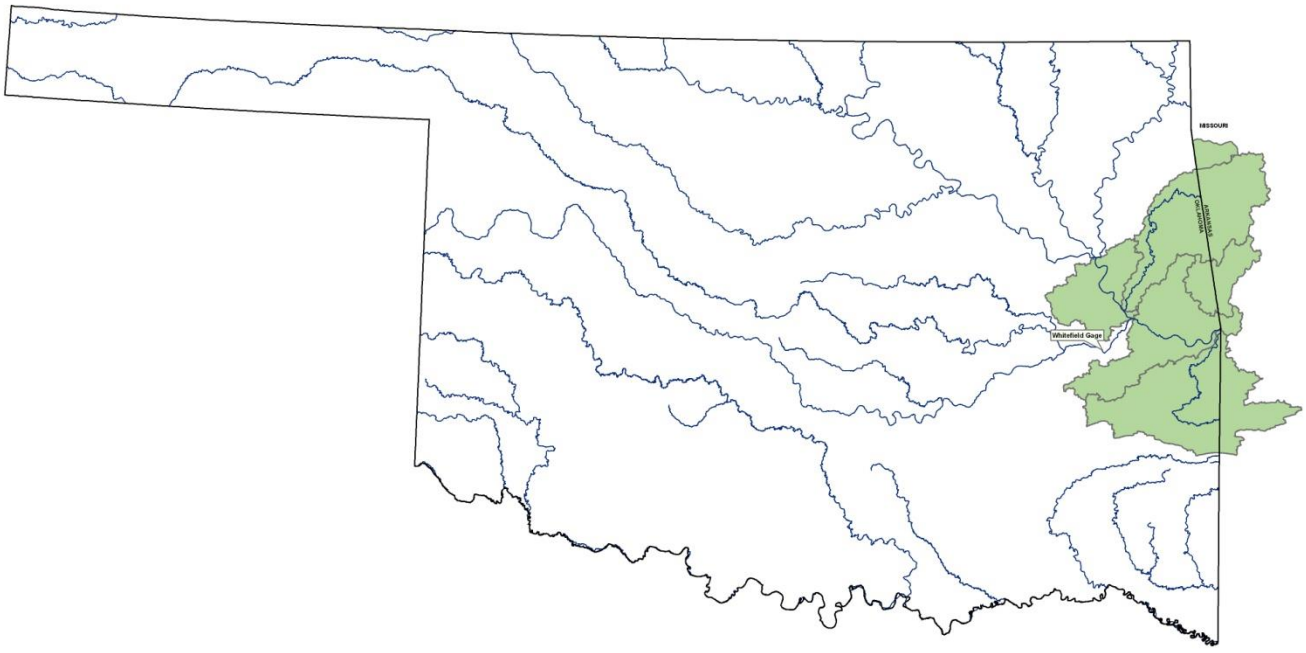
Arkansas - Oklahoma
Arkansas River Compact Commission
Environmental Committee Report



Attachment I.

Arkansas-Oklahoma Arkansas River Compact Commission

Environmental Committee Report



September 27, 2018

INTRODUCTION

This document is a compilation of data that has been collected within the Arkansas/Oklahoma Arkansas River Compact area. Items included for review;

	Introduction
	Water Quality Trends at Different Flow Regimes
	OWRB Beneficial Use Monitoring Program - Streams/Rivers
	OWRB Beneficial Use Monitoring Program – Lakes/Reservoirs
	Compact Waters included in the Oklahoma Water Quaity Integrated Report – 303(d)
	Water Quality Standards Revisions Relevant to the Arkansas-Oklahoma Compact Commission Area
	TMDL's Completed in the Compact Area
	Oklahoma's Phosphorus Loading Report for the Illinois River Basin
	Funding Provided by OWRB's Financial Assistance Program
	Permits Issued for Water Rights in the Illinois River Watershed
	Oklahoma Conservation Commission Efforts in the Illinois River Watershed

Table 1. Comparison of geometric means to the Oklahoma Scenic River total phosphorus criterion calculated from 1999-2017[1] and 2013-2017.

Station (see footnotes)	1999-2016 (3-month GM'S)			2011-2016 (3-month GM'S)		
	N (Period)	N< 0.037	% Exceeding 0.037	N (Period)	N< 0.037	% Exceeding 0.037
Illinois River near Watts[2]	333	14	96%	93	11	88%
Illinois River near Tahlequah[2]	334	29	91%	92	23	75%
Flint Creek near Kansas[2]	295	0	100%	91	0	100%
Barren Fork near Eldon[2]	319	180	44%	88	62	30%
Little Lee Creek near Nicut[1]	101	99	2%	60	60	0%
Lee Creek near Short	214	212	<1%	65	64	1.5%
Mountain Fork River near Smithville	186	158	15%	59	57	3%

[1]Little Lee Creek near Nicut Period of Record Dataset from 2008-2016
[2]Dataset meets USAP data requirements

Table 2. Waters Listed on Oklahoma's 2016 303(d) List

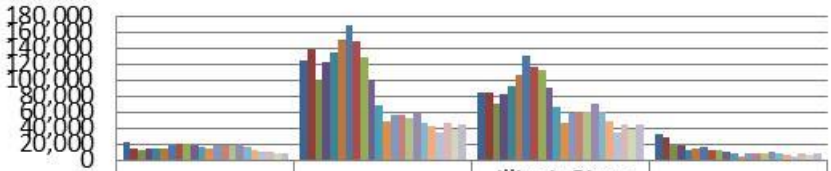
Impaired Waters in the Illinois River Basin

OKWBID	Name	Listed on 303(d) for Impairments
121700020020	Tenkiller Ferry Lake	Dissolved Oxygen, TP
121700020110	Chicken Creek	Fish Bioassessment
121700020220	Tenkiller Ferry Lake, Illinois River Arm	Chlorophyll-a, TP
121700030010	Illinois River – Tahlequah	TP, Enterococcus
121700030040	Tahlequah Creek (Town Branch)	*Eschericia coli*
121700030080	Illinois River	TP, Lead, *Eschericia coli*,
121700030280	Illinois River – Chewey Bridge	TP, *Escherichia coli.* Turbidity, Enterococcus
121700030290	Flint Creek	TP,Dissolved Oxygen
121700030350	Illinois River – Watts	TP, Enterococcus, *Escherichia coli*
121700030370	Ballard Creek	Enterococcus
121700040010	Caney Creek	Enterococcus
121700050010	Illinois River - Baron Fork	TP, Enterococcus
121700050090	Tyner Creek	Enterococcus
121700050120	Peacheater Creek	Enterococcus
121700060010	Flint Creek	TP,Enterococcus
121700060040	Battle Creek (Battle Branch)	Enterococcus
121700060080	Sager Creek	DO, Sedimentation/Siltation, Enterococcus, Macro

Other Notable Impaired Waters in the Compact Area

OKWBID	Name	Listed on 303(d) for Impairements
220100010010	Poteau River (Below Wister)	Silver, Cadmium, Copper, Lead, Selenium, Turbidty
220100020020	Wister Lake	Chlorophyll-a, pH, Dissolved Oxygen, Turbidity TP, , listed as an NLW in the OWQS
220200050010	Lee Creek	Lead, Enterococcus
220200050040	Little Lee Creek	Lead

Oklahoma's Average Annual Total P Loading in Kilograms per Year (excluding targeted high flows)



	Flint Creek near Kansas	Illinois River near Watts	Illinois River near Tahlequah	Barren Fork near Eldon
Total P 80-93	22,279	124,832	85,235	33,001
Total P 93-97	15,727	138,508	83,799	29,482
Total P 94-98	12,986	99,898	70,546	19,163
Total P 95-99	14,974	123,581	83,632	19,257
Total P 96-00	15,100	134,986	92,876	13,163
Total P 97-01	15,989	149,927	106,797	14,548
Total P 98-02	19,224	167,987	131,491	17,603
Total P 99-03	20,579	148,151	117,524	14,059
Total P 00-04	20,963	129,533	112,341	13,685
Total P 01-05	19,098	100,347	91,325	11,465
Total P 02-06	17,415	69,482	67,345	8,500
Total P 03-07	15,977	48,448	47,216	5,716
Total P 04-08	19,356	56,951	58,605	8,574
Total P 05-09	19,586	57,272	60,830	9,197
Total P 06-10	19,818	53,127	61,131	9,335
Total P 07-11	21,700	58,493	70,259	11,159
Total P 08-12	17,473	47,682	61,180	9,837
Total P 09-13	13,543	43,412	48,513	7,054
Total P 10-14	10,154	35,998	35,578	5,357
Total P 11-15	11,382	47,254	45,505	8,711
Total P 12-16	9,516	38,292	38,711	7,831
Total P 13-17	10,063	44,029	45,051	9,461

Values represent all available data, which is routinely collected and excludes targeted high flow events.

Water Quality Trends at Different Flow Regimes

Trend analyses were performed on total phosphorus concentrations as well as assessment geometric means at four BUMP permanent monitoring stations in the Arkansas River Compact area (Table 1). Using a Seasonal Kendall test, a series of trends was calculated for each station including all total phosphorus data from both 1993-2016 and 1999-2016, total phosphorus concentrations measured at both higher and lower flows from 1999-2016, and use assessment geometric means from 1999-2016. Furthermore, for each concentration data set, a trend was calculated using both unadjusted and flow-adjusted total phosphorus data. Graphical representations of these trends are not presented but may be obtained by contacting Monty Porter with the OWRB at 405-530-8933. Some general conclusions may be drawn from the data set.

1. When considering all total phosphorus data with a period of record (POR) beginning in 1993, no station demonstrated a significant upward trend regardless of flow adjusting data. The Barren Fork River demonstrated no significant trend in both flow adjusted and unadjusted data, while Flint Creek did so for unadjusted data.
2. When all data from 1999-2016 are analyzed, all stations demonstrate a highly significant downward trend.
3. All stations show some significant downward trend when only higher flow total phosphorus concentrations are considered. Unadjusted data from the Barren Fork River show no significant trend in total phosphorus concentrations. All stations demonstrate highly significant downward trends in flow adjusted concentrations.
4. When only lower flow data from 1999-2016 are analyzed, all stations except the Barren Fork demonstrate a highly significant downward trend. The Barren Fork shows a slightly or moderately significant downward trend, depending on the flow adjusting of data.
5. All stations show a highly significant downward trend for use assessment geometric means. (Figures 1-4).

Table 1. Trends calculated for total phosphorus concentrations and use assessment geometric means at certain BUMP permanent monitoring stations in the Compact area. (Boxes shaded in yellow represent changes from the 2013 report, and 2013 results are in superscript.)

Station	All Data (1993-2015)		All Data (1999-2015)		Higher Flow Data (1999-2015)		Lower Flow Data (1999-2015)		Geomtric Mean For Assessment (1999-2015)
	Unadj	Flow Adj	Unadj	Flow Adj	Unadj	Flow Adj	Unadj	Flow Adj	Unadj
Illinois River near Watts	↓↓↓	↓↓↓	↓↓↓	↓↓↓	↓(↓↓↓)	↓↓↓	↓↓↓	↓↓↓	↓↓↓
Illinois River near Tahlequah	↓↓↓	↓↓↓	↓↓↓	↓↓↓	↓(↓↓)	↓↓↓	↓↓↓	↓↓↓	↓↓↓
Flint Creek near Kansas	NT(↑↑)	↓↓(NT)	↓↓↓	↓↓↓	↓↓↓(↓)	↓↓↓	↓↓↓	↓↓↓	↓↓↓
Barren Fork near Eldon	NT	NT	↓↓↓	↓↓↓	NT	↓↓↓	↓↓↓	↓↓↓	↓↓↓

↓↓↓ = Decreasing Trend at the 95% Confidence Level
↓↓ = Decreasing Trend at the 90% Confidence Level
↓ = Decreasing Trend at the 80% Confidence Level
↑↑ = Increasing Trend at the 90% Confidence Level
NT = No Signficant Trend

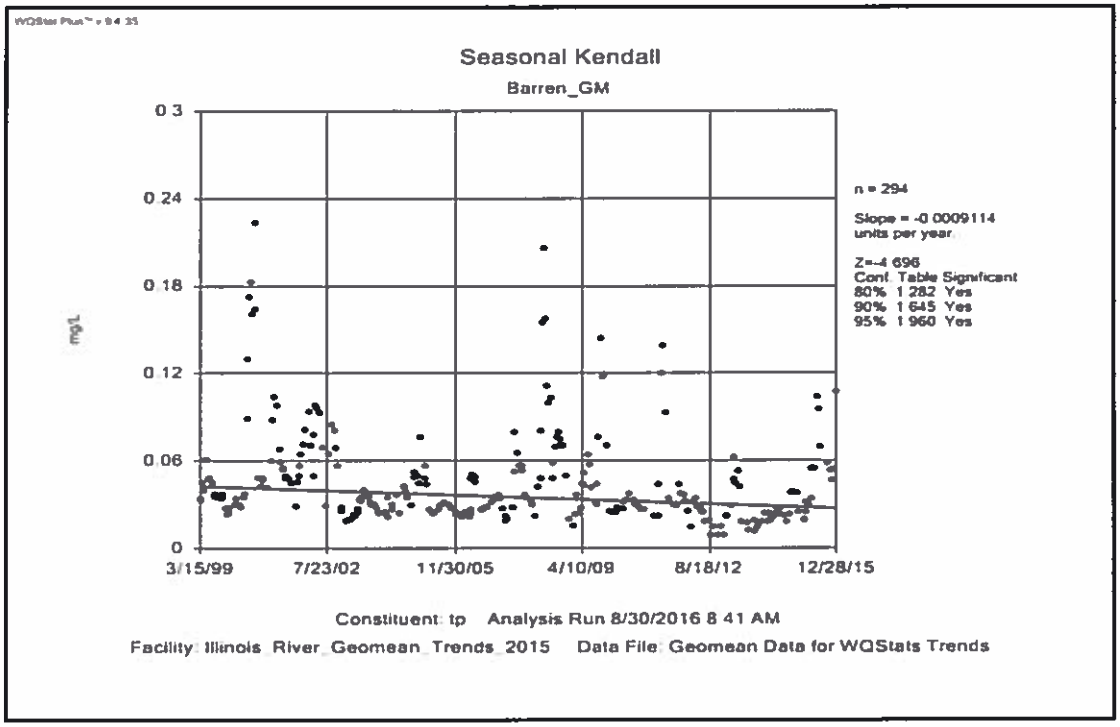


Figure 1. Trend for use assessment geometric means (1999-2016) on the Barren Fork River near Eldon.

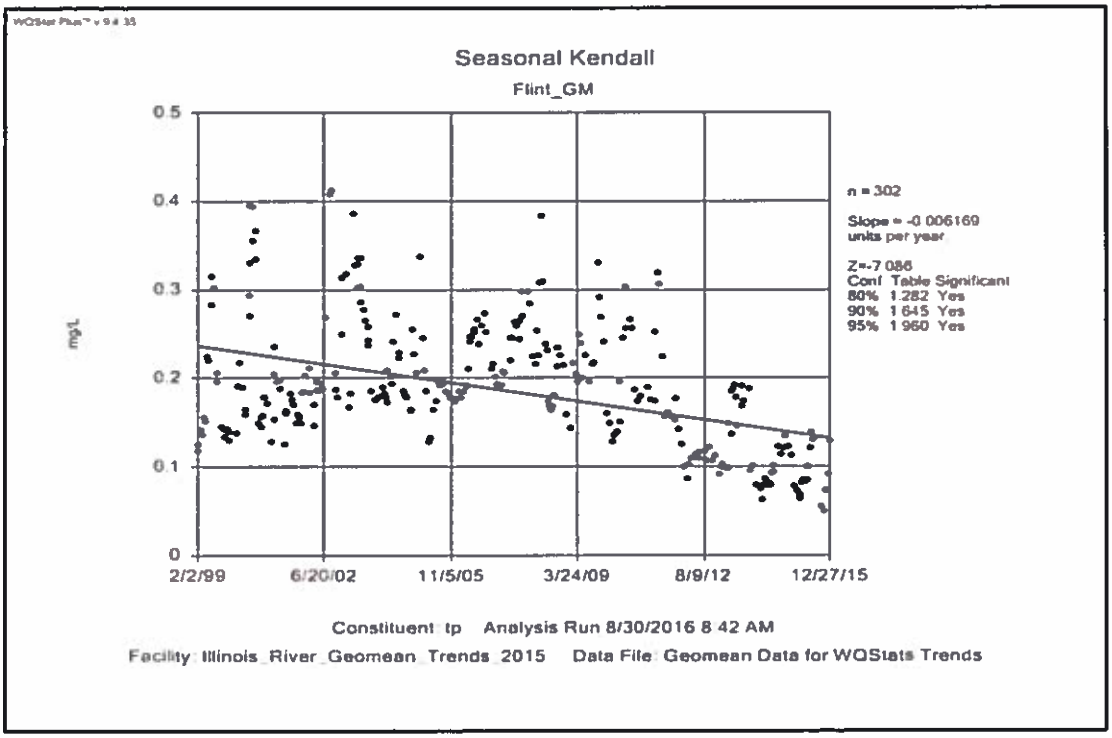


Figure 2. Trend for use assessment geometric means (1999-2016) on Flint Creek near Kansas.

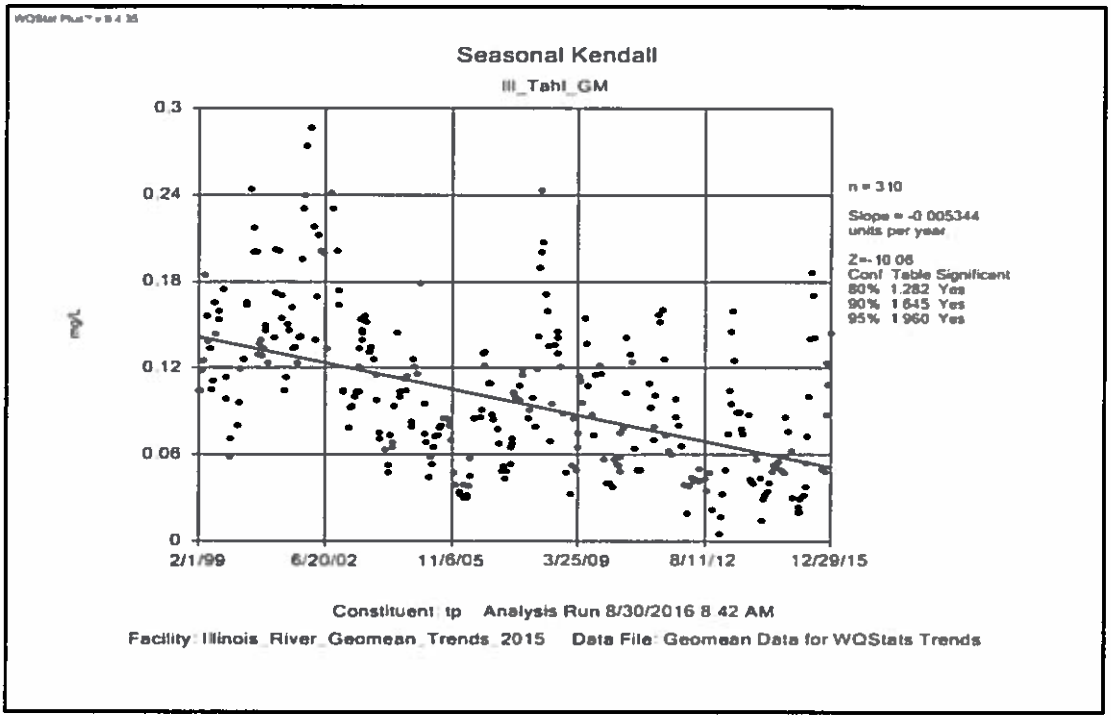


Figure 3. Trend for use assessment geometric means (1999-2016) on Illinois River near Tahlequah.

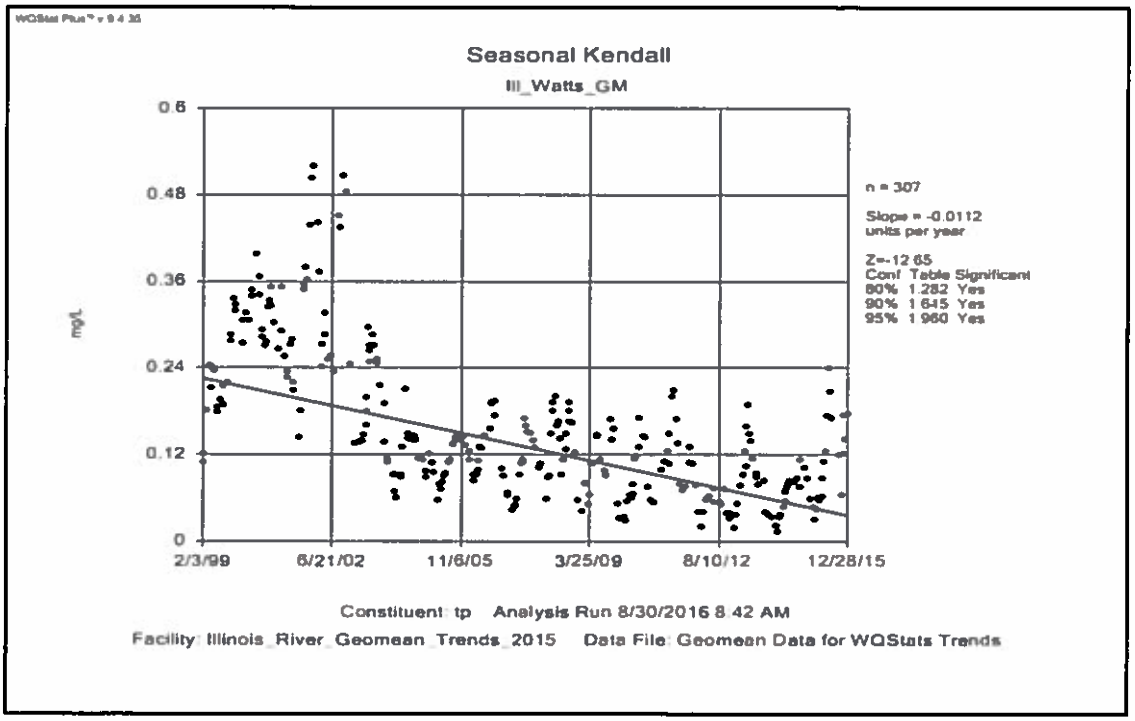
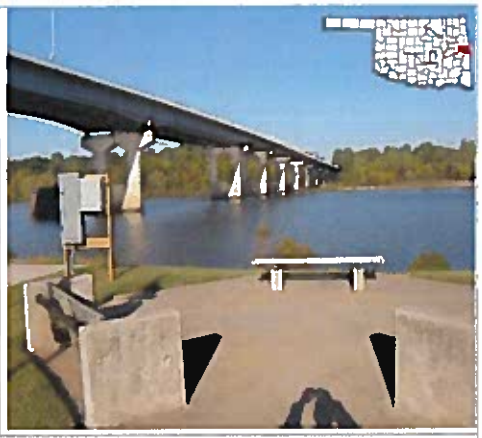


Figure 4. Trend for use assessment geometric means (1999-2016) on Illinois River near Watts.

Arkansas River at Moffett



Sample Record	Times Visited	Station ID
November 1998 - Current	85	220200010010-001AT

Stream Data

County	Sequoyah	Request Data By Email
Location	East of the Town of Moffett on State Highway 64	
Latitude/Longitude	35.39242903, -94.43267795	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110104)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	82	19.4	21.1	1.7/30.9	12.8/27.1	
	Turbidity (NTU)	85	35	22	7/194	16/44	
	pH (units)	82	7.82	7.82	6.87/8.79	7.60/8.08	
	Dissolved Oxygen (mg/L)	82	9.38	8.76	5.35/16.48	7.53/10.53	
	Hardness (mg/L)	82	158	139	39/658	125/177	
Minerals	Total Dissolved Solids (mg/L)	40	310	301	146/536	243/386	
	Specific Conductivity (uS/cm)	80	607	575	195/1333	484/730	
	Chloride (mg/L)	84	101	92	13/293	57/128	
	Sulfate (mg/L)	84	53	50	22/116	36/60	
Nutrients	Total Phosphorus (mg/L)	84	0.118	0.111	0.050/0.330	0.090/0.130	
	Total Nitrogen (mg/L)	83	0.96	0.91	0.45/2.82	0.71/1.12	
	Nitrate/Nitrite (mg/L)	84	0.30	0.23	<0.05/1.17	0.10/0.44	
	Chlorophyll A (mg/m^3)	43	15.6	12.5	0.1/71.8	7.1/15.9	TSI=57.5
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	24	955	10	<10/12000	<10/20	
	E. Coli (cfu/100ml)(*-Geo. Mn.)	24	140	10	<10/2035	<10/18	

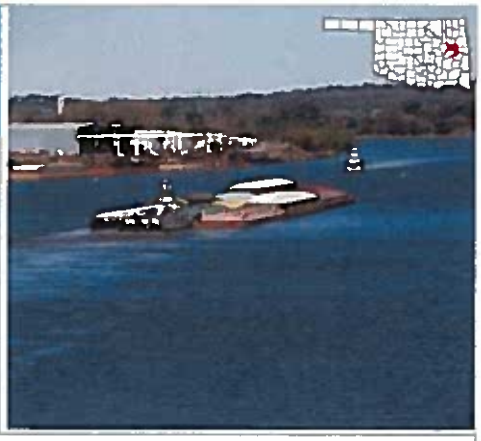
Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment
Fish & Wildlife Propagation	S	S	S	S						U	S	S
Aesthetics												S
Agriculture					S		S	S				
Primary Body Contact Recreation									S			
Public & Private Water Supply				S		S			S			
Fish Consumption				S								

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes: U = Assessment yielded undetermined supporting status

Arkansas River at Muskogee



Sample Record	Times Visited	Station ID
November 1998 - Current	132	121400010260-001AT

Stream Data

County	Muskogee	Request Data By Email
Location	East of the Town of Muskogee on State Highway 62	
Latitude/Longitude	35.77016066, -95.30031102	
Planning Watershed	Middle Arkansas (8-digit HUC - 11110102)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	131	18.0	18.6	1.9/32.4	10.9/25.6	
	Turbidity (NTU)	132	44	23	5/387	15/40	
	pH (units)	129	8.04	8.01	7.09/9.48	7.73/8.32	
	Dissolved Oxygen (mg/L)	131	8.94	8.72	4.20/14.88	7.06/10.66	
	Hardness (mg/L)	129	184	172	92/418	142/218	
Minerals	Total Dissolved Solids (mg/L)	71	455	402	155/1040	305/598	
	Specific Conductivity (uS/cm)	130	919	787	215/2746	459/1225	
	Chloride (mg/L)	118	169	135	11/713	77/212	
	Sulfate (mg/L)	119	73	65	28/202	44/90	
Nutrients	Total Phosphorus (mg/L)	132	0.162	0.144	0.050/0.710	0.110/0.170	
	Total Nitrogen (mg/L)	131	1.18	1.10	0.40/3.90	0.92/1.39	
	Nitrate/Nitrite (mg/L)	132	0.43	0.40	<0.05/1.21	0.18/0.63	
	Chlorophyll A (mg/m^3)	58	19.5	14.5	0.1/90.0	8.9/26.7	TSI=59.7
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	31	3685	20	<10/75000	<10/200	
	E. Coli (cfu/100ml)(*-Geo. Mn.)	31	378	20	<10/5492	<10/52	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment
Fish & Wildlife Propagation	S	S	S	S						S	S	S
Aesthetics												S
Agriculture					S		S	S				
Primary Body Contact Recreation									S			
Public & Private Water Supply				S		S			S			
Fish Consumption				S								

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

Barren Fork at Eldon

Sample Record	Times Visited	Station ID
November 1998 - Current	192	121700050010-001AT

Stream Data

County	Cherokee	Request Data By Email
Location	South of the Town of Eldon on State Highway 51	
Latitude/Longitude	35.92173377, -94.83726494	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110103)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	140	17.0	17.5	3.1/29.9	11.2/22.1	
	Turbidity (NTU)	138	4	2	1/45	2/3	
	pH (units)	139	7.62	7.56	6.37/8.82	7.35/7.88	
	Dissolved Oxygen (mg/L)	140	9.60	9.69	4.40/14.53	7.90/11.17	
	Hardness (mg/L)	141	100	98	46/159	90/108	
Minerals	Total Dissolved Solids (mg/L)	24	137	118	92/545	107/126	
	Specific Conductivity (uS/cm)	140	202	200	20/713	177/221	
	Chloride (mg/L)	102	8	10	<10/44	<10/10	
	Sulfate (mg/L)	102	10	10	<10/40	<10/10	
Nutrients	Total Phosphorus (mg/L)	146	0.032	0.027	<0.010/0.220	0.020/0.040	
	Total Nitrogen (mg/L)	145	1.52	1.40	0.20/4.20	0.86/2.00	
	Nitrate/Nitrite (mg/L)	146	1.36	1.29	0.14/3.83	0.73/1.76	
	Chlorophyll A (mg/m^3)	86	1.4	1.1	0.1/11.7	0.6/1.7	TSI=34.00
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	83	228	20	<10/3900	<10/80	
	E. Coli (cfu/100ml)(*-Geo. Mn.)	83	99	10	<10/2420	<10/41	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment	Total Phosphorus
Fish & Wildlife Propagation	S	S	S	S						S	S	S	
Aesthetics												S	S
Agriculture					S		S	S					
Primary Body Contact Recreation									S				
Public & Private Water Supply				S		S			S				
Fish Consumption				S									

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NS = Not Supporting
NEI = Not Enough Information

Notes

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Brushy Creek

Sample Period	Times Visited	Sampling Sites
December 2014 – September 2015	4	3

General

Location	Sequoyah County
Impoundment	1964
Area	358 acres
Capacity	3,258 acre-feet
Purposes	Flood Control and Recreation

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	8 NTU	0% of values > OWQS of 25 NTU
	Average Secchi Disk Depth	79 cm	
	Water Clarity Rating	Good	
	Chlorophyll-a	13 mg/m3	
	Trophic State Index	56	Previous value = 53
	Trophic Class	Eutrophic	
Profile	Salinity	0.02 - 0.09 ppt	
	Specific Conductivity	52.3 – 179.6 µS/cm	
	pH	5.86 - 8.53 pH units	11 (11.6%) values < 6.5 units
	Oxidation-Reduction Potential	49 to 486.4 mV	
	Dissolved Oxygen	Up to 67% of water column < 2 mg/L in June	
Nutrients	Surface Total Nitrogen	0.42 mg/L to 0.89 mg/L	
	Surface Total Phosphorus	0.008 mg/L to 0.038 mg/L	
	Nitrogen to Phosphorus Ratio	21:1	Phosphorus limited

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
Fish & Wildlife Propagation	S	NS	NEI	S							
Aesthetics					S	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											NS

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

*Standards revision, true color is for permitting purposes only.

NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Caney Creek at Barber

Sample Record	Times Visited	Station ID
September 1999 - 2012	145	121700040010-001AT

Stream Data

County	Cherokee	Request Data by Email
Location	North of the Town of Barber off State Highway 100	
Latitude/Longitude	35.72381643, -94.85787184	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110103)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	99	18.1	17.6	4.1/29.3	13.0/23.3	
	Turbidity (NTU)	100	4	2	1/103	1/3	
	pH (units)	97	7.77	7.76	6.46/9.06	7.56/8.02	
	Dissolved Oxygen (mg/L)	99	9.66	9.42	3.94/15.60	8.29/11.12	
	Hardness (mg/L)	99	109	109	64/174	98/120	
Minerals	Total Dissolved Solids (mg/L)	12	149	143	116/237	133/157	
	Specific Conductivity (uS/cm)	99	219	218	123/391	200/243	
	Chloride (mg/L)	90	9	10	<5/37	<5/10	
	Sulfate (mg/L)	90	9	10	<5/33	7/10	
Nutrients	Total Phosphorus (mg/L)	105	0.060	0.037	<0.005/1.532	0.030/0.047	
	Total Nitrogen (mg/L)	104	1.14	1.05	0.18/7.06	0.71/1.41	
	Nitrate/Nitrite (mg/L)	105	0.99	0.91	0.06/6.68	0.55/1.26	
	Chlorophyll A (mg/m^3)	53	1.3	0.8	<0.1/12.1	0.5/1.2	TSI=32.9
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	46	94	20	<10/1408	<10/52	Mean>OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	46	124	15	<10/2382	<10/41	Mean>OWQS

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chloride	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment
Fish & Wildlife Propagation	S	S	S	S						S	NS	S
Aesthetics												S
Agriculture					S		S	S				
Primary Body Contact Recreation									NS			
Public & Private Water Supply				S		S			S			
Fish Consumption				S								

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

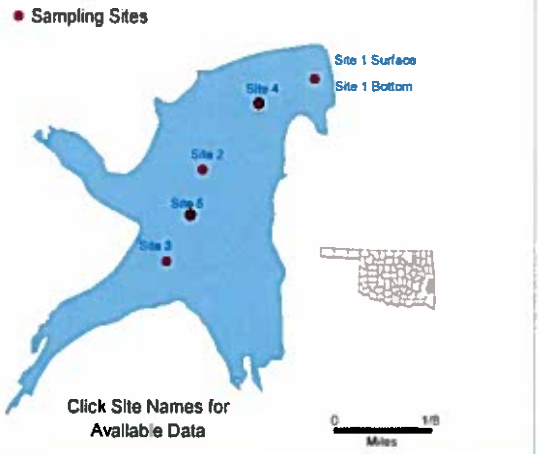
Notes

Cedar

Sample Period	Times Visited	Sampling Sites
November 2015 – Sept. 2016	4	5

General

Location	Le Flore County	Click map for site data
Impoundment	1937	
Area	78 acres	
Capacity	1,000 acre-feet	
Purposes	Recreation	



Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	7 NTU	100% of values < OWQS of 25 NTU
	Average Secchi Disk Depth	92 cm	
	Water Clarity Rating	Excellent	
	Chlorophyll-a	25.3 mg/m3	
	Trophic State Index	62	Previous Value=56
	Trophic Class	Hypereutrophic	
Profile	Salinity	0.01– 0.08 ppt	
	Specific Conductivity	31.7 – 170.4 µS/cm	
	pH	5.92 – 7.36 pH units	51.56% < 6.5
	Oxidation-Reduction Potential	-58.9 – 416.9 mV	
	Dissolved Oxygen	Up to 40% of water column < 2 mg/L in summer	
Nutrients	Surface Total Nitrogen	0.56 mg/L to 0.98 mg/L	
	Surface Total Phosphorus	0.023 mg/L to 0.043 mg/L	
	Nitrogen to Phosphorus Ratio	24:1	Phosphorus limited

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Entero. & E. coli	Chlor-a
Fish & Wildlife Propagation	NEI	NS	NS	S							
Aesthetics					S	*					
Agriculture							*	*	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

*Standards revision, true color is for permitting purposes only.

NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

Flint Creek at Flint

Sample Record	Times Visited	Station ID
November 1998 - Current	192	121700060010-001AT

Stream Data

County	Delaware	Request Data By Email
Location	North of the Town of Flint on county road	
Latitude/Longitude	36.1867733, -94.70680493	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110103)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	138	16.9	16.5	2.5/28.7	11.0/22.9	
	Turbidity (NTU)	138	3	1	1/58	1/2	
	pH (units)	137	7.67	7.68	6.44/8.79	7.44/7.89	
	Dissolved Oxygen (mg/L)	138	9.44	9.20	4.97/14.94	7.97/10.74	
	Hardness (mg/L)	141	115	114	<10/218	105/125	
Minerals	Total Dissolved Solids (mg/L)	24	183	162	112/552	152/186	
	Specific Conductivity (uS/cm)	136	295	297	152/452	262/333	
	Chloride (mg/L)	103	15	14	<10/43	10/18	
	Sulfate (mg/L)	103	17	15	<10/69	12/20	
Nutrients	Total Phosphorus (mg/L)	151	0.183	0.156	0.060/1.450	0.100/0.190	See Notes
	Total Nitrogen (mg/L)	145	2.96	2.84	0.97/7.95	2.18/3.60	
	Nitrate/Nitrite (mg/L)	147	2.75	2.57	0.80/7.55	2.07/3.32	
	Chlorophyll A (mg/m^3)	86	1.0	0.8	<0.1/4.2	0.5/1.2	TSI=30.4
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	74	523	41	<10/18000	<10/109	Mean>OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	74	207	31	<10/4611	<10/74	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment	Total Phosphorus
Fish & Wildlife Propagation	S	S	S	S						S	S	S	
Aesthetics												S	NS
Agriculture					S		S	S					
Primary Body Contact Recreation									NS				
Public & Private Water Supply				S					S				
Fish Consumption				S									

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

100%(79 of 79) of rolling Geo. Mean exceed OWQS criterion of 0.037 ppm

Fourche-Maline Creek at Red Oak

Sample Record	Times Visited	Station ID
November 1998 - Current	173	220100040020-001AT

Stream Data

County	Latimer	Request Data By Email
Location	S.E. of the Town of Red Oak off US Highway 270	
Latitude/Longitude	34.91232472, -95.15608416	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110105)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	154	17.6	18.9	1.0/31.6	10.2/23.9	
	Turbidity (NTU)	159	37	28	5/390	18/43	
	pH (units)	156	7.16	7.04	5.77/8.76	6.84/7.47	
	Dissolved Oxygen (mg/L)	155	6.10	6.16	0.84/15.69	3.28/8.48	55% of values<OWQS and 42% of values<alt OWQS
	Hardness (mg/L)	156	53	48	<10/212	33/64	
Minerals	Total Dissolved Solids (mg/L)	40	102	99	50/175	78/125	
	Specific Conductivity (uS/cm)	153	166	138	11/1106	101/203	
	Chloride (mg/L)	105	<10	10	<10/22	<10/10	
	Sulfate (mg/L)	106	22	21	<10/49	16/25	
Nutrients	Total Phosphorus (mg/L)	158	0.082	0.068	<0.010/0.870	0.050/0.090	
	Total Nitrogen (mg/L)	156	0.79	0.76	0.16/1.70	0.56/0.97	
	Nitrate/Nitrite (mg/L)	158	0.15	0.12	<0.05/0.97	<0.05/0.21	
	Chlorophyll A (mg/m^3)	40	8.3	3.2	0.8/34.0	2.0/13.4	TSI=51.4
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	42	417	76	<10/8000	51/214	Mean>OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	42	231	69	<10/1986	30/219	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment
Fish & Wildlife Propagation	S	S	NS	NS						S	NS	S
Aesthetics												S
Agriculture					S		S	S				
Primary Body Contact Recreation									NS			
Public & Private Water Supply				NEI		NEI			NEI			
Fish Consumption				S								

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes: *Fish & Wildlife Propagation not supporting for Lead*

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Greenleaf

Sample Period	Times Visited	Sampling Sites
November 2013 – July 2014	4	5

Click Site Names for Available Data

General

Location	Muskogee County	Click map for site data
Impoundment	1939	
Area	920 acres	
Capacity	14,720 acre-feet	
Purposes	Recreation	

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	4 NTU	100% of values < OWQS of 25 NTU (n=12)
	Average Secchi Disk Depth	103 cm	
	Water Clarity Rating	Good	
	Chlorophyll-a	16.6 mg/m3	
	Trophic State Index	58	Previous value = 54
	Trophic Class	Eutrophic	
Profile	Salinity	0.08– 0.10 ppt	
	Specific Conductivity	165 – 203 µS/cm	
	pH	6.07 – 8.62 pH units	10.3% of recorded values <6.5
	Oxidation-Reduction Potential	-39 – 436.8 mV	
	Dissolved Oxygen	Up to 64% of water column < 2 mg/L in July	
Nutrients	Surface Total Nitrogen	0.33 mg/L to 0.70 mg/L	
	Surface Total Phosphorus	0.005 mg/L to 0.032 mg/L	
	Nitrogen to Phosphorus Ratio	30:1	Phosphorus limited

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Entero. & E. coli	Chlor-a
Fish & Wildlife Propagation	NS	S	NEI	S							
Aesthetics					S	*					
Agriculture							N/A	N/A	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											NS

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

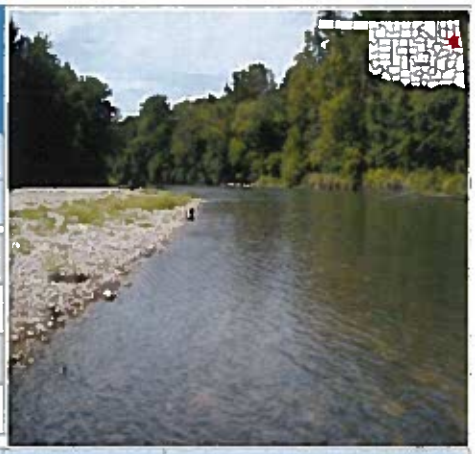
Notes

*Standards revision, true color is for permitting purposes only.
* 50-70% range is undetermined for DO.

NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Illinois River at Tahlequah



Sample Record	Times Visited	Station ID
November 1998 - Current	186	121700030010-001AT

Stream Data

County	Cherokee	Request Data By Email
Location	East of the Town of Tahlequah on US Highway 62	
Latitude/Longitude	35.92606447, -94.92380373	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110103)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	139	17.4	17.2	0.8/31.7	10.8/24	
	Turbidity (NTU)	138	8	4	1/84	3/6	
	pH (units)	137	7.87	7.83	6.47/9.29	7.57/8.13	
	Dissolved Oxygen (mg/L)	139	9.98	10.02	4.66/15.88	7.65/12.06	
	Hardness (mg/L)	139	115	113	69/161	106/123	
Minerals	Total Dissolved Solids (mg/L)	24	171	156	104/565	133/170	
	Specific Conductivity (uS/cm)	139	269	273	66/713	238/294	
	Chloride (mg/L)	103	11	<10	<10/24	<10/14	
	Sulfate (mg/L)	103	14	13	<10/48	11/15	
Nutrients	Total Phosphorus (mg/L)	148	0.079	0.066	<0.010/0.440	0.040/0.110	See Notes
	Total Nitrogen (mg/L)	147	1.77	1.70	0.4/3.76	1.17/2.27	
	Nitrate/Nitrite (mg/L)	148	1.53	1.53	0.23/3.61	0.96/1.97	
	Chlorophyll A (mg/m^3)	86	3.7	1.9	<0.5/46.4	1.2/3.1	TSI=43.4
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	73	142	20	<10/2500	<10/100	Mean>OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	73	61	<10	<10/884	<10/36	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dssolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment	Total Posphorus
Fish & Wildlife Propagation	S	S	S	S						S	S	S	
Aesthetics												S	NS
Agriculture					S		S	S					
Primary Body Contact Recreation									S				
Public & Private Water Supply				S		S			NS				
Fish Consumption				S									

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes: *79%(64 of 81) of 3-month rolling Geo. Mean above OWQS criterion of 0.037 ppm*

Illinois River at Watts

Sample Record	Times Visited	Station ID
November 1998 - Current	191	121700030350-001AT

Stream Data

County	Adair	Request Data By Email
Location	North of the Town of Watts on US Highway 59	
Latitude/Longitude	36.12994064, -94.57151225	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110103)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	141	17.0	16.1	2/31.5	10.3/24	
	Turbidity (NTU)	139	11	6	1/95	4/13	
	pH (units)	140	7.90	7.92	6.51/9.03	7.73/8.12	
	Dissolved Oxygen (mg/L)	141	10.60	10.31	4.51/18.88	8.63/11.97	
	Hardness (mg/L)	142	127	127	10/215	115/138	
Minerals	Total Dissolved Solids (mg/L)	24	190	173	116/566	147/206	
	Specific Conductivity (uS/cm)	141	309	315	149/713	275/341	
	Chloride (mg/L)	102	14	13	<10/28	10/17	
	Sulfate (mg/L)	102	16	14	<10/97	12/18	
Nutrients	Total Phosphorus (mg/L)	147	0.143	0.101	0.01/1.15	0.05/0.19	See Notes
	Total Nitrogen (mg/L)	146	2.52	2.45	0.86/5.06	2.04/2.9	
	Nitrate/Nitrite (mg/L)	147	2.19	2.16	0.65/4.64	1.7/2.55	
	Chlorophyll A (mg/m^3)	86	3.1	2.1	0.1/15.3	1.4/3.3	TSI=41.6
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	74	526	20	<10/15531	10/99	
	E. Coli (cfu/100ml)(*-Geo. Mn.)	74	358	19	<10/12997	10/63	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment	Total Posphorus
Fish & Wildlife Propagation	S	S	S	S						S	S	S	
Aesthetics												S	NS
Agriculture					S		S	S					
Primary Body Contact Recreation									S				
Public & Private Water Supply				S		S			S				
Fish Consumption				S									

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

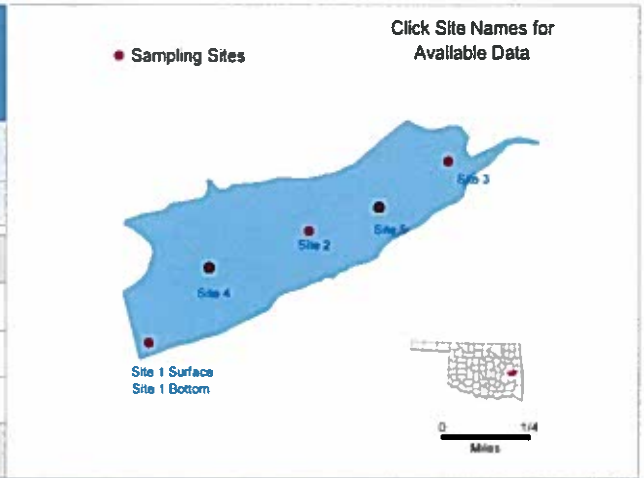
Notes

91%(73 of 80) of rolling Geo. Mean exceed OWQS criterion of 0.037 ppm

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

John Wells

Sample Period	Times Visited	Sampling Sites
October 2008 – July 2009	4	5



General

Location	Haskell County — Click map for site data
Impoundment	1936
Area	194 acres
Capacity	1,352 acre-feet
Purposes	Water Supply, Recreation

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	3 NTU	100% of values < OWQS of 25 NTU (n=12)
	Average True Color		Did not collect for true color
	Average Secchi Disk Depth	180 cm	
	Water Clarity Rating	Excellent	
	Trophic State Index	45	Previous value = 46
	Trophic Class	Mesotrophic	
Profile	Salinity	0.02 – 0.10 ppt	
	Specific Conductivity	73 – 207.5 µS/cm	
	pH	6.3 – 9.13 pH units	1% of values < 6.50 and 2.38% > 9.00 pH units
	Oxidation-Reduction Potential	-35 – 503 mV	
	Dissolved Oxygen	Up to 50% of water column < 2.0 mg/L in July	
Nutrients	Surface Total Nitrogen	0.30 mg/L to 0.54 mg/L	
	Surface Total Phosphorus	0.005 mg/L to 0.014 mg/L	
	Nitrogen to Phosphorus Ratio	43:1	Phosphorus limited

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E. coli	Chlor-a
Fish & Wildlife Propagation	S	S	S	S							
Aesthetics					S	•					
Agriculture							•	•	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply				S							

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

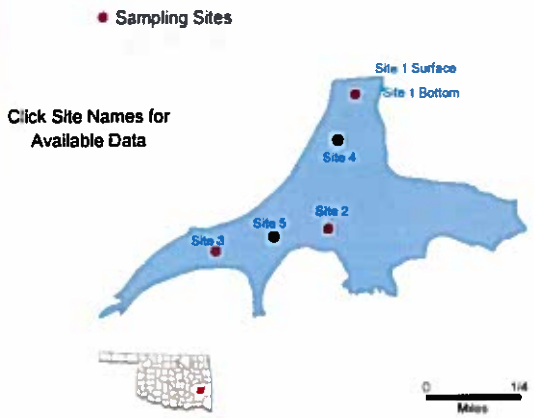
Notes: Standards revision, true color is for permitting purposes only.

NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Lloyd Church (Wilburton)

Sample Period	Times Visited	Sampling Sites
October 2014 – July 2015	4	3



General

Location	Latimer County
Impoundment	1964
Area	160 acres
Capacity	3,060 acre-feet
Purposes	Water Supply, Recreation, Flood Control

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	11 NTU	100% of values < 25 NTU (n=12)
	Average Secchi Depth	84 cm	
	Water Clarity Rating	Good	
	Chlorophyll-a	4.7 mg/m3	
	Trophic State Index	46	Previous value = 56
	Trophic Class	Mesotrophic	
Profile	Salinity	0.02 – 0.06 ppt	
	Specific Conductivity	42 – 123.9 µS/cm	
	pH	5.72 – 8.21 pH units	26% of values <6.5 pH units
	Oxidation-Reduction Potential	76.1 -596.8 mV	
	Dissolved Oxygen	Up to 64% of water column < 2 mg/L in July	
Nutrients	Surface Total Nitrogen	0.37 mg/L to 0.60 mg/L	
	Surface Total Phosphorus	0.010 mg/L to 0.032 mg/L	
	Nitrogen to Phosphorus Ratio	20:1	Phosphorus limited

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
Fish & Wildlife Propagation	NS	NS	NEI	S							
Aesthetics					S	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

* Standards revision, true color is for permitting purposes only

NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Bathy map available: http://www.owrb.ok.gov/maps/PMG/owrbdata_Bathy.html

Lee Creek at Short

Sample Record	Times Visited	Station ID
January 2003 - Present	183	220200050010-001AT

Stream Data

County	Sequoyah	Request Data by Email
Location	West of the Town of Short on State Highway 101	
Latitude/Longitude	35.56589868, -94.53152717	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110104)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	167	17.4	16.4	0.2/32.5	9.8/25	
	Turbidity (NTU)	166	9	5	1/124	4/8	
	pH (units)	167	7.60	7.60	6.31/8.7	7.35/7.84	
	Dissolved Oxygen (mg/L)	167	9.40	9.07	5.23/13.94	7.63/11.18	
	Hardness (mg/L)	164	47	45	10/130	36/56	
Minerals	Total Dissolved Solids (mg/L)	11	52	50	40/66	44/58	
	Specific Conductivity (uS/cm)	166	99	98	<10/266	77/113	
	Chloride (mg/L)	78	10	10	<10/10	10/10	
	Sulfate (mg/L)	78	11	10	<10/49	10/10	
Nutrients	Total Phosphorus (mg/L)	166	0.013	0.010	0.01/0.15	0.01/0.02	
	Total Nitrogen (mg/L)	166	0.31	0.23	<0.1/1.72	0.16/0.35	
	Nitrate/Nitrite (mg/L)	166	0.14	0.06	<0.05/1.62	0.05/0.15	
	Chlorophyll A (mg/m^3)	135	2.2	0.8	0.1/92	0.4/1.7	TSI=39.3
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	61	413	10	<10/7100	10/41	
	E. Coli (cfu/100ml)(*-Geo. Mn.)	61	127	10	<10/2359	10/33	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment	Total Phosphorus
Fish & Wildlife Propagation	S	S	S	S						S	S	S	
Aesthetics												NEI	NEI
Agriculture					S		S	S					
Primary Body Contact Recreation									S				
Public & Private Water Supply				S									
Fish Consumption				S									

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

Little Lee Creek at Nicut

Sample Record	Times Visited	Station ID
February 2008 - Current	123	220200050040-001AT

Stream Data

County	Sequoyah	Request Data by Email
Location	West of the Town of Short on State Highway 101	
Latitude/Longitude	35.58, -94.56	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110104)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	121	17.2	16.6	0.3/31.4	9.8/24.7	
	Turbidity (NTU)	123	8	4	1/223	2/5	
	pH (units)	123	7.58	7.57	6.3/8.52	7.36/7.83	
	Dissolved Oxygen (mg/L)	123	9.79	9.59	5.01/14.47	8.17/11.81	
	Hardness (mg/L)	119	65	63	36/140	53/72	
Minerals	Total Dissolved Solids (mg/L)	21	73	76	50/94	65/85	
	Specific Conductivity (uS/cm)	120	141	136	74/314	117/153	
	Chloride (mg/L)	43	9	<10	<10/<10	<10/<10	
	Sulfate (mg/L)	43	<10	<10	<10/15	<10/<10	
Nutrients	Total Phosphorus (mg/L)	120	0.013	<0.010	<0.010/0.26	<0.010/<0.010	
	Total Nitrogen (mg/L)	119	0.26	0.19	0.08/1.41	0.15/0.25	
	Nitrate/Nitrite (mg/L)	119	0.11	<0.05	<0.05/0.96	<0.05/0.10	
	Chlorophyll A (mg/m^3)	98	0.8	<0.5	<0.5/6.44	0.36/0.89	TSI=28.2
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	23	241	<10	<10/2419.6	<10/16	
	E. Coli (cfu/100ml)(*-Geo. Mn.)	23	359	<10	<10/6488	<10/13.4	

Beneficial Uses

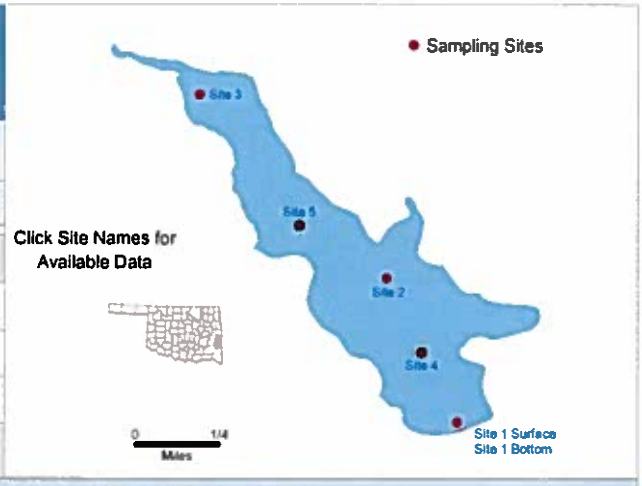
Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment	Phosphorus
Fish & Wildlife Propagation	S	S	S	S						S	S	S	
Aesthetics												NEI	NEI
Agriculture					S		S	S					
Primary Body Contact Recreation									S				
Public & Private Water Supply				S		S			S				
Fish Consumption				S									

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

New Spiro

Sample Period	Times Visited	Sampling Sites
October 2005 – July 2006	4	5



General

Location	Le Flore County	Click map for site data
Impoundment	1960	
Area	254 acres	
Capacity	2,160 acre-feet	
Purposes	Water Supply, Recreation	

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	18 NTU	8% of values >OWQS of 25 NTU
	Average True Color	26 units	100% of values < OWQS of 70
	Average Secchi Disk Depth	47 cm	
	Water Clarity Rating	good	
	Trophic State Index	68	
	Trophic Class	hypereutrophic	
Profile	Salinity	0.04 – 0.09 ppt	
	Specific Conductivity	106.8 – 155.4 µS/cm	
	pH	7.09 – 9.24 pH units	10% of values > 9.0 pH units
	Oxidation-Reduction Potential	121 - 483 mV	
	Dissolved Oxygen	Up to 33% of water column < 2 mg/L in August	Occurred at site 2
Nutrients	Surface Total Nitrogen	0.98 mg/L to 1.68 mg/L	
	Surface Total Phosphorus	0.076 mg/L to 0.170 mg/L	
	Nitrogen to Phosphorus Ratio	11:1	Phosphorus limited

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
Fish & Wildlife Propagation	S	S	NS	S							
Aesthetics					NEI	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											NS

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

*The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status
*Standards revision, true color is for permitting purposes only

NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

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Bathy map available: http://www.owrb.ok.gov/maps/PMG/owrbdata_Bathy.html

Poteau River at Heavener

Sample Record	Times Visited	Station ID
November 1998 – December 2012	141	220100020010-001AT

Stream Data

County	LeFlore	Request Data By Email
Location	South of the Town of Heavener on State Highway 59	
Latitude/Longitude	34.85833476, -94.62923436	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110105)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	118	19.0	19.2	1.8/34.9	12.1/25.8	
	Turbidity (NTU)	121	23	16	0/152	11/25	
	pH (units)	118	7.27	7.25	5.96/8.97	6.92/7.63	
	Dissolved Oxygen (mg/L)	118	8.19	7.80	3.77/16	6.58/9.79	
	Hardness (mg/L)	118	48	35	<10/188	21/62	
Minerals	Total Dissolved Solids (mg/L)	20	94	66	42/292	53/112	
	Specific Conductivity (uS/cm)	118	136	102	<10/486	57/180	
	Chloride (mg/L)	77	10	10	<10/105	<10/10	
	Sulfate (mg/L)	78	35	21	10/146	16/41	
Nutrients	Total Phosphorus (mg/L)	114	0.075	0.054	<0.010/0.430	0.038/0.087	
	Total Nitrogen (mg/L)	112	0.67	0.64	0.19/1.62	0.46/0.78	
	Nitrate/Nitrite (mg/L)	113	0.19	0.16	<0.05/0.74	<0.05/0.29	
	Chlorophyll A (mg/m^3)	13	9.5	9.4	1.8/29.7	3.2/13.1	TSI=52.7
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	28	65	20	<10/400	<10/80	Mean>OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	28	58	31	<10/393	13/52	

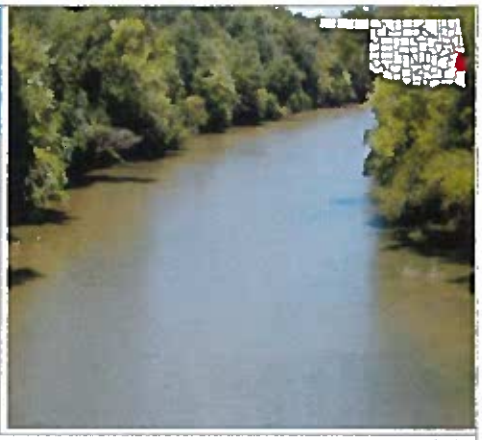
Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment
Fish & Wildlife Propagation	S	S	S	S						S	NEI	S
Aesthetics												S
Agriculture					S		S	S				
Primary Body Contact Recreation									NS			
Public & Private Water Supply				NEI		NEI			NEI			
Fish Consumption				S								

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

Poteau River at Pocola



Sample Record	Times Visited	Station ID
November 1998 - Current	185	220100010010-001AT

Stream Data

County	LeFlore	Request Data By Email
Location	West of the Town of Pocola on County Road E 1220	
Latitude/Longitude	35.23864842, -94.52021262	
Planning Watershed	Lower Arkansas (8-digit HUC -11110105)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	178	18.9	19.9	2.9/34.6	11.0/26.0	
	Turbidity (NTU)	187	70	51	11/476	35/84	19% of values>OWQS
	pH (units)	182	7.29	7.26	5.39/8.99	6.97/7.63	
	Dissolved Oxygen (mg/L)	183	8.13	7.97	3.31/15.94	6.54/9.57	
	Hardness (mg/L)	185	51	47	<10/414	35/57	
Minerals	Total Dissolved Solids (mg/L)	29	118	96	16/675	71/125	
	Specific Conductivity (uS/cm)	179	142	133	<10/530	83/175	
	Chloride (mg/L)	90	9	10	<10/33	<10/10	
	Sulfate (mg/L)	90	37	34	<10/88	25/46	
Nutrients	Total Phosphorus (mg/L)	183	0.120	0.104	0.020/0.420	0.070/0.150	
	Total Nitrogen (mg/L)	180	1.10	0.98	0.17/6.45	0.79/1.22	
	Nitrate/Nitrite (mg/L)	182	0.36	0.24	<0.05/4.96	0.13/0.41	
	Chlorophyll A (mg/m^3)	97	16.2	14.6	1.9/77.3	9.6/19.3	TSI=57.9
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	48	173	40	<10/2420	20/72	Mean>OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	48	136	26	<10/2420	<10/41	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment
Fish & Wildlife Propagation	NS	S	S	NS						S	S	S
Aesthetics												S
Agriculture					S		S	S				
Primary Body Contact Recreation									NS			
Public & Private Water Supply				NEI		NEI			NEI			
Fish Consumption				NS								

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

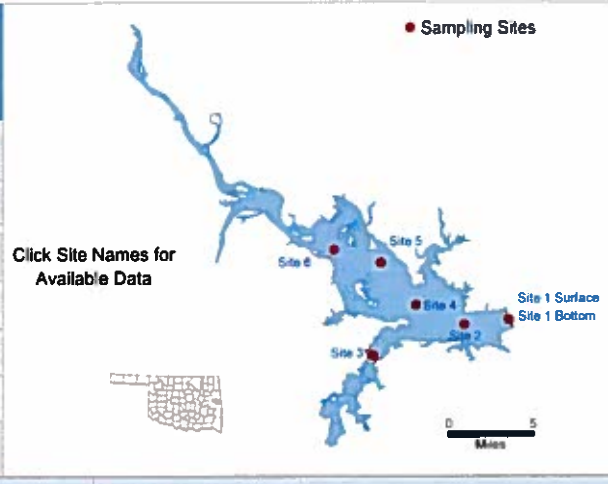
Fish & Wildlife Propagation not supporting for Lead
Fish Consumption not supporting for Lead

Robert S. Kerr

Sample Period	Times Visited	Sampling Sites
November 2015 – September 2016	4	6

General

Location	Sequoyah County	Click map for site data
Impoundment	1970	
Area	43,800 acres	
Capacity	525,700 acre feet	
Purposes	Navigation, Hydropower, and Recreation	



Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In-Situ	Average Turbidity	28NTU	42% of values > 25 NTU
	Average Secchi Depth	36 cm	
	Water Clarity Rating	Fair	
	Chlorophyll-a	17.9 mg/m3	
	Trophic State Index	59	Previous value = 56
	Trophic Class	Eutrophic	
Profile	Salinity	0.19– 0.44 ppt	
	Specific Conductivity	402.6 – 888.8 µS/cm	
	pH	7.66 – 8.26 pH units	Neutral to slightly alkaline
	Oxidation-Reduction Potential	-9.2.8 to 356.1 mV	
	Dissolved Oxygen	All data are above screening level of 2.0 mg/L	
Nutrients	Surface Total Nitrogen	0.61mg/L to 0.98 mg/L	
	Surface Total Phosphorus	0.062 mg/L to 0.172 mg/L	
	Nitrogen to Phosphorus Ratio	6:1	Possibly co- limited

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
Fish & Wildlife Propagation	NS	S	S	NEI							
Aesthetics					S	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										NEI	
Public & Private Water Supply				NEI							

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

*Standards revision, true color is for permitting purposes only

NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

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Sager Creek at West Siloam Springs

Sample Record	Times Visited	Station ID
November 1998 – December 2012	163	121700060080-001AT

Stream Data

County	Delaware	Request Data By Email
Location	West of the Town of West Siloam Springs off US Highway 412	
Latitude/Longitude	36.20164298, -94.60538182	
Planning Watershed	Lower Arkansas (8-digit HUC - 11110103)	

Parameters

	Parameter (Descriptions)	n	Mean	Median	Min./Max	p25/p75	Comments
In-Situ	Water Temperature (°C)	110	17.4	17.2	5.9/29.2	12.3/22.1	
	Turbidity (NTU)	111	3	1	1/55	1/3	
	pH (units)	109	7.71	7.72	6.59/8.65	7.46/7.98	
	Dissolved Oxygen (mg/L)	110	9.11	8.75	4.66/15.35	8.05/10.2	21% of values<OWQS and 13% of values<alt OWQS
	Hardness (mg/L)	109	132	134	<10/198	120/146	
Minerals	Total Dissolved Solids (mg/L)	21	244	227	10/657	186/283	
	Specific Conductivity (uS/cm)	110	424	427	164/713	357/495	
	Chloride (mg/L)	100	36	34	<5/95	23/47	
	Sulfate (mg/L)	100	25	21	<5/64	16/29	
Nutrients	Total Phosphorus (mg/L)	114	1.117	1.040	0.012/3.965	0.644/1.501	
	Total Nitrogen (mg/L)	113	7.46	7.20	2.32/17.55	4.88/9.08	
	Nitrate/Nitrite (mg/L)	114	7.02	6.48	2.01/17.5	4.39/8.62	
	Chlorophyll A (mg/m^3)	54	1.6	0.7	<0.5/8.3	<.5/2.4	TSI=35.5
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	56	512	109	<10/9700	34/475	Mean>OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	56	218	31	<10/4360	<10/98	

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment
Fish & Wildlife Propagation	S	S	NS	S						S	S	S
Aesthetics												NEI
Agriculture					S		S	S				
Primary Body Contact Recreation									NS			
Public & Private Water Supply				S		S			S			
Fish Consumption				S								

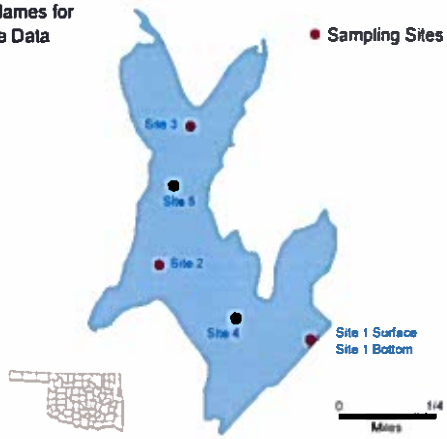
S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

Stilwell City

Sample Period	Times Visited	Sampling Sites
December 2015 – October 2016	3	5

Click Site Names for Available Data



General

Location	Adair County
Impoundment	1965
Area	188 acres
Capacity	3,110 acre-feet
Purposes	Water Supply, Recreation, Flood Control

Click map for site data

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	14 NTU	33% of values > OWQS of 25 NTU
	Average Secchi Disk Depth	69 cm	100% of values < OWQS of 70
	Water Clarity Rating	Average	
	Chlorophyll-a	9.6mg/m3	
	Trophic State Index	53	Previous value = 54
	Trophic Class	Eutrophic	
Profile	Salinity	0.06 – 0.12 ppt	
	Specific Conductivity	117.3 – 249.5 µS/cm	
	pH	6.74 – 8.03 pH units	
	Oxidation-Reduction Potential	64 – 459 mV	
	Dissolved Oxygen	Up to 54% of water column < 2 mg/L in October	Occurred at site 1, the dam
Nutrients	Surface Total Nitrogen	0.63 mg/L to 1.24 mg/L	
	Surface Total Phosphorus	0.027 mg/L to 0.281 mg/L	
	Nitrogen to Phosphorus Ratio	7:1	Possibly co- limited

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
Fish & Wildlife Propagation	NS	S	NS	S							
Aesthetics					S	S					
Agriculture							S	S	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

*Standards revision, true color is for permitting purposes only

NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

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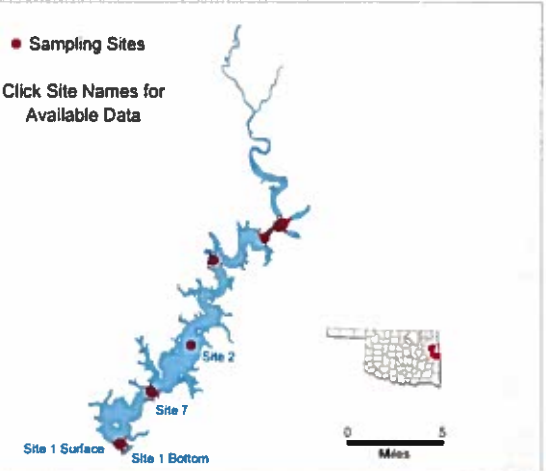
Tenkiller (1,2,7)

Sample Period	Times Visited	Sampling Sites
October 2014 – June 2015	4	7



General

Location	Sequoyah County
Impoundment	1953
Area	12,900 acres
Capacity	654,100 acre-feet
Purposes	Flood Control, Hydropower

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	7 NTU	100% of values < OWQS of 25 NTU
	Average Secchi Disk Depth	240 cm	
	Water Clarity Rating	Excellent	
	Chlorophyll-a	13 mg/m3	
	Trophic State Index	56	Previous value = 51
	Trophic Class	Eutrophic	
Profile	Salinity	0.09 – 0.18 ppt	
	Specific Conductivity	188 – 366.2 µS/cm	
	pH	6.81 – 8.55 pH units	
	Oxidation-Reduction Potential	133.2-461.8mV	
	Dissolved Oxygen	Up to 50% of water column < 2 mg/L	
Nutrients	Surface Total Nitrogen	0.82 mg/L to 1.69 mg/L	
	Surface Total Phosphorus	0.142 mg/L to 0.240 mg/L	
	Nitrogen to Phosphorus Ratio	7:1	Possibly co-limited for this sample year

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
Fish & Wildlife Propagation	S	S	NS	NEI							
Aesthetics					NEI	*					
Agriculture							N/A	N/A	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply				NEI							

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

*The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status.
**N/A – parameters not collected in current sample year.*

NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

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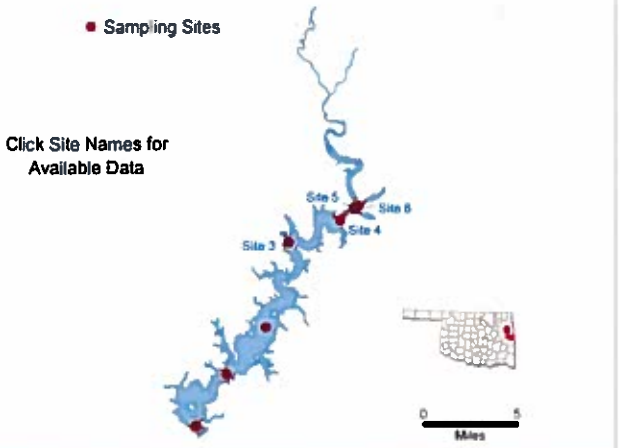
Tenkiller, Illinois River Arm (3-6)

Sample Period	Times Visited	Sampling Sites
October 2014 – June 2015	4	7



General

Location	Sequoyah County
Impoundment	1953
Area	12,900 acres
Capacity	654,100 acre-feet
Purposes	Flood Control, Hydropower

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	5 NTU	100% of values < OWQS of 25 NTU
	Average Secchi Disk Depth	84cm	
	Water Clarity Rating	Average	
	Chlorophyll-a	19 mg/m3	
	Trophic State Index	59	Previous value = 58
	Trophic Class	Eutrophic	
Profile	Salinity	0.08 – 0.17 ppt	
	Specific Conductivity	179 – 356.1 µS/cm	
	pH	7.25 – 8.9 pH units	
	Oxidation-Reduction Potential	215.3-417.4 mV	
	Dissolved Oxygen		
Nutrients	Surface Total Nitrogen	0.83 mg/L to 2.76 mg/L	
	Surface Total Phosphorus	0.127 mg/L to 0.455 mg/L	
	Nitrogen to Phosphorus Ratio	6:1	Possibly co- limited for this sample year

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
Fish & Wildlife Propagation	S	S	NEI	NEI							
Aesthetics					NEI	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply				NEI							NS

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NS = Not Supporting
NEI = Not Enough Information

Notes

*The lake is listed in the WQS as a NLW indicating that the Aesthetics beneficial use is considered threatened by nutrients until studies can be conducted to confirm non-support status.

NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

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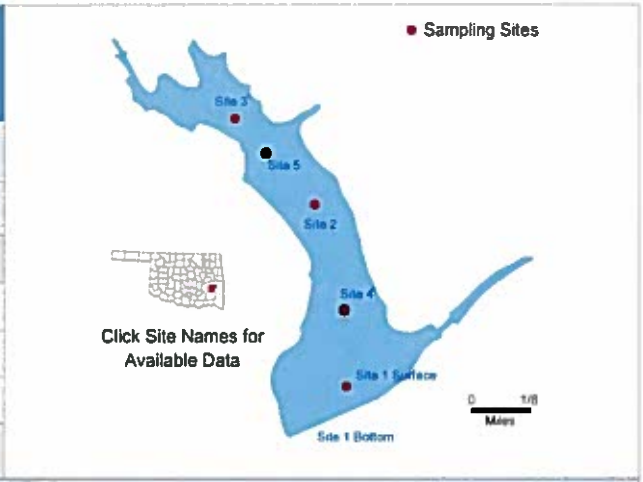
Wayne Wallace

Sample Period	Times Visited	Sampling Sites
February 2012 – August 2012	4	5



General

Location	Latimer County
Impoundment	1969
Area	94 acres
Capacity	1,746 acre feet
Purposes	Flood Control and Recreation

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
	Average Turbidity	6 NTU	100% of values < OWQS of 25 NTU (n=6)
	Average Secchi Disk Depth	115 cm	
	Water Clarity Rating	Excellent	
	Chlorophyll-a	27 mg/m3	
	Trophic State Index	63	Previous value = 48
	Trophic Class	Hypereutrophic	
Profile	Salinity	0.02 – 0.07 ppt	
Profile	Specific Conductivity	56 – 153.5 µS/cm	
Profile	pH	6.11 – 9.4 pH units	14.5% of recorded values are < 6.5 pH units
Profile	Oxidation-Reduction Potential	51 to 484 mV	
Profile	Dissolved Oxygen	Up to 60% of water column < 2 mg/L in August	
Nutrients	Surface Total Nitrogen	0.48 mg/L to 0.59 mg/L	
Nutrients	Surface Total Phosphorus	0.005 mg/L to 0.014 mg/L	
Nutrients	Nitrogen to Phosphorus Ratio	74:1	Phosphorus limited

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
Fish & Wildlife Propagation	S	NS	NS	S							
Aesthetics					S	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											

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NEI = Not Enough Information

Notes *Slightly acidic conditions are common in this part of the state, due to relatively low soil pH and lack of soluble bedrock. Due to these conditions it is likely that the low pH values may be due to natural causes; therefore the Water Board is looking at the applicability of developing site-specific criteria for waters in the southeastern portion of the state.* * Standards revision, true color is for permitting purposes only.

NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

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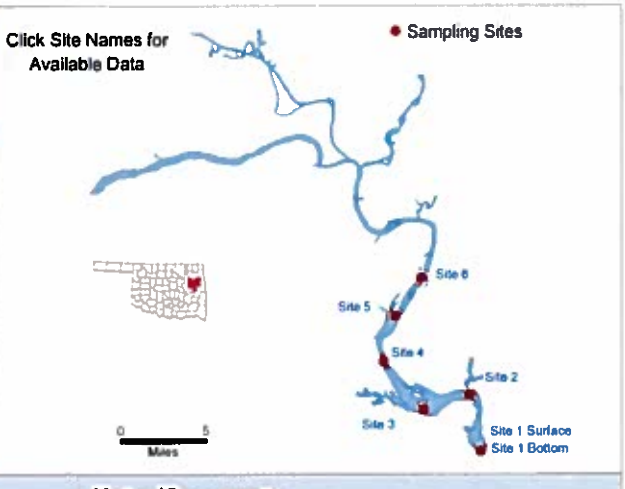
Webbers Falls

Sample Period	Times Visited	Sampling Sites
December 2015 – October 2016	4	6



General

Location	Muskogee County
Impoundment	170
Area	11,600 acres
Capacity	170,100 acre-feet
Purposes	Navigation, Hydropower

Click map for site data

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In-Situ	Average Turbidity	81 NTU	100% of values > OWQS of 25 NTU
	Average Secchi Disk Depth	16 cm	
	Water Clarity Rating	Poor	
	Chlorophyll-a	8.6 mg/m3	
	Trophic State Index	52	Previous value = 59
	Trophic Class	Eutrophic	
Profile	Salinity	0.13 – 0.31 ppt	
	Specific Conductivity	271.8 – 645 µS/cm	
	pH	7.5 – 7.74 pH units	
	Oxidation-Reduction Potential	251.2 – 475.2 mV	
	Dissolved Oxygen	All data are above screening level of 2.0 mg/L	
Nutrients	Surface Total Nitrogen	0.99 mg/L to 1.38 mg/L	
	Surface Total Phosphorus	0.170 mg/L to 0.306 mg/L	
	Nitrogen to Phosphorus Ratio	5:1	Possibly co-limited

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E. coli	Chlor-a
Fish & Wildlife Propagation	NS	S	S	S							
Aesthetics					S	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										NS	
Public & Private Water Supply											

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NEI = Not Enough Information

Notes

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NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

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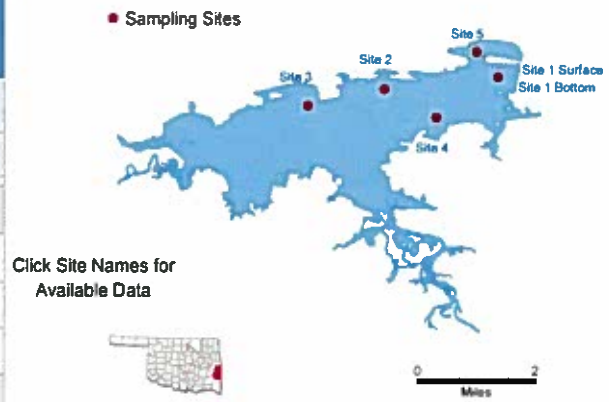
Wister

Sample Period	Times Visited	Sampling Sites
November 2015 – Sept. 2016	4	5



General

Location	LeFlore County
Impoundment	1949
Area	7,333 acres
Capacity	62,360 acre feet
Purposes	Flood Control, Water Supply, Low flow Regulation, and Conservation

Click map for site data

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In-Situ	Average Turbidity	22 NTU	30% of values < OWQS 25 NTU
	Average Secchi Disk Depth	44 cm	
	Water Clarity Rating	Fair	
	Chlorophyll-a	24 mg/m3	
	Trophic State Index	62	Previous value =60
	Trophic Class	Hypereutrophic	
Profile	Salinity	0.03 – 0.04 ppt	
	Specific Conductivity	75.7 – 87 µS/cm	
	pH	6.45 – 7.49 pH units	2 % of Values < 6.5 pH units
	Oxidation-Reduction Potential	23 to 332.2 mV	
	Dissolved Oxygen		All readings above 2 mg/L
Nutrients	Surface Total Nitrogen	0.54 mg/L to 0.66 mg/L	
	Surface Total Phosphorus	0.037 mg/L to 0.062 mg/L	
	Nitrogen to Phosphorus Ratio	12:1	Phosphorus limited

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	En & E. coli	Chlor-a
Fish & Wildlife Propagation	NS	NS	NEI	S							
Aesthetics					NEI*	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											NS

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes: *Standards revision, true color is for permitting purposes only. *Currently, the lake is listed as a Nutrient Limited Watershed (NLW) in the Oklahoma Water Quality Standards (WQS). This listing means that the lake is considered threatened from nutrients until a more intensive study can confirm the Aesthetics beneficial use non-support status.

NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

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Bathy map available: http://www.owrb.ok.gov/maps/PMG/owrbdata_Bathy.html

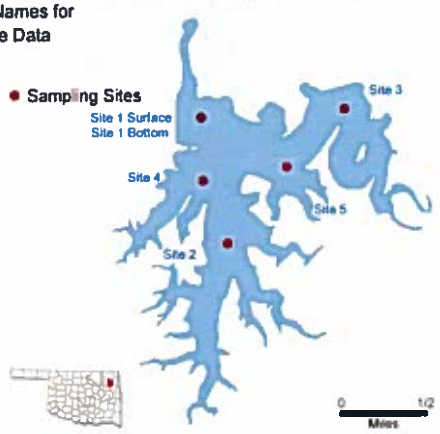
W.R. Holway

Sample Period	Times Visited	Sampling Sites
November 2015 – August 2016	4	5

General

Location	Mayes County	Click map for site data
Impoundment	1968	
Area	712 acres	
Capacity	48,000 acre-feet	
Purposes	Water Supply, Hydropower, Recreation	

Click Site Names for Available Data



Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In-Situ	Average Turbidity	2 NTU	100% of Values < OWQS of 25
	Average Secchi Disk Depth	147 cm	
	Water Clarity Rating	Excellent	
	Chlorophyll-a	18.9 mg/m3	
	Trophic State Index	59	Previous Value= 56
	Trophic Class	Eutrophic	
Profile	Salinity	0.09 – 0.22 ppt	
	Specific Conductivity	201.8 – 451.2 µS/cm	
	pH	6.66 – 9.00 pH units	
	Oxidation-Reduction Potential	128.5 to 514 mV	
	Dissolved Oxygen	Up to 48% of water column < 2 mg/L in summer	
Nutrients	Surface Total Nitrogen	0.41 mg/L to 0.59mg/L	
	Surface Total Phosphorus	0.042 mg/L to 0.067 mg/L	
	Nitrogen to Phosphorus Ratio	9:1	Phosphorus limited

Beneficial Uses

Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	TSI	True Color	Sulfates	Chlorides	Total Dissolved Solids	Enterro. & E. coli	Chlor-a
Fish & Wildlife Propagation	S	S	NS	S							
Aesthetics					S	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											

S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes

*Standards revision, true color is for permitting purposes only

NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

Sampling and Assessment by the **Oklahoma Water Resources Board** – 3800 Classen Blvd, Oklahoma City, OK, 73118 – 405.530.8800 – http://www.owrb.ok.gov

Bathy map available: http://www.owrb.ok.gov/maps/PMG/owrbdata_Bathy.html

Oklahoma 2014 Integrated Report
Appendix B

Legend

Legend for Attainment	
Code	**Description**
F	Fully Supporting
N	Not Supporting
I	Insufficient Information
X	Not Assessed

USE ID	Description
124	Aesthetic
125	Agriculture
129	Emergency Water Supply
130	Cool Water Aquatic Community
131	Habitat Limited Aquatic Community
132	Trout Fishery
133	Warm Water Aquatic Community
134	Hydropower
135	Indus. & Muni. Process/Cooling Water
136	Navigation
137	Primary Body Contact Recreation
138	Public and Private Water Supply
139	Secondary Body Contact Recreation
1003	Fish Consumption
1004	Outstanding Resource
1005	Sensitive Water Supply
1006	High Quality Water

Category	Description
1	Attaining the Water Quality Standard and no use is threatened
2	Attaining some of the designated uses; no use is threatened; and insufficient or no data or information is available to determine if the remaining uses are attained or threatened
3	Insufficient or no data and information to determine if any designated use is attained
4 4a 4b 4c	Impaired or threatened for one or more designated uses but does not require the development of a TMDL • TMDL has been completed • Other pollution control requirements are reasonable expected to result in the attainment of the water quality standard in the near future • Impairment is not caused by a pollutant
5	The water quality standard is not attained. The waterbody is impaired or threatened for one or more designated uses by a pollutant(s), and requires a TMDL

ID	Description
91	Ammonia (Unionized) -Toxin
96	Arsenic
104	Barium
127	Cadmium
138	Chloride
153	Chlorpyrifos
154	Chromium (total)
163	Copper
187	Diazinon
198	Dieldrin
215	Enterococcus
217	Escherichia coli
230	Fishes Bioassessments
267	Lead
302	Nitrates
317	Oil and Grease
322	Oxygen, Dissolved
372	Selenium
375	Silver
385	Sulfates
398	Total Coliform
399	Total Dissolved Solids
400	Total Fecal Coliform
413	Turbidity
423	Zinc
441	pH
462	Total Phosphorus

ID	Description
2	Acid Mine Drainage
33	Discharges from Biosolids (SLUDGE) Storage, Application or Disposal
62	Industrial Point Source Discharge
68	Land Application of Wastewater Biosolids (Non-agricultural)
70	Leaking Underground Storage Tanks
82	Mine Tailings
84	Municipal (Urbanized High Density Area)
85	Municipal Point Source Discharges
92	On-site Treatment Systems (Septic Systems and Similar Decencentralized Systems)
100	Runoff from Permitted Confined Animal Feeding Operations (CAFOs)
102	Petroleum/natural Gas Activities (Legacy)
119	Silviculture Harvesting
124	Spills from Trucks or Trains
127	Surface Mining
140	Source Unknown
155	Natural Sources
156	Agriculture
157	Habitat Modification - other than Hydromodification

2014 Category 5 Waters for the Oklahoma/Arkansas Compact Area

WBID	Name	Size	Unit	Causes	Potential Sources	TMDL Date
OK120400010070_00	Webbers Falls Lake	11600.0	ACRES	215, 413	140	2025
OK120400010130_00	Greenleaf Lake	920.0	ACRES	413, 150	140	2022
OK120400010400_00	Coody Creek	16.2	MILES	322	46, 59, 87 , 92, 108,111, 133, 136, 140	2013
OK120400020010_00	Dirty Creek	44.2	MILES	322	21, 46,49,87, 108, 92, 136, 140	2025
OK120400020030_00	Dirty Creek, South Fork	15.5	MILES	215217, 385, 322	84, 140, 46, 85, 87, 92, 108, 111, 133, 136,59 ,	2025
OK120400020110_00	Dirty Creek, Georges Fork	10.0	MILES	230, 322	46, 87, 92, 108, 111, 133, 136, 140	2025
OK120400020160_00	Butler Creek	10.3	MILES	322	46, 59, 92, 87, 108, 111, 133, 136, 140	2025
OK120400020190_00	Elk Creek	13.9	MILES	385, 322	46, 49,62, 85, 87, 92, 108, 136, 111, 133, 140 ,97	2025
OK120400020240_00	Shady Grove Creek	10.8	MILES	441, 385, 399	49, 140	2025
OK121700020020_00	Tenkiller Ferry Lake	8440.0	ACRES	322, 462	4, 59, 108, 136, 146, 140	2016
OK121700020110_00	Chicken Creek	4.9	MILES	230	140	2016
OK121700020220_00	Tenkiller Ferry Lake, Illinois River Arm	5030.0	ACRES	462, 150	4, 46, 59, 92, 108, 136, 146, 140	2016
OK121700030010_00	Illinois River	7.7	MILES	462, 215	4,46,59,85,92,100,108,136,146,140	2016
OK121700030040_00	Tahlequah Creek (Town Branch)	6.2	MILES	217	46, 92, 108, 133, 136, 140	2016
OK121700030080_00	Illinois River	32.0	MILES	462, 217, 267	4,46,59,92,108,133,136,140	2016
OK121700030280_00	Illinois River	15.2	MILES	462 ,215, 217, 413	4,46,59,92,108,133,136,146,140	2016
OK121700030290_00	Flint Creek	1.6	MILES	322, 462	4,46,59,92,108,133,136,146,140	2016
OK121700030350_00	Illinois River	5.2	MILES	462, 215, 217	4,34,46,59,92,100,108,133,136,146,140	2019
OK121700030370_00	Ballard Creek	12.6	MILES	215	4,46,59,92,108,111,133,136,140	2019
OK121700040010_00	Caney Creek	20.9	MILES	215	4,46,59,62,92,108,111,133,136,140	2022
OK121700050010_00	Illinois River, Baron Fork	23.3	MILES	462, 215	4,34,46,59,92,100,108,133,136,146,140	2019
OK121700050090_00	Tyner Creek	14.8	MILES	215	4,46,59,92,108,136,140	2019
OK121700050120_00	Peacheater Creek	10.3	MILES	215	4,46,59,92,100,108,128,136,140	2019
OK121700060010_00	Flint Creek	7.8	MILES	462, 215	4,46,59,92,100,108,111,133,136,146,140	2016
OK121700060040_00	Battle Creek (Battle Branch)	5.4	MILES	215	4,46,59,92,108,111,133,136,140	2016
OK121700060080_00	Sager Creek	4.2	MILES	215, 322, 371, 105	4,46,59,85,92,108,133,136,146,140	2016
OK220100010010_00	Poteau River	23.9	MILES	267, 413	46,49,59,62,85,108,133,136,140	2019
OK220100010010_30	Poteau River	1.6	MILES	127, 163, 267, 372, 375	140	2025
OK220100010010_40	Poteau River	21.4	MILES	163, 267, 413	140	2022
OK220100010050_00	New Spiro Lake	254.0	ACRES	150, 322,	46,92,108,133,136,140	2019
OK220100010180_00	Caston Creek	14.4	MILES	105, 230	46,49,59,87,92,102,108,111,136,140,	2022
OK220100020010_10	Poteau River	27.0	MILES	215	46,59,85,92,100,108,136,140	2016

OK220100020020_00	Wister Lake	7333.0	ACRES	150, 462, 413, 441, 274	46,92,108,133,136,140	2016
OK220100020040_00	Poteau River, Black Fork	30.2	MILES	441	140	2019
OK220100020060_00	Cedar Lake	78.0	ACRES	322, 441	46,92,108,133,136,140	2019
OK220100030010_00	Brazil Creek	17.8	MILES	215	4, 46, 59, 92, 108, 133, 136, 140	
OK220100040020_00	Fourche Maline Creek	36.9	MILES	267, 322, 215	140, 46, 62, 69, 85, 87, 92, 108, 111, 133, 136	2019
OK220100040050_00	Red Oak Creek	11.0	MILES	441, 322	46,.85, 92, 108, 133, 136, 140	2019
OK220100040080_00	Bandy Creek	12.5	MILES	230	140	2019
OK220100040100_00	Lloyd Church Lake (Wilburton City)	160.0	ACRES	413, 441	46,92,108,133,136,140	2019
OK220100040150_00	Wayne Wallace Lake	94.0	ACRES	322, 441	46,92,108,133,136,140	2019
OK220200010010_00	Arkansas River	20.7	MILES	215, 399	49, 102, 140	2022
OK220200020020_00	Robert S. Kerr Lake	43380.0	ACRES	413	140	2019
OK220200020040_00	Little Salisaw Creek	17.6	MILES	163	140	2019
OK220200030010_10	Sallisaw Creek	9.0	MILES	215	49, 140	2019
OK220200030010_20	Sallisaw Creek	13.3	MILES	215	4,46,59,92,10,111,128,133,136,140	
OK220200030040_00	Brushy Creek Lake	358.0	ACRES	150, 441	46,92,108,133,136,140	2019
OK220200030120_00	Stilwell City Lake	188.0	ACRES	322, 413	46,108,133,136,140	2019
OK220200040010_10	Sans Bois Creek	10.8	MILES	215,385	49, 103, 140, 46, 85, 87, 92, 108, 111, 133, 136	2025
OK220200040010_40	Sans Bois Creek	27.8	MILES	322, 215, 217	4,46,59,85,92,108,133,136,140	2025
OK220200040050_00	Sans Bois Creek, Mountain Fork	18.8	MILES	215	46,92,108,133,136,156,140	
OK220200050010_00	Lee Creek	1.9	MILES	215,267	46,92,108,133,136,146,140	2022
OK220200050040_10	Lee Creek	15.7	MILES	267	46,92,108,133,136,146,140	2022
OK220200050040_00	Little Lee Creek	23.6	MILES	215	46,92,108,133,136,146,140	2013

Oklahoma Water Resources Board Water Quality Standards Update

September 28, 2017

Revision topics for the 2017-2018 Interim Rulemaking will include changes to Oklahoma's antidegradation policy and implementation rules (785:45-5; 785:46-13), implementation rules for Sensitive Water Supply—Reuse Waters (785:46-13), implementation policies for the Oklahoma Groundwater Quality Standards (OGWQS) (OAC 785:45-7), site specific copper criteria for Mud Creek in southeastern Oklahoma, and an updated methyl-mercury criterion. For information on the draft rule revisions and to view revised language, please visit the OWRB website at http://www.owrb.ok.gov/util/rules/wqs_revisions.php. Also, standards changes proposed in the most recent interim revision were recently approved and became state rule in September. Changes relevant to the Ark/Ok compact area included:

- Revisions and updates to the Oklahoma Groundwater Quality Standards (OGWQS) (OAC 785:45-7). The revision included the addition of an updated antidegradation policy for groundwaters, revisions to classifications of fresh groundwater, development of a new Domestic Untreated Water Supply beneficial use, and promulgation of numeric and narrative criteria for recharge projects to groundwaters.

Preparation continues on revision topics slated for 2018-2019 triennial revision. Preliminary work will continue for development of EPA recommended criteria, including updated human health criterion (HLC), an ALC for ammonia, a tissue based ALC for selenium with implantation rules, revisions to recreational criteria for bacteria, and new recreational criteria for algal cyanotoxins. Other topics will include development of the biotic ligand model for site specific copper criteria and implementation rules for continuous water quality data. Staff will use the latest and most relevant science and implementation guidance to complete this work. Additionally, staff continues to explore a technical workgroup process to revise Oklahoma's minerals criteria and explore implementation within both the agriculture and aquatic life beneficial uses. Finally, work will continue to draft rules for indirect potable reuse for all reservoirs, including those classified as SWS-R.

OKLAHOMA'S 2017-2018 WATER QUALITY STANDARDS REVISIONS RELEVANT TO THE ARK/OK COMPACT AREA

Completed TMDL's In the Arkansas-Oklahoma Compact Area: Provided by the Oklahoma Department of Environmental Quality

COMPLETED TMDL'S PROVIDED BY THE OKLAHOMA DEPT. OF ENVIRONMENTAL QUALITY

11070209 - Lower Neosho

Waterbody ID	Station Name	Parameter	Cause Code(s)	EPA TMDL ID	DATE
OK121600050020_00	Spavinaw Lake	Phosphorus	462	38670	6/9/2010
OK121600050070_00	Lake Eucha	Phosphorus	462	38667	6/9/2010
OK121600010430_00	Chouteau Creek	Enterococcus, E. coli	215,217	42585	9/24/2012
OK121600010440_00	Crutchfield Branch	Enterococcus, E. coli	215,217	34849	7/28/2008
OK121600010060_00	Ranger Creek	Enterococcus	215	34847	7/28/2008
OK121600010100_00	Fourteenmile Creek	Enterococcus	215	34848	7/28/2008
OK121600010010_00	Neosho River	Enterococcus	215	42581	9/27/2012
OK121600020030_10	Saline Creek	Enterococcus	215	58701	5/13/2014
OK121600020070_00	Little Saline Creek	Enterococcus	215	58702	5/13/2014
OK121600050150_00	Spavinaw Creek	Enterococcus	215	58705	5/13/2014
OK121600050160_00	Beaty Creek	Enterococcus	215	58707	5/13/2014
OK121600050180_00	Cloud Creek	Enterococcus	215	58708	5/13/2014
OK121600060080_00	Little Cabin Creek	Enterococcus, E. coli	215, 217	50980	10/1/2012
OK121610000050_10	Pryor Creek	Enterococcus, E. coli	215, 217	58709	5/13/2014
OK121610000090_00	Pryor Creek	Turbidity	413	58709	5/13/2014
OK121600010430_00	Chouteau Creek	Enterococcus, E. coli	215, 217	42582	

11110102 - Dirty-Greenleaf

Waterbody ID	Station Name	Parameter	Cause Code(s)	EPA TMDL ID	DATE
OK120400010260_00	Arkansas River	Enterococcus	215	42530	9/27/2012
OK120400020160_00	Butler Creek	Enterococcus, E. coli, Turbidity	215,217,413	42538	9/27/2012
OK120400010400_00	Coody Creek	Enterococcus, E. coli	215,217	42532	9/27/2012
OK120400020010_00	Dirty Creek	Enterococcus, Turbidity	215,413	42533	9/27/2012
OK120400020110_00	Dirty Creek, Georges Fork	Enterococcus	215	42536	9/27/2012
OK120400020030_00	Dirty Creek, South Fork	Enterococcus	215	42535	9/27/2012
OK120400020190_00	Elk Creek	Enterococcus	215	42537	9/27/2012
OK120400020240_00	Shady Grove Creek	Enterococcus	215	42539	9/27/2012

11110103 - Illinois

Waterbody ID	Station Name	Parameter	Cause Code(s)	EPA TMDL ID	DATE

11110104 - Robert S Kerr

Waterbody ID	Station Name	Parameter	Cause Code(s)	EPA TMDL ID	DATE
OK220200040010_40	Sans Bois Creek	Enterococcus, E. coli	215,217	35635	10/20/2008
OK220200040050_00	Sans Bois Creek, Mountain Fork	E. coli	217	35634	10/20/2008
OK220200030010_20	Sallisaw Creek	Enterococcus	215	58780	5/13/2014
OK220200040010_10	Sans Bois Creek	Enterococcus	215	58782	5/13/2014
OK220200040050_00	Sans Bois Creek, Mountain Fork	E. coli	217	35626	

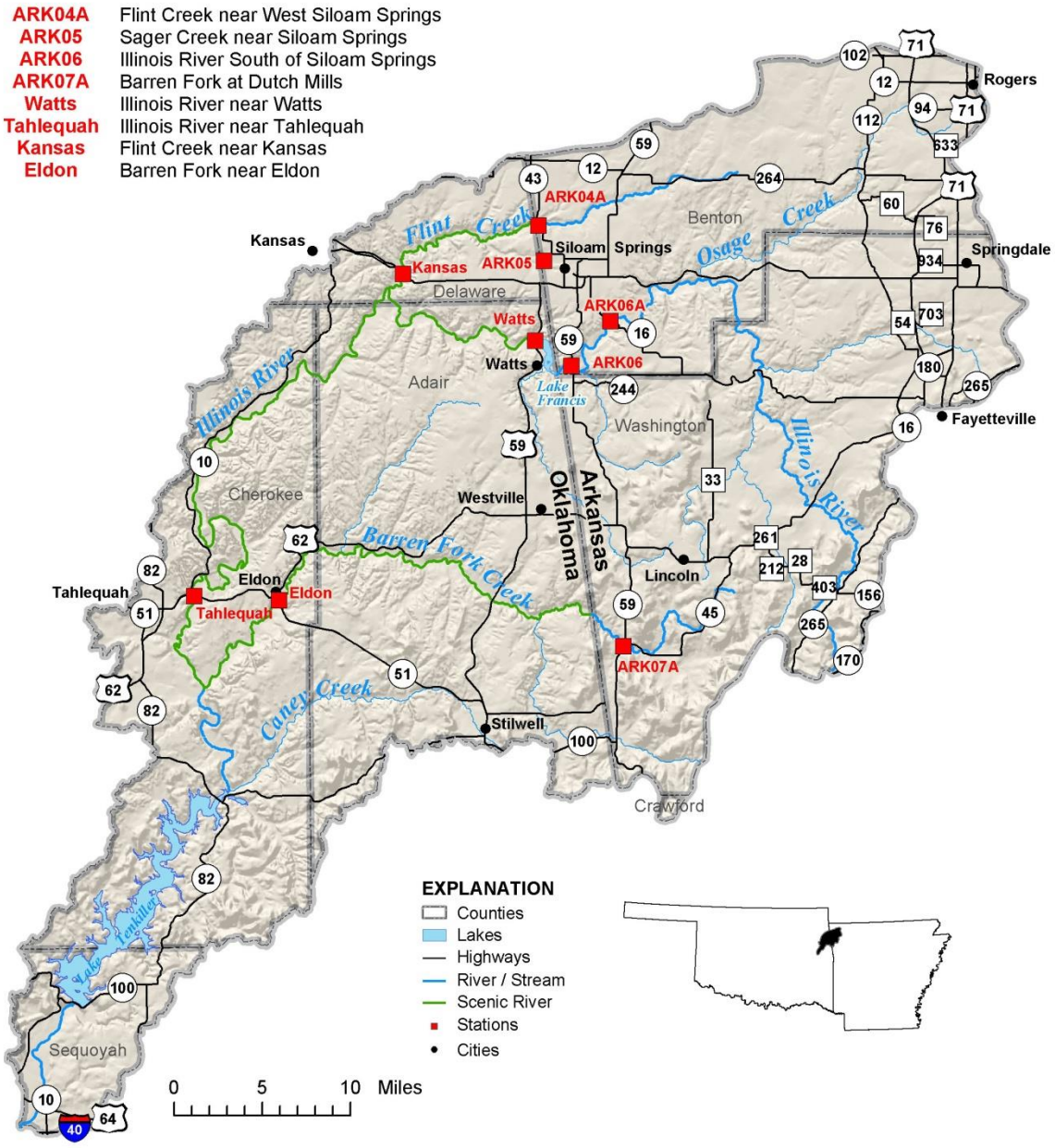
11110105 - Poteau

Waterbody ID	Station Name	Parameter	Cause Code(s)	EPA TMDL ID	DATE
OK220100040020_00	Fourche Maline Creek	Enterococcus	215	35634	10/28/2008
OK220100010010_00	Poteau River	Turbidity	413	58800	5/13/2014
OK220100010010_40	Poteau River	Turbidity	413	58820	5/13/2014
OK220100030010_00	Brazil Creek	Enterococcus	215	58760	5/13/2014

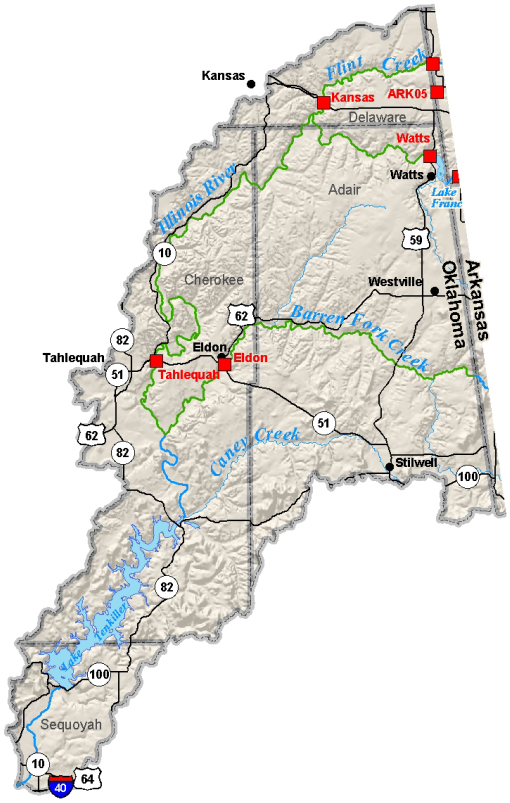
Water Quality Monitoring Report for the Illinois River Basin

Illinois River Basin

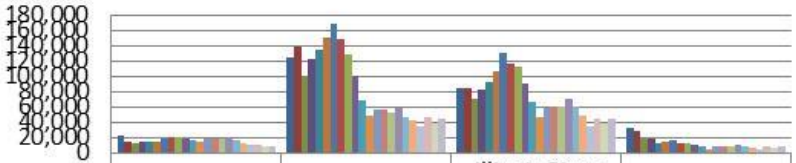
Arkansas – Oklahoma Compact



CY 2017



Oklahoma's Average Annual Total P Loading in Kilograms per Year (excluding targeted high flows)



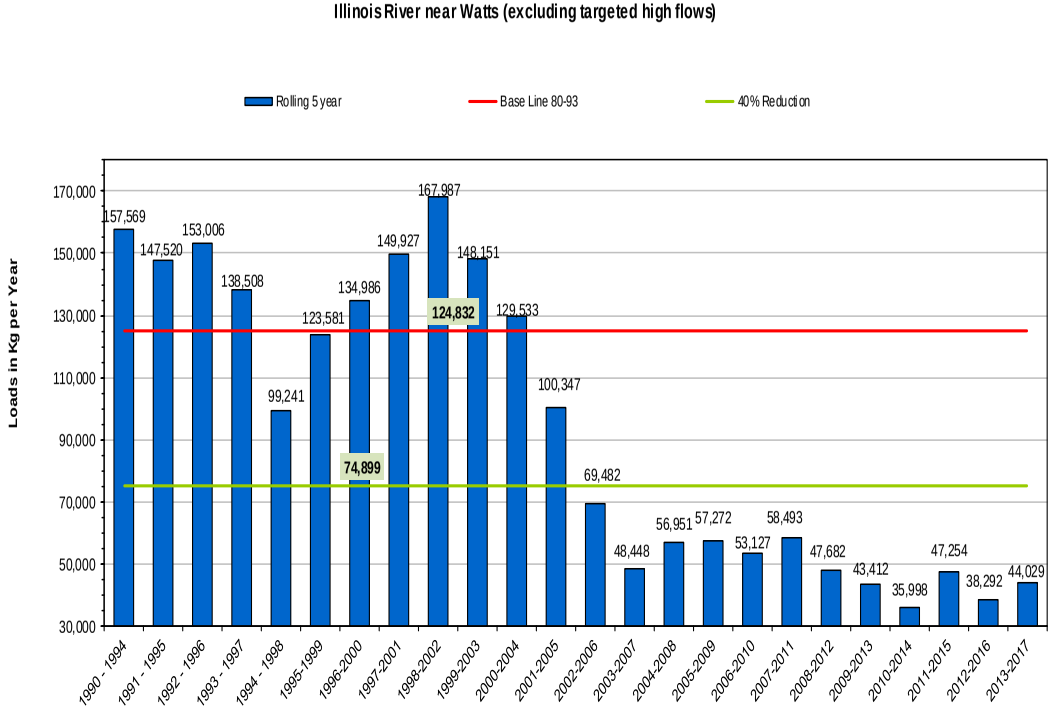
	Flint Creek near Kansas	Illinois River near Watts	Illinois River near Tahlequah	Barren Fork near Eldon
Total P 80-93	22,279	124,832	85,235	33,001
Total P 93-97	15,727	138,508	83,799	29,482
Total P 94-98	12,986	99,898	70,546	19,163
Total P 95-99	14,974	123,581	83,632	19,257
Total P 96-00	15,100	134,986	92,876	13,163
Total P 97-01	15,989	149,927	106,797	14,548
Total P 98-02	19,224	167,987	131,491	17,603
Total P 99-03	20,579	148,151	117,524	14,059
Total P 00-04	20,963	129,533	112,341	13,685
Total P 01-05	19,098	100,347	91,325	11,465
Total P 02-06	17,415	69,482	67,345	8,500
Total P 03-07	15,977	48,448	47,216	5,716
Total P 04-08	19,356	56,951	58,605	8,574
Total P 05-09	19,586	57,272	60,830	9,197
Total P 06-10	19,818	53,127	61,131	9,335
Total P 07-11	21,700	58,493	70,259	11,159
Total P 08-12	17,473	47,682	61,180	9,837
Total P 09-13	13,543	43,412	48,513	7,054
Total P 10-14	10,154	35,998	35,578	5,357
Total P 11-15	11,382	47,254	45,505	8,711
Total P 12-16	9,516	38,292	38,711	7,831
Total P 13-17	10,063	44,029	45,051	9,461

Values represent all available data, which is routinely collected and excludes targeted high flow events.

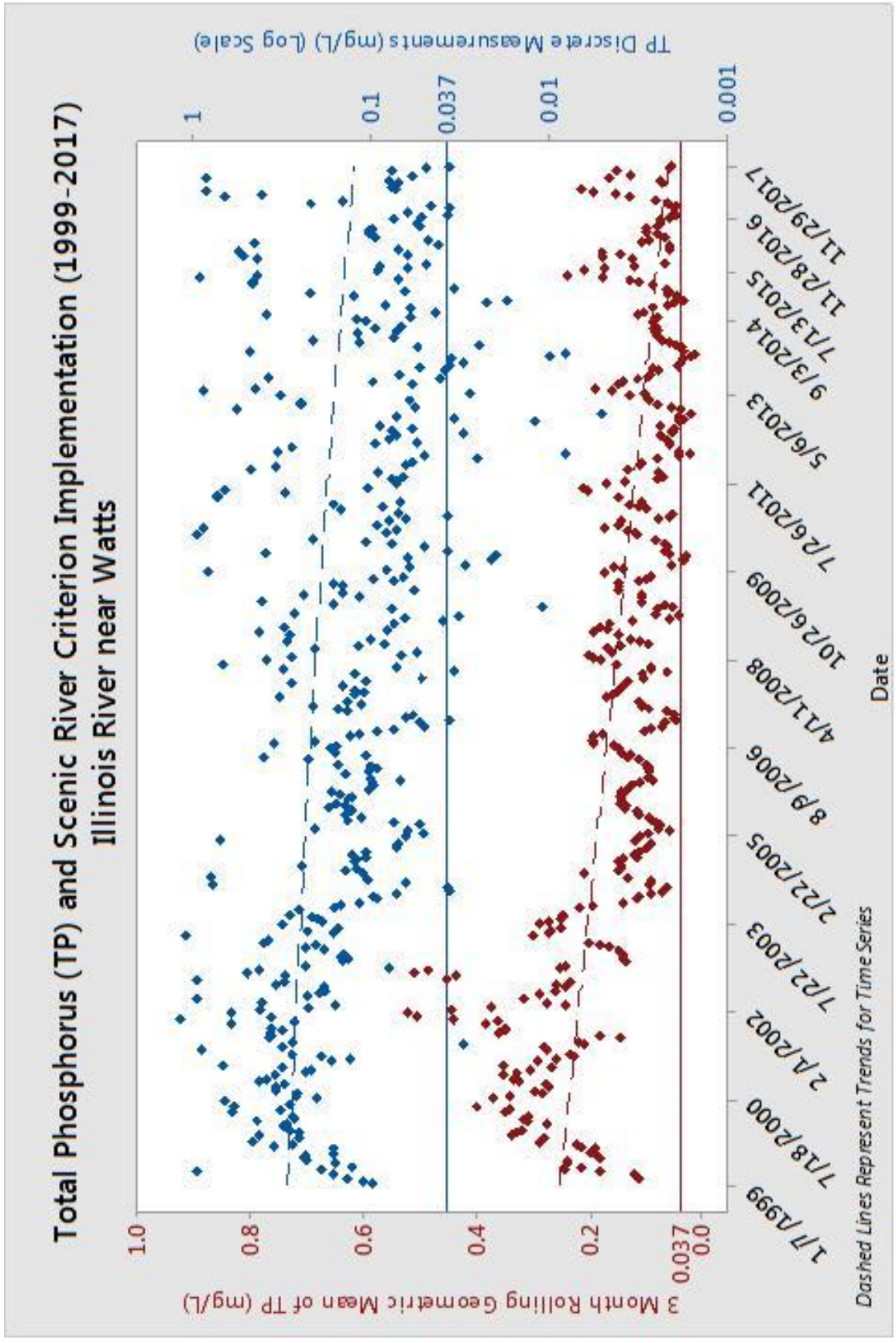
Illinois River near Watts

Illinois River near Watts			Loadings
Year	Flow (cfs)	Total P (mg/L)	Total P kg/year
1980	173	0.423	65,279
1981	260	0.190	44,119
1982	591		
1983	352		
1984	706		
1985	947		
1986	879		
1987	815		
1988	531		
1989	558	0.210	104,653
1990	1,127	0.181	182,432
1991	724	0.162	104,534
1992	760	0.161	109,571
1993	1,163	0.277	287,317
1994	674	0.168	101,127
1995	783	0.143	100,233
1996	693	0.188	116,542
1997	573	0.163	83,415
1998	713	0.138	87,876
1999	793	0.250	177,057
2000	648	0.309	178,827
2001	649	0.346	200,549
2002	619	0.316	174,694
2003	347	0.155	48,035
2004	688	0.104	63,903
2005	459	0.106	43,453
2006	349	0.116	36,156
2007	464	0.106	43,926
2008	1177	0.068	71,480
2009	915	0.069	56,386
2010	587	0.057	29,882
2011	1101	0.081	79,648
2012	336	0.052	15,594
2013	642	0.082	46,994
2014	448	0.056	22,412
2015	1364	0.061	74,303
2016	434	0.065	25,189
2017	918	0.064	52,481
Average	683	0.157	95,791

Year	80-93	90-94	91-95	92-96	93-97	94-98	95-99	96-00	97-01	98-02	99-03	00-04	01-05	02-06	03-07	04-08	05-09	06-10	07-11	08-12	09-13	10-14	11-15	12-16	13-17
Pt (mg/l)	0.204	0.198	0.201	0.210	0.200	0.162	0.195	0.221	0.249	0.275	0.271	0.246	0.203	0.158	0.118	0.102	0.095	0.085	0.077	0.065	0.068	0.066	0.068	0.064	0.065
Flow (cfs)	685	890	821	815	777	687	711	684	675	684	611	590	552	492	461	627	673	698	849	823	716	623	778	690	761
Pt (kg/yr)	124,832	157,569	147,520	153,006	138,508	99,241	123,581	134,986	149,927	167,987	148,151	129,533	100,347	69,482	48,448	56,951	57,272	53,127	58,493	47,682	43,412	35,998	47,254	38,292	44,029
% Decrease	0.0%	-26.2%	-18.2%	-22.6%	-11.0%	20.5%	1.0%	-8.1%	-20.1%	-34.6%	-18.7%	-3.8%	19.6%	44.3%	61.2%	54.4%	54.1%	57.4%	53.1%	61.8%	65.2%	71.2%	62.1%	69.3%	64.7%



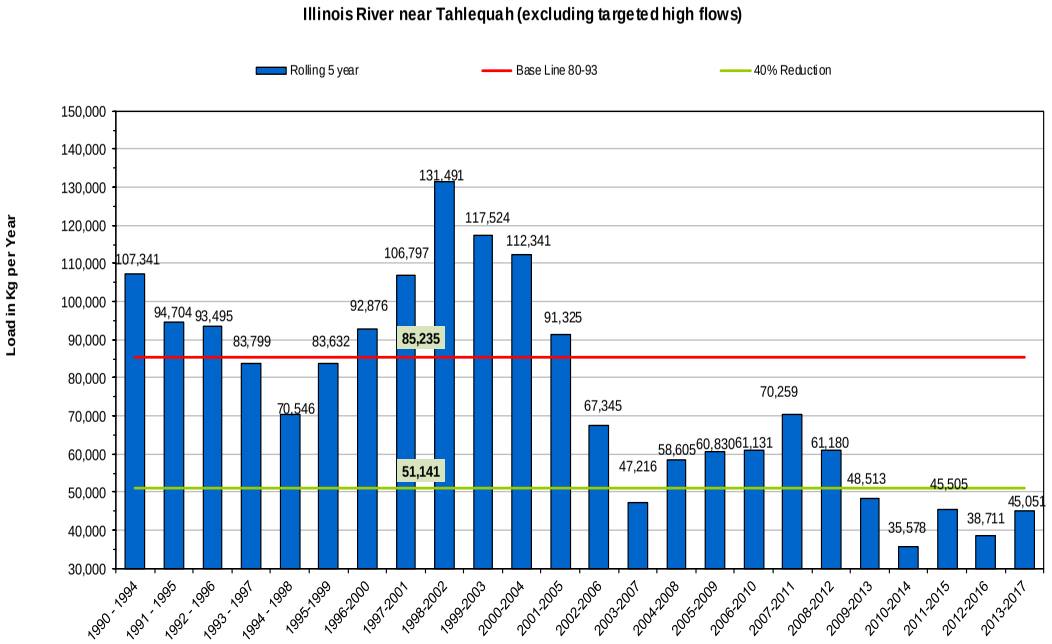
Arkansas - Oklahoma Compact

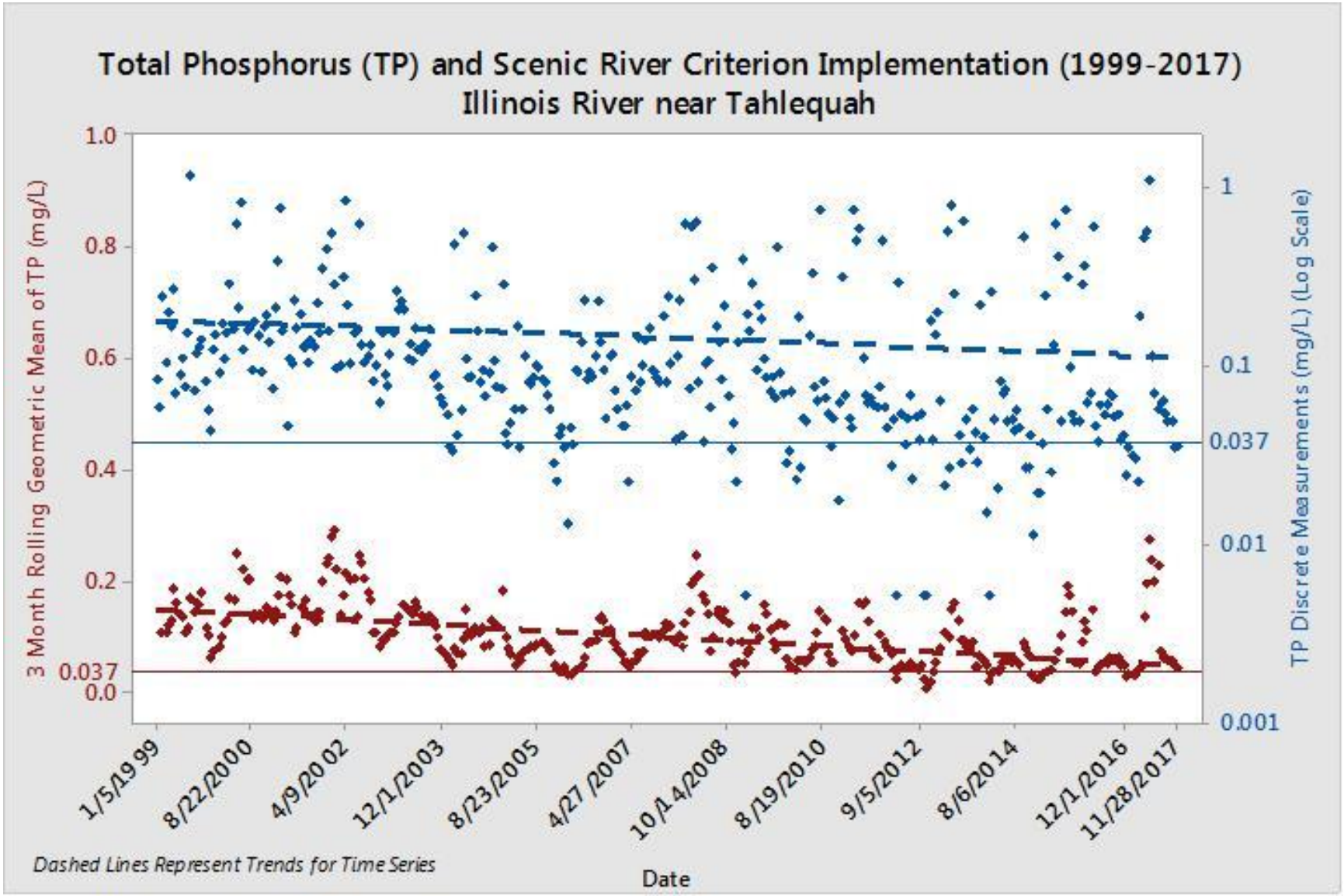

Total Phosphorus (TP) and Scenic River Criterion Implementation (1999-2017)
Illinois River near Watts
TP Discrete Measurements (mg/L) (Log Scale)
1
0.1
0.037
0.01
0.001
3 Month Rolling Geometric Mean of TP (mg/L)
1.0
0.8
0.6
0.4
0.2
0.037
0.0
1/1/1999
7/18/2000
2/1/2002
7/22/2003
2/22/2005
8/9/2006
4/11/2008
10/26/2009
7/26/2011
5/6/2013
9/3/2014
7/13/2015
11/28/2016
11/29/2017
Date
Dashed Lines Represent Trends for Time Series

Illinois River near Tahlequah

Illinois River Near Tahlequah			Loadings
Year	Flow (cfs)	Total P (mg/L)	Total P kg/year
1980	249		
1981	384		
1982	812		
1983	537		
1984	1,157		
1985	1,651		
1986	1,452		
1987	1,218		
1988	820		
1989	808		
1990	1,695	0.098	147,579
1991	1,094	0.079	76,796
1992	1,207	0.080	86,205
1993	1,751	0.099	154,647
1994	1,071	0.084	80,223
1995	1,123	0.080	80,229
1996	938	0.085	71,207
1997	812	0.069	49,797
1998	1,044	0.081	75,524
1999	1,143	0.121	123,518
2000	1,083	0.136	131,543
2001	1,033	0.158	145,766
2002	851	0.211	160,366
2003	478	0.100	42,690
2004	1,157	0.075	77,499
2005	712	0.060	38,148
2006	426	0.074	28,154
2007	736	0.066	43,383
2008	1,839	0.062	101,829
2009	1,407	0.072	90,475
2010	819.8	0.050	36,608
2011	1,540.8	0.058	79,813
2012	491.8	0.038	16,689
2013	946.1	0.043	36,331
2014	659.4	0.038	22,378
2015	2,174.6	0.041	79,628
2016	700.6	0.050	31,286
2017	1,219.7	0.050	54,465
Average	1,033	0.081	74,325

Year	80-93	90-94	91-95	92-96	93-97	94-98	95-99	96-00	97-01	98-02	99-03	00-04	01-05	02-06	03-07	04-08	05-09	06-10	07-11	08-12	09-13	10-14	11-15	12-16	13-17
Pt (mg/l)	0.090	0.088	0.085	0.086	0.082	0.079	0.093	0.104	0.117	0.143	0.143	0.137	0.121	0.104	0.075	0.067	0.067	0.065	0.062	0.056	0.052	0.045	0.044	0.042	0.044
Flow (cfs)	1060	1364	1249	1218	1139	998	1012	1004	1023	1031	918	920	846	725	702	974	1024	1046	1269	1220	1041	892	1163	1032	1140
Pt (kg/yr)	85,235	107,341	94,704	93,495	83,799	70,546	83,632	92,876	106,797	131,491	117,524	112,341	91,325	67,345	47,216	58,605	60,827	61,131	70,259	61,180	48,513	35,578	45,505	38,711	45,051
% Decrease	0.0%	-25.9%	-11.1%	-9.7%	1.7%	17.2%	1.9%	-9.0%	-25.3%	-54.3%	-37.9%	-31.8%	-7.1%	21.0%	44.6%	31.2%	28.6%	28.3%	17.6%	28.2%	43.1%	58.3%	46.6%	54.6%	47.1%

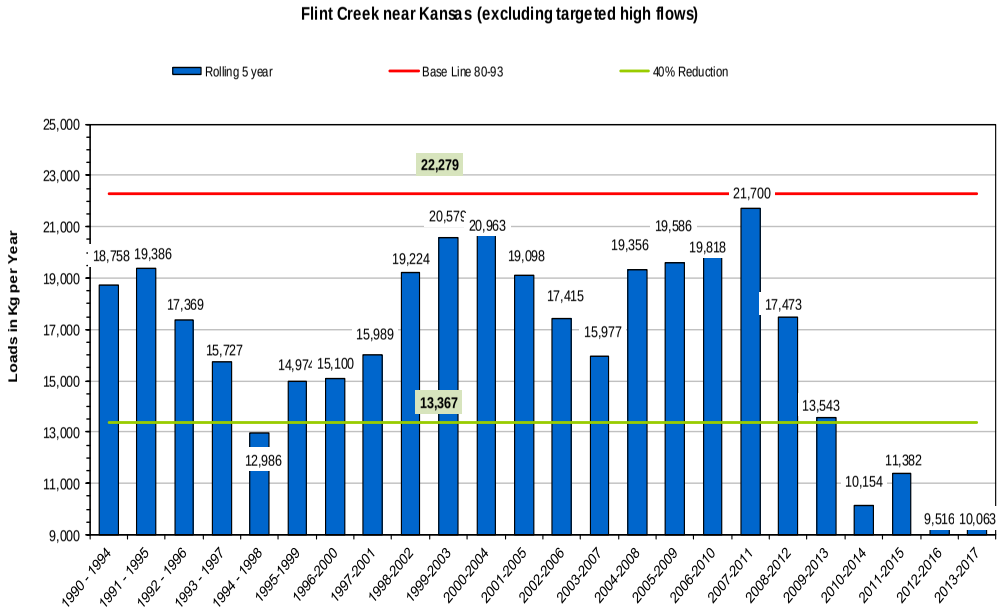


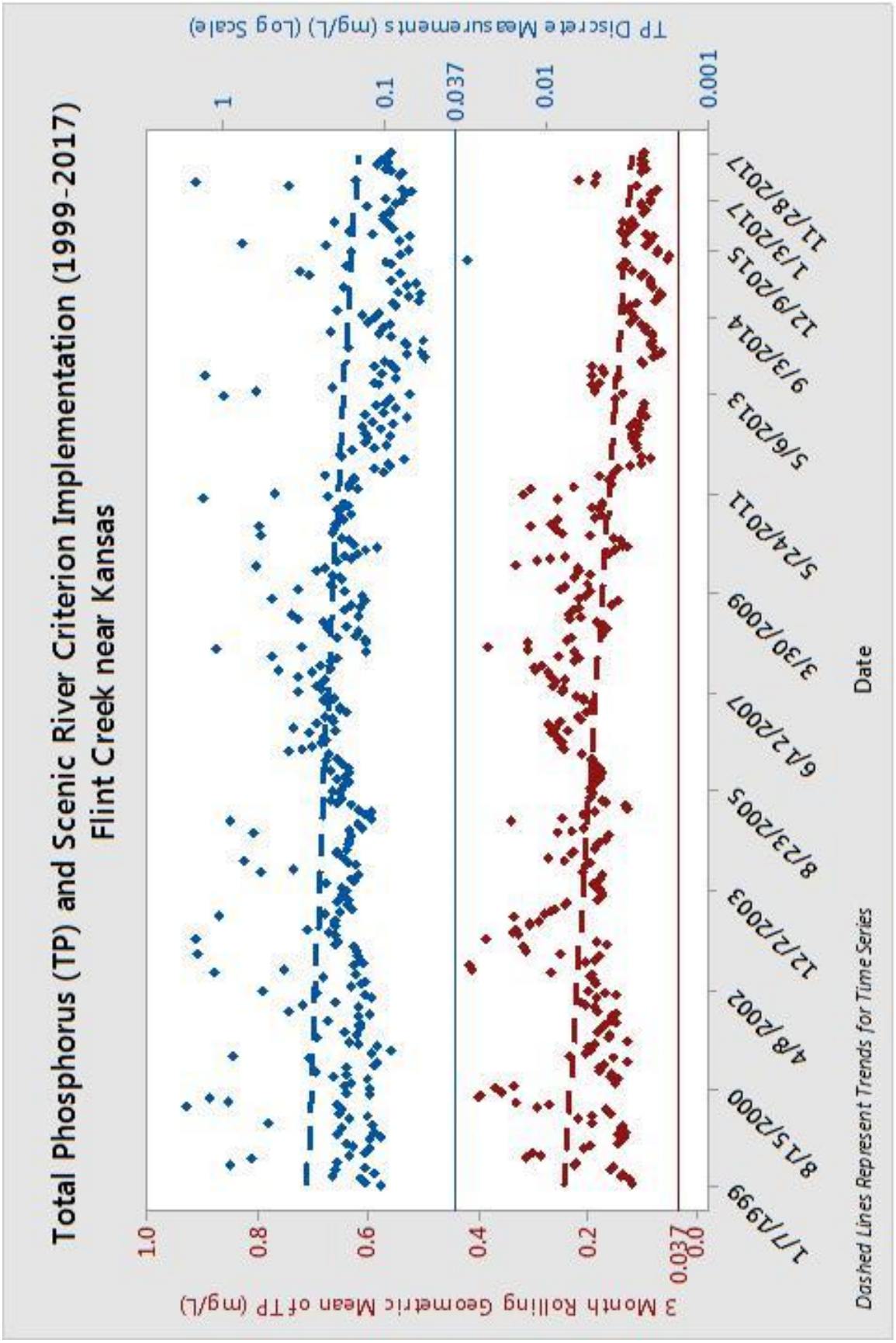

Total Phosphorus (TP) and Scenic River Criterion Implementation (1999-2017)
Illinois River near Tahlequah
3 Month Rolling Geometric Mean of TP (mg/L)
1.0
0.8
0.6
0.4
0.2
0.037
0.0
TP Discrete Measurements (mg/L) (Log Scale)
1
0.1
0.037
0.01
0.001
1/5/1999
8/22/2000
4/9/2002
12/1/2003
8/23/2005
4/27/2007
10/14/2008
8/19/2010
9/5/2012
8/6/2014
12/1/2016
11/28/2017
Dashed Lines Represent Trends for Time Series
Date

Flint Creek near Kansas

Flint Creek Near Kansas			Loadings
Year	Flow (cfs)	Total P (mg/L)	Total P kg/year
1980	32	0.189	5,454
1981	57	0.178	9,077
1982	69	0.186	11,537
1983	49	0.284	12,415
1984	143	0.240	30,532
1985	237	0.224	47,591
1986	183	0.223	36,430
1987	141	0.157	19,840
1988	97	0.265	22,946
1989	90	0.557	44,981
1990		0.114	0
1991		0.120	0
1992		0.118	0
1993	182	0.156	25,359
1994	136	0.127	15,418
1995	140	0.185	23,207
1996	76	0.152	10,294
1997	95.7	0.117	9,964
1998	96.5	0.127	10,945
1999	137	0.186	22,758
2000	132	0.178	20,984
2001	101	0.164	14,793
2002	82	0.310	22,675
2003	49.8	0.316	14,055
2004	149.0	0.165	21,957
2005	91.8	0.168	13,774
2006	36.8	0.226	7,428
2007	70.3	0.240	15,068
2008	218.0	0.157	30,567
2009	141.6	0.187	23,649
2010	91.7	0.171	14,004
2011	137.8	0.152	18,707
2012	48.1	0.107	4,598
2013	121.2	0.093	10,070
2014	72.4	0.096	6,206
2015	253.8	0.070	15,864
2016	82.7	0.092	6,796
2017	130.1	0.085	9,877
Average	114	0.181	18,360

Year	80-93	90-94	91-95	92-96	93-97	94-98	95-99	96-00	97-01	98-02	99-03	00-04	01-05	02-06	03-07	04-08	05-09	06-10	07-11	08-12	09-13	10-14	11-15	12-16	13-17
Pt (mg/l)	0.214	0.132	0.142	0.146	0.140	0.133	0.154	0.157	0.159	0.196	0.230	0.228	0.226	0.238	0.225	0.191	0.196	0.199	0.184	0.154	0.140	0.121	0.101	0.090	0.085
Flow (cfs)	117	159	153	134	126	109	109	107	112	110	101	103	95	82	80	113	112	112	132	127	108	94	127	118	132
Pt (kg/yr)	22,279	18,758	19,386	17,369	15,705	12,986	14,949	15,103	15,992	19,259	20,620	21,004	19,098	17,415	15,977	19,356	19,586	19,818	21,700	17,473	13,543	10,154	11,382	9,516	10,063
% Decrease	0.0%	15.8%	13.0%	22.0%	29.5%	41.7%	32.9%	32.2%	28.2%	13.6%	7.4%	5.7%	14.3%	21.8%	28.3%	13.1%	12.1%	11.0%	2.6%	21.6%	39.2%	54.4%	48.9%	57.3%	54.8%

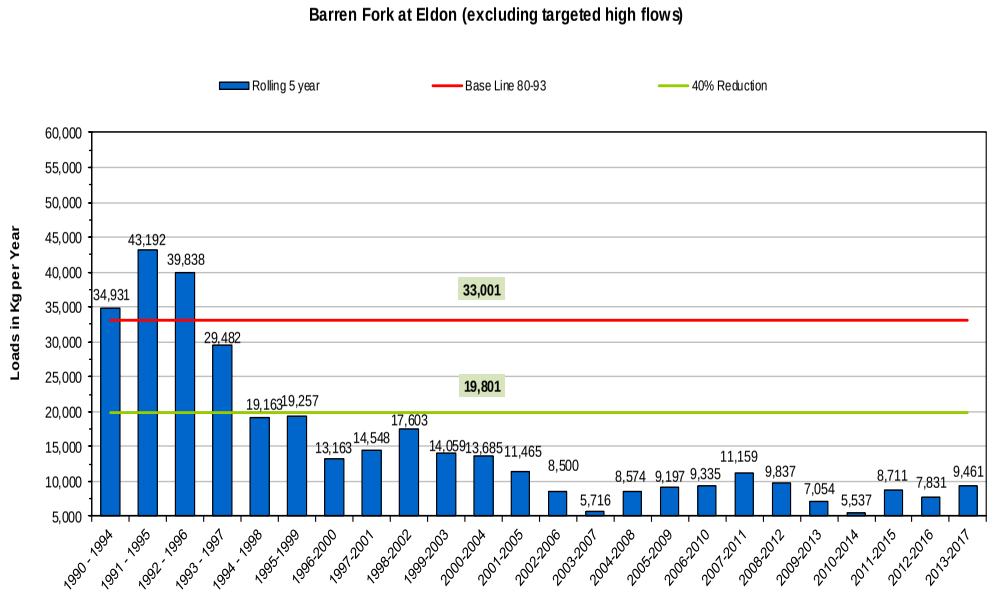


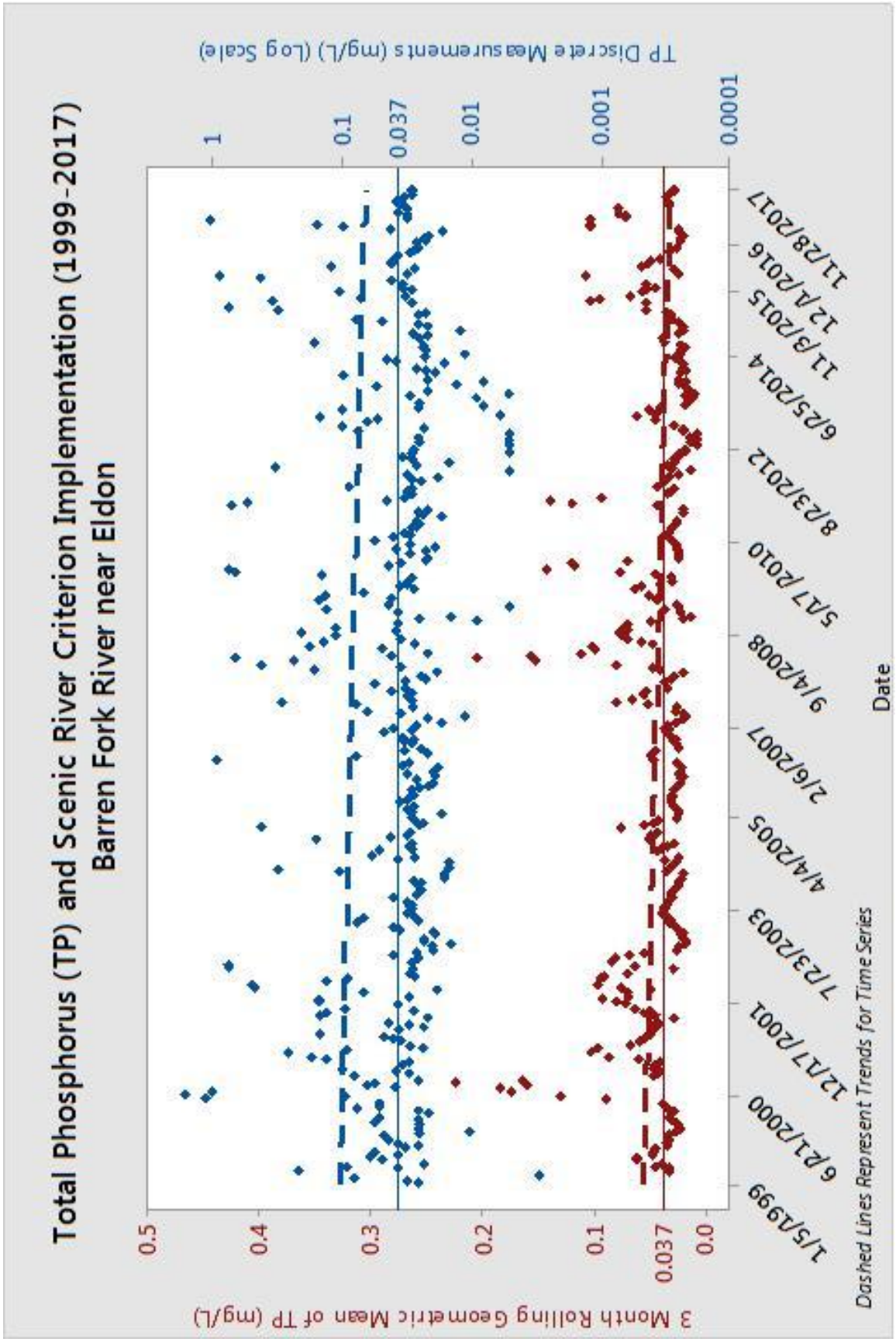

Total Phosphorus (TP) and Scenic River Criterion Implementation (1999-2017)
Flint Creek near Kansas
TP Discrete Measurements (mg/L) (Log Scale)
1
0.1
0.037
0.01
0.001
3 Month Rolling Geometric Mean of TP (mg/L)
1.0
0.8
0.6
0.4
0.2
0.037
0.0
1/1/1999
8/15/2000
4/8/2002
12/2/2003
8/23/2005
6/12/2007
3/30/2009
5/24/2011
5/6/2013
9/3/2014
12/9/2015
1/3/2017
11/28/2017
Date
Dashed Lines Represent Trends for Time Series

Barren Fork at Eldon

Barren Fork at Eldon			Loadings
Year	Flow (cfs)	Total Phos. (mg/L)	Total P kg/year
1980	77		
1981	201		
1982	296		
1983	184		
1984	364		
1985	593		
1986	536		
1987	491		
1988	269		
1989	320		
1990	666		
1991	451	0.060	24,145
1992	440	0.095	37,315
1993	700	0.108	67,234
1994	328	0.037	10,878
1995	422	0.263	98,819
1996	432	0.025	9,645
1997	332	0.023	6,671
1998	409	0.033	12,054
1999	361	0.048	15,476
2000	376	0.043	14,440
2001	343	0.064	19,605
2002	262	0.088	20,591
2003	145	0.025	3,237
2004	403	0.029	10,438
2005	228	0.027	5,498
2006	169	0.027	4,075
2007	254	0.026	5,898
2008	559	0.045	22,466
2009	460	0.033	13,557
2010	225	0.027	5,426
2011	471	0.028	11,783
2012	130	0.019	2,201
2013	219	0.026	5,083
2014	184	0.024	3,938
2015	872	0.040	31,154
2016	214	0.033	6,309
2017	320	0.028	8,013
Average	361	0.049	15,780

Year	80-93	90-94	91-95	92-96	93-97	94-98	95-99	96-00	97-01	98-02	99-03	00-04	01-05	02-06	03-07	04-08	05-09	06-10	07-11	08-12	09-13	10-14	11-15	12-16	13-17
Pt (mg/l)	0.093	0.076	0.103	0.096	0.075	0.056	0.055	0.039	0.045	0.056	0.053	0.050	0.046	0.039	0.027	0.030	0.031	0.031	0.032	0.030	0.026	0.024	0.026	0.027	0.029
Flow (cfs)	399	517	468	464	443	384	391	382	364	350	297	306	276	241	24	323	334	333	394	369	301	246	375	323	362
Pt (kg/yr)	33,001	34,931	43,192	39,838	29,482	19,163	19,257	13,163	14,548	17,603	14,059	13,865	11,465	8,500	5,716	8,574	9,197	9,335	11,159	9,837	7,054	5,357	8,711	7,831	9,461
% Decrease	0.0%	-5.8%	-30.9%	-20.7%	10.7%	41.9%	41.6%	60.1%	55.9%	46.7%	57.4%	58.0%	65.3%	74.2%	82.7%	74.0%	72.1%	71.7%	66.2%	70.2%	78.6%	83.8%	73.6%	76.3%	71.3%




Total Phosphorus (TP) and Scenic River Criterion Implementation (1999-2017)
Barren Fork River near Eldon
TP Discrete Measurements (mg/L) (Log Scale)
1
0.1
0.037
0.01
0.001
0.0001
3 Month Rolling Geometric Mean of TP (mg/L)
0.5
0.4
0.3
0.2
0.1
0.037
0.0
1/5/1999
6/21/2000
12/17/2001
7/23/2003
4/4/2005
2/6/2007
9/4/2008
5/17/2010
8/23/2012
6/25/2014
11/8/2015
12/1/2016
11/28/2017
Date
Dashed Lines Represent Trends for Time Series

Funding for Cities and Districts In the Illinois River Basin Provided by the OWRB's Financial Assistance Program

FUNDING PROVIDED BY OWRB'S FINANCIAL ASSISTANCE PROGRAM

Loan Number	Borrower	County	Closed Amount	Approved Date	App Type
FAP-83-0033-G	Cherry Tree Rural Water District	Adair	$10,000.00	1/10/1984	Emergency
FAP-85-0129-G	Watts Public Works Authority	Adair	$10,000.00	2/12/1985	Emergency
FAP-85-0155-G	Adair County RWS & SWMD #2	Adair	$100,000.00	6/11/1985	Emergency
FAP-88-0053-G	Watts Public Works Authority	Adair	$85,000.00	7/16/1990	Emergency
FAP-89-0062-G	Adair County Rural Water District #5	Adair	$50,000.00	9/10/1991	Emergency
FAP-93-0073-L	Stilwell Area Development Authority	Adair	$1,000,000.00	12/12/1995	FA Loan
FAP-97-0125-R	Watts Public Works Authority	Adair	$149,750.00	2/10/1998	REAP
FAP-97-0124-R	Adair County Rural Water District #5	Adair	$75,000.00	6/8/1999	REAP
ORF-98-0010-CW	Stilwell Area Development Authority	Adair	$4,000,000.00	8/10/1999	CWSRF
FAP-99-0080-R	Watts Public Works Authority	Adair	$99,800.00	11/16/1999	REAP
FAP-00-0058-R	Adair County Rural Water District #5	Adair	$99,500.00	7/10/2001	REAP
ORF-99-0020-CW	Westville Utility Authority	Adair	$430,400.00	12/11/2001	CWSRF
FAP-01-0013-L	Stilwell Area Development Authority	Adair	$2,760,000.00	3/12/2002	FA Loan
FAP-00-0071-R	Adair County Rural Water District #6	Adair	$146,875.00	4/9/2002	REAP
FAP-03-0019-R	Westville Utility Authority	Adair	$99,969.00	6/14/2005	REAP
FAP-05-0013-G	Westville Utility Authority	Adair	$100,000.00	10/11/2005	Emergency
FAP-06-0015-R	Adair County RWS & SWMD #2	Adair	$99,999.00	3/11/2008	REAP
FAP-12-0006-L	Westville Utility Authority	Adair	$1,350,000.00	3/13/2012	FA Loan
FAP-05-0051-R	Westville Utility Authority	Adair	$0.00	7/16/2013	REAP
FAP-83-0019-G	Burnt Cabin Rural Water District Incorporated	Cherokee	$24,000.00	11/2/1983	Emergency
FAP-83-0021-G	Cherokee County Rural Water District #8 -- Briggs	Cherokee	$53,000.00	1/10/1984	Emergency
FAP-83-0044-G	Hulbert	Cherokee	$100,000.00	1/10/1984	Emergency
FAP-90-0055-G	Cherokee County Rural Water District #10	Cherokee	$27,000.00	3/12/1991	Emergency
FAP-91-0057-G	Cherokee County Rural Water District #7 -- Welling	Cherokee	$23,180.00	9/10/1991	Emergency
FAP-91-0058-G	Cherokee County Rural Water District #8 -- Briggs	Cherokee	$23,180.00	9/10/1991	Emergency
FAP-85-0152-G	Cherokee County Rural Water District #9	Cherokee	$13,465.00	10/16/1991	Emergency
FAP-91-0120-G	Hulbert Public Works Authority	Cherokee	$25,000.00	9/15/1992	Emergency
FAP-95-0060-G	Cherokee County Rural Water District #13	Cherokee	$100,000.00	1/9/1996	Emergency
FAP-95-0031-L	Cherokee County Rural Water District #13	Cherokee	$170,000.00	1/9/1996	FA Loan
FAP-97-0126-R	Cherokee County Rural Water District #9	Cherokee	$99,900.00	1/13/1998	REAP
FAP-98-0011-R	Burnt Cabin Rural Water District Incorporated	Cherokee	$65,427.00	6/9/1998	REAP
FAP-98-0081-R	Cherokee County Rural Water District #14	Cherokee	$54,000.00	2/10/1999	REAP
FAP-98-0052-G	Cherokee County Rural Water District #3	Cherokee	$45,000.00	2/10/1999	Emergency
FAP-99-0082-R	Hulbert Public Works Authority	Cherokee	$79,350.00	11/16/1999	REAP
FAP-97-0110-R	Cherokee County Rural Water District #1	Cherokee	$100,000.00	12/14/1999	REAP
FAP-97-0098-R	Cherokee County Rural Water District #13	Cherokee	$80,000.00	3/14/2000	REAP
FAP-99-0072-R	Cherokee County Rural Water District #9	Cherokee	$69,900.00	11/14/2000	REAP
FAP-98-0029-L	Cherokee County Rural Water District #1	Cherokee	$380,000.00	12/12/2000	FA Loan
FAP-00-0007-L	Cherokee County Rural Water District #13	Cherokee	$1,810,000.00	6/11/2002	FA Loan
FAP-02-0001-L	Cherokee County Rural Water District #8 -- Briggs	Cherokee	$285,000.00	6/11/2002	FA Loan
FAP-01-0066-R	Hulbert Public Works Authority	Cherokee	$99,000.00	7/9/2002	REAP
FAP-02-0004-L	Cherokee County Rural Water District #2	Cherokee	$645,000.00	8/13/2002	FA Loan
FAP-02-0026-R	Cherokee County Rural Water District #13	Cherokee	$135,000.00	6/8/2004	REAP
FAP-06-0011-R	Cherokee County Rural Water District #8 -- Briggs	Cherokee	$99,999.00	6/12/2007	REAP
FAP-08-0033-R	Cherokee County Rural Water District #7 -- Welling	Cherokee	$39,069.00	12/9/2008	REAP
FAP-08-0005-R	Cherokee County Rural Water District #12	Cherokee	$70,000.00	6/9/2009	REAP
FAP-09-0011-G	Hulbert Public Works Authority	Cherokee	$75,000.00	11/10/2009	Emergency
ORF-09-0040-DW	Tahlequah Public Works Authority	Cherokee	$16,320,000.00	12/8/2009	DWSRF

FAP-09-0034-R	Cherokee County Rural Water District #8 -- Briggs	Cherokee	$34,914.00	4/13/2010	REAP
ORF-11-0002-DW	Cherokee County Rural Water District #3	Cherokee	$3,110,000.00	7/12/2011	DWSRF
ORF-11-0010-DW	Tahlequah Public Works Authority	Cherokee	$1,680,000.00	12/13/2011	DWSRF
FAP-12-0010-L	Cherokee County Rural Water District #13	Cherokee	$1,600,000.00	3/13/2012	FA Loan
FAP-12-0002-D	Cherokee County Rural Water District #3	Cherokee	$26,870.00	9/18/2012	Drought
FAP-83-0027-G	Drumright	Creek	$100,000.00	1/10/1984	Emergency
FAP-83-0075-G	Oilton	Creek	$28,420.00	4/10/1984	Emergency
FAP-85-0131-G	Drumright	Creek	$76,000.00	5/14/1985	Emergency
FAP-85-0127-G	Creek County RWS & SWMD #79-1	Creek	$100,000.00	10/8/1985	Emergency
FAP-85-0208-G	Creek County Rural Water District #9	Creek	$90,800.00	8/12/1986	Emergency
FAP-85-0181-G	Shamrock Public Works Authority	Creek	$60,000.00	3/16/1987	Emergency
FAP-87-0148-L	Sapulpa Municipal Authority	Creek	$7,250,000.00	9/14/1988	FA Loan
FAP-90-0057-G	Kiefer Public Works Authority	Creek	$11,000.00	8/14/1990	Emergency
FAP-90-0097-G	Creek County Rural Water District #10	Creek	$40,000.00	12/8/1992	Emergency
FAP-93-0047-L	Creek County Rural Water District #1	Creek	$2,255,000.00	1/11/1994	FA Loan
ORF-94-0008-CW	Kiefer Public Works Authority	Creek	$320,000.00	9/12/1995	CWSRF
FAP-96-0132-R	Depew	Creek	$59,000.00	1/14/1997	REAP
FAP-96-0186-R	Mounds	Creek	$55,200.00	4/8/1997	REAP
FAP-97-0108-R	Keystone Development Authority	Creek	$79,000.00	1/12/1999	REAP
FAP-98-0094-R	Depew Public Works Authority	Creek	$79,000.00	11/16/1999	REAP
ORF-99-0002-DW	Creek County Rural Water District #7	Creek	$615,000.00	2/8/2000	DWSRF
FAP-98-0093-R	Depew Public Works Authority	Creek	$38,000.00	3/14/2000	REAP
FAP-00-0007-G	Creek County Rural Water District #11	Creek	$100,000.00	6/13/2000	Emergency
FAP-99-0001-L	Creek County Rural Water District #2	Creek	$1,345,000.00	10/10/2000	FA Loan
FAP-00-0062-R	Kiefer Public Works Authority	Creek	$150,000.00	4/10/2001	REAP
FAP-03-0035-R	Olive Public School	Creek	$50,000.00	12/13/2005	REAP
ORF-08-0004-DW	Creek County Rural Water District #7	Creek	$3,230,000.00	8/12/2008	DWSRF
FAP-08-0023-R	Kellyville Public Works Authority	Creek	$99,990.00	7/14/2009	REAP
FAP-09-0013-R	Oilton	Creek	$78,400.00	7/13/2010	REAP
FAP-11-0023-R	Slick Public Works Authority	Creek	$81,825.00	7/17/2012	REAP
FAP-11-0015-R	Depew Public Works Authority	Creek	$0.00	7/16/2013	REAP
ORF-13-0012-CW	Oilton Public Works Authority	Creek	$2,850,000.00	8/20/2013	CWSRF
ORF-14-0006-CW	Kiefer Public Works Authority	Creek	$320,000.00	12/17/2013	CWSRF
FAP-16-0003-G	Depew Public Works Authority	Creek		9/20/2016	Emergency
FAP-83-0080-G	Cherokee Housing Authority	Delaware	$64,000.00	1/10/1984	Emergency
FAP-83-0012-G	Kansas	Delaware	$92,516.00	3/13/1984	Emergency
FAP-84-0015-G	Colcord	Delaware	$95,816.00	4/10/1984	Emergency
FAP-84-0059-G	West Siloam Springs	Delaware	$100,000.00	6/10/1986	Emergency
FAP-85-0229-G	Delaware County Rural Water District #1	Delaware	$63,000.00	9/8/1987	Emergency
FAP-86-0002-G	Kansas Public Works Authority	Delaware	$65,000.00	1/12/1988	Emergency
FAP-90-0086-G	Delaware County Rural Water District #3	Delaware	$34,300.00	5/6/1991	Emergency
FAP-92-0019-G	Delaware County RWSG & SWMD #6	Delaware	$75,000.00	4/12/1994	Emergency
FAP-92-0079-G	Delaware County Rural Water District #7	Delaware	$25,000.00	7/12/1994	Emergency
FAP-94-0013-G	West Siloam Springs	Delaware	$18,315.00	7/12/1994	Emergency
FAP-96-0028-G	Delaware County RWSG & SWMD #9	Delaware	$100,000.00	8/13/1996	Emergency
FAP-96-0009-L	Delaware County RWSG & SWMD #9	Delaware	$635,000.00	8/13/1996	FA Loan
FAP-95-0053-G	Delaware County RWSG & SWMD #6	Delaware	$100,000.00	10/8/1996	Emergency
FAP-97-0068-R	Delaware County RWSG & SWMD #9	Delaware	$10,000.00	5/13/1997	REAP
FAP-96-0020-G	Delaware County Rural Water District #1	Delaware	$85,000.00	7/8/1997	Emergency
FAP-97-0008-L	Delaware County Rural Water District #1	Delaware	$360,000.00	7/8/1997	FA Loan

FAP-97-0044-L	Grand Lake Public Works Authority	Delaware	$655,000.00	12/9/1997	FA Loan
FAP-97-0040-R	Kansas Public Works Authority	Delaware	$139,270.00	3/10/1998	REAP
FAP-98-0017-G	Moseley School District 34	Delaware	$46,750.00	6/9/1998	Emergency
FAP-97-0107-R	Colcord Public Works Authority	Delaware	$94,800.00	1/12/1999	REAP
FAP-99-0005-R	Grand Lake Public Works Authority	Delaware	$94,000.00	4/13/1999	REAP
FAP-97-0097-R	Kansas Public Works Authority	Delaware	$109,500.00	11/16/1999	REAP
FAP-98-0044-R	West Siloam Springs	Delaware	$96,350.00	3/14/2000	REAP
ORF-99-0011-CW	Jay Utilities Authority	Delaware	$3,766,000.00	8/8/2000	CWSRF
FAP-00-0010-L	Grand Lake Public Works Authority	Delaware	$575,000.00	3/13/2001	FA Loan
ORF-99-0022-CW	Grand Lake Public Works Authority	Delaware	$2,700,000.00	3/13/2001	CWSRF
FAP-97-0047-R	Delaware County Rural Water District #1	Delaware	$50,000.00	11/13/2001	REAP
FAP-01-0008-L	West Siloam Springs Municipal Authority	Delaware	$275,000.00	11/13/2001	FA Loan
FAP-97-0009-R	Bernice Public Works Authority	Delaware	$99,500.00	12/11/2001	REAP
FAP-01-0016-L	Grand Lake Public Works Authority	Delaware	$335,000.00	2/12/2002	FA Loan
ORF-99-0004-DW	Delaware County RWSG & SWMD #10	Delaware	$4,865,193.00	4/9/2002	DWSRF
FAP-02-0003-R	Kansas Public Works Authority	Delaware	$67,000.00	11/12/2002	REAP
ORF-02-0020-CW	Grand Lake Public Works Authority	Delaware	$800,000.00	4/8/2003	CWSRF
ORF-02-0003-CW	Grove Municipal Services Authority	Delaware	$7,500,000.00	6/10/2003	CWSRF
ORF-07-0004-DW	Jay Utilities Authority	Delaware	$2,470,000.00	2/12/2008	DWSRF
FAP-07-0034-R	Delaware County RWSG & SWMD #10	Delaware	$98,653.20	5/14/2008	REAP
ORF-07-0008-CW	Grove Municipal Services Authority	Delaware	$1,900,000.00	7/14/2009	CWSRF
ORF-09-0004-CW	Grand Lake Public Works Authority	Delaware	$992,500.00	9/8/2009	CWSRF
FAP-09-0001-L	Grand Lake Public Works Authority	Delaware	$1,990,000.00	9/8/2009	FA Loan
FAP-09-0013-G	Delaware County RWSG & SWMD #10	Delaware	$19,125.00	1/12/2010	Emergency
FAP-04-0025-R	Delaware County RWSG & SWMD #11	Delaware	$99,990.00	2/8/2011	REAP
ORF-11-0007-DW	Delaware County Rural Water District #1	Delaware	$260,000.00	10/17/2011	DWSRF
FAP-12-0016-L	Grand Lake Public Works Authority	Delaware	$1,000,000.00	7/17/2012	FA Loan
ORF-11-0003-DW	Grand Lake Public Works Authority	Delaware	$5,500,000.00	7/17/2012	DWSRF
ORF-13-0007-DW	Grove Municipal Services Authority	Delaware	$8,765,000.00	3/19/2013	DWSRF
FAP-08-0004-R	Oaks Public Works Authority	Delaware	$0.00	6/18/2013	REAP
ORF-14-0003-DW	Delaware County RWSG & SWMD #11	Delaware	$950,000.00	4/15/2014	DWSRF
FAP-13-0014-R	Colcord Public Works Authority	Delaware		7/15/2014	REAP
FAP-17-0006-L	Delaware County Rural Water District #3	Delaware	$1,040,000.00	1/17/2017	FA Loan
ORF-16-0004-DW	South Delaware County Regional Water Authority	Delaware	$3,000,000.00	4/18/2017	DWSRF
ORF-17-0018-CW	Grand Lake Public Works Authority	Delaware	$1,825,182.60	6/20/2017	CWSRF
FAP-83-0003-G	Boynton	Muskogee	$27,695.00	8/12/1983	Emergency
FAP-83-0091-G	Taft	Muskogee	$86,620.00	1/10/1984	Emergency
FAP-83-0041-G	Muskogee County Rural Water District #7	Muskogee	$90,000.00	4/10/1984	Emergency
FAP-84-0020-G	Warner	Muskogee	$100,000.00	5/8/1984	Emergency
FAP-86-0059-G	Muskogee County Rural Water District #3	Muskogee	$50,000.00	12/13/1988	Emergency
FAP-88-0040-L	Porum Public Works Authority	Muskogee	$730,000.00	1/10/1989	FA Loan
FAP-89-0016-L	Warner Utilities Authority	Muskogee	$240,000.00	2/13/1990	FA Loan
FAP-90-0019-G	Oktaha Public Works Authority	Muskogee	$19,700.00	4/10/1990	Emergency
FAP-90-0100-G	Braggs Public Works Authority	Muskogee	$70,000.00	2/12/1991	Emergency
FAP-91-0040-G	Muskogee County Rural Water Management District #12	Muskogee	$45,000.00	9/10/1991	Emergency
ORF-90-0004-CW	Muskogee Municipal Authority	Muskogee	$11,553,000.00	2/11/1992	CWSRF
FAP-93-0005-L	Fort Gibson Utilities Authority	Muskogee	$820,000.00	3/9/1993	FA Loan
ORF-93-0001-L	Muskogee Municipal Authority	Muskogee	$3,670,000.00	3/9/1993	FA Loan
ORF-93-0001-CW	Muskogee Municipal Authority	Muskogee	$2,141,969.36	3/9/1993	CWSRF

FAP-91-0047-G	Boynton Public Works Authority	Muskogee	$50,000.00	2/8/1994	Emergency
FAP-92-0038-G	Muskogee County Rural Water District #6	Muskogee	$25,000.00	4/12/1994	Emergency
ORF-94-0011-CW	Muskogee Municipal Authority	Muskogee	$2,479,230.64	7/12/1994	CWSRF
ORF-94-0011-L	Muskogee Municipal Authority	Muskogee	$4,390,000.00	7/12/1994	FA Loan
FAP-94-0042-L	Porum Public Works Authority	Muskogee	$350,000.00	11/1/1994	FA Loan
FAP-96-0077-R	Braggs	Muskogee	$36,995.00	1/14/1997	REAP
ORF-96-0017-CW	Muskogee Municipal Authority	Muskogee	$14,112,000.00	2/11/1997	CWSRF
FAP-97-0021-R	East Central Oklahoma Water Authority	Muskogee	$59,700.00	3/11/1997	REAP
FAP-96-0051-L	Warner Utilities Authority	Muskogee	$435,000.00	4/8/1997	FA Loan
FAP-97-0064-R	Muskogee County Rural Water District #3	Muskogee	$65,800.00	5/13/1997	REAP
FAP-95-0064-L	Muskogee County Rural Water District #1	Muskogee	$430,000.00	8/12/1997	FA Loan
FAP-96-0045-G	East Central Oklahoma Water Authority	Muskogee	$97,750.00	4/14/1998	Emergency
ORF-97-0011-CW	Fort Gibson Utilities Authority	Muskogee	$445,100.00	5/12/1998	CWSRF
ORF-98-0004-L	Muskogee Municipal Authority	Muskogee	$5,850,000.00	6/9/1998	FA Loan
ORF-98-0004-CW	Muskogee Municipal Authority	Muskogee	$3,480,000.00	6/9/1998	CWSRF
FAP-98-0049-G	Council Hill	Muskogee	$100,000.00	3/9/1999	Emergency
ORF-99-0007-CW	Muskogee Municipal Authority	Muskogee	$1,970,765.66	6/8/1999	CWSRF
ORF-99-0007-L	Muskogee Municipal Authority	Muskogee	$3,335,000.00	6/8/1999	FA Loan
ORF-96-0022-CW	Warner Utilities Authority	Muskogee	$258,000.00	8/10/1999	CWSRF
ORF-99-0015-CW	Haskell Public Works Authority	Muskogee	$320,000.00	12/14/1999	CWSRF
ORF-99-0017-CW	Fort Gibson Utilities Authority	Muskogee	$710,000.00	3/14/2000	CWSRF
FAP-98-0014-R	Muskogee County Rural Water District #3	Muskogee	$91,992.00	6/13/2000	REAP
FAP-00-0006-G	Warner Utilities Authority	Muskogee	$45,000.00	6/13/2000	Emergency
FAP-00-0060-R	Muskogee County Rural Water District #11	Muskogee	$150,000.00	12/12/2000	REAP
FAP-00-0032-G	Boynton Public Works Authority	Muskogee	$81,591.00	1/9/2001	Emergency
FAP-01-0075-R	Muskogee County Rural Water District #14	Muskogee	$150,000.00	8/31/2001	REAP
FAP-02-0001-G	Muskogee County Rural Water District #3	Muskogee	$91,035.00	3/12/2002	Emergency
FAP-02-0058-R	Muskogee County Rural Water District #10	Muskogee	$99,999.00	4/8/2003	REAP
FAP-02-0011-L	Muskogee County Rural Water District #5	Muskogee	$1,390,000.00	5/13/2003	FA Loan
FAP-03-0005-L	Muskogee Municipal Authority	Muskogee	$4,575,000.00	6/10/2003	FA Loan
FAP-02-0011-G	Muskogee County Rural Water District #5	Muskogee	$100,000.00	6/8/2004	Emergency
FAP-04-0064-R	Taft	Muskogee	$99,557.68	1/11/2005	REAP
ORF-08-0007-DW	Muskogee Municipal Authority	Muskogee	$30,410,000.00	7/8/2008	DWSRF
ORF-09-0020-CW	Muskogee Municipal Authority	Muskogee	$1,435,000.00	8/11/2009	CWSRF
FAP-10-0001-G	Boynton	Muskogee	$13,607.53	3/9/2010	Emergency
FAP-05-0023-R	Muskogee County Rural Water District #3	Muskogee	$99,999.00	6/8/2010	REAP
ORF-11-0004-CW	Fort Gibson Utilities Authority	Muskogee	$980,000.00	4/12/2011	CWSRF
ORF-11-0008-CW	Muskogee Municipal Authority	Muskogee	$12,775,000.00	8/9/2011	CWSRF
ORF-14-0012-CW	Muskogee Municipal Authority	Muskogee	$7,300,000.00	12/17/2013	CWSRF
FAP-14-0012-R	Porum Public Works Authority	Muskogee		12/16/2014	REAP
ORF-17-0008-CW	Porum Public Works Authority	Muskogee	$780,000.00	9/20/2016	CWSRF
ORF-17-0014-CW	Muskogee Municipal Authority	Muskogee	$110,000.00	2/21/2017	CWSRF
ORF-17-0019-CW	Muskogee Municipal Authority	Muskogee	$27,360,000.00	4/18/2017	CWSRF
FAP-17-0008-L	Muskogee County Rural Water District #3	Muskogee	$1,595,000.00	5/16/2017	FA Loan
FAP-83-0024-G	Sequoyah County RWS & SWMD #4	Sequoyah	$86,000.00	1/10/1984	Emergency
FAP-83-0008-G	Marble City	Sequoyah	$100,000.00	2/14/1984	Emergency
FAP-84-0043-G	Muldrow	Sequoyah	$77,200.00	4/10/1984	Emergency
FAP-84-0067-G	Sequoyah County Rural Water District #3	Sequoyah	$18,000.00	8/14/1984	Emergency
FAP-84-0090-G	Gans	Sequoyah	$100,000.00	5/14/1985	Emergency
FAP-89-0071-G	Utility Service Authority	Sequoyah	$20,097.00	1/9/1990	Emergency

FAP-86-0050-G	Sequoyah County Rural Water District #5	Sequoyah	$75,000.00	5/8/1990	Emergency
FAP-91-0069-G	Sequoyah County RWSG & SWMD #7	Sequoyah	$30,000.00	12/8/1992	Emergency
FAP-95-0001-G	Roland Utilities Authority	Sequoyah	$75,000.00	5/14/1996	Emergency
FAP-95-0053-L	Roland Utilities Authority	Sequoyah	$4,890,000.00	4/8/1997	FA Loan
FAP-98-0013-R	Sequoyah County Rural Water District #5	Sequoyah	$99,883.00	1/12/1999	REAP
FAP-99-0081-R	Vian	Sequoyah	$59,500.00	11/16/1999	REAP
FAP-99-0083-R	Sequoyah County Rural Water District #8	Sequoyah	$138,500.00	2/8/2000	REAP
ORF-98-0017-CW	Vian Public Works Authority	Sequoyah	$1,100,000.00	2/8/2000	CWSRF
FAP-01-0005-R	Gore Public Works Authority	Sequoyah	$60,000.00	11/13/2001	REAP
FAP-02-0025-G	Sequoyah County Rural Water District #5	Sequoyah	$49,384.91	11/12/2002	Emergency
FAP-97-0089-R	Vian Public Works Authority	Sequoyah	$150,000.00	6/10/2003	REAP
FAP-02-0064-R	Gans	Sequoyah	$110,000.00	4/16/2006	REAP
FAP-07-0006-G	Vian Public Works Authority	Sequoyah	$75,000.00	1/8/2008	Emergency
ORF-08-0003-CW	Roland Utilities Authority	Sequoyah	$3,855,000.00	6/10/2008	CWSRF
ORF-09-0034-DW	Sallisaw Municipal Authority	Sequoyah	$5,360,000.00	11/10/2009	DWSRF
FAP-10-0004-R	Vian Public Works Authority	Sequoyah	$99,999.00	2/8/2011	REAP
FAP-01-0067-R	Sequoyah County Rural Water District #5	Sequoyah	$80,000.00	7/12/2011	REAP
ORF-11-0007-CW	Muldrow Public Works Authority	Sequoyah	$3,705,000.00	9/13/2011	CWSRF
FAP-12-0001-L	Roland Utilities Authority	Sequoyah	$3,360,000.00	2/13/2012	FA Loan
ORF-11-0006-CW	Vian Public Works Authority	Sequoyah	$1,655,000.00	2/13/2012	CWSRF
FAP-03-0003-R	Sequoyah County RWS & SWMD #4	Sequoyah	$99,950.00	3/13/2012	REAP
ORF-16-0003-DW	Gore Public Works Authority	Sequoyah	$885,000.00	10/12/2016	DWSRF

Permits for Water Rights in the Illinois River Watershed Issued by the OWRB's Planning and Management Division in CY 2016

PERMITS FOR WATER RIGHTS ISSUED BY OWRB'S PLANNING & MANAGEMENT DIVISION

			Permits Issues within the Illinois River Basin for Calendar Year 2016											
			Diversion Point Legal											
Permit #	LAST NAME	FIRST NAME	1/4	1/4	1/4	SECT	TWP	RNG	COUNTY	STREAM SYSYTEM	DATE FILED	DATE ISSUED	PURPOSE	AMT (af/yr)
20140003		Flint Ridge Rural Water District	NE	NW	SE	33	20N	24EI	Delaware	2170	1/27/2014	6/17/2014	Public Water Supply	487
20160005		OK Dept. of Wildlife	NW	NW	NE	28	13N	21EI	Sequoyah	2170	3/25/2016	5/16/2017	Recreation, Fish & Wildlife	48324

Only 2new permits have been issued for either surface water use or groundwater use since 2012.

PERMITS FOR WATER RIGHTS ISSUED BY OWRB'S PLANNING & MANAGEMENT DIVISION

OKLAHOMA CONSERVATION COMMISSION

OKLAHOMA CONSERVATION COMMISSION
Program Activities in the Illinois River Watershed
for the period of October 2016 through September 2017

1.) Illinois River Implementation

For twenty-five years the OCC has monitored water quality and implemented best management practices in the Illinois River watershed. Despite challenges of 500 year floods and dwindling funding, the OCC continues to make the health of the watershed a priority.

Continuing a federal §319(h) program now with State funding, the OCC maintains a program of paying landowners to exclude their riparian property from production. This year 2,144 acres were set aside at a cost of $130,947. Forty-eight landowners participated.

2.) Illinois River CREP/GRDA

In April 2007, Oklahoma and the Farm Services Agency (FSA) signed an agreement for Conservation Reserve Enhancement Program to protect 9,500 acres of riparian area in the northeastern Oklahoma watersheds of the Illinois River and Eucha-Spavinaw. The CREP program provided incentives to farmers and ranchers to remove streamside pasture or cropland from production activities for ten to fifteen years. In return, the landowners were reimbursed for the cost of installing practices such as alternative water supplies for livestock, fencing, grass planting, and stream crossings. They also received an annual rental payment for the ten/fifteen-year period based on the average area rental rate for marginal pasture land.

Through the OCC CREP has a total of 78 contracts, of which 72 of these contracts are in the Illinois River Watershed. CREP contracted a total of 703 acres of which 625 acres are contracted in the Illinois River watershed.

Despite these good works, landowner interest waned for further CREP enrollments. The OCC made the decision to discontinue the CREP program. Payments for the annual maintenance to current participants continue through the end of their ten or fifteen year contracts.

In 2016 purview of Oklahoma's scenic rivers was transferred to the Grand River Dam Authority which continues oversight of activities along the Illinois River. Based on input from producers and experience with the CREP program, OCC worked with GRDA to develop a replacement for CREP in the Illinois River Basin that will also involve long-term riparian protection easements. These riparian exclusions will be funded through U.S. EPA §319 funding, with oversight from GRDA. The initial round of these easements is expected to begin implementation in early fall of 2017, with subsequent enrollments anticipated.

3.) Streambank Stabilization

Before After

The Illinois River alongside Highway 10

ODOT Partnership After a lot of planning and some earth-moving, a section of the scenic "river road," Highway 10, is safe from erosion threats and the Illinois River is on a slightly different path.

Through a joint project of the Oklahoma Department of Transportation and the Oklahoma Conservation Commission, about a quarter mile of the west bank of the Illinois River has been moved away from the highway and stabilized. Rock, soil and grass were used to create a natural shoreline, and indigenous tree species have been planted from the waterline to the highway. The river itself is narrower, facilitating sediment transport.

The highway needed to be protected and because this is a scenic river that is afforded special protection, the U.S. Army Corps of Engineers and the Oklahoma Department of Environmental Quality did not want the problem fixed with riprap along the bank. Riprap would not have stopped the erosion and would be unsightly on a scenic river. Fluvial geomorphological techniques were applied.

Four Critical Area Channel Restorations With EPA §319(h) funding the OCC contracted to have four reaches in the Illinois River watershed repaired with Rosgen designed streambank stabilization. These areas were delivering significant sediment and associated nutrient loads and were threatening private and public property. Natural channel design and environmentally sound implementation techniques were

utilized. The four sites were chosen for their ability to be constructed in a short period of time and the impact their restoration would provide. Those four sites are: Towne Branch Creek-Felts Park site, Towne Branch Creek-History Trail site, Illinois River Ranch, and a small portion of Tyner Creek. The OCC remains committed to seeking funding for the crucial and very beneficial streambank stabilization work in this sensitive watershed.

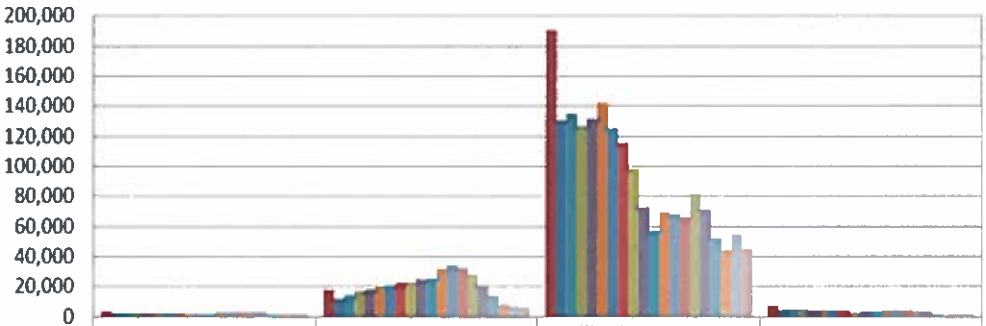
4.) Blue Thumb Monitoring and Education

The OCC's Blue Thumb education division supports volunteers monitoring five sites in the watershed. This data is centrally compiled and accessible.

A Blue Thumb volunteer group in Tahlequah has created Friends of Town Branch; Town Branch is a tributary of the Illinois River. Their mission is to educate citizens about water quality issues, preserve the biological integrity of the natural resource, and promote the aesthetic value of the creek.

Education was also extended by Blue Thumb with support from GRDA for a youth camp, Journey to the Bottom of the Creek, on the Illinois River where kids learned about pollution, conservation, watersheds, the water cycle, and what lives in the water. This was followed a month later with a teacher workshop at which instructors learned much the same points and were provided with curriculum texts.

Arkansas's Five Year Rolling Average Total Phosphorus Loading in Kilograms Per Year (excluding targeted high flows)



	Flint Ck ARK04A	Sager Ck ARK05	Illinois R. ARK06	Baron Fk ARK07A
Total P 80-93	3,267	17,566	190,577	7,160
Total P 94-98	2,488	12,133	130,567	4,519
Total P 95-99	2,555	14,284	134,951	4,874
Total P 96-00	2,187	16,796	126,713	4,571
Total P 97-01	2,213	18,008	131,495	4,002
Total P 98-02	2,043	19,332	142,446	4,354
Total P 99-03	2,019	20,798	125,156	3,792
Total P 00-04	2,106	22,418	115,417	3,661
Total P 01-05	2,049	22,616	98,479	2,777
Total P 02-06	1,855	24,905	72,654	3,274
Total P 03-07	1,707	25,113	56,817	3,062
Total P 04-08	2,848	31,649	69,349	4,145
Total P 05-09	2,723	34,345	67,883	4,237
Total P 06-10	2,762	32,462	65,668	4,267
Total P 07-11	3,102	28,313	81,467	3,678
Total P 08-12	2,919	20,984	70,853	3,156
Total P 09-13	1,794	13,856	51,777	1,898
Total P 10-14	1,551	7,661	44,170	1,347
Total P 11-15	2,033	6,591	54,452	1,935
Total P 12-16	1,978	6,045	44,675	1,690

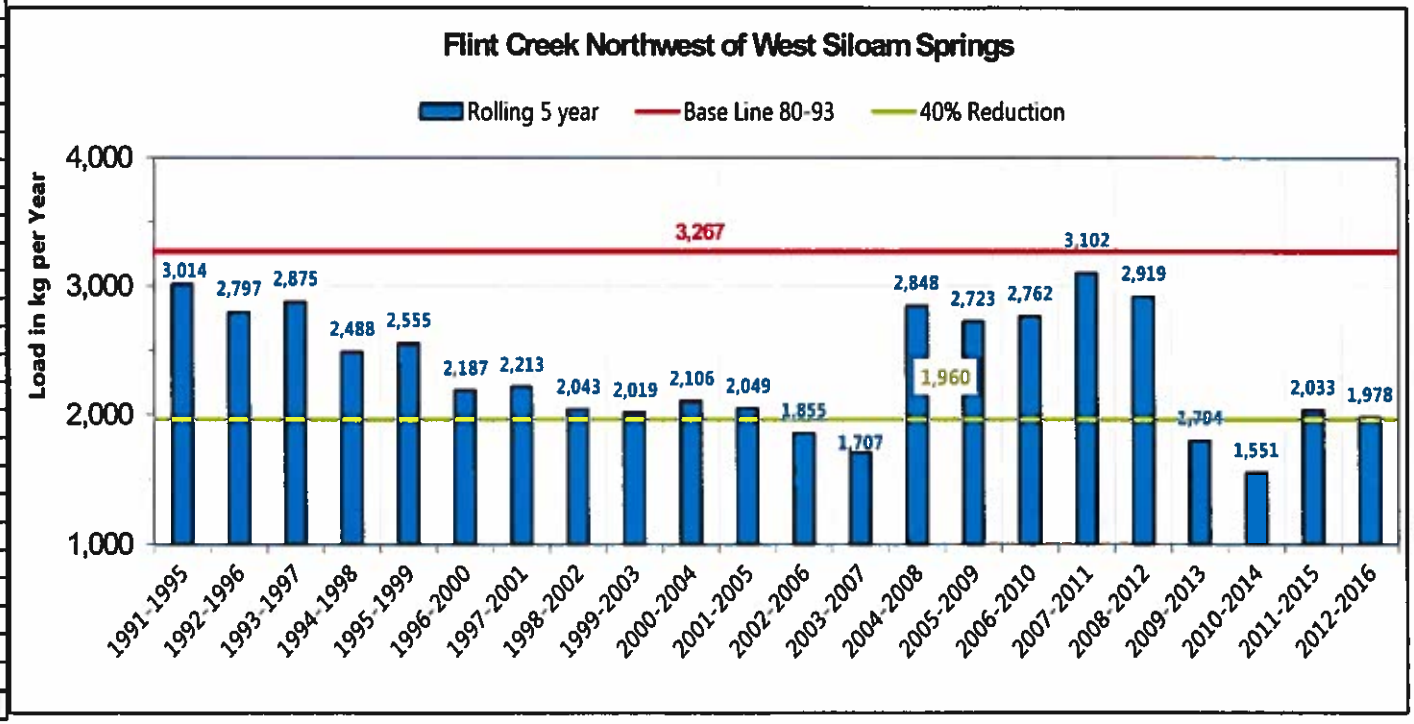
Values represent all available data routinely collected. Targeted high flows excluded beginning 2016.

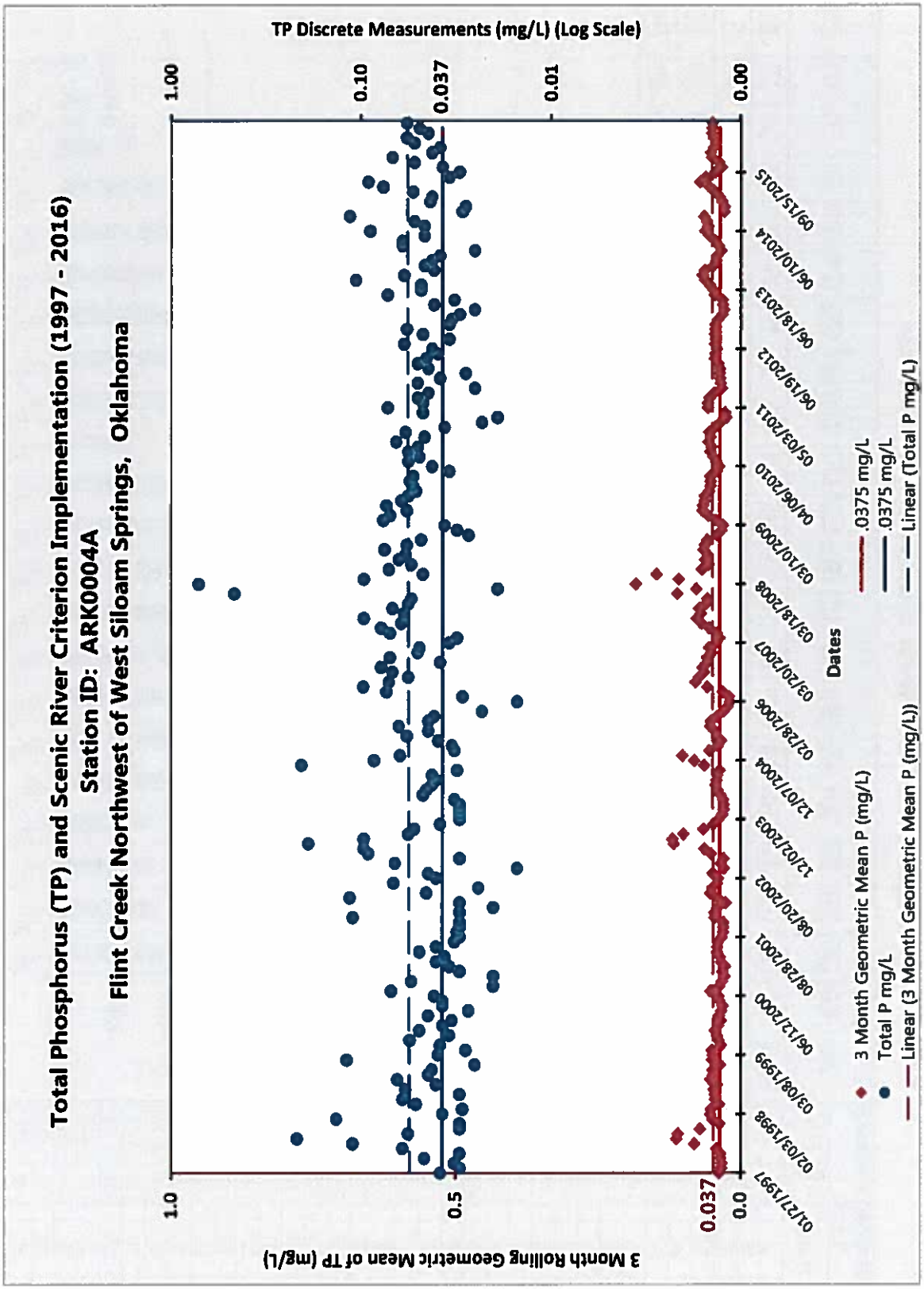
Flint Creek Northwest of Siloam Springs, Arkansas

Flint Creek Northwest of West Siloam Springs- Loadings			
ARK04A Year	Flow(cfs)	Total P (mg/L)	Total P (kg/yr)
1991	19[illegible]	0.14[illegible]	263[illegible]
1992	29[illegible]	0.171	4,56[illegible]
1993	19[illegible]	0.07[illegible]	1,23[illegible]
1994	53[illegible]	0.11[illegible]	5,351
1995	91[illegible]	0.06[illegible]	5,137
1996	78[illegible]	0.06[illegible]	4,691
1997	58[illegible]	0.04[illegible]	2,551
1998	41[illegible]	0.031	1,157
1999	38[illegible]	0.05[illegible]	1,697
2000	71[illegible]	0.05[illegible]	3,821
2001	51[illegible]	0.05[illegible]	2,48[illegible]
2002	56.1	0.04[illegible]	2,35[illegible]
2003	88[illegible]	0.04[illegible]	3,54[illegible]
2004	53[illegible]	0.051	2,414
2005	61[illegible]	0.07[illegible]	4,10[illegible]
2006	33[illegible]	0.05[illegible]	1,48[illegible]
2007	37[illegible]	0.07[illegible]	2,44[illegible]
2008	42[illegible]	0.05[illegible]	2,14[illegible]
2009	63[illegible]	0.04[illegible]	2,57[illegible]
2010	55[illegible]	0.03[illegible]	1,89[illegible]
2011	39[illegible]	0.04[illegible]	1,63[illegible]
2012	44[illegible]	0.04[illegible]	1,85[illegible]
2013	21[illegible]	0.07[illegible]	1,43[illegible]
2014	64[illegible]	0.05[illegible]	3,17[illegible]
2015	43[illegible]	0.04[illegible]	1,77[illegible]
2016	12[illegible]	0.05[illegible]	63[illegible]
2017	22[illegible]	0.05[illegible]	1,16[illegible]
2018	76[illegible]	0.14[illegible]	10,03[illegible]
2019	55[illegible]	0.05[illegible]	2,681
2020	44[illegible]	0.04[illegible]	1,93[illegible]
2011	48[illegible]	0.04[illegible]	1,79[illegible]
2012	19[illegible]	0.04[illegible]	73[illegible]
2013	45.1	0.04[illegible]	1,97[illegible]
2014	30.7	0.04[illegible]	1,34[illegible]
2015	103[illegible]	0.04[illegible]	4,44[illegible]
2016	32[illegible]	0.051	1,467
Ag	48[illegible]	0.05[illegible]	2,74[illegible]

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
P(mg/l)	0.09	0.054	0.054	0.059	0.061	0.06	0.053	0.052	0.046	0.05	0.052	0.054	0.056	0.058	0.073	0.072	0.073	0.07	0.067	0.047	0.046	0.046	0.049			
Flow(cfs)	51	62	58	55	46	43	47	43	49	45	45	43	37	33	41	42	42	50	49	43	38	49	50			
P(kg/yr)	3,267	3,014	2,797	2,875	2,488	2,555	2,187	2,213	2,043	2,019	2,106	2,049	1,855	1,707	2,848	2,723	2,762	3,102	2,919	1,794	1,551	2,033	1,978			
Decrease%	0.0%	7.7%	14.4%	12.0%	23.9%	21.8%	33.1%	32.3%	37.5%	38.2%	35.5%	37.3%	43.2%	47.7%	12.8%	16.6%	15.5%	5.1%	10.7%	45.1%	52.5%	37.8%	39.4%			

Five Year Average Value



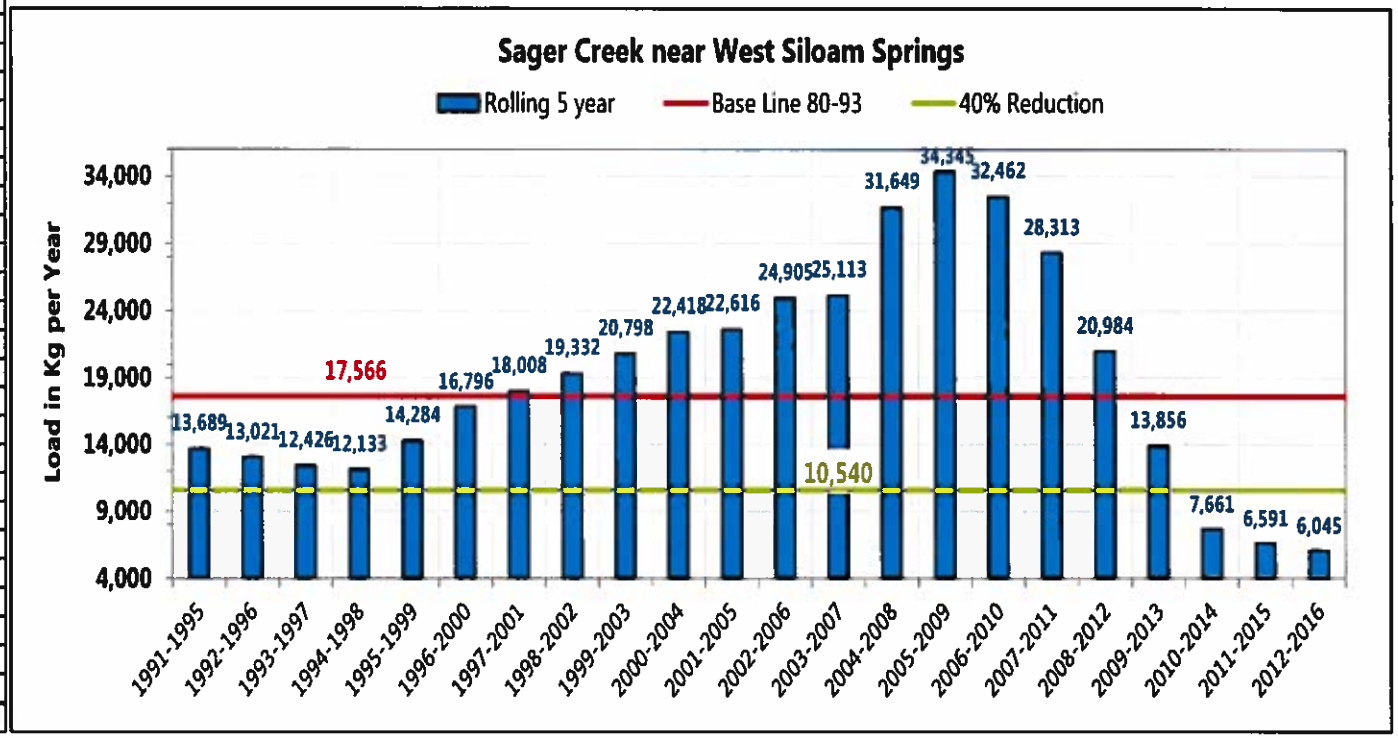

Total Phosphorus (TP) and Scenic River Criterion Implementation (1997 - 2016)
Station ID: ARK0004A
Flint Creek Northwest of West Siloam Springs, Oklahoma
TP Discrete Measurements (mg/L) (Log Scale)
1.00
0.10
0.037
0.01
0.00
3 Month Rolling Geometric Mean of TP (mg/L)
1.0
0.5
0.037
0.0
01/27/1997
02/03/1998
03/08/1999
06/12/2000
08/28/2001
08/20/2002
12/02/2003
12/07/2004
02/28/2006
03/20/2007
03/18/2008
03/10/2009
04/06/2010
05/03/2011
06/19/2012
06/18/2013
06/10/2014
09/15/2015
Dates
3 Month Geometric Mean P (mg/L)
Total P mg/L
Linear (3 Month Geometric Mean P (mg/L))
.0375 mg/L
.0375 mg/L
Linear (Total P mg/L)

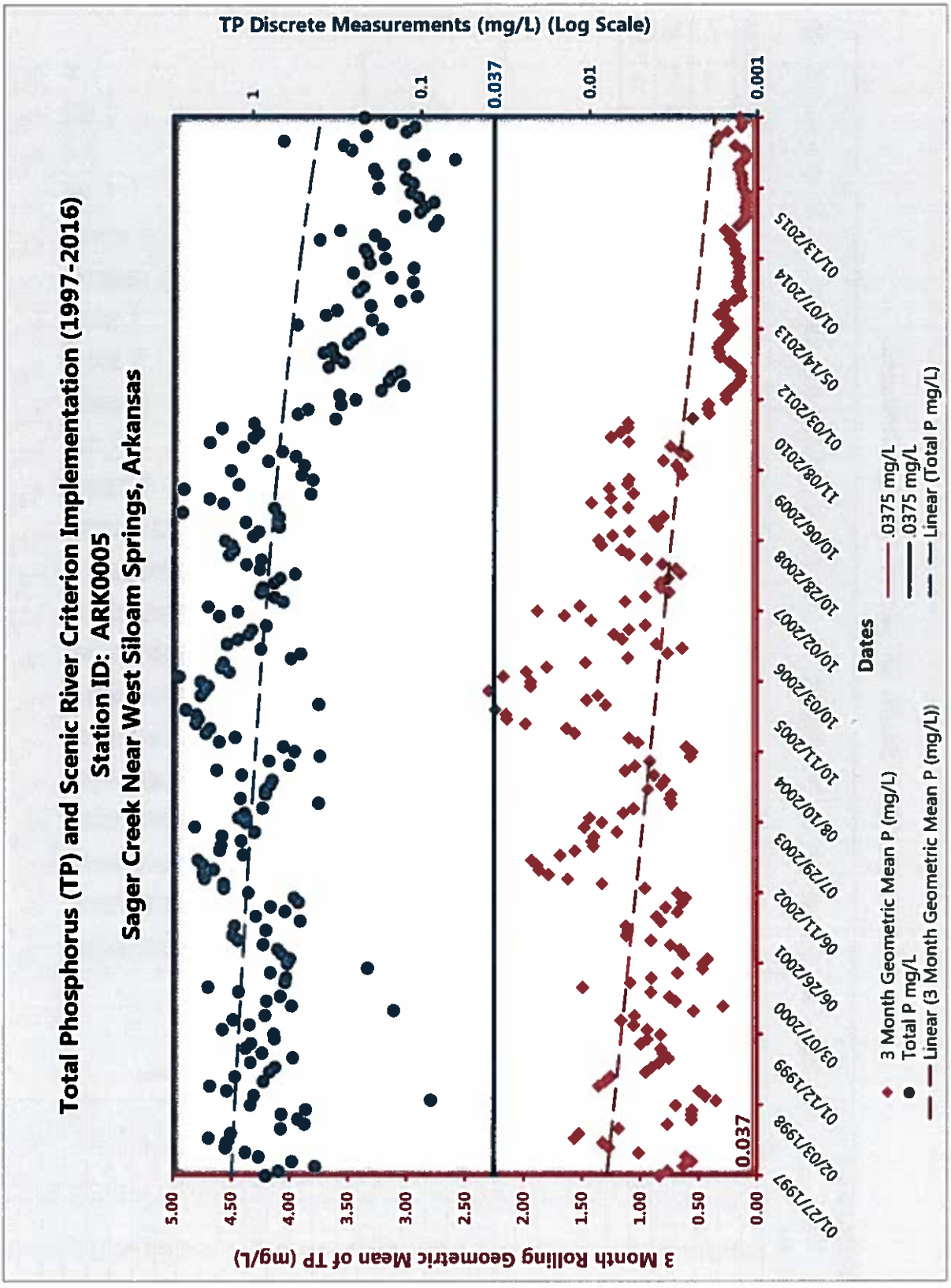
Sager Creek near West Siloam Sprngs, Arkansas

Sager Creek near West Siloam Springs Loading			
ARKOK Year	Flow (cfs)	Total P (mg/L)	Total P (kg/yr)
1981	65	2.12	12,336
1982	90	2.02	16,277
1983	63	1.99	11,081
1984	154	0.93	13,086
1985	246	1.73	38,467
1986	211	0.83	15,716
1987	167	0.94	14,136
1988	126	1.15	12,936
1989	117	1.27	12,821
1990	202	0.88	15,516
1991	155	0.91	12,665
1992	165	1.28	18,921
1993	246	0.63	13,993
1994	157	0.72	10,110
1995	178	0.69	11,081
1996	110	0.91	9,035
1997	178	1.02	16,354
1998	181	0.85	13,876
1999	245	0.95	21,422
2000	307	0.88	22,468
2001	212	0.80	15,201
2002	215	1.19	23,231
2003	117	1.50	15,700
2004	345	0.91	28,224
2005	185	1.46	24,201
2006	145	1.79	23,941
2007	210	1.30	24,494
2008	485	0.95	41,271
2009	381	1.28	43,755
2010	225	0.89	18,335
2011	274	0.57	14,027
2012	114	0.25	2,541
2013	202	0.22	4,103
2014	182	0.19	3,191
2015	570	0.12	6,521
2016	163	0.20	3,013
Avg	206	1.01	18,561

Year	8008	9405	9506	9607	9708	9809	9910	9701	9802	9903	0004	0105	0206	0307	0408	0711	0812	0913	1014	1115	1216
Rolling	1.35	0.85	0.85	0.89	0.84	0.89	0.92	0.89	0.98	1.05	1.04	1.17	1.32	1.39	1.28	1.00	0.74	0.64	0.42	0.22	0.20
Flow (cfs)	14.	18.	17.	17.	16.	17.	20.	22.	23.	22.	24.	24.	20.	20.	27.	31.	25.	24.	20.	26.	25.
Rolling	17,566	13,689	13,02	12,42	12,13	14,28	16,79	18,00	19,33	20,79	22,41	22,61	24,90	25,11	31,64	28,31	20,98	13,85	7,66	6,59	4,81
% Reduction	0%	22%	26%	29%	31%	19%	4%	-3%	-10%	-18%	-28%	-29%	-42%	-43%	-80%	-61%	-19%	21%	56%	62%	73%

Five Year Annual Average



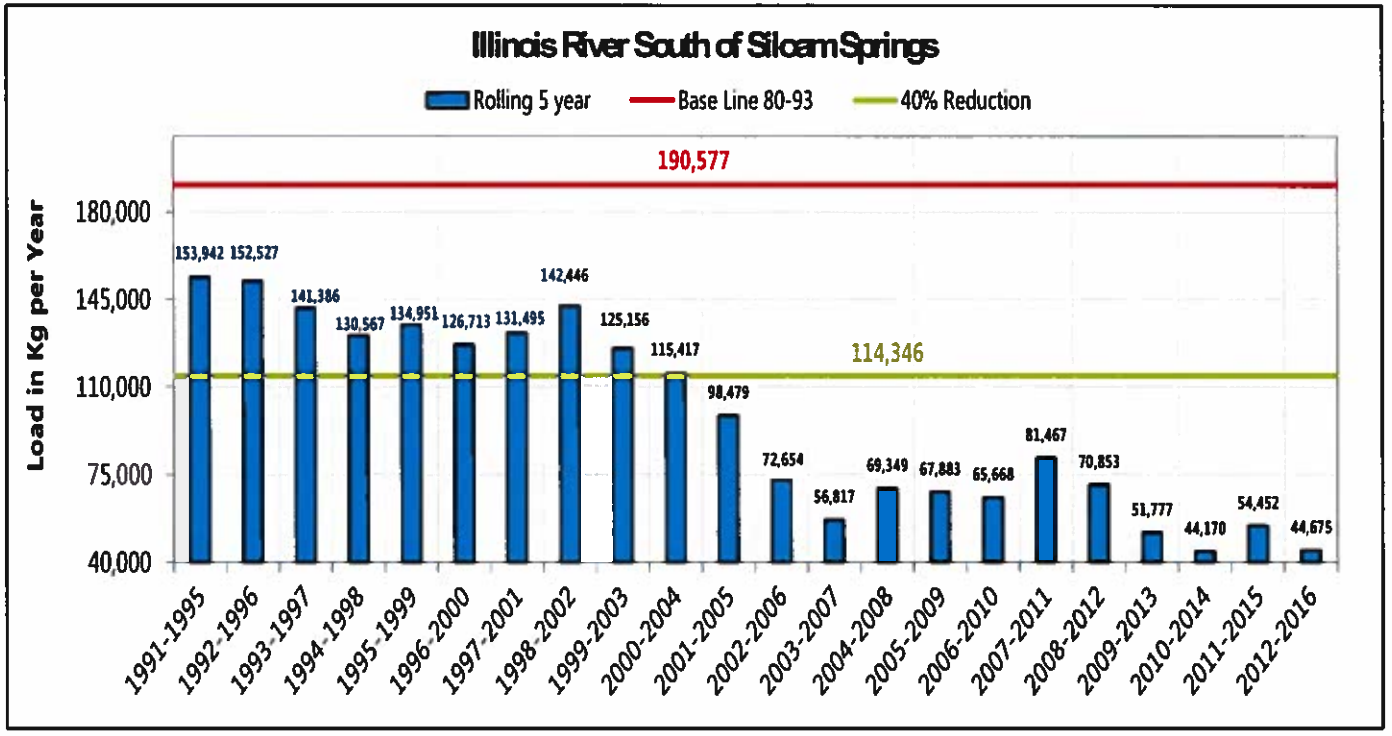

Total Phosphorus (TP) and Scenic River Criterion Implementation (1997-2016)
Station ID: ARK0005
Sager Creek Near West Siloam Springs, Arkansas
TP Discrete Measurements (mg/L) (Log Scale)
3 Month Rolling Geometric Mean of TP (mg/L)
Dates
3 Month Geometric Mean P (mg/L)
Total P mg/L
Linear (3 Month Geometric Mean P (mg/L))
.0375 mg/L
.0375 mg/L
Linear (Total P mg/L)
0.037
0.037
0.001
0.01
0.1
1
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
01/27/1997
02/03/1998
01/12/1999
03/07/2000
06/26/2001
06/11/2002
07/29/2003
08/10/2004
10/11/2005
10/03/2006
10/02/2007
10/28/2008
10/06/2009
11/08/2010
01/03/2012
05/14/2013
01/07/2014
01/13/2015

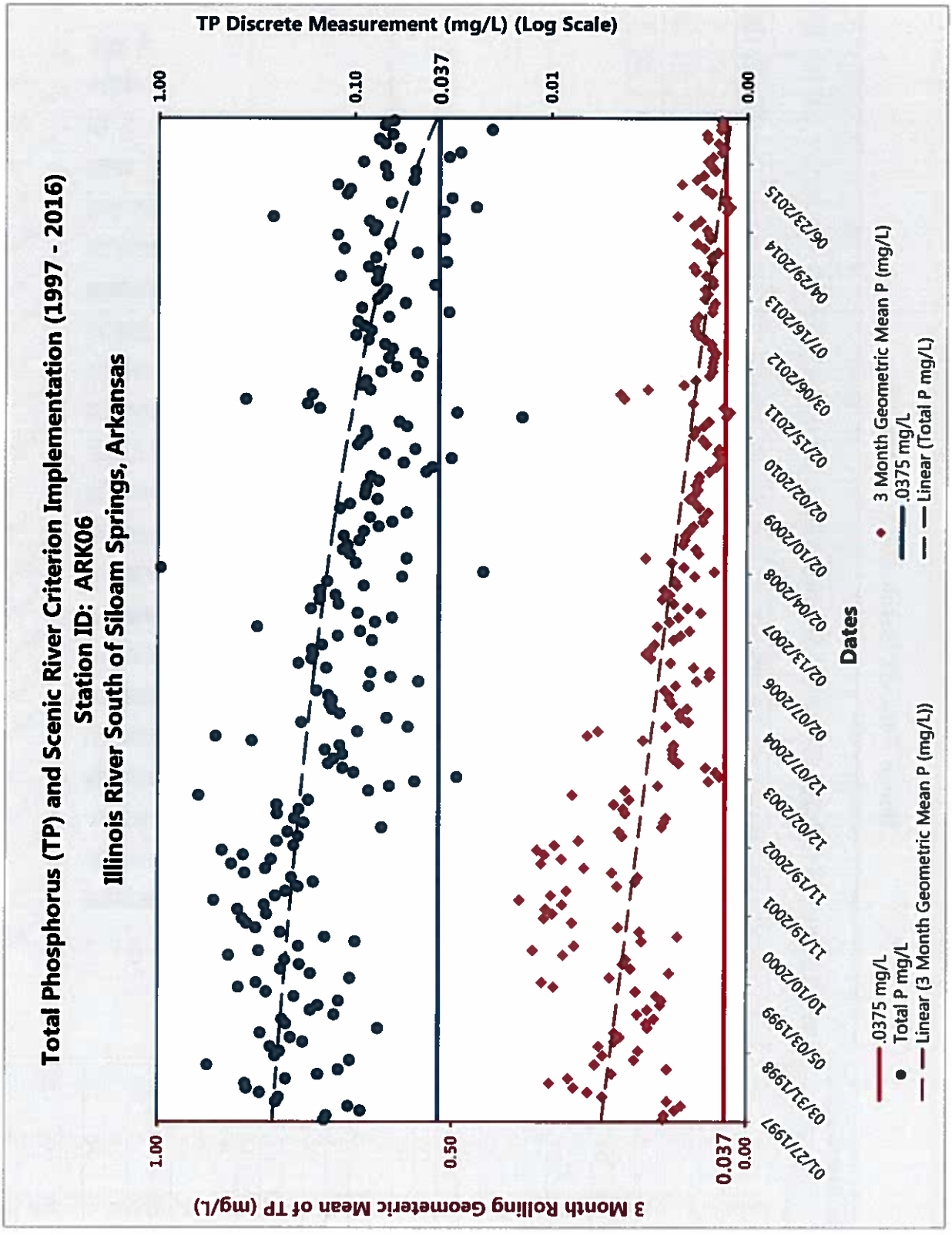
Illinois River South of Siloam Springs, Arkansas

Illinois River South of Siloam Springs - Loading			
ARKOS Year	Flow (cfs)	Total P (mg/L)	Total P (kg/yr)
1981	197	0.42	73,88
1982	591	0.37	195,29
1983	35	0.38	121,34
1984	70	0.44	278,69
1985	94	0.28	244,42
1986	87	0.31	239,43
1987	81	0.29	213,99
1988	531	0.25	119,99
1989	58	0.29	145,01
1990	112	0.20	205,33
1991	72	0.22	142,25
1992	76	0.22	150,68
1993	116	0.16	168,00
1994	67	0.19	114,30
1995	78	0.23	165,73
1996	66	0.22	134,03
1997	49	0.21	94,50
1998	68	0.24	146,95
1999	73	0.20	135,41
2000	59	0.23	122,83
2001	58	0.29	156,58
2002	57	0.28	143,70
2003	34	0.21	67,42
2004	63	0.15	86,49
2005	43	0.12	46,78
2006	28	0.12	31,04
2007	43	0.13	51,02
2008	1,051	0.15	148,30
2009	90	0.08	64,78
2010	68	0.06	35,88
2011	1,09	0.12	117,15
2012	34	0.06	21,54
2013	58	0.07	37,98
2014	40	0.07	28,01
2015	1,33	0.08	78,66
2016	41	0.05	21,26
Ag	66	0.20	124,57

Year	83	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04	05	06
P (mg/L)	031	020	021	029	022	025	024	028	032	026	026	024	019	019	016	012	010	010	008	008	008	008	008
Flow (cfs)	68	82	89	757	68	60	68	69	64	59	58	56	45	48	59	62	66	80	81	78	62	76	67
P (kg/yr)	190,577	152,527	152,527	141,386	130,567	134,951	126,713	131,495	142,446	125,156	115,417	98,479	72,654	56,817	69,349	67,883	65,668	81,467	70,853	51,777	44,170	54,452	44,675
% Reduction	0%	19%	20%	26%	31%	29%	34%	31%	25%	34%	39%	48%	62%	70%	64%	64%	66%	57%	63%	73%	77%	71%	73%

Five Year Average Value

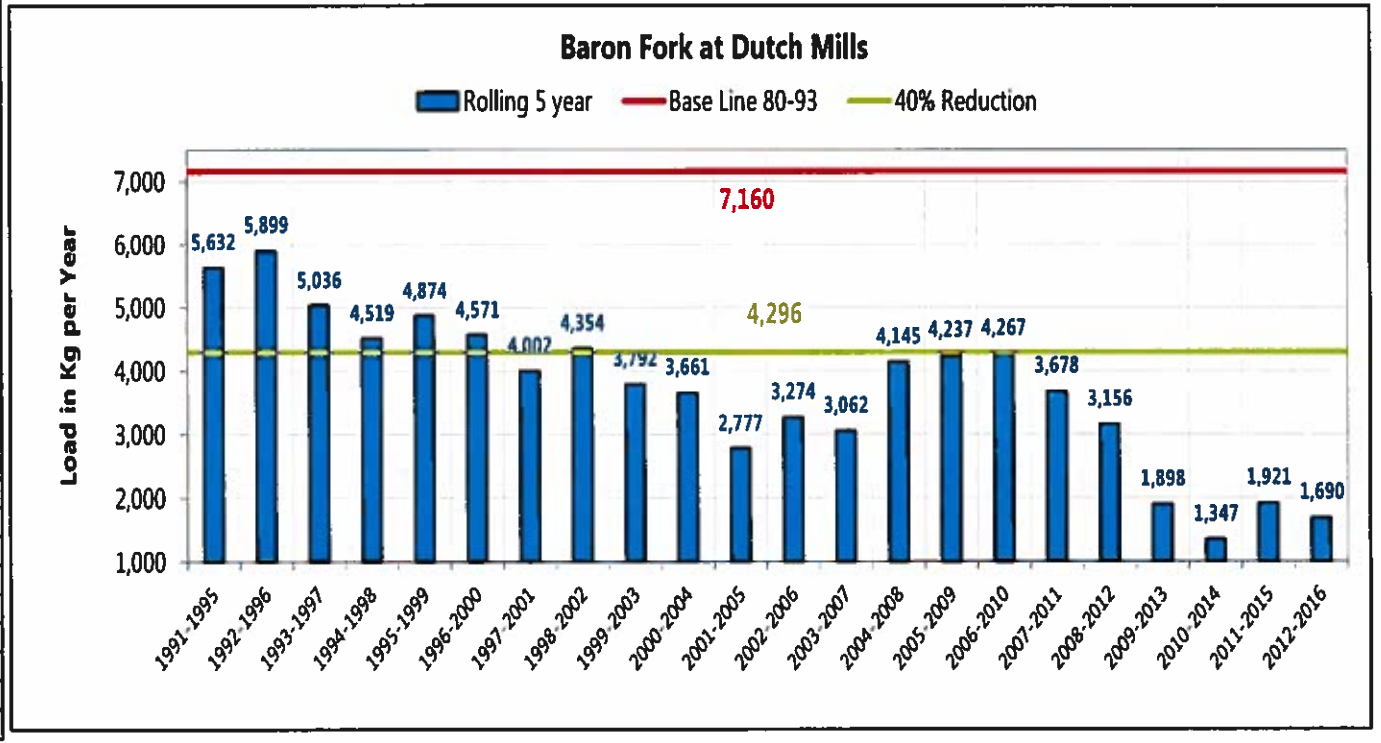


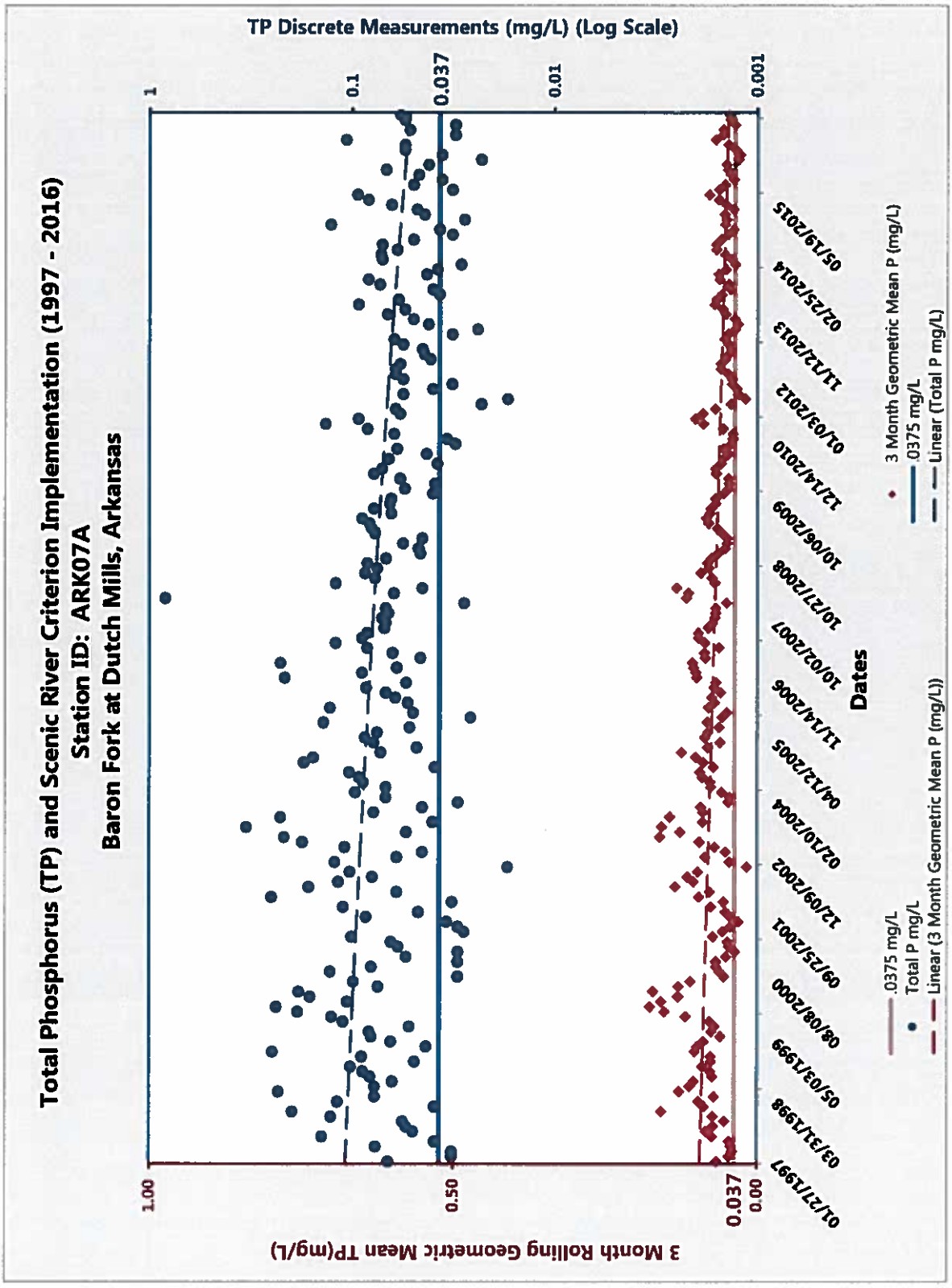

Total Phosphorus (TP) and Scenic River Criterion Implementation (1997 - 2016)
Station ID: ARK06
Illinois River South of Siloam Springs, Arkansas
TP Discrete Measurement (mg/L) (Log Scale)
1.00
0.10
0.037
0.01
0.00
3 Month Rolling Geometric Mean of TP (mg/L)
1.00
0.50
0.037
0.00
01/27/1997
03/31/1998
05/03/1999
10/10/2000
11/19/2001
11/19/2002
12/02/2003
12/07/2004
02/07/2006
02/13/2007
02/04/2008
02/10/2009
02/02/2010
02/15/2011
03/06/2012
07/16/2013
04/29/2014
06/23/2015
Dates
3 Month Geometric Mean P (mg/L)
.0375 mg/L
Linear (Total P mg/L)
.0375 mg/L
Total P mg/L
Linear (3 Month Geometric Mean P (mg/L))

Baron Fork at Dutch Mills, Arkansas

Baron Fork at Dutch Mills - Loadings			
ARKOTA Year	Flow (cfs)	Total P (mg/L)	Total P (kg/yr)
1991	184	0.13	2,216
1992	374	0.48	16,167
1993	272	0.12	3,039
1994	518	0.18	8,468
1995	794	0.211	14,952
1996	640	0.147	8,402
1997	632	0.13	7,555
1998	318	0.09	2,755
1999	502	0.12	5,555
2000	1020	0.10	9,992
2001	484	0.08	3,794
2002	479	0.12	5,433
2003	1040	0.08	7,705
2004	370	0.081	2,677
2005	542	0.16	7,842
2006	644	0.08	4,831
2007	359	0.06	2,151
2008	611	0.10	5,822
2009	458	0.10	4,176
2010	526	0.13	6,231
2011	414	0.08	2,387
2012	380	0.10	3,553
2013	201	0.13	2,388
2014	445	0.08	3,465
2015	261	0.08	1,958
2016	620	0.08	4,873
2017	323	0.08	2,510
2018	860	0.13	10,133
2019	623	0.08	3,672
2020	371	0.05	1,785
2021	402	0.08	2,161
2022	197	0.04	841
2023	263	0.08	1,364
2024	175	0.04	771
2025	1015	0.05	4,545
2026	155	0.05	692
Avg	486	0.111	4,795

Year	93	94	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
Flow (cfs)	53	59	62	59	51	52	52	47	46	40	39	34	38	37	50	54	56	52	49	37	28	41	41	
Five Year Average Value																								




Total Phosphorus (TP) and Scenic River Criterion Implementation (1997 - 2016)
Station ID: ARK07A
Baron Fork at Dutch Mills, Arkansas
TP Discrete Measurements (mg/L) (Log Scale)
1
0.1
0.037
0.01
0.001
3 Month Rolling Geometric Mean TP(mg/L)
1.00
0.50
0.037
0.00
01/27/1997
03/31/1998
05/03/1999
08/08/2000
09/25/2001
12/09/2002
02/10/2004
04/12/2005
11/14/2006
10/02/2007
10/27/2008
10/06/2009
12/14/2010
01/03/2012
11/12/2013
02/25/2014
05/19/2015
Dates
3 Month Geometric Mean P (mg/L)
.0375 mg/L
Linear (Total P mg/L)
.0375 mg/L
Total P mg/L
Linear (3 Month Geometric Mean P (mg/L))

2017 LEGAL COMMITTEE REPORT

RESOLUTION NO. 2017-4

of the

ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION

A RESOLUTION TO RECOGNIZE THE ARKANSAS-OKLAHOMA JOINT STUDY COMMITTEE AND THE BAYLOR UNIVERSITY RESEARCH TEAM FOR THEIR WORK TO COMPLETE A 2-YEAR STUDY ON PHOSPHORUS IN THE OKLAHOMA SCENIC RIVERS AND TO REQUEST THAT THE STATES OF ARKANSAS AND OKLAHOMA FULLY IMPLEMENT THE RECOMMENDATIONS OF THE JOINT STUDY

WHEREAS, the Second Statement of Joint Principles and Actions between the States of Arkansas and Oklahoma dated February 20, 2013, called upon the Governors of Arkansas and Oklahoma to each appoint three qualified individuals to select a contractor and to oversee a phosphorus stressor response study for the Oklahoma Scenic Rivers phosphorus Water Quality Standard;

WHEREAS, the Joint Study Committee selected a research group from Baylor University which was led by Dr. Ryan King to complete the Joint Study;

WHEREAS, the primary purpose of the Joint Study was to determine the total phosphorus threshold response level at which any statistical shift occurs in algal species composition or algal biomass production resulting in undesirable aesthetics or water quality conditions in the Designated Scenic Rivers;

WHEREAS, the Joint Study Committee and the Baylor University research group unanimously recommended a six-month average total phosphorus level, not to exceed 0.035 milligrams per liter based on water samples collected during critical conditions, as necessary to protect the designated Scenic Rivers and made additional recommendations to address water quality in the Scenic Rivers;

WHEREAS, these recommendations represent the first unanimous agreement between the States of Arkansas and Oklahoma on the appropriate phosphorus standard for the Scenic Rivers; and

NOW THEREFORE, BE IT RESOLVED BY THE MEMBERS OF THE ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION,

1. That the Joint Study Committee (Arkansas Appointees: Brian Haggard, Marty Matlock, Thad Scott and Ryan Benefield; Oklahoma Appointees: Derek Smithee, Shellie Chard and Shanon Phillips) and the Baylor University Research team be

Attachment J.

duly recognized for their service, dedication, and determination to reach a unanimous recommendation;

2. That the States of Arkansas and Oklahoma are encouraged to fully consider the recommendations of the Joint Study Committee. Further, the states are encouraged to implement the proposed revised phosphorus criteria, including frequency and duration component, and develop a joint monitoring and assessment program informed by the Joint Study and other scientific information to determine attainment of the revised criteria; and
3. That the States of Arkansas and Oklahoma are encouraged to jointly develop the Illinois River Strategic Action Plan to implement recommendations of the Joint Study Committee to improve water quality in the Arkansas River Basin.

Adopted this 28th day of September, 2017

Delia Haak

Delia Haak, Federal Commissioner and Chairman

FEDERAL AND STATE
GOVERNMENT REPORTS

Illinois River Watershed Partnership (IRWP) Introduction and Education Programming

Created in 2005 as a response to decades of dissention between Northwest Arkansas and Oklahoma, IRWP chose stakeholder collaboration over contentious and expensive lawsuits to address water quality in the Illinois River Watershed (IRW). The mission of IRWP is to improve the integrity of the IRW via education and outreach, monitoring, and implementation of conservation and restoration projects.

Priority Subwatershed Strategy

IRWP proposes to implement the following projects in five priority areas of the watershed: Moore's Creek (around Lincoln, AR), Sager Creek (around Siloam Springs), lower Muddy Fork (around Prairie Grove), Clear Creek (around Fayetteville), and along the main stem of the Illinois River. All of these subwatersheds are listed as impaired by ADEQ and are high priority for sediment, nitrogen, and phosphorus on ANRC's Non-Point Source Management Plan.

Education

IRWP will be implementing a new project called "Ecological Assessment of Priority Subwatersheds" at the end of 2017. The purpose of this project is to engage local public schools to do an in-depth study of priority subwatersheds via water quality monitoring and ecological assessment. The goal for this project is to identify high priority tributaries within each subwatershed, with the long-term goal of implementing targeted and specific BMP's within those tributaries. Deliverables for the project include:

Accomplishment	Quantity	Timing
Stream Teams will be established in four priority subwatersheds.	4 teams, 4 watersheds	October 1, 2017
Volunteer teams will be trained on EPA-recommended methods of data collection.	Anticipating 5 volunteers at 14 schools	December 1, 2017
Final report with geographically-specific management recommendations for each subwatershed.	Four raw datasets for each subwatershed, compiled into one final report.	August 1, 2018

Monitoring

IRWP is working to install monitoring sites at areas with very high rates of streambank erosion. Five sites have already been installed along the main stem of the IR and in the Muddy Fork subwatershed. IRWP seeks funding for ten additional sites in the Moore's Creek and Sager Creek subwatersheds and at additional locations on the main stem. The data generated from the sites will be the required baseline data for any future streambank restoration activities. Deliverables for this project include:

Accomplishment	Quantity	Timing
Monitoring sites established	15 sites	December 1, 2017
Annual monitoring	1 time/year	September 1, 2017
Production of baseline report for all sites	1 report	December 1, 2018

Thank you for your interest in supporting IRWP and our programming! We look forward to and appreciate your support for these projects!

RECLAMATION

Managing Water in the West

Summary of Current and Recently Completed Activities

Planning, Construction Assistance, and Grant Programs

Oklahoma-Texas Area Office

Mission Statements

The mission of the *Department of the Interior* is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the *Bureau of Reclamation* is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Table of Contents

Introduction

The Bureau of Reclamation (Reclamation) is an agency within the Department of the Interior with a primary mission designated to manage, develop, and protect water and related resources in an environmentally and economically sound manner within the 17 western states. The Oklahoma-Texas Area Office (OTAO) is responsible for administering 11 reservoir projects and associated water distribution systems in southern Kansas, Oklahoma, and Texas. The combined water delivery is more than 680,000 acre-feet (ac-ft) of Municipal and Industrial (M&I) water annually to approximately three million water users, providing additional fish and wildlife, recreation, and flood control benefits. The OTAO supports two Irrigation Districts, one in Oklahoma and one in Texas.

Reclamation works in conjunction with other Federal and state agencies, Indian Tribes, and local entities in performing these responsibilities. Significant areas of activity include providing oversight of operations and maintenance of existing facilities and water resources planning along with construction assistance.

The purpose of this activity report is to provide a summary of current and recently completed activities under the Planning, Construction Assistance, and Grant Programs.

Native American Affairs Program

The Native American Affairs Program, which is a formal program funded through the Native American Affairs line item in Reclamation's budget, is small but integral part of the overall Native American Program. The Native American and International Affairs Office in the Commissioner's Office serve as the central coordination point for the Native American Affairs Program and lead for policy guidance for Native American issues in Reclamation.

Four new projects were recently awarded in FY 17 totaling $277,900 in Federal funding:

- **Cherokee Nation**
  Hydraulic and Water Loss Assessment of Cherokee Rural Water District #2
- **Chickasaw Nation**
  Davis to Sulphur Pipeline Feasibility Study
- **Kickapoo Tribe of Oklahoma**
  Establishing Reference Conditions for the Northern Cross Timbers EcoRegion Using Macroinvertebrate Assemblages
- **Miami Tribe of Oklahoma**
  Water Assessment of Tribal Land

Two projects were awarded in FY 16 totaling $55,000 in Federal funding:

- **Muscogee Creek Nation**
  Groundwater Study
- **Cherokee Nation**
  Cherokee Rural Water District #8 Hydraulic and Water Loss Assessment

Three projects were initiated in FY 15 (one already completed) totaling $180,000 in Federal funding:

- **Cherokee Nation**
  Hydraulic and Water Loss Study of Adair County Rural Water District #1
- **Cherokee Nation**
  Viability Assessment for Regionalization of Rural Water Systems in Western Cherokee County, OK
- **Peoria Tribe of Indians of Oklahoma**

Potential for Utilization of Contaminated Portions of the Boone Aquifer

Water Conservation Field Services (WCFS) Program

One new project was awarded in FY 17 totaling $100,000 in Federal funding:

- **Central Oklahoma Master Conservancy District (COMCD)**
  Evaluate the Effectiveness of Floating Wetland/Breakwater Unit Designs to Reduce the Energy of Wave Action before Contacting the Lake's Shoreline

Two projects were initiated in FY 16 totaling $432,504 in Federal funding:

- **City of Norman, OK**
  Test-Pilot Hexavelent Chromium (Cr6) Removal Technologies to Address Cr6 Groundwater Occurrence and Potentially Reduce Stress on Lake Thunderbird (COMCD) Water Supply and Improve Drought Resiliency
- **City of Garden City, KS**
  Installation of a Subsurface Drip Irrigation System at Clint Lightner Field Subsurface Irrigation to Demonstration Effluent Reuse

Two projects were initiated in FY 15 (both scheduled to be completed by end of September 2017) totaling $115,433 in Federal Funding

- **City of Wichita Falls, TX**
  Implement Water and Energy Conservation Measures for the Operations, Management, and Use of Water within the District.
- **Texas Water Development Board**
  Development of Methodologies to Evaluate the Environmental, Financial and Social Benefits of Water Reuse Projects.

WaterSMART Program

Reclamation's WaterSMART (Sustain and Manage America's Resources for Tomorrow) Program aims to leverage Federal (up to 50 percent cost-share) and non-Federal funds to improve water management, increase energy efficiency in water delivery, facilitate water marketing projects, protect threatened and endangered species, and carry out activities to address potential climate-related impacts on water resources. Eligible entities include irrigation and water districts, river authorities, tribes, states and other entities with water or power delivery authority.

Basin Study Program

This program addresses water needs on a basin-wide scale through development of future supply/demand projections that include state-of-the-art data on climate variability; an analysis of how infrastructure and operations will perform in the face of changing realities; and development of mitigation strategies and management solutions. Studies are cost-shared on a 50/50 basis with willing state, tribal, and local partners and generally take two years to complete. Reclamation's share of study costs are used to support work done by Reclamation or its contractors.

Upper Washita Basin Study

A Basin Study on the Upper Washita Basin in Oklahoma was awarded $350,000 in FY 12 Federal funds to partner with the Oklahoma Water Resources Board (OWRB) and Fort Cobb and Foss Reservoir Master Conservancy Districts to identify sustainable solutions to infrastructure issues and existing and projected imbalances between water supply and demand. To date, including both Federal and non-Federal cost-share contributions from partners, the total cost is over $900,000 and is expected to be completed in late 2018.

OWRB is in the process of completing a groundwater-flow model on the Rush Springs Aquifer and a surface water allocation model (SWAM) on the Washita River. Completion of these models is critical toward being able to evaluate the reliability of existing infrastructure and options under current and future climate conditions, as well as evaluating adaptation and mitigation strategies. The Fort Cobb Reservoir Master Conservancy District has been working closely with Reclamation to develop conveyance alternatives to address aging infrastructure issues. Designs and cost estimates are under development.

Upper Red River Basin Study

A Basin Study on the Upper Red River Basin in Oklahoma was awarded $640,000 in FY 14 Federal funds to partner with the OWRB, Lugert-Altus Irrigation District, and Mountain Park Master Conservancy District to identify sustainable solutions to infrastructure issues and existing and projected imbalances between water supply and demand. The study will evaluate infrastructure and permitting options that help ensure long-term reliability of water supplies during critical drought periods. To date, including

both Federal and non-Federal cost-share contributions from partners, the total cost is approximately $1,435,000. The study is expected to be completed in late 2018.

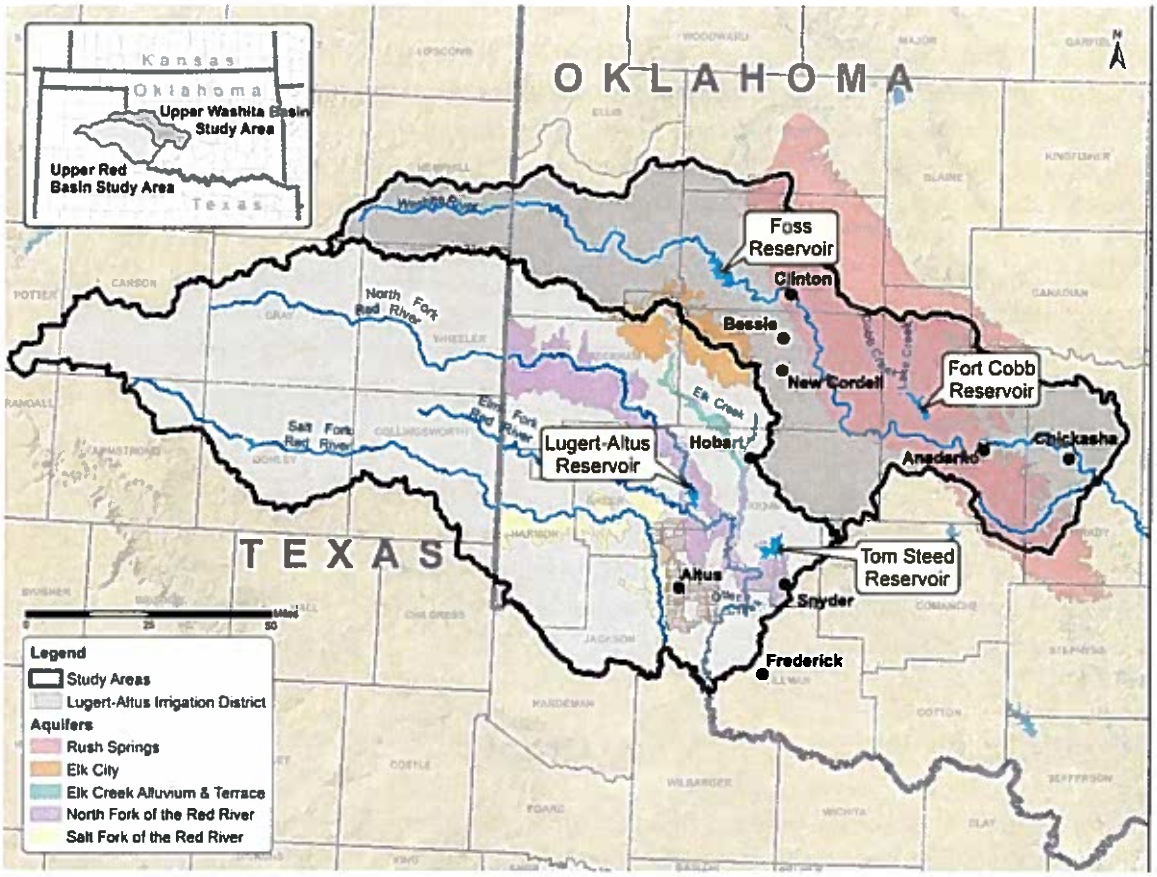


Figure 1: Upper Washita and Upper Red River Basin Study area map.

Water and Energy Efficiency Grants

This program seeks to conserve and use water more efficiently, increase the use of renewable energy, improve energy efficiency, benefit endangered and threatened species, facilitate water markets, carry out activities to address climate-related impacts on water or prevent any water-related crisis or conflict. Since 2010, Reclamation has awarded about $7.3 million to 32 projects in Texas and Oklahoma with a cumulative project cost of $25.5 million. The estimated total amount of water saved or better managed is about 26,863 acre-feet per year.

Cameron County Irrigation District #2 (CCID2)

CCID2 in Texas was awarded a total of $1,049,999 in FY 17 comprised of four separate projects.

CCID2 Canal F was awarded $299,973 in FY 17 for the conversion of Lateral "F" from an open canal to a pipeline. The proposed project consists of approximately 7,000 liner

feet (lf). These improvements are expected to improve water deliveries by conserving approximately 542.60 acre-feet per year of water and an estimated 25,865 kilowatt hours per year in energy efficiency.

CCID2 Lateral JN-1 was awarded $173,311 in FY 17 for the conversion of Lateral "JN-1" from an open canal to a pipeline. The proposed project consists of approximately 3,900 liner feet (lf). These improvements are expected to improve water deliveries by conserving approximately 621.50 acre-feet per year of water and an estimated 25,015 kilowatt hours per year in energy efficiency.

CCID2 Canal E was awarded $299,674 in FY 17 for the conversion of Canal "E" from an open canal to a pipeline. The proposed project consists of approximately 4,900 liner feet (lf). These improvements are expected to improve water deliveries by conserving approximately 802.81 acre-feet per year of water and an estimated 32,312 kilowatt hours per year in energy efficiency.

CCID2 Lateral 8 was awarded $299,731 in FY 17 for the conversion of Lateral "8" from an open canal to a pipeline. The proposed project consists of approximately 6,800 liner feet (lf). These improvements are expected to improve water deliveries by conserving approximately 915 acre-feet per year of water and an estimated 36,827 kilowatt hours per year in energy efficiency.

Small-Scale Water Efficiency Grants

In FY 17, new small-scale water efficiency projects funding opportunities for small improvements that have been identified through previous planning efforts were created. Eligible projects include installation of flow measurement or automation in a specific part of a water delivery system, lining of a section of canal to address seepage, small rebate programs that result in reduced residential water use, or other similar projects that are limited in scope.

Locust Grove Public Works Authority

Locus Grove Public Works Authority in Oklahoma was awarded $74,395 in FY 17 for a project to improve approximately 2,175 Linear feet (LF) of inefficient water line comprised of asbestos cement, steel, and schedule 40 PVC to NSF61 recommended C900 pipe in District Metering Area (DMA) #1 to address the 70% water loss as confirmed by the Locust Grove Water Loss Study completion 2017. Estimated water saved (ac-ft/yr) is 705.

Thomas Public Works Authority

Thomas Public Works Authority in Oklahoma was awarded $75,000 in FY 17 for a project where all of the current mechanical residential and commercial meters will be replaced with electronic smart meters which will provide more accurate readings and more efficient use of public works employee' time. Estimated water saved (ac-ft/yr) is 625.

City of Purcell
The City of Purcell in Oklahoma was awarded $59,480 in FY 17 to install a floating pump in the lake and construct a 6" line to supply water to the little league complex.

Brownsville Public Utilities Board
The Brownsville Public Utilities Board was awarded $74,868 in FY 17 in collaboration with Brownsville Independent School District to install water efficient shower head kits and faucets at Hanna Early College High School and Porter Early College High School. Efforts will result in quantifiable and sustainable water savings by approximately 11.4%.

Hidalgo County Irrigation District #2
Hidalgo County Irrigation District No. 2 was awarded $74,978 in FY 17 for the automation of the Lateral B and C Canal Gate.

Cameron County Irrigation District #6
Cameron County Irrigation District #6 in Los Fresnos, Texas was awarded $300,000 in FY 15 for a project that will enclose 3,800 feet of open canal with pipe, replace an existing pump station with a new aerial crossing, and install a solar powered lift pump. The project is expected to result in annual water savings of 275 acre-feet through reduced seepage losses, which will help to alleviate shortages due to drought in the Lower Rio Grande Basin. In addition, the solar powered lift pump is expected to generate 53,000 kilowatt-hours per year. The project also includes the construction of an outlet that will facilitate supplying water to the Lower Rio Grande Valley National Wildlife Refuge. Conserved water will be allocated to District customers and the Wildlife Refuge.

Santa Cruz Irrigation District No. 15
The Santa Cruz Irrigation District No. 15 in southern Texas was awarded $300,000 in FY 15 to: line 7,265 feet of the existing N-Canal, install a variable frequency drive at the existing Pump-15 Lift Station, and construct a wind powered pump to provide auxiliary power to the Pump-15 Lift Station. Annually, the project is expected to result in water savings of 955 acre-feet by eliminating seepage in the canal and provide wind power generation of 1,733 kilowatt-hours. Conserved water will be left in the system.

Title XVI - Water Reclamation & Reuse Program

Title XVI of P.L. 102-575, as amended (Title XVI), provides authority for Reclamation's water recycling and reuse program, titled "Title XVI." Through the Title XVI program, Reclamation identifies and investigates opportunities to reclaim and reuse wastewaters and naturally impaired ground and surface water in the 17 Western States and Hawaii. Title XVI includes funding for the planning, design, and construction of water recycling and reuse projects, on a project specific basis, in partnership with local governmental entities. In FY 17, Reclamation announced three separate categories of funding opportunities including Authorized Project, Feasibility Studies and Research Studies. In previous years Reclamation has had sufficient funding for two categories: up to $150,000 for relatively small studies and up to $450,000 for larger, regional scale studies.

To date, approximately $2.5 million has been awarded to 17 studies within the Oklahoma-Texas Area Office (OTAO).

In FY 17, six entities from all three states (Kansas, Oklahoma and Texas) within OTAO were awarded federal grants totaling over $786,000 to conduct both feasibility and research studies.

Oklahoma Water Resources Board

The Oklahoma Water Resources Board was awarded a $150,000 grant in FY 17 for a feasibility study of potential impacts of select alternative produced water management and reuse scenarios. This study responds to both of Oklahoma Governor Mary Fallin's recent mandates to the OWRB to search for ways to use produced water as a benefit to the state as part of the Water for 2060 Initiative and to find solutions that deep-well injection volumes and thereby reduce the threat of seismicity within the state.

City of Ada, OK

The City of Ada, Oklahoma was awarded a $136,193 grant in FY 17 for a feasibility study within the "Assessment of the Potential for Recycled Water Development to Offset Potable Water Demands with Non-Potable Supply and Reducing Negative Water Quality Impacts in the Receiving Streams within Tribal Territory" Phase II Reuse Study. This study will provide the City with the means to continued down the path of a sustainable water supply future.

City of Bartlesville, OK

The City of Bartlesville, Oklahoma was awarded a $150,000 grant in FY 17 for a feasibility study to augment Bartlesville water supply with drought-resilient reclaimed water. This feasibility study will determine the environmental, technical and cost viabilities of reclaiming wastewater effluent by relocating the existing Caney River effluent discharge approximately 5 to 7 miles upstream, which places the effluent

City of Garden City, KS

The City of Garden City, Kansas was awarded a $65,369 grant in FY 17 for a feasibility study to gather information regarding the current state of the fragile water supply and long-term supply outlook with eminent reuse opportunities. The scope of the study will provide the City with information to develop or enhance several policies including enhancing the most cost effective method to reuse the maximum quantity of water with the lowest cost impact and maximum benefit for long-term water availability.

North Alamo Water Supply Corp. (NAWSC)

North Alamo Water Supply Corporation in Texas was awarded a $90,000 grant in FY 17 for a feasibility study of energy-effluent alternatives for brackish groundwater desalination. This study will build on work recently completed by Reclamation, the Lower Rio Grande Regional Water Planning Group (region M), the Texas Water Development Board and the Rio Grande Regional Water Authority.

Kansas Water Office

The Kansas Water Office (KWO) was awarded a $199,175 grant in FY 17 for a research study to pilot test produced water near Hardtner, Kansas. The project will involve the

treatment of produced oil field water to a quality standard acceptable for agricultural irrigation and the watering of livestock.

Projects awarded in FY 15:

City of Lubbock, Texas – Potable Water Reuse Implementation Feasibility Study

The City of Lubbock, Texas was awarded a $150,000 grant for a feasibility study of Potable Water Reuse. The following potable reuse options to be evaluated in this study will focus on the three main categories of potable reuse identified in their 2013 Strategic Water Supply Plan:

1. Indirect potable reuse (IPR) – surface water augmentation;
2. Indirect potable reuse (IPR) – groundwater augmentation; and
3. Direct potable reuse (DPR).

City of Hudson Oaks, Texas – Feasibility of Water Reclamation and Reuse in Hudson Oaks

City of Hudson Oaks, Texas was awarded $147,600 to exam the feasibility of three potential alternatives for water reclamation and reuse, including: 1) Constructing a wastewater treatment plant in the City of Hudson Oaks to treat and reuse local effluent; 2) Collecting and utilizing stormwater runoff for reuse and distribution in the community, as well as for an added environmental habitat and recreation amenity; and 3) Pumping treated wastewater from the City of Weatherford Wastewater Treatment Plant to Hudson Oaks for reuse.

City of McAllen, Texas – Water Reuse Study

The City of McAllen, Texas was awarded $150,000 to perform a comprehensive feasibility evaluation of brackish and wastewater to develop a strategic plan that provides the best and highest use of the available water sources for McAllen Public Utility. The study will build on previous efforts and will consider indirect potable reuse via surface water and groundwater augmentation, direct potable reuse, and use of brackish groundwater. As appropriate, this study would coordinate with regional water supply studies and initiatives.

Drought Response Program

Reclamation's Drought Response Program aims to provide competitive grants for drought contingency planning, as well as mitigation actions that build long-term drought resiliency. This program focuses on leveraging Reclamation funds to avoid drought-related crises in the short term, while laying a foundation for climate resiliency in the long term. Over the last three fiscal cycles, over $3.1 million in funding was provided to support four drought contingency plans and eight drought resiliency projects in Oklahoma and Texas.

Drought Resiliency

Projects awarded in FY 16:

Altus City Reservoir East Basin Improvements for Drought Preparedness

The City of Altus in Oklahoma was awarded $300,000 in FY 17 to redirect available raw water from Tom Steed Reservoir, a Reclamation project and the City's principal source of supply, to Altus City Reservoir, a largely unused municipal supply originally constructed in 1940. This two-year project also includes the installation of sluice gates and weirs and renovation of the original pump station, built almost 80 years ago but currently unused.

Little Elm Improvements for Drought Preparedness

The Town of Little Elm, Texas was awarded $200,000 in FY 16 to construct a 100,000-gallon water reuse storage tank adjacent to their wastewater treatment plant. This two-year project will provide a consistent supply of treated wastewater available for irrigation and other uses during times of drought, saving the imported potable water supply for culinary purposes. This project is also supported by the city's drought plan, which specifically identifies the expanded reuse of treated effluent as a drought mitigation action.

Projects awarded in FY 15:

City of Duncan, Clear Creek Lake Improvements Project

The City of Duncan, Oklahoma was awarded $300,000 to install 1,520 linear feet of pipeline to allow the City to access up to 1,596 acre-feet per year from Clear Creek Lake to prevent water shortages during drought. The City will also upgrade the existing pump station with pumps having variable frequency drives and a Supervisory Control and Data Acquisition System. The City, which provides treated water to approximately 30,000 people, experienced severe drought conditions in 2015 and is in one of 12 basins identified in the Oklahoma Comprehensive Water Plan as having the most significant water challenges over the next 50 years. The City has reduced water consumption by 40% from 2011 to 2014 through mandatory and voluntary conservation measures. This project is supported by the City's drought plan and was identified by the City Council as a top priority to build resiliency to future droughts.

Waurika Lake Master Conservancy District, Waurika Lake Water Intake Channel Improvement Project

The Waurika Lake Master Conservancy District in southwestern Oklahoma was awarded $300,000 to install an extension intake pipe to the lowest point in Waurika Lake and add a floating intake to access water at more points, including the lake's lowest elevations. It will also improve its intake gates to reduce entry of debris and protect fish. The lower intake will enable the District to access an additional 25,000 acre-feet during drought conditions. The District provides water to 6 cities and 250,000 people in an area that had been in drought for 5 years prior to 2015.

Southmost Regional Water Authority, Well Field Monitoring Project

Southmost Regional Water Authority, a consortium of six water conservation and reclamation entities in Brownsville, Texas, was awarded $300,000 to develop a monitoring and management program for brackish groundwater wells that are part of a desalination treatment facility which provides a reliable supply of water for approximately 50,000 people, decreasing dependence on the Rio Grande River. This project will: (1) implement a system for monitoring water levels and water quality in the local aquifer; (2) develop a groundwater flow model to forecast responses and changes in the aquifer; and (3) upgrade the pump in one well within the existing brackish wellfield. This project will build drought resiliency by increasing the reliability of water production during stress periods, monitoring aquifer health, and increasing production capacity in an area that is drought-prone and where brackish groundwater provides an important alternative to fluctuating surface water supplies. This project is supported by the Lower Rio Grande Basin Study that identified brackish groundwater desalination as the best option for meeting long-term water needs and deficits exacerbated by climate change.

Texas Water Development Board, Early Warning Drought Tool

The Texas Water Development Board was awarded $144,763 to modify their existing drought prediction tool to provide more accurate probabilistic forecasts of average May-July rainfall, reservoir levels, and reservoir storage, by county, for the State of Texas. Water user groups in Texas are required to have a strategy for reducing Final Draft water use when water sources reach certain drought response trigger levels. By providing early warning of drought probability, early response measures may be taken to mitigate the impacts of drought and to reduce the need for more severe use restrictions. The forecasts will be updated on a bi-weekly basis and made accessible to water managers across the state through the Water Data for Texas website. Texas has recently come out of a four-year drought, which is described as the second worst on record.

Drought Contingency Plans

Projects awarded in FY 16:

Gulf Coast Water Authority Drought Contingency Plan Update

The Gulf Coast Water Authority was awarded $148,250in FY 16 to prepare a Drought Contingency Plan.

Projects awarded in FY 15:

Chickasaw and Choctaw Nations, Regional Drought Contingency Plan for the Arbuckle Simpson Aquifer Region

The Choctaw and Chickasaw Nations were awarded $187,081 to prepare a Regional Drought Contingency Plan for their homeland in south-central Oklahoma. The Arbuckle Simpson Aquifer covers approximately 500 miles and is the principal source of water for more than 100,000 people, supplies water for mining and irrigation, and is the source for nearly 100 known springs that are culturally important and generate approximately $100 million in tourism revenues per year. The area experienced an exceptional drought from 2010 until the spring 2015, causing significant economic hardship and requiring

emergency actions, such as hauling water and drilling emergency wells. A wide range of regional stakeholders, representing numerous sectors will support the drought planning process. The plan is close to completion and will identify mitigation and response actions that can be implemented at the local and regional levels.

Foss Reservoir Master Conservancy District, Drought Contingency Plan

The Foss Reservoir Master Conservancy District was awarded $200,000, to develop and implement a drought contingency plan for west-central Oklahoma that focuses on the water supply needs of communities that rely upon the Foss Reservoir Master Conservancy District, a Bureau of Reclamation project. Reclamation's Foss and Fort Cobb Reservoirs provide 90-percent of the surface water supplies for the region, including municipal water to 40,000 people and two power generation facilities. The Drought Contingency Plan will build on the existing Upper Washita Basin Study and evaluate several additional sources of water supply not evaluated in the Basin Study to address drought. The area is currently experiencing a five-year extended drought, with Foss Reservoir being declared "effectively out of water" last October. Recent climate studies predict future droughts will be longer-lasting and more severe.

McLennan County, McLennan County Drought Contingency and Water Supply Resiliency Plan

McLennan County, Texas was awarded $75,000 to prepare a regional drought contingency plan that will address drought impacts to the Trinity Aquifer, including intensified arsenic contamination in the aquifer and problems created by zebra mussels in certain surface waters. The County will partner with the McLennan County Water Resources Group (Group) to conduct the plan. The Group includes cities, water supply corporations, the Brazos River Authority, a groundwater conservation district, and local citizen and business interests. The Trinity Aquifer is the primary source of water for many of the towns and cities in the planning area, and also provides water for industrial, agricultural, manufacturing, and mining operations. Recent drought conditions have resulted in historically low water levels in the aquifer. As a result, pumping costs have increased, water supplies have declined, and the demand on surface sources has expanded. The drought plan will incorporate a "conjunctive use" approach to improve the efficient use of both groundwater and surface water sources.

Research and Development Program

Reclamation's R&D Program provides technical and financial assistance to internal and external research projects that help Reclamation accomplish its mission of developing water supplies in a sustainable manner.

Science and Technology Program

Internal research is funded under Reclamation's Science and Technology (S&T) Program. Through S&T, Reclamation can investigate new and innovative solutions on important issues where there may be a unique or unknown risk and for which capital investment may not occur otherwise. Recent research priorities have focused on addressing challenges associated with climate change, invasive zebra/quagga mussels, and advanced water treatment. Over the last seven years, the R&D program has awarded $50 million to more than 800 research projects. To date, about nearly $1 million has been awarded to research activities in Texas and Oklahoma. Active projects are listed below:

Investigating Biochar as a Water Treatment Filtration Media for Adsorption and Biological Reduction of Dissolved Metals and Fluoride

As climate change and drought continue to negatively impact freshwater availability and quality in the western US, impaired water sources are becoming more attractive to supplement existing freshwater supplies. However, these water sources can be expensive to treat, highlighting the need for more economical forms of treatment. Biochar is gaining attention as a less expensive and more sustainable alternative to granular activated carbon (GAC) for use as an adsorbent and biological filtration (biofilter) media. This project will focus on three case studies in the Mid-Pacific and Great Plains Regions and the use of biochar for the treatment of waters within these Regions contaminated by selenium, metals, and fluoride. Partners include Reclamation Regional Offices. Please use the following link for additional information: https://www.usbr.gov/research/projects/detail.cfm?id=1785

Research Opportunities to Treat Impaired Water Sources Associated with Reclamation Projects: A Case Study in the Great Plains Region

By using a survey-based approach to gather information on water quantity and quality challenges associated with Reclamation projects, can we better inform future investments under programs such as the Title XVI and Research & Development that address core, mission-related needs involving treatment of impaired water sources? This activity has been identified as a high-priority need by the Regional Director for the Great Plains Region. Please use the following link for additional information: https://www.usbr.gov/research/projects/detail.cfm?id=1715

Beneficial Reuse and Waste Minimization of Hexavalent Chrome Ion Exchange Brine

Hexavalent chromium occurrence in potable water sources is of concern to water utilities due to undetermined human carcinogenicity and toxicological effect. EPA is currently reviewing health assessments to determine if new federal standards need to be set for chromium. Minimizing the brine waste generated by ion exchange processes for beneficial purposes through membrane filtration with and without additional chemical addition allows for simpler regeneration processes and decreased operator expertise requirements. The research question to be answered is: Can a system that is simple to operate and inherently contains multiple barriers to chrome release be used to address chromium contamination in potable water sources? Please use the following link for additional information: https://www.usbr.gov/research/projects/detail.cfm?id=9085

Refining Interpretation Techniques for Determining Brackish Aquifer Water Quality

This project will define specific research areas required to support geophysical log interpretation for water quality in brackish aquifers. The project will build on the state of practice and methods outlined in the previous scoping level effort by delineating the confounding factors identified by that work and presenting research topics to resolve those factors. This work will be a collaborative effort supported and enhanced by key stakeholders identified in the scoping level effort, including the USGS, Texas Water Development Board, Brackish Water Work Group, and other state and federal agencies. The report produced by this project is intended to supplement the Reclamation S&T Advanced Water Treatment Roadmap and to aid stakeholders in securing funding for and directing future research efforts. Please use the following link for additional information: https://www.usbr.gov/research/projects/detail.cfm?id=2924

Development of Methodologies to Evaluate the Environmental, Financial and Social Benefits of Water Reuse Projects

The TWDB's Texas Water Reuse Research Agenda (2011) identified "triple bottom line" analyses as a top priority research area for Texas. Both water providers and rate payers alike often question whether reuse is worth the financial investment relative to other strategies. In fact, many water reuse projects in Texas have been halted due to a lack of funding or inability to justify the required capital expenditures. Reclamation is coordinating with TWDB and other state and local water suppliers to evaluate the state-of-the science of TBL analyses, and to develop a clear, well-defined economic and financial evaluation approach that can be used by entities to evaluate the merits of water reuse projects. Please use the following link for additional information: http://www.usbr.gov/research/projects/detail.cfm?id=4180.

Concentrate Management Toolbox and Selected Case Studies

Concentrate management is an important component driving the cost and feasibility of desalination. The understanding necessary to optimize inland desalination facilities and associated concentrate management solutions is still being improved through detailed assessments, especially as technology advances and provides more flexibility in treatment. A wide variety of concentrate management methodologies exist, and many water purveyors are overwhelmed when considering which technology is the best for their situation. This Concentrate Management Toolbox will inventory existing technologies and identify practical and economical strategies to optimize concentrate management based on various feed water quality parameters, so water planners can more

rapidly assess concentrate management options. Reclamation is partnering with the North Texas Municipal Water District in Texas and the Eastern Municipal Water District in California to then apply the Toolbox to a set of site-specific saline source waters and recommend an optimal array of concentrate management technologies. Please use the following link for additional information: http://www.usbr.gov/research/projects/detail.cfm?id=5239.

Desalination and Water Purification Research

External research is funded under Reclamation's Desalination and Water Purification Research Program (DWPR). DWPR was established to facilitate partnerships with academia, private industry, and local communities to develop more cost-effective, technologically efficient means by which to desalinate water. Over the past three fiscal cycles (FY 15-17), six new research projects totaling nearly $500,000 dollars were funded.

Pilot Testing a Fixed-Bed Biological Treatment System for Efficient Hexavalent Chromium Removal

Carollo Engineers, Inc. in partnership with City of Norman to pilot test a fixed-bed biological treatment system for efficient hexavalent chromium removal. A potential also exists for this method to be cost-effective in removing arsenic and other metals.

Advanced Pretreatment for Nanofiltration of Brackish Surface Water: Fouling Control and Water Quality Improvements

Texas A&M University in partnership with Foss Reservoir Master Conservancy District is performing a research/laboratory study evaluating the use of electrocoagulation as an advanced pretreatment method for nanofiltration of brackish surface water for fouling control and water quality improvements. If successful, this technology may help the District reduce high TDS levels at Foss Reservoir.

Fouling-Resistant, Self-Decontaminating Membranes for Effective Desalination of Oily Saline Wastewater

The University of Kansas Center for Research will be conducting the research.

Thermoplasmonic Membrane Desalination

The University of Tulsa will be conducting the research.

Development of Inorganic Membrane Systems for Treatment of Produced Water

Oklahoma State University will be conducting the research.

Emerging Ion Concentration Polarization for Brackish Desalination

Texas Tech University will be conducting the research.

Summary of Programs and Funding Opportunities

All Reclamation program Funding Opportunity Announcements (FOAs) for Grants or Cooperative Agreements to utilize Reclamation funding are posted on the Grants.gov website: http://www.grants.gov/

The following is a list of specific weblinks for each of the Reclamation programs mentioned above:

Native American Affairs Program: http://www.usbr.gov/native/

Research and Development:

- Desalination and Water Purification Research Program: https://www.usbr.gov/research/dwpr/
- Science and Technology Program: https://www.usbr.gov/research/st/index.html
- Water Prize Challenges: http://www.usbr.gov/research/challenges/

Rural Water Supply Program: http://www.usbr.gov/ruralwater/

Water Conservation Field Services Program: http://www.usbr.gov/waterconservation/

WaterSMART Program:

- Drought Response Program: http://www.usbr.gov/drought/
- Water and Energy Efficiency Grants: http://www.usbr.gov/watersmart/weeg/
- Title XVI: http://www.usbr.gov/watersmart/title/index.html
- Basin Studies: http://www.usbr.gov/watersmart/bsp/

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RECLAMATION
Managing Water in the West

ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT

RULES, REGULATIONS & MODES OF PROCEDURE

ARKANSAS - OKLAHOMA ARKANSAS RIVER COMPACT

1972

ARKANSAS RIVER BASIN COMPACT

ARKANSAS-OKLAHOMA, 1972

Approved

by the

ARKANSAS RIVER COMPACT COMMITTEE

FOR ARKANSAS:

S. Keith Jackson
Committee Member

John Luce
Committee Member
(alternate)

FOR OKLAHOMA:

Glade R. Kirkpatrick
Committee Member

Milton Craig
Committee Member
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FOR UNITED STATES OF AMERICA:

Trigg Twichell
Federal Representative and Chairman of Committee

Attest:

Willard B. Mills
Secretary

March 16, 1970
Revised March 3, 1972

PREFACE

In 1955, the Congress of the United States by Public Law 97, 84th Congress, 1st Session, granted consent to the States of Arkansas and Oklahoma to negotiate and enter into a Compact for the apportionment of the waters of the Arkansas River and its tributaries between the two States. With this authorization and the appointment of a Federal Representative to act as Chairman, the States created the Arkansas-Oklahoma Arkansas River Compact Committee on March 14, 1956, for the purpose of drafting a proposed Compact for the apportionment of the waters of the Arkansas River and its tributaries as they affect those States.

From the beginning the Committee was deliberate in its operations. Two important subcommittees: engineering and legal, were appointed early for the purpose of assembling, analyzing, and interpreting essential engineering and legal data needed by the Compact Committee.

The engineering subcommittee made hydrologic studies which were utilized in determining that portion of the Arkansas River Basin that should be covered by the interstate Compact, analyzed the quantity, quality, and mode of occurrence of the water resources of the area in question and made long-range estimates of the quantities of water that would be needed by the States in future years, recognizing existing water rights and water uses.

The legal committee researched existing Interstate Water Compacts and continuously advised the Compact Committee on legal matters that related to Compact negotiations.

The work of these subcommittees and their reports were invaluable to the Compact committee in reaching its unanimous agreement of the proposed Compact.

The Federal Representative employed a consulting engineer in the field of interstate compacts, and received legal counsel from the U.S. Department of Justice on matters that were of concern to the Federal agencies.

The Arkansas River Compact Committee approved its first formal interstate Compact draft March 16, 1970.

The State of Arkansas ratified this Compact draft through its Act No. 16, 1971, as passed by the Arkansas General Assembly and signed by Governor Dale Bumpers, January 26, 1971.

The State of Oklahoma ratified the interstate Compact draft through H. B. No. 1326, as passed by the Oklahoma Legislature and signed by Governor David Hall, April 24, 1971. This ratification, however, carried the following amendment:

> "SECTION 2. This ratification is subject to the State of Oklahoma and the State of Arkansas, acting through their duly authorized compact representatives, amending said 'Arkansas River Basin Compact' in the particulars as set forth hereinafter, and further, that ratification of said amendment of said compact by the Legislature of the State of Arkansas. Said amendment being expressed as follows:
>
> "The following language shall be added to Article VI, Section A of said compact, to-wit: 'Provided however that nothing contained in this compact or its ratification by Arkansas or Oklahoma shall be interpreted as granting either State or the parties hereto the right or power of eminent domain in any manner whatsoever outside the borders of its own state.'"

The Arkansas River Compact Committee unanimously approved the Oklahoma amendment as an appropriate clarification statement in the Compact. The Federal member of the Committee was formally advised that the Federal agencies had no objections to this amendment.

The State of Arkansas adopted the State of Oklahoma's amendment to the Arkansas River Compact draft through Act No. 40, as passed by the Arkansas General Assembly and signed by Governor Dale Bumpers, February 17, 1972.

The Arkansas River Basin Compact, Arkansas-Oklahoma, 1972, as revised March 3, 1972, contains the amendment as approved by both States and corrections of typographical errors found in the March 16, 1970 draft.

ARKANSAS RIVER BASIN COMPACT
ARKANSAS-OKLAHOMA, 1972

with
SUPPLEMENTAL INTERPRETIVE COMMENTS
Prepared by the Compact Committee

Compact

The State of Arkansas and the State of Oklahoma, acting through their duly authorized Compact representatives, S. Keith Jackson of Arkansas and Glade R. Kirkpatrick of Oklahoma, after negotiations participated in by Trigg Twichell, appointed by the President as the representative of the United States of America, pursuant to and in accordance with the consent to such negotations granted by an Act of Congress of the United States of America (Public Law 97, 84th Congress, 1st session), approved June 28, 1955, have agreed as follows respecting the waters of the Arkansas River and its tributaries:

Comment

On November 25, 1969, the authorized representatives of the States of Arkansas and Oklahoma approved the language of a draft of a Compact relating to the apportionment of the waters of the Arkansas River Basin originating in the two States between Muskogee, Oklahoma, and Van Buren, Arkansas; including Spavinaw Creek, a tributary to the Grand River upstream from Muskogee; and except the Canadian River above Eufaula Dam, a tributary to the Arkansas River between Muskogee and Van Buren.

The Compact is the result of negotiations between the parties over a period of years. The Compact Committee had the cooperation and advice of all interested Federal agencies, including the counsel of representatives of the United States Department of Justice. Its activities were supported by the water resources agencies of the States. In addition, extensive studies were conducted for the benefit of the Committee by the engineering departments of the University of Arkansas and Oklahoma State University under the federal Water Resources Research program.

These interpretive comments on the approved draft of November 25, 1969, have been prepared so that members of the respective legislatures, congressional committees, Federal agencies, and subsequent Compact administrators might be fully appraised of the intent of the Compact negotiating Committee with regard to each Article of the Compact.

ARTICLE I

Compact

The major purposes of this Compact are:

A. To promote interstate comity between the States of Arkansas and Oklahoma;

B. To provide for an equitable apportionment of the waters of the Arkansas River between the States of Arkansas and Oklahoma and to promote the orderly development thereof;

C. To provide an agency for administering the water apportionment agreed to herein;

D. To encourage the maintenance of an active pollution abatement program in each of the two States and to seek the further reduction of both natural and man-made pollution in the waters of the Arkansas River Basin; and

E. To facilitate the cooperation of the water administration agencies of the States of Arkansas and Oklahoma in the total development and management of the water resources of the Arkansas River Basin.

Comment

Article I is self-explanatory.

ARTICLE II

Compact

As used in this Compact:-

A. The term "State" means either State signatory hereto and shall be construed to include any person or

persons, entity or agency of either State who, by reason of official responsibility or by designation of the Governor of that State, is acting as an official representative of that State.

B. The term "Arkansas-Oklahoma Arkansas River Compact Commission," or the term "Commission" means the agency created by this Compact for the administration thereof.

C. The term "Arkansas River Basin" means all of the drainage basin of the Arkansas River and its tributaries from a point immediately below the confluence of the Grand-Neosho River with the Arkansas River near Muskogee, Oklahoma, to a point immediately below the confluence of Lee Creek with the Arkansas River near Van Buren, Arkansas, together with the drainage basin of Spavinaw Creek in Arkansas, but excluding that portion of the drainage basin of the Canadian River above Eufaula Dam.

D. The term "Spavinaw Creek Sub-basin" means the drainage area of Spavinaw Creek in the State of Arkansas.

E. The term "Illinois River Sub-basin" means the drainage area of Illinois River in the State of Arkansas.

F. The term "Lee Creek Sub-basin" means the drainage area of Lee Creek in the State of Arkansas and the State of Oklahoma.

G. The term "Poteau River Sub-basin" means the drainage area of Poteau River in the State of Arkansas.

H. The term "Arkansas River Sub-basin" means all areas of the Arkansas River Basin except the four sub-basins described above.

I. The term "water year" means a twelve-month period beginning on October 1, and ending September 30.

J. The term "annual yield" means the computed annual gross runoff from any specified sub-basin which would have passed any certain point on a stream and would have originated within any specified area under natural conditions, without any man-made depletion or accretion during the water year.

K. The term "pollution" means contaimination or other alterations of the physical, chemical, biological or radiological properties of water or the discharge of any liquid, gaseous, or solid substances into any waters which creates, or is likely to result in a nuisance, or which renders or

is likely to render the waters into which it is discharged harmful, detrimental or injurious to public health, safety, or welfare, or which is harmful, detrimental or injurious to beneficial uses of the water.

Comment

This is the Article of specific definition of terms as they apply to this Compact.

Subsections A and B are self-explanatory.

Subsection C defines the "Arkansas River Basin" as it pertains to this Compact. (See figure 1). It isolates that portion of the overall Arkansas River drainage basin in which the States of Arkansas and Oklahoma are primarily and mutually concerned. All of the area above the gaging station on the main stem of the Arkansas River near Muskogee, Oklahoma, and the Eufaula Dam in the Canadian River except the Spavinaw Creek Basin in the State of Arkansas, has been excluded from consideration.

The intent of the Committee has been to deal with the water originating within the area delineated by this definition and no attempt has been made to define the rights, if any, of either State in waters originating outside the defined area which might flow into and through the area in the main stem of the Arkansas River or the Canadian River.

Waters of the Arkansas River Basin originating above Muskogee and Eufaula Dam have been allocated in part by Compacts between the States of Kansas and Oklahoma, and in the upper reaches of the basin between the States of Colorado and Kansas. The State of Arkansas was not a party to either of those Compacts, and the State of Oklahoma was not a party to the Colorado-Kansas Compact. Waters originating above

Eufaula Dam have been allocated in part by Compact between the States of New Mexico, Oklahoma and Texas; and the State of Arkansas was not a party to that Compact.

Both States recognize that storage has been constructed in the State of Oklahoma above Muskogee for the impounding and release of water to aid navigation in both the States of Oklahoma and Arkansas; and that such waters will in whole or in part flow through the Compact area. It is recognized also that power releases from reservoirs upstream of Muskogee will flow through the Compact area in the main stem of the Arkansas River, and may be subject to diversions and/or impoundment and use in either State. Flood control releases from upstream reservoirs will fall in the same category as power releases.

The drainage area in the State of Arkansas of Spavinaw Creek, a tributary of the Neosho River, has been included in this Compact area. The portion of Spavinaw Creek Basin lying in the State of Oklahoma was included in the physical delineation of the Grand-Neosho River Basin in the Kansas-Oklahoma Arkansas River Basin Compact. In the Kansas-Oklahoma Compact, Spavinaw Creek was excluded from the conservation storage limitation provisions which were the basis of that Compact.

The Spavinaw Creek Sub-basin has been included in this Compact, even though it is not directly tributary to the rest of the Compact area, because (1) the headwaters are in the State of Arkansas and the stream flows into the State of Oklahoma as is the case with all the other tributaries under consideration; (2) the rights of the State of Arkansas were not considered in the Kansas-Oklahoma Compact; and (3) the State of Oklahoma already has substantial development and interest in water supply of the stream.

The lower cutoff point of the Compact area has been placed immediately below the confluence of Lee Creek with the Arkansas River near Van Buren, Arkansas. Lee Creek is the farthest downstream tributary having headwaters in the State of Arkansas and flowing into the State of Oklahoma. It re-enters the State of Arkansas and flows into the Arkansas River in that State. There is interest in the Van Buren-Fort Smith area in Lee Creek as a source of municipal water supply.

Subsections D through H define the various sub-basins which, for purposes of this Compact, have been designated on Spavinaw Creek, Illinois River, Lee Creek and Poteau River, as well as for the Arkansas River main stem. These sub-basins differ from the sub-basins outlined in the Report of the Engineering Advisory Committee, dated January 1969, except for Lee Creek Sub-basin which remains consistent with the original report. It also differs from the Engineering Committee's original recommendations to the Compact Committee concerning the delineation of sub-basins. (See figure 1):

Subsection I is self-explanatory.

Subsection J defines "annual yield," which is a term basic to the allocations of this Compact. It refers to the runoff originating within any area and which would occur under unaltered natural conditions, i.e., where there would be no artificial man-made depletions of, or additions to, the original supply and no regulation of that supply.

The only time this could be measured absolutely would be before any facilities to utilize, import or impound water were constructed. After the first such facility is introduced, the measurement becomes something of an approximation relative to how accurately depletions can be computed

and their ratio to water yield. An excellent opportunity exists in this Compact area to establish relationship of "annual yield" and runoff at key points or with precipitation, or a combination of runoff and precipitation. This is true since depletions are small in relation to the average yield of this basin.

Subsection K is self-explanatory.

ARTICLE III

Compact

A. The physical and other conditions peculiar to the Arkansas River Basin constitute the basis of this Compact, and neither of the States hereby, nor the Congress of the United States by its consent hereto, concedes that this Compact establishes any general principle with respect to any other interstate stream.

B. By this Compact, neither State signatory hereto is relinquishing any interest or right it may have with respect to any waters flowing between them which do not originate in the Arkansas River Basin as defined by this Compact.

Comment

Subsection A confirms the principle that each Compact area has its own special problems and solutions thereto, and cannot provide per se the solutions for other compacting areas.

Subsection B is an affirmation of the principle of equitable apportionment between States of the water of interstate streams (Kansas v. Colorado, 206 U.S. 46; Colorado v. Kansas, 320 U.S. 383).

ARTICLE IV

Compact

The States of Arkansas and Oklahoma hereby agree upon the following apportionment of the waters of the Arkansas River Basin:

A. The State of Arkansas shall have the right to develop and use the waters of the Spavinaw Creek Sub-basin subject to the limitation that the annual yield shall not be depleted by more than fifty percent (50%).

B. The State of Arkansas shall have the right to develop and use the waters of the Illinois River Sub-basin subject to the limitation that the annual yield shall not be depleted by more than sixty percent (60%).

C. The State of Arkansas shall have the right to develop and use all waters originating within the Lee Creek Sub-basin in the State of Arkansas, or the equivalent thereof.

D. The State of Oklahoma shall have the right to develop and use all waters originating within the Lee Creek Sub-basin in the State of Oklahoma, or the equivalent thereof.

E. The State of Arkansas shall have the right to develop and use the waters of the Poteau River Sub-basin subject to the limitation that the annual yield shall not be depleted by more than sixty percent (60%).

F. The State of Oklahoma shall have the right to develop and use the waters of the Arkansas River Sub-basin subject to the limitation that the annual yield shall not be depleted by more than sixty percent (60%).

Comment

This Article apportions the available water resources of the Basin between the two States. Although large quantities of good quality water are available in the Basin, flows fluctuate widely, and provisions for storage will be essential to any substantial development of water use.

The record of Compact negotiations will show that early consideration was given to the possibility of writing a compact based on allocation of conservation storage. Near the end of negotiations and after careful deliberation and study, the consideration of conservation storage allocations was dropped and it was agreed to make allocations on the basis of percentages of annual yield.

It is realized that problems of deficient low flows presently exist and will no doubt continue in the future. Base flows of tributary streams in the Basin are generally low and most streams recede to no flow during dry periods. It is anticipated that future developments of storage facilities will provide for low flow augmentation but it is considered infeasible to specify minimum flows for any stream system. Release of flows from the system of major reservoirs presently constructed and planned for flood control, hydroelectric power and navigation should assure the maintenance of adequate flows throughout the main stem of the Arkansas River in the Compact area.

The percentages of annual flows apportioned between the States are based on the assumptions that the "upstream" State should generally have first call on available waters. Engineering studies have shown it is generally infeasible to develop over sixty percent (60%) of the long-term yield of any Basin in this area.

The division of water is on the basis that forty percent (40%) of the annual yield would be delivered from the upstream State. Exceptions to this have been made in the cases of Spavinaw and Lee Creek Basins.

The City of Tulsa has developed 96,000 acre-feet of conservation storage on lower Spavinaw Creek in the State of Oklahoma for municipal water supply. These reservoirs collect flows from 386 square miles, of which 120 square miles are in the State of Arkansas. In recognition of these existing developments, it was agreed to limit the State of Arkansas allocation to fifty percent (50%) of the annual yield from the area in that State.

The Lee Creek Basin roughly parallels the Arkansas-Oklahoma stateline. The drainage area is approximately sixty percent (60%) in the State of Arkansas and forty percent (40%) in the State of Oklahoma. The main stem rises in the State of Arkansas, but some small tributaries in the upper reaches rise in the State of Oklahoma and flow into the State of Arkansas. The main stem first crosses the Arkansas-Oklahoma stateline at mile 24.6, and then flows back into the State of Arkansas at mile 9.0, crossing and recrossing the stateline until entering the State of Arkansas for the last time at mile 7.6. This watershed is an excellent source of water for the Fort Smith metropolitan area, including nearby areas in the State of Oklahoma, and for which there is a large potential need for future water supplies. In order to permit the full development of this Basin, it was agreed that waters of this Basin be allocated on the basis of origin. This will permit either State to fully develop, use and consume a quantity of water equal to the total annual yield of the Lee Creek Basin in each State.

Each State recognizes that waters are now being transported from one basin to another and that these transbasin diversions could increase in the future. It is also recognized that such transbasin diversion of water is a charge against the apportionment to the respective States.

ARTICLE V

Compact

A. On or before December 31 of each year, following the effective date of this Compact, the Commission shall determine the stateline yields of the Arkansas River Basin for the previous water year.

B. Any depletion of annual yield in excess of that allowed by the provisions of this Compact shall, subject to the control of the Commission, be delivered to the downstream State, and said delivery shall consist of not less than sixty percent (60%) of the current runoff of the basin.

C. Methods for determining the annual yield of each of the sub-basins shall be those developed and approved by the Commission.

Comments

Subsection A provides for the computation of "annual yield" before the end of the calendar year, while the computation itself is based on data available for the water year ending September 30 of that same calendar year. This means that necessary hydrologic data (such as stream flow, water quality, precipitation, etc.) will be required in less than three months after the end of the water year.

Subsection B provides for adjustment of annual depletions so that a depletion in excess of the allocation to either State during the previous water year shall be delivered (restored to the downstream State) as soon as practicable consistent with proper water management.

It is anticipated that each State should control its water management so that consumptive-use depletions will not exceed its allocation. Excess stream-flow depletions, which would be a withholding of water by any means (consumptive uses or storage) could possibly occur in low yield years, but could be made up in subsequent periods of high runoff.

No provisions are made in this Compact for credits for over-deliveries nor for continuing debits for under-deliveries. As a practical manner the water resources of the area are of such a magnitude, and the physical conditions limiting storage facilities are such that complete utilization of the allocated quantities might never be reached.

The allocations are of such magnitude in relation to these factors that the States essentially will be unrestricted in the control and use of the water resources of the Compact area. The Compact does, however, protect against the possibility of either State encroaching upon the rights of the other at some future time when maximum utilization could be approached. (There is a distinct possibility in this area that such a condition might never occur). Or, in a period of extreme drought, it would provide an equitable distribution of a limited water supply.

Subsection C is intended as a directive for determining annual yield. Appendix I attached to these comments outlines procedures for this purpose. Present depletions are small in relation to the original yield and an opportunity exists to establish correlations of yield at agreed-to points in both States. As developments occur in the future, it may be necessary to refine procedures and make arrangements for the collection of additional basic data. It is anticipated that a technical advisory group will be available to the Commission and will develop adequate procedures and make recommendations for the collection of necessary basic data as required for the proper administration of the Compact.

ARTICLE VI

Compact

A. Each State may construct, own and operate for its needs water storage reservoirs in the other State; provided, however, that nothing contained in this Compact or its ratification by Arkansas or Oklahoma shall be interpreted as granting either State or the parties hereto the right or power of eminent domain in any manner whatsoever outside the borders of its own State.

B. Depletion in annual yield of any sub-basin of the Arkansas River Basin caused by the operation of any water storage reservoir either heretofore or hereafter constructed by the United States or any of its agencies, instrumentalities or wards, or by a State, political sub-division thereof, or any person or persons shall be charged against the State in which the yield therefrom is utilized.

C. Each State shall have the free and unrestricted right to utilize the natural channel of any stream within the Arkansas River Basin for conveyance through the other State of waters released from any water storage reservoir for an intended downstream point of diversion or use without loss of ownership of such waters; provided, however, that a reduction shall be made in the amount of water which can be withdrawn at point of removal, equal to the transmission losses.

Comment

This Article recognizes the possibilities of special problems arising and sets forth general provisions for handling some of these problems.

In Subsection A, the Committee recognizes that storage capacity may be constructed by one State in the other and that the Compact creates no bar to such construction. Each State, either individually or the two States jointly, may construct, own and operate for their needs water storage reservoirs in either State.

Subsection B makes it quite clear that depletions resulting from storage constructed at any point in the Basin by the United States, the States or individuals shall be charged against the State in which the benefits of the depletion are realized. Although the Compact is silent as to what part the Commission might take in the event that storage is constructed in one State for the benefit of the other State, it is the view of the Committee that such matters would be worked out at State level so long as the provisions of the Compact are complied with.

Subsection C allows either State to use the channel as a conveyor to transport water from a structure in one State to a point in the other State where it can be used. The only restriction is that a carriage or transmission loss will be charged against the State utilizing the natural channel in the other State. The amount of such transmission loss will be determined by the Compact Commission whenever the need arises.

ARTICLE VII

Compact

The States of Arkansas and Oklahoma mutually agree to:

A. The principle of individual State effort to abate man-made pollution within each State's respective borders, and the continuing support of both States in an active pollution abatement program;

B. The cooperation of the appropriate State agencies in the States of Arkansas and Oklahoma to investigate and abate sources of alleged interstate pollution within the Arkansas River Basin;

C. Enter into joint programs for the identification and control of sources of pollution of the waters of the Arkansas River and its tributaries which are of interstate significance;

D. The principle that neither State may require the other to provide water for the purpose of water quality control as a substitute for adequate waste treatment;

E. Utilize the provisions of all Federal and State water pollution laws and to recognize such water quality standards as may be now or hereafter established under the Federal Water Pollution Control Act in the resolution of any pollution problems affecting the waters of the Arkansas River Basin.

Comment

The States recognize that there is no serious interstate pollution problem in the Basin at present; and that the States are obligated to maintain adequate water quality in the Arkansas River Basin through

whatever means is available to them. An important provision is that neither State may require the other to provide water for the purpose of water quality control as a substitute for adequate waste treatment.

Through active pollution abatement programs the States hope to avoid the conflict over future problems, but have provided that, if necessary, they may utilize the provisions of the Federal Water Pollution Control Act in cases which cannot be resolved within the provisions of the Compact.

ARTICLE VIII

Compact

A. There is hereby created an interstate administrative agency to be known as the "Arkansas-Oklahoma Arkansas River Compact Commission." The Commission shall be composed of three Commissioners representing the State of Arkansas and three Commissioners representing the State of Oklahoma, selected as provided below; and, if designated by the President or an authorized Federal agency, one Commissioner representing the United States. The President, or the Federal agency authorized to make such appointments, is hereby requested to designate a Commissioner and an alternate representing the United States. The Federal Commissioner, if one be designated, shall be the Chairman and presiding officer of the Commission, but shall not have the right to vote in any of the deliberations of the Commission.

B. One Arkansas Commissioner shall be the Director of the Arkansas Soil and Water Conservation Commission, or such other agency as may be hereafter responsible for administering water law in the State. The other two Commissioners shall reside in the Arkansas River drainage area in the State of Arkansas and shall be appointed by the Governor, by and with the advice and consent of the Senate, to four-year staggered terms with the first two Commissioners being appointed simultaneously to terms of two (2) and four (4) years, respectively.

C. One Oklahoma Commissioner shall be the Director of the Oklahoma Water Resources Board, or such other agency as may be hereafter responsible for administering water law in the State. The other two Commissioners shall reside within the Arkansas River drainage area in the State of Oklahoma and shall be appointed by the Governor, by and with the advice and consent of the Senate, to four-year staggered terms, with the first two Commissioners being appointed simultaneously to terms of two (2) and four (4) years, respectively.

D. A majority of the Commissioners of each State and the Commissioner or his alternate representing the United States, if they are so designated, must be present to constitute a quorum. In taking any Commission action, each signatory State shall have a single vote representing the majority opinion of the Commissioners of that State.

E. In the case of a tie vote on any of the Commission's determinations, orders, or other actions, a majority of the Commissioners of either State may, upon written request to the Chairman, submit the question to arbitration. Arbitration shall not be compulsory, but on the event of arbitration, there shall be three arbitrators:

(1) One named by resolution duly adopted by the Arkansas Soil and Water Conservation Commission, or such other State agency as may be hereafter responsible for administering water law in the State of Arkansas; and

(2) One named by resolution duly adopted by the Oklahoma Water Resources Board, or such other State agency as may be hereafter responsible for administering water law in the State of Oklahoma; and

(3) The third chosen by the two arbitrators who are selected as provided above.

If the arbitrators fail to select a third within sixty (60) days following their selection, then he shall be chosen by the Chairman of the Commission.

F. The salaries and personal expenses of each Commissioner shall be paid by the Government which he represents. All other expenses which are incurred by the Commission incident to the administration of this Compact shall be borne equally by the two States and shall be paid by the

Commission out of the "Arkansas-Oklahoma Arkansas River Compact Fund," initiated and maintained as provided in Article IX(B)(5) below. The States hereby mutually agree to appropriate sums sufficient to cover its share of the expenses incurred in the administration of this Compact, to be paid into said fund. Disbursements shall be made from said fund in such manner as may be authorized by the Commission. Such funds shall not be subject to the audit and accounting procedures of the States; however, all receipts and disbursements of funds handled by the Commission shall be audited by a qualified independent public accountant at regular intervals, and the report of such audit shall be included in and become a part of the annual report of the Commission, provided by Article IX(B)(6) below. The Commission shall not pledge the credit of either State and shall not incur any obligations prior to the availability of funds adequate to meet the same.

Comment

This Article creates the administrative agency which will administer the terms of this Compact after it becomes effective through ratification by the States and approval by the Congress. The provisions are similar to those adopted in a number of other interstate stream compacts.

The Article provides for three members for each of the signatory States as Commission members and staggers the terms of those members in order to insure some degree of continuity in its membership.

Subsection D defines a quorum and provides that each State shall have only one vote which represents the majority decision of each State in conducting the business affairs of the Commission.

Subsection E sets forth arbitration procedures for the Commission in the event of a tie vote on important matters. Arbitration is not to be compulsory but is provided in the event that some matter of extreme concern to one of the States requires such action.

Subsection F sets forth the procedure for paying the salaries and expenses of the Commissioners and costs incurred by the Commission in the administration of the Compact. This subsection together with Article IX(B)(5) creates a Compact fund which is essential to flexibility of operation. It also provides for auditing procedures and the report of such audit.

ARTICLE IX

Compact

A. The Commission shall have the power to:

(1) Employ such engineering, legal, clerical and other personnel as in its judgment may be necessary for the performance of its functions under this Compact;

(2) Enter into contracts with appropriate State or Federal agencies for the collection, correlation, and presentation of factual data, for the maintenance of records and for the preparation of reports;

(3) Establish and maintain an office for the conduct of its affairs;

(4) Adopt and procure a seal for its official use;

(5) Adopt rules and regulations governing its operations. The procedures employed for the administration of this Compact shall not be subject to any Administrative Procedures Act of either State, but shall be subject to the provisions hereof and to the rules and regulations of the Commission; provided, however, all rules and regulations of the Commission shall be filed with the Secretary of State of the signatory States;

(6) Cooperate with Federal and State agencies and political subdivisions of the signatory States in developing principles, consistent with the provisions of this Compact and with Federal and State policy, for the storage and release of

water from reservoirs, both existing and future within the Arkansas River Basin, for the purpose of assuring their operation in the best interests of the States and the United States;

(7) Hold hearings and compel the attendance of witnesses for the purpose of taking testimony and receiving other appropriate and proper evidence and issuing such appropriate orders as it deems necessary for the proper administration of this Compact, which orders shall be enforceable upon the request by the Commission or any other interested party in any court of competent jurisdiction within the county wherein the subject matter to which the order relates is in existence, subject to the right of review through the appellate courts of the State of situs. Any hearing held for the promulgation and issuance of orders shall be in the county and State of the subject matter of said hearing;

(8) Make and file official certified copies of any of its findings, recommendations or reports with such officers or agencies of either State, or the United States, as may have any interest in or jurisdiction over the subject matter. Findings of fact made by the Commission shall be admissible in evidence and shall constitute prima facie evidence of such fact in any court or before any agency of competent jurisdiction. The making of findings, recommendations, or reports by the Commission shall not be a condition precedent to instituting or maintaining any action or proceeding of any kind by a signatory State in any court, or before any tribunal, agency or officer, for the protection of any right under this Compact or for the enforcement of any of its provisions;

(9) Secure from the head of any department or agency of the Federal or State government such information, suggestions, estimates and statistics as it may need or believe to be useful for carrying out its functions and as may be available to or procurable by the department or agency to which the request is addressed;

(10) Print or otherwise reproduce and distribute all of its proceedings and reports; and

(11) Accept, for the purposes of this Compact, any and all private donations and gifts and Federal grants of money.

B. The Commission shall:

(1) Cause to be established, maintained and operated such stream, reservoir or other gaging stations as may be necessary for the proper administration of this Compact;

(2) Collect, analyze and report on data as to stream flows, water quality, annual yields and such other information as is necessary for the proper administration of this Compact;

(3) Continue research for developing methods of determining total basin yields;

(4) Perform all other functions required of it by the Compact and do all things necessary, proper or convenient in the performance of its duties thereunder;

(5) Establish and maintain the "Arkansas-Oklahoma Arkansas River Compact Fund," consisting of any and all funds received by the Commission under the authority of this Compact and deposited in one or more banks qualifying for the deposit of public funds of the signatory States;

(6) Prepare and submit an annual report to the Governor of each signatory State and to the President of the United States covering the activities of the Commission for the preceding fiscal year, together with an accounting of all funds received and expended by it in the conduct of its work;

(7) Prepare and submit to the Governor of each of the States of Arkansas and Oklahoma an annual budget covering the anticipated expenses of the Commission for the following fiscal year; and

(8) Make available to the Governor or any State agency of either State or to any authorized representative of the United States, upon request, any information within its possession.

Comment

Article IX sets forth the powers and duties of the administrative Commission. It provides the Commission with the necessary latitude and flexibility for carrying out the provisions and purposes of the Compact.

Subsection A enumerates the powers of the Commission while Subsection B sets out certain specific duties of the Commission. Other duties not specifically stated in Subsection B are implied in the inherent powers granted in Subsection A.

Subsection A(2) enables the Commission to obtain data which is important to the Commission's work and findings. Most of the data useful to the Commission will be gathered by other agencies. However, there could be times when necessary engineering or other data is not gathered by any other agency, and it might be desirable for the Commission to collect the data.

Subsection A(6) gives the Commission the power to cooperate directly and closely with Federal agencies in its administrative activities as they relate to interstate phases of project operation. This subsection deals with all types of storage and release of water whether it is under Federal or State control. Essentially it gives the Commission the power to manage the water resources of the Basin in the best possible manner.

In Subsection A(9) "secure" means that the Commission may obtain information, of whatever nature, by request or purchase if necessary, and is not intended to infer that the Commission will have the power to obtain such information by adverse means from any agency or such information as any agency is prevented by law from releasing. It is not the intent of the subsection that the Commission shall compete with other data collecting agencies of either State or Federal government, but rather that the Commission will utilize these available sources to the extent possible. It is necessary this Commission be given authority to do such work when it is not able to obtain needed information from other agencies due to budget or personnel limitations.

Subsections B(6) and (7) provide for annual reports and annual budgets to be submitted to the respective Governors of the signatory States and to the President of the United States, but sets no date for the submission of these reports. Therefore, it is incumbent upon the Compact Commission to set such a date in the rules and regulations of the Commission. This provides some flexibility in the preparation of the annual report permitting the date to be changed if and when it should become necessary.

All other subsections are self-explanatory.

ARTICLE X

Compact

A. The provisions hereof shall remain in full force and effect until changed or amended by unanimous action of the States acting through their Commissioners and until such changes are ratified by the legislatures of the respective States and consented to by the Congress of the United States in the same manner as this Compact is required to be ratified to become effective.

B. This Compact may be terminated at any time by the appropriate action of the legislature of both signatory States.

C. In the event of amendment or termination of the Compact, all rights established under the Compact shall continue unimpaired.

Comment

This Article affirms the rather obvious fact that no action can be taken to modify the provisions of the Compact without unanimous action of the States and until the changes are ratified by the legislatures and the Congress. It also recognizes the right to terminate by the appropriate action of the States, and the protection of vested rights in the case of such an event.

ARTICLE XI

Compact

Nothing in this Compact shall be deemed:

A. To impair or affect the powers, rights or obligations of the United States, or those claiming under its authority in, over and to the waters of the Arkansas River Basin;

B. To interfere with or impair the right or power of either signatory State to regulate within its boundaries the appropriation, use and control of waters within that State not inconsistent with its obligations under this Compact.

Comment

This Article is a general declaration whereby the States disclaim any intention of impairing or affecting the powers, rights, or obligations of the United States, as they apply to the Arkansas River Basin.

It clearly states that the Compact is not intended to interfere with or impair the rights or powers of either signatory State to regulate the waters within its own boundaries.

ARTICLE XII

Compact

If any part or application of this Compact should be declared invalid by a court of competent jurisdiction, all other provisions and applications of this Compact shall remain in full force and effect.

Comment

This Article is self-explanatory.

ARTICLE XIII

Compact

A. This Compact shall become binding and obligatory when it shall have been ratified by the legislature of each

State and consented to by the Congress of the United States, and when the Congressional Act consenting to this Compact includes the consent of Congress to name and join the United States as a party in any litigation in the United States Supreme Court, if the United States is an indispensable party, and if the litigation arises out of this Compact or its application, and if a signatory State is a party thereto.

B. The States of Arkansas and Oklahoma mutually agree and consent to be sued in the United States District Court under the provisions of Public Law 87-830 as enacted October 15, 1962, or as may be thereafter amended.

C. Notice of ratification by the legislature of each State shall be given by the Governor of that State to the Governor of the other State, and to the President of the United States, and the President is hereby requested to give notice to the Governor of each State of consent by the Congress of the United States.

IN WITNESS WHEREOF, the authorized representatives have executed three counterparts hereof each of which shall be and constitute an original, one of which shall be deposited with the Administrator of General Services of the United States, and one of which shall be forwarded to the Governor of each State.

DONE at the City of Tulsa, State of Oklahoma, this 3rd day of March, A.D., 19 72.

Comment

The Committee wishes to stress the importance of this Article. The utilization of the water resources of this Basin is in large part dependent upon storage facilities. Regulatory works are needed to control and to put the water to use. This area is a single unit within a larger area, the Arkansas-Red-White River Basins in which the pattern of development has been well established. It is now being and must in the future be achieved largely with the assistance and cooperation of the United States government. It is the hope of this Committee that there will be no need to exercise the consent authority which is sought in this Article. As a practical matter, however, should interstate litigation arise out of

the Compact or its application in which the United States is an indispensable party, no satisfactory solution can be reached unless the United States is made a party thereto.

The members of the Arkansas-Oklahoma Arkansas River Compact Committee agree March 3, 1972, that the foregoing statement expresses the intent of the Committee with regard to the draft of the Arkansas-Oklahoma Arkansas River Basin Compact dated November 25, 1969.

FOR ARKANSAS:

S. Keith Jackson
Committee Member

John Luce
Committee Member
(Alternate)

FOR OKLAHOMA:

Glade R. Kirkpatrick
Committee Member

Milton Craig
Committee Member
(Alternate)

Approved: Trigg Twichell
Trigg Twichell, Representative
United States of America

Attest: Willard B. Mills
Willard B. Mills, Secretary

ARKANSAS RIVER BASIN COMPACT

ARKANSAS-OKLAHOMA

APPENDIX I

Computation of Annual Yield

Article II J of the Arkansas River Compact - Arkansas-Oklahoma described "annual yield," which is a term basic to the allocations of this Compact. It refers to the runoff which would occur from any specified area under unaltered natural conditions - i.e., where there would be no artificial man-made depletions of or additions to the original supply and no regulation of that supply.

The only time this could be measured absolutely would be before any facilities to utilize, import or impound water were constructed; and before any of man's activities altered rainfall-runoff relations. Land management practices, while possibly significant for some areas, are difficult to evaluate and will be disregarded, at this time, in the computations to meet the requirements for the administration of this Compact. The accuracy of annual yield determinations will be dependent upon how accurately depletions, and their ratio to total water yield, can be computed. Fortunately, present depletions for most of the compact area are small in relation to the original yield and, until such time that additional developments are made, only reasonable estimates will suffice to assure that terms of the Compact are being met.

Basically, the determinations that are required are as follows: (1) the measurement or computation of the actual runoff from each of the several "sub-basins" as defined by the Compact for each water

year; (2) the computation of the corresponding total depletions and/or accretions in each of the respective sub-basins; (3) the sum of items (1) and (2) to obtain the "annual yield" for each basin; and (4) multiply item (3) by 100 minus the percent depletion allowed in Article IV of the Compact; and (5) compute deficiency, if any, by comparing item (4) with item (1). The following outlines procedures for computing each of these items:

Item 1. Reliable estimates to meet this requirement can be readily made for the several sub-basins on the basis of the existing (1970) stream-gaging stations. (See figure 1 for location of stations). All of the larger streams draining from the State of Arkansas into the State of Oklahoma are gaged in or near the stateline, and acceptable estimates for the total outflow from each sub-basin can be made on the basis of these records plus estimated flows from ungaged areas.

The computation of actual runoff from the Arkansas River Sub-basin will need to take into account both the inflow and outflow from the area. This computation can be made by application of the following equation:

$$Q_A = Q_V - [Q_M + Q_W + Q_2 + Q_3 + Q_4]$$

in which

Q_A = Total annual discharge originating from the Arkansas River Sub-Basin.

Q_V = Total annual discharge of the Arkansas River immediately below the mouth of Lee Creek presently measured at Van Buren gaging station.

Q_M = Total annual discharge of the Arkansas River immediately below the mouth of the Grand Neosho River, presently measured at the Muskogee gaging station.

Q_W = Total annual discharge of the Canadian River at Eufaula Dam, presently measured at Whitefield gaging station.

Q_2 = Total annual outflow from the Illinois River Sub-basin.

Q_3 = Total annual outflow from the Lee Creek Sub-basin.

Q_4 = Total annual outflow from the Poteau River Sub-basin.

Item 2. The total annual depletion in each sub-basin will be the sum of the following:

(a) Total stream diversions minus return flows.
(b) Depletions and/or accretions by major reservoirs.
(c) Evaporation losses from other than major reservoirs.
(d) Pumpage of ground water from alluvium aquifers.

The following comments relate to each of the above:

(a) Reliable data on this item are not generally available at this time but will need to be firmed up as development of the area's resources progresses. The principal items will be diversions for irrigation and for municipal and industrial water supplies. In the case of small irrigation uses, satisfactory estimates of consumption can be made on basis of acres and types of crops irrigated. Withdrawals for municipal and industrial uses are generally available but estimates of return flows may be necessary. So long as these diversions are small in relation to total runoff no high degree of accuracy will be required.

(b) Depletions caused by major reservoirs will probably be most significant. The depletion from such reservoirs for a given period will be the difference between inflow and outflow and can be determined from the following (all terms expressed in acre-feet):

The inflow, I, at damsite that would have occurred if reservoir had not been in place, can be computed by the following:

$$I = O \pm \Delta S + E + D - P + p,$$

in which

O = Outflow as measured at gaging station below dam, or from gate and spillway ratings.

ΔS = Change in storage volume at beginning and end of period.

P = Precipitation on reservoir surface.

p = Runoff that would have occurred from area covered by reservoir, computed by a derived rainfall-runoff factor, c times P, or cP.

E = Evaporation from reservoir surface.

D = Direct diversions from reservoir storage, not included in outflow; seepage from reservoir may also be a factor and, if not included in measured outflow as at gaging station below dam, should be estimated.

As the depletion is inflow minus outflow, this can be written:

$$I - O = -P + p \pm \Delta S + E + D.$$

(c) Evaporation from small lakes, such as those not designed for water supply, including flood-detention structures, farm ponds, and recreation lakes, may be estimated on basis of average water surface area and appropriate data from evaporation-pan records.

(d) Pumpage from stream alluviums may cause appreciable depletions in stream flow. This is not believed to be a factor at the present (1969) time, but could conceivably be in the future for some stream reaches.

CONCLUSION

The Arkansas River Compact Commission, with the assistance of a Technical Advisory Group, should include, as part of their annual

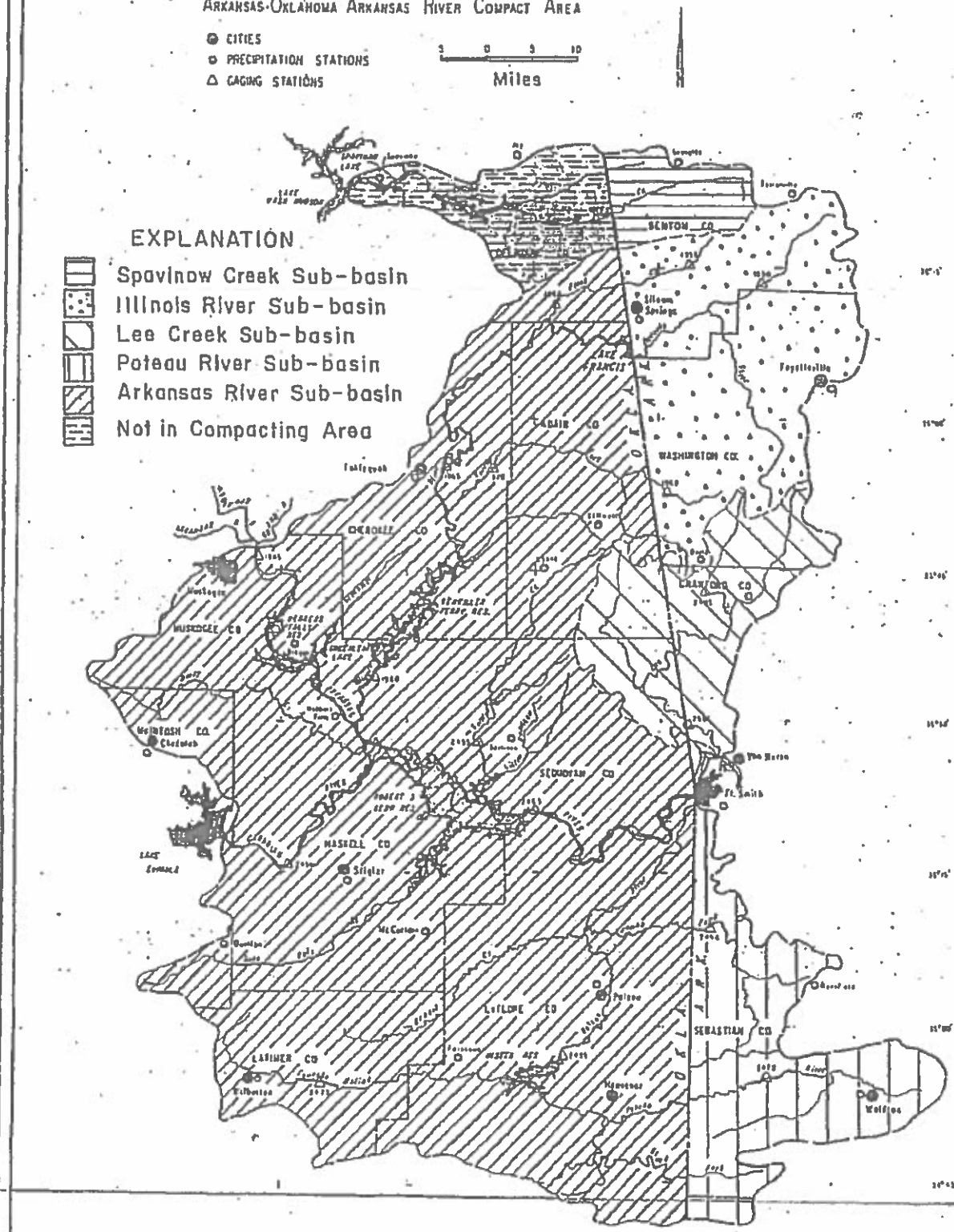
report, information on basin yields and depletions. Until such time as available data reveal that allocations between the States for any of the several sub-basins is in prospect of not being met, only generalized information will be adequate. As additional developments occur, the Commission should take steps to assure that the collection of basic data will be adequate to meet the needs of administration. As a minimum, the Commission should require the installation of instrumentation at such new reservoirs as will permit accurate determination of sub-basin inflow-outflow records.

Although allocations are to be based on annual yields, to be determined by December 31 of each year, current records will be required in the event provisions of Article V(B) need to be met, i.e., the delivery of sixty percent of current runoff to make up a deficiency.

The Commission should make continuing studies of the hydrology of the Basin for improvements or expansions in the collection of basic data as are needed to meet the changing needs for the administration of the Compact.

FIGURE 1

ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT AREA



Revised March 3, 1972
NOVEMBER 25, 1969

ARKANSAS-OKLAHOMA
ARKANSAS RIVER COMPACT COMMISSION

RULES, REGULATIONS AND MODES OF PROCEDURE

(As Amended September 25, 1985,
September 25, 1991, and September 24, 1993)

ARKANSAS-OKLAHOMA
ARKANSAS RIVER COMPACT COMMISSION

RULES, REGULATIONS AND MODES OF PROCEDURE

(As Amended September 25, 1985, September 25, 1991, September 24, 1993, and September 27, 2012)

ARTICLE I
THE COMMISSION

1.1 The "Commission" is the "Arkansas-Oklahoma Arkansas River Compact Commission" referred to in Article VIII of the Arkansas River Basin Compact, Arkansas-Oklahoma.

1.2 The credentials of each Commissioner shall be filed with both the Chairman and the Secretary of the Commission. When the credentials of a new Commissioner are received, the Secretary shall promptly notify all other Commissioners of the name and address of the new Commissioner.

1.3 Each Commissioner shall advise the Commission in writing of the address to which all official notices and other Commission communications shall be sent for their receipt and shall further promptly advise in writing the office of the Commission of any changes in address.

ARTICLE II
COMMISSION OFFICERS

2.1 The officers of the Commission shall be a Chairman, a Secretary and a Treasurer.

2.2 The Commissioner (or "alternate") representing the United States shall be the Chairman of the Commission. The Chairman shall preside at meetings of the Commission. His duties shall be those usually imposed upon such officers and as may be assigned by these rules or by the Commission from time to time.

2.3 The Secretary shall be selected by the Commission. The Secretary shall serve for the term, and shall perform the duties, as the Commission shall direct. In case of a vacancy in the office of the Secretary, the Commission shall select a new Secretary as expeditiously as possible.

2.4 The Treasurer shall be selected by the Commission. The Treasurer shall receive, hold and disperse all funds of the Commission which shall come into his hands, and shall furnish a fidelity bond in an amount satisfactory to the Commission. The cost of the bond shall be paid by the Commission.

2.5 As the Commission may determine and direct, the various Commission officer positions may be joined and simultaneously held by the same person.

ARTICLE III
PRINCIPAL OFFICE

3.1 The principal office of the Commission shall be the office of the Chairman or the Secretary, as the Commission shall direct.

3.2 All official files, books and records of the Commission shall be kept and maintained in the principal office of the Commission. All such files, books and records shall be open to inspection by the public at the principal office of the Commission.

ARTICLE IV
COMMISSION MEETINGS

4.1 The annual meeting of the Commission shall be held on the fourth Thursday in September of each year. By prior agreement of all Commissioners, the Commission may select and designate a different date for holding the annual meeting.

4.2 Special meetings of the Commission may be called by the Chairman at any time. Upon written request of a majority of the Commissioners of either of the signatory states setting forth the matters to be considered at a special meeting, it shall be the duty of the Chairman to call a special meeting. Notice of all special meetings shall be sent by the Secretary to all members of the Commission by ordinary mail at least ten days in advance of the meeting and such notice shall state the purpose thereof.

4.3 Emergency meetings of the Commission may be called by the Chairman at any time upon request of either signatory state. For purposes of this rule, an "emergency" situation, for which an emergency meeting may be called, is understood to mean a situation involving an imminent threat of injury to persons or injury and damage to public or personal property or threat of imminent financial loss when time requirements make prior notice procedures impractical and, if adhered to, would increase the likelihood of injury, damage or financial loss.

4.4 Except as otherwise provided herein, prior notice of all Commission meetings shall be given by the Secretary to all Commissioners. Such notice shall advise of the date, time and place of the meeting and shall include an agenda for the meeting or, as may be applicable, a statement of the purpose of or matters to be considered at the meeting. Upon receipt of such notice, it shall be the responsibility of the signatory state to, in-turn, furnish notice to the public in its state such as may be required or provided under the laws of that state. Except as may be otherwise required under the laws of a signatory state, no advance public notice shall be required for the calling and conducting of emergency meetings. At the earliest possible time following any emergency meeting, the public will be notified of any Commission action taken at the meeting.

4.5 Meetings of the Commission shall be held at such places as shall be agreed upon by the Commissioners.

4.6 Minutes of Commission meetings shall be made and preserved in a suitable manner. Until approved by the Commission, minutes shall not be official and shall be furnished only to members of the Commission, its employees and committees.

4.7 A majority of the Commissioners of each state, and the Commissioner (or alternate) representing the United States, must be present to constitute a quorum.

4.8 In taking any Commission action, each signatory state shall have a single vote representing the majority opinion of the Commissioners of that State. The Commissioner (or alternate) representing the United States shall not have the right to vote in any of the deliberations or actions of the Commission.

4.9 In the case of a tie vote on any of the Commission's determinations, orders, or other actions, a majority of the Commissioners of either state may, upon written request to the Chairman, submit the question to arbitration. Arbitration shall not be compulsory, but, in the event of arbitration, there shall be three arbitrators chosen as follows:

(1) One named by resolution duly adopted by the Arkansas Soil and Water Conservation Commission, or such other State agency as may be hereafter responsible for administering water law in the State of Arkansas; and

(2) One named by resolution duly adopted by the Oklahoma Water Resources Board, or such other State agency as may be hereafter responsible for administering water law in the State of Oklahoma; and

(3) The third chosen by the two arbitrators who are selected as provided above.

If the two arbitrators fail to select a third within sixty (60) days following their selection, then the third arbitrator shall be chosen by the Chairman of the Commission.

4.10 At each annual meeting of the Commission, the order of business, unless agreed otherwise, shall be as follows:

Call to Order;
Introductions and Announcements;
Approval of Agenda;
Reading, Correction and Approval of the Last Meeting;
Report of the Chairman;
Report of Secretary;
Report of Treasurer;
Report of Commissioners;
Report of Committees;

Unfinished Business;
New Business;
Adjournment.

4.11 All meetings of the Commission, except executive sessions, shall be open to the public. Executive sessions shall be open only to members of the Commission and such advisers as may be designated by each member and employees as permitted by the Commission; provided, however, that the Commission may call witnesses before it when in executive session. The Commission may hold executive sessions only for the purposes of discussing:

(1) The employment, appointment, promotion, demotion, disciplining or resignation of a Commission employee or employees, members, advisers, or committee members.

(2) Pending or contemplated litigation or litigation settlement offers, and matters where the duty of the Commission's counsel to its client, pursuant to the Code of Professional Responsibility, clearly conflicts with the public's right to know.

(3) The report, development, or course of action regarding security, personnel, plans, or devices.

No executive session may be held except on a vote, taken in public, by a majority of a quorum of the members present. Any motion or other decision considered or arrived at in executive session shall be voidable unless, following the executive session, the Commission reconvenes in public session and presents and votes on such motion or other decision.

ARTICLE V
COMMITTEES

*** 5.1 There shall be the following standing committees:
(a) Budget Committee;
(b) Engineering Committee;
(c) Environmental and Natural Resources Committee;
(d) Legal Committee.

*** 5.2 The Committees shall have the following duties:
(a) The Budget Committee shall prepare the annual budget and advise the Commission on all fiscal matters that may be referred to it.
(b) The Engineering Committee shall advise the Commission on all engineering matters that may be referred to it.
(c) The Environmental and Natural Resources Committee shall advise the Commission on all environmental and natural resource matters including: (1) the identification of common areas of environmental concerns and potential solutions to shared environmental and natural resource problems; (2) the promotion of environmental awareness and sustainable economic development; and (3) other environmental and natural resource matters that may be referred to it.

(d) The Legal Committee shall advise the Commission on all legal matters that may be referred to it.

5.3 Members of the standing committees shall be appointed by the Commission. The number of members of each committee shall be determined by the Commission. Each state shall be represented by an equal number of members on each committee with the Chairmanship for each committee alternating annually between the States of Arkansas and Oklahoma. Each state shall nominate the member or members representing the state to serve on each committee.

5.4 Formal committee reports shall be made in writing by the Chairman thereof, and shall be filed with the Commission at least ten days prior to the meeting scheduled for its discussion.

ARTICLE VI
RULES AND REGULATIONS

6.1 So far as is consistent with the Arkansas-Oklahoma Arkansas River Basin Compact, the Commission may adopt rules and regulations and may amend them from time to time. Amendments and/or revisions to the rules, regulations and modes of procedure may be made at any meeting of the Commission.

6.2 Rules and regulations of the Commission may be compiled and copies may be prepared for distribution to the public under such terms and conditions as the Commission may prescribe.

ARTICLE VII
FISCAL

7.1 All Commission funds shall be deposited in a depository, or depositories, designated by the Commission under the name of the "Arkansas-Oklahoma Arkansas River Compact Fund." Such funds shall be initiated and maintained by equal payments of each state into the fund.

**** 7.2 Disbursements of funds in the hands of the Treasurer shall be made by check signed by the Treasurer and another authorized signatory upon voucher approved by and reported to the Commission. All Commissioners are authorized signatories.

7.3 At each annual meeting of the Commission, the Commission shall adopt and transmit to the Governors of the two states the budget covering an estimate of its expenses for the following fiscal year. For purposes of this rule and requirement, the signatory states may individually assume and carry-out the responsibility of transmitting the Commission's adopted budget to that state's respective Governor.

** 7.4 All Commission receipts and disbursements shall be audited at least once every two years by a qualified independent certified public accountant to be selected by the

Commission, and the report of the audit shall be included in, and become a part of, the annual report of the Commission.

7.5 An up-to-date inventory of all Commission property shall be kept at the principal office of the Commission.

7.6 The fiscal year of the Commission shall begin July 1 of each year and end June 30 of the next succeeding year.

ARTICLE VIII
ANNUAL REPORT

8.1 The Commission shall annually make and transmit as soon as available to the Governors of the signatory states, and to the President of the United States, a report covering the activities of the Commission for the preceding fiscal year.

*** 8.2 The annual report shall include the following:

(a) Minutes of all regular, special or emergency meetings held during the year;
(b) All findings of facts made by the Commission during the preceding year;
(c) Recommendations for actions by the signatory states;
(d) Statements as to any cooperative studies made during the preceding year;
(e) All data which the Commission deems pertinent;
(f) The budget for current and future years;
(g) The most recent audit or financial statement of the Arkansas-Oklahoma Arkansas River Compact Fund;
(h) Name, address and phone number each Commissioner and each member of all standing committees;
(i) Such other pertinent matters as the Commission may require.

ARTICLE IX
MISCELLANEOUS

9.1 The Commission shall on request make available to the Governor of each of the signatory states any information within its possession at any time.

9.2 All contracts or other instruments in writing to be signed for and on behalf of the Commission, except matters related to the receipt or disbursement of funds, shall be signed by the Chairman when authorized by the Commission and attested to by at least one Commissioner from each State.

9.3 The Commission shall have the power to employ such engineering, legal, clerical and other personnel as in its judgment may be necessary for the performance of its functions under the Compact.

ARTICLE X

HEARINGS BEFORE THE COMMISSION

* **10.1(A)** As the Commission may determine and direct, the Commission may hold hearings for the purpose of taking testimony and receiving evidence for the identification of interstate problems within the purposes of this Compact and issuing such appropriate orders as it deems necessary for the proper administration of the Arkansas-Oklahoma Arkansas River Basin Compact. Any interested person or entity may make application to the Commission requesting that a hearing be held on any matter arising under, or otherwise within the purview of, the Compact, provided, such applications must meet the following requirements:

(a) The application must be in writing and filed with the Chairman, with a copy thereof being simultaneously furnished, by the applicant, to all Commissioners.

(b) The application must state and describe the identity and address of the applicant(s) and, where appropriate, the applicant's representatives in pursuit of the application; the interest of the applicant(s) in presenting the application and requesting that a hearing be held; the purpose, subject matter, issues, concerns and/or allegations sought to be entertained and considered through the hearing applied for; and, as may be appropriate to the purposes of the hearing sought, the relief or other official Commission action being requested through the hearing.

Unless determined and directed otherwise by the Commission, applications for Commission hearings shall be placed, for Commission review and consideration, on the agenda for the next regularly scheduled annual meeting of the Commission following the filing of the application. Applicant(s) shall be notified, in advance by the Chairman, of the date, time and place of the meeting at which the application will be considered and acted upon by the Commission.

10.1(B) All hearings shall be open to the public and may be scheduled and conducted as part of an annual or special meeting of the Commission or as may be determined otherwise by the Commission. The presiding officers at such hearings shall be one Commissioner from each state designated and appointed to serve as presiding officer by the respective state.

10.2 Orders of the Commission shall be enforceable upon the request of the Commission or any other interested party in any court of competent jurisdiction within the county wherein the subject matter to which the order relates is in existence, subject to the right of review through the appellate courts of the state of situs.

10.3 Any hearing held for the promulgation and issuance of orders shall be in the county and state of the subject matter of said hearing.

10.4 In the event the Commission directs that a hearing be held, all interested parties shall be afforded an opportunity to be heard after reasonable notice. Such notice shall include, among other matters deemed appropriate:

(a) A statement of the date, time, place, and nature of the hearing;
(b) A statement of the legal authority and jurisdiction under which the hearing is to be held;
(c) A reference to any particular matter or any statute and/or rules involved; and
(d) A short and plain statement of the matters asserted or which are the subject or purpose of the hearing.

If the Commission, or any other interested party, is unable to state the matters in detail at the time the notice is served, the initial notice may be limited to a statement of the issues. Thereafter, and upon application, a more definite and detailed statement shall be furnished.

10.5 A record of the hearing shall be kept and maintained and shall include:
(a) All pleadings, motions and intermediate rulings;
(b) Evidence received or considered;
(c) A statement of matters officially noticed;
(d) Questions and offers of proof, objections, and rulings thereon;
(e) Proposed findings and exceptions thereto;
(f) Any decision, opinion or report by the officers presiding at the hearing; and
(g) All staff memoranda or data submitted to the Commission in connection with their consideration of the matter before such hearing.

10.6 Findings of facts shall be based exclusively on the evidence and on the matters officially noticed by the Commission.

10.7 Oral proceedings or any part thereof shall be transcribed on request of any party and the cost of transcription shall be paid by the requesting party.

10.8 At its hearings, the Commission may admit and give probative effect to evidence which possesses probative value commonly accepted by reasonably prudent men in the conduct of their affairs. It shall give effect to the rules of privileged communications recognized by law. No greater exclusionary effect shall be given any such rule or privilege than would be obtained in an action in court. The Commission may exclude incompetent, irrelevant, immaterial and unduly repetitious evidence. Objections to evidentiary offers may be made and shall be noted in the record. Subject to these requirements, when a hearing will be expedited and the interest of the parties will not be prejudiced substantially thereby, any part of the evidence may be received in written form.

* 10.9 Documentary evidence may be received in the form of copies or excerpts if the original is not readily available. Upon request, the parties shall be given an opportunity to compare the copy with the original. The record of hearings may be held open for a reasonable length of time to afford either party time to submit additional written statements and/or evidence. An original and two copies (or three copies) of each document sought to be introduced into

evidence by a party at a Commission hearing must be presented to the officers presiding over the hearing by the party desiring and moving its admission.

10.10 A party may conduct cross-examination required for a full and true disclosure of the facts.

10.11 Notice may be taken of judicially recognized facts. In addition, notice may be taken of generally recognized technical or scientific facts within the Commission's specialized knowledge. Parties shall be notified, either before or during the hearing or be referenced in preliminary reports or otherwise, of the material noticed, including any staff memoranda or data, and they shall be afforded an opportunity to contest the material so noticed. The Commission's experience, technical competence and specialized knowledge may be utilized in the evaluation of the evidence.

10.12 In the case of hearings involving alleged or apparent violations of the Compact, the following procedures shall apply:

(a) If there is an alleged or apparent violation of the Compact, it should be made known to the Commission;

(b) Alleged violators shall submit an explanation for, or response to, the alleged violation to the Commission within thirty days of receipt of written notification of said violation from the Commission;

(c) The Commission shall refer the alleged violation to the Engineering and/or Legal Committee for investigation and review;

(d) After due investigation has been made, the Engineering and/or Legal Committee shall refer the matter to the Commission with recommendations concerning the action to be taken.

10.13 Any party shall at all times have the right to counsel, provided that such counsel must be duly licensed to practice law in one of the signatory States, or associated with an attorney thereof.

ARTICLE XI
PUBLICITY

11.1 Prior to the close of each meeting, the Chairman may draft a press release as directed by the Commission and submit it to the Commission for approval. All approved releases may be made available to the press by any member of the Commission.

11.2 The Commissioners shall not be restricted from participation in a press conference or interview, conducted at the request of a member of the press or other news media, but may not speak on behalf of the Commission without the prior approval of the Commission.

ARTICLE XII
POLLUTION

12.1 The Commission may provide a forum for the identification and discussion of pollution occurring in the Arkansas River Basin to the end that the signatory states will cooperate with each other and jointly encourage the maintenance of an active pollution abatement program in each of the two states.

12.2 The Commission shall encourage each individual state to take positive steps in the abatement of pollution identified by the Commission to exist in the Arkansas River Basin; provided however, neither state may require the other to provide water for the purpose of water quality control as a substitute for adequate waste treatment.

12.3 The Commission shall collect, analyze and report on data pertaining to water quality within the basin. For this purpose the Commission may enter into contracts as provided by Article IX A(2) to be approved at a Commission meeting. Unless formally approved by the Commission, no such report shall be published or have any validity.

*As amended at the annual meeting, September 25, 1985.
**As amended at the annual meeting, September 25, 1991.
***As amended at the annual meeting, September 24, 1993.
****As amended at the annual meeting, September 27, 2012.

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Little Rock, AR 72203

ARKANSAS-OKLAHOMA
ARKANSAS RIVER COMPACT COMMISSION

RULES, REGULATIONS AND MODES OF PROCEDURE

(As Amended September 25, 1985, September 25, 1991, September 24, 1993, September 27, 2012, and September 24, 2015)

ARTICLE I
THE COMMISSION

1.1 The "Commission" is the "Arkansas-Oklahoma Arkansas River Compact Commission" referred to in Article VIII of the Arkansas River Basin Compact, Arkansas-Oklahoma.

1.2 The credentials of each Commissioner shall be filed with both the Chairman and the Secretary of the Commission. When the credentials of a new Commissioner are received, the Secretary shall promptly notify all other Commissioners of the name and address of the new Commissioner.

1.3 Each Commissioner shall advise the Commission in writing of the address to which all official notices and other Commission communications shall be sent for their receipt and shall further promptly advise in writing the office of the Commission of any changes in address.

ARTICLE II
COMMISSION OFFICERS

2.1 The officers of the Commission shall be a Chairman, a Secretary and a Treasurer.

2.2 The Commissioner (or "alternate") representing the United States shall be the Chairman of the Commission. The Chairman shall preside at meetings of the Commission. His duties shall be those usually imposed upon such officers and as may be assigned by these rules or by the Commission from time to time.

2.3 The Secretary shall be selected by the Commission. The Secretary shall serve for the term, and shall perform the duties, as the Commission shall direct. In case of a vacancy in the office of the Secretary, the Commission shall select a new Secretary as expeditiously as possible.

2.4 The Treasurer shall be selected by the Commission. The Treasurer shall receive, hold and disperse all funds of the Commission which shall come into his hands, and shall furnish a fidelity bond in an amount satisfactory to the Commission. The cost of the bond shall be paid by the Commission.

2.5 As the Commission may determine and direct, the various Commission officer positions may be joined and simultaneously held by the same person.

ARTICLE III
PRINCIPAL OFFICE

3.1 The principal office of the Commission shall be the office of the Chairman or the Secretary, as the Commission shall direct.

3.2 All official files, books and records of the Commission shall be kept and maintained in the principal office of the Commission. All such files, books and records shall be open to inspection by the public at the principal office of the Commission.

ARTICLE IV
COMMISSION MEETINGS

4.1 The annual meeting of the Commission shall be held on the fourth Thursday in September of each year. By prior agreement of all Commissioners, the Commission may select and designate a different date for holding the annual meeting.

4.2 Special meetings of the Commission may be called by the Chairman at any time. Upon written request of a majority of the Commissioners of either of the signatory states setting forth the matters to be considered at a special meeting, it shall be the duty of the Chairman to call a special meeting. Notice of all special meetings shall be sent by the Secretary to all members of the Commission by ordinary mail at least ten days in advance of the meeting and such notice shall state the purpose thereof.

4.3 Emergency meetings of the Commission may be called by the Chairman at any time upon request of either signatory state. For purposes of this rule, an "emergency" situation, for which an emergency meeting may be called, is understood to mean a situation involving an imminent threat of injury to persons or injury and damage to public or personal property or threat of imminent financial loss when time requirements make prior notice procedures impractical and, if adhered to, would increase the likelihood of injury, damage or financial loss.

4.4 Except as otherwise provided herein, prior notice of all Commission meetings shall be given by the Secretary to all Commissioners. Such notice shall advise of the date, time and place of the meeting and shall include an agenda for the meeting or, as may be applicable, a statement of the purpose of or matters to be considered at the meeting. Upon receipt of such notice, it shall be the responsibility of the signatory state to, in-turn, furnish notice to the public in its state such as may be required or provided under the laws of that state. Except as may be otherwise required under the laws of a signatory state, no advance public notice shall be required for the calling and conducting of emergency meetings. At the earliest possible time following any emergency meeting, the public will be notified of any Commission action taken at the meeting.

4.5 Meetings of the Commission shall be held at such places as shall be agreed upon by the Commissioners.

4.6 Minutes of Commission meetings shall be made and preserved in a suitable manner. Until approved by the Commission, minutes shall not be official and shall be furnished only to members of the Commission, its employees and committees.

4.7 A majority of the Commissioners of each state, and the Commissioner (or alternate) representing the United States, must be present to constitute a quorum.

4.8 In taking any Commission action, each signatory state shall have a single vote representing the majority opinion of the Commissioners of that State. The Commissioner (or alternate) representing the United States shall not have the right to vote in any of the deliberations or actions of the Commission.

4.9 In the case of a tie vote on any of the Commission's determinations, orders, or other actions, a majority of the Commissioners of either state may, upon written request to the Chairman, submit the question to arbitration. Arbitration shall not be compulsory, but, in the event of arbitration, there shall be three arbitrators chosen as follows:

(1) One named by resolution duly adopted by the Arkansas Soil and Water Conservation Commission, or such other State agency as may be hereafter responsible for administering water law in the State of Arkansas; and

(2) One named by resolution duly adopted by the Oklahoma Water Resources Board, or such other State agency as may be hereafter responsible for administering water law in the State of Oklahoma; and

(3) The third chosen by the two arbitrators who are selected as provided above.

If the two arbitrators fail to select a third within sixty (60) days following their selection, then the third arbitrator shall be chosen by the Chairman of the Commission.

4.10 At each annual meeting of the Commission, the order of business, unless agreed otherwise, shall be as follows:

1. Call to Order;
2. Introductions and Announcements;
3. Approval of Agenda;
4. Reading, Correction and Approval of the Last Meeting;
5. Report of the Chairman;
6. Report of Secretary;
7. Report of Treasurer;
8. Report of Commissioners;
9. Report of Committees;

10. Unfinished Business;
11. New Business; and
12. Adjournment.

4.11 All meetings of the Commission, except executive sessions, shall be open to the public. Executive sessions shall be open only to members of the Commission and such advisers as may be designated by each member and employees as permitted by the Commission; provided, however, that the Commission may call witnesses before it when in executive session. The Commission may hold executive sessions only for the purposes of discussing:

(1) The employment, appointment, promotion, demotion, disciplining or resignation of a Commission employee or employees, members, advisers, or committee members;

(2) Pending or contemplated litigation or litigation settlement offers, and matters where the duty of the Commission's counsel to its client, pursuant to the Code of Professional Responsibility, clearly conflicts with the public's right to know; or

(3) The report, development, or course of action regarding security, personnel, plans, or devices.

No executive session may be held except on a vote, taken in public, by a majority of a quorum of the members present. Any motion or other decision considered or arrived at in executive session shall be voidable unless, following the executive session, the Commission reconvenes in public session and presents and votes on such motion or other decision.

ARTICLE V
COMMITTEES

*** 5.1 There shall be the following standing committees:
(a) Budget Committee;
(b) Engineering Committee;
(c) Environmental and Natural Resources Committee; and
(d) Legal Committee.

*** 5.2 The Committees shall have the following duties:
(a) The Budget Committee shall prepare the annual budget and advise the Commission on all fiscal matters that may be referred to it.
(b) The Engineering Committee shall advise the Commission on all engineering matters that may be referred to it.
(c) The Environmental and Natural Resources Committee shall advise the Commission on all environmental and natural resource matters including:
(1) the identification of common areas of environmental concerns and potential solutions to shared environmental and natural resource problems;
(2) the promotion of environmental awareness and sustainable economic development; and

(3) other environmental and natural resource matters that may be referred to it.

(d) The Legal Committee shall advise the Commission on all legal matters that may be referred to it.

5.3 Members of the standing committees shall be appointed by the Commission. The number of members of each committee shall be determined by the Commission. Each state shall be represented by an equal number of members on each committee with the Chairmanship for each committee alternating annually between the States of Arkansas and Oklahoma. Each state shall nominate the member or members representing the state to serve on each committee.

5.4 Formal committee reports shall be made in writing by the Chairman thereof, and shall be filed with the Commission at least ten days prior to the meeting scheduled for its discussion.

ARTICLE VI
RULES AND REGULATIONS

6.1 So far as is consistent with the Arkansas-Oklahoma Arkansas River Basin Compact, the Commission may adopt rules and regulations and may amend them from time to time. Amendments and/or revisions to the rules, regulations and modes of procedure may be made at any meeting of the Commission.

6.2 Rules and regulations of the Commission may be compiled and copies may be prepared for distribution to the public under such terms and conditions as the Commission may prescribe.

ARTICLE VII
FISCAL

7.1 All Commission funds shall be deposited in a depository, or depositories, designated by the Commission under the name of the "Arkansas-Oklahoma Arkansas River Compact Fund." Such funds shall be initiated and maintained by equal payments of each state into the fund.

**** 7.2 Disbursements of funds in the hands of the Treasurer shall be made by check signed by the Treasurer and another authorized signatory upon voucher approved by and reported to the Commission. All Commissioners are authorized signatories.

7.3 At each annual meeting of the Commission, the Commission shall adopt and transmit to the Governors of the two states the budget covering an estimate of its expenses for the following fiscal year. For purposes of this rule and requirement, the signatory states may individually assume and carry-out the responsibility of transmitting the Commission's adopted budget to that state's respective Governor.

** 7.4 All Commission receipts and disbursements shall be audited at least once every two years by a qualified independent certified public accountant to be selected by the Commission, and the report of the audit shall be included in, and become a part of, the annual report of the Commission.

7.5 An up-to-date inventory of all Commission property shall be kept at the principal office of the Commission.

7.6 The fiscal year of the Commission shall begin July 1 of each year and end June 30 of the next succeeding year.

ARTICLE VIII
ANNUAL REPORT

8.1 The Commission shall annually make and transmit as soon as available to the Governors of the signatory states, and to the President of the United States, a report covering the activities of the Commission for the preceding fiscal year.

*** 8.2 The annual report shall include the following:

(a) Minutes of all regular, special or emergency meetings held during the year;

(b) All findings of facts made by the Commission during the preceding year;

(c) Recommendations for actions by the signatory states;

(d) Statements as to any cooperative studies made during the preceding year;

(e) All data which the Commission deems pertinent;

(f) The budget for current and future years;

(g) The most recent audit or financial statement of the Arkansas-Oklahoma Arkansas River Compact Fund;

(h) Name, address and phone number of each Commissioner and each member of all standing committees; and

(i) Such other pertinent matters as the Commission may require.

ARTICLE IX
MISCELLANEOUS

9.1 The Commission shall on request make available to the Governor of each of the signatory states any information within its possession at any time.

9.2 All contracts or other instruments in writing to be signed for and on behalf of the Commission, except matters related to the receipt or disbursement of funds, shall be signed by the Chairman when authorized by the Commission and attested to by at least one Commissioner from each State.

9.3 The Commission shall have the power to employ such engineering, legal, clerical and other personnel as in its judgment may be necessary for the performance of its functions under the Compact.

ARTICLE X
HEARINGS BEFORE THE COMMISSION

* **10.1(A)** As the Commission may determine and direct, the Commission may hold hearings for the purpose of taking testimony and receiving evidence for the identification of interstate problems within the purposes of this Compact and issuing such appropriate orders as it deems necessary for the proper administration of the Arkansas-Oklahoma Arkansas River Basin Compact. Any interested person or entity may make application to the Commission requesting that a hearing be held on any matter arising under, or otherwise within the purview of, the Compact, provided, such applications must meet the following requirements:

(a) The application must be in writing and filed with the Chairman, with a copy thereof being simultaneously furnished, by the applicant, to all Commissioners.

(b) The application must state and describe the identity and address of the applicant(s) and, where appropriate, the applicant's representatives in pursuit of the application; the interest of the applicant(s) in presenting the application and requesting that a hearing be held; the purpose, subject matter, issues, concerns and/or allegations sought to be entertained and considered through the hearing applied for; and, as may be appropriate to the purposes of the hearing sought, the relief or other official Commission action being requested through the hearing.

Unless determined and directed otherwise by the Commission, applications for Commission hearings shall be placed, for Commission review and consideration, on the agenda for the next regularly scheduled annual meeting of the Commission following the filing of the application. Applicant(s) shall be notified, in advance by the Chairman, of the date, time and place of the meeting at which the application will be considered and acted upon by the Commission.

10.1(B) All hearings shall be open to the public and may be scheduled and conducted as part of an annual or special meeting of the Commission or as may be determined otherwise by the Commission. The presiding officers at such hearings shall be one Commissioner from each state designated and appointed to serve as presiding officer by the respective state.

10.2 Orders of the Commission shall be enforceable upon the request of the Commission or any other interested party in any court of competent jurisdiction within the county wherein the subject matter to which the order relates is in existence, subject to the right of review through the appellate courts of the state of situs.

10.3 Any hearing held for the promulgation and issuance of orders shall be in the county and state of the subject matter of said hearing.

10.4 In the event the Commission directs that a hearing be held, all interested parties shall be afforded an opportunity to be heard after reasonable notice. Such notice shall include, among other matters deemed appropriate:

(a) A statement of the date, time, place, and nature of the hearing;

(b) A statement of the legal authority and jurisdiction under which the hearing is to be held;

(c) A reference to any particular matter or any statute or rules involved; and

(d) A short and plain statement of the matters asserted or which are the subject or purpose of the hearing.

If the Commission, or any other interested party, is unable to state the matters in detail at the time the notice is served, the initial notice may be limited to a statement of the issues. Thereafter, and upon application, a more definite and detailed statement shall be furnished.

10.5 A record of the hearing shall be kept and maintained and shall include:

(a) All pleadings, motions and intermediate rulings;

(b) Evidence received or considered;

(c) A statement of matters officially noticed;

(d) Questions and offers of proof, objections, and rulings thereon;

(e) Proposed findings and exceptions thereto;

(f) Any decision, opinion or report by the officers presiding at the hearing; and

(g) All staff memoranda or data submitted to the Commission in connection with their consideration of the matter before such hearing.

10.6 Findings of facts shall be based exclusively on the evidence and on the matters officially noticed by the Commission.

10.7 Oral proceedings or any part thereof shall be transcribed on request of any party and the cost of transcription shall be paid by the requesting party.

10.8 At its hearings, the Commission may admit and give probative effect to evidence which possesses probative value commonly accepted by reasonably prudent men in the conduct of their affairs. It shall give effect to the rules of privileged communications recognized by law. No greater exclusionary effect shall be given any such rule or privilege than would be obtained in an action in court. The Commission may exclude incompetent, irrelevant, immaterial and unduly repetitious evidence. Objections to evidentiary offers may be made and shall be noted in the record. Subject to these requirements, when a hearing will be expedited and the interest of the parties will not be prejudiced substantially thereby, any part of the evidence may be received in written form.

* **10.9** Documentary evidence may be received in the form of copies or excerpts if the original is not readily available. Upon request, the parties shall be given an opportunity to compare the copy with the original. The record of hearings may be held open for a reasonable length of time to afford either party time to submit additional written statements ~~and~~/or evidence. An original and two copies (or three copies) of each document sought to be introduced into

evidence by a party at a Commission hearing must be presented to the officers presiding over the hearing by the party desiring and moving its admission.

10.10 A party may conduct cross-examination required for a full and true disclosure of the facts.

10.11 Notice may be taken of judicially recognized facts. In addition, notice may be taken of generally recognized technical or scientific facts within the Commission's specialized knowledge. Parties shall be notified, either before or during the hearing or be referenced in preliminary reports or otherwise, of the material noticed, including any staff memoranda or data, and they shall be afforded an opportunity to contest the material so noticed. The Commission's experience, technical competence and specialized knowledge may be utilized in the evaluation of the evidence.

10.12 In the case of hearings involving alleged or apparent violations of the Compact, the following procedures shall apply:

(a) If there is an alleged or apparent violation of the Compact, it should be made known to the Commission;

(b) Alleged violators shall submit an explanation for, or response to, the alleged violation to the Commission within thirty days of receipt of written notification of said violation from the Commission;

(c) The Commission shall refer the alleged violation to the Engineering and/or Legal Committee for investigation and review;

(d) After due investigation has been made, the Engineering and/or Legal Committee shall refer the matter to the Commission with recommendations concerning the action to be taken.

10.13 Any party shall at all times have the right to counsel, provided that such counsel must be duly licensed to practice law in one of the signatory States, or associated with an attorney thereof.

ARTICLE XI
PUBLICITY

11.1 Prior to the close of each meeting, the Chairman may draft a press release as directed by the Commission and submit it to the Commission for approval. All approved releases may be made available to the press by any member of the Commission.

11.2 The Commissioners shall not be restricted from participation in a press conference or interview, conducted at the request of a member of the press or other news media, but may not speak on behalf of the Commission without the prior approval of the Commission.

ARTICLE XII
POLLUTION

12.1 The Commission may provide a forum for the identification and discussion of pollution occurring in the Arkansas River Basin to the end that the signatory states will cooperate with each other and jointly encourage the maintenance of an active pollution abatement program in each of the two states.

12.2 The Commission shall encourage each individual state to take positive steps in the abatement of pollution identified by the Commission to exist in the Arkansas River Basin; provided however, neither state may require the other to provide water for the purpose of water quality control as a substitute for adequate waste treatment.

12.3 The Commission shall collect, analyze and report on data pertaining to water quality within the basin. For this purpose the Commission may enter into contracts as provided by Article IX, A(2) to be approved at a Commission meeting. Unless formally approved by the Commission, no such report shall be published or have any validity.

ARTICLE XIII
PROCEDURE FOR DISAGREEMENT ON CALCULATION OF ANNUAL YIELD*****

13.1 The Arkansas Natural Resources Commission and the Oklahoma Water Resources Board representatives of the Engineering Committee will calculate the annual yield using the following data:

- **(a)** Stream flows (USGS);
- **(b)** Precipitation on reservoir surface (USACE);
- **(c)** Evaporation from reservoir surface (USACE);
- **(d)** Diversions from streams (OWRB and ANRC);
- **(e)** Diversions from reservoir (USACE); and
- **(f)** Return flows (State's DEQ).

13.2 The most recent data available will be used for all calculations. Each state agency shall have free access to the other state agency's data. The states should review, investigate, and possibly include historical data and averages if current year reported data is significantly different from previous years. If there is disagreement regarding the data used in the

calculations, the agencies may schedule a conference call for clarification and resolution of the disagreement.

13.3. Current computation methods used to calculate the annual yield have been agreed to by both state agencies and are attached to these rules as A-1.

13.4 Any state proposing a change to the "Guidelines for the Computation of Annual Yields" for calculating the annual yield for a certain water year must bring the proposed change to the engineering committee for review. If the changes are deemed important enough to be included in the current year's report, the engineering committee members shall hold a conference call to discuss the topic. Prior to adopting the method for usage in the yield report, the engineering committee must agree upon a defined process for using the changed methodology to consistently obtain and calculate data.

13.5 Any grievances regarding the calculation of the annual yield should be presented to the Commission with supporting evidence.

*As amended at the annual meeting, September 25, 1985.
**As amended at the annual meeting, September 25, 1991.
***As amended at the annual meeting, September 24, 1993.
****As amended at the annual meeting, September 27, 2012.
*****As amended at the annual meeting, September 24, 2015.

A-1

ARKANSAS RIVER BASIN COMPACT

Guidelines for the Computation of Annual Yields

September 24, 2015

This document describes methods developed and approved by the Arkansas River Basin Compact Commission to compute the annual yields for the Spavinaw Creek, Illinois River, Lee Creek, Poteau River and Arkansas River Sub-basins of the Oklahoma-Arkansas River Compact.

General Description of Computation of Annual Yields

To compute annual yields for the Sub-basins identified above, one must take the following steps:

1. Determine the computation of actual runoff from each Sub-basin.
2. Determine the computation of total depletions or accretions in each of the respective Sub-basins.
3. Combine items (1) and (2) to obtain the "annual yield" for each basin.
4. Multiply item (3) by 100 minus the percentage of depletion allowed in Article IV of the Compact.
5. Compute deficiency, if any, by comparing item (4) to (1).

Items 1 and 2 are explained in this document, as these involve interpretation of the Compact, data collection and application of appropriate methods for computation of runoff, accretions, and depletions. Items 3 to 5 are not included herein as these are self-explanatory.

1. Computation of Actual Runoff from each Sub-basin

- The Engineering Committee will compute runoff data from the sub-basins using the areas defined by the Compact in Article II in accordance with Appendix I. Active USGS streamflow gauges should be used to retrieve measured runoff as available. Since most gauges are not located on the Oklahoma-Arkansas state border, estimates of runoff should account for the ungauged flows generated in the drainage area above or below the selected gauge.

  The Engineering Committee will adjust the runoff measured at the gauges for the Spavinaw Creek, Illinois River, Lee Creek, and Poteau River Sub-basins using simple linear interpolation, as follows:

$$R = R_M * \left[\frac{A_T}{A_G}\right] \qquad \textbf{(Eq. 1)}$$

Where,

R = Actual runoff at the OK-ARK state line

R_M = Measured runoff at the gauge

A_G = Contributing area at the gauge

A_U = Area ungauged above or below gauge

A_T = Total area including ungauged portion. Because water from these Sub-basins originates in the state of Arkansas, then:

- *If gauge is located on the Oklahoma side: $A_T = A_G - A_U$*
- *If gauge is located on Arkansas side: $A_T = A_G + A_U$*

The annual yields report should include a brief description of the procedure used to compute actual runoff (R) in these Sub-basins, and should also include the measured ungauged drainage areas used for such computation.

The Engineering Committee will use the following formula contained in Appendix I of the Compact to calculate runoff for the Arkansas River Sub-basin:

$$Q_A = Q_V - [Q_M + Q_W + Q_2 + Q_3 + Q_4] \quad \textbf{(Eq. 2)}$$

Where,

Q_A = *Total annual discharge originating from the Arkansas River Sub-basin.*
Q_V = *Total annual discharge of the Arkansas River immediately below the mouth of Lee Creek presently measured at the Van Buren gauging station.*
Q_M = *Total annual discharge of the Arkansas River immediately below the mouth of the Grand Neosho River, presently measured at the Muskogee gauging station.*
Q_W = *Total annual discharge of the Canadian River at Eufaula Dam, presently measured at Whitefield gauging station.*
Q_2 = *Total annual outflow from the Illinois River Sub-basin.*
Q_3 = *Total annual outflow from the Lee Creek Sub-basin.*
Q_4 = *Total annual outflow from the Poteau River Sub-basin.*

- The Engineering Committee will obtain data, as available, from the USGS website (http://waterdata.usgs.gov/nwis) for the following gauges (Table 1):

Table 1. Current USGS gauges used for Computation of Runoff at Sub-basins in the Compact Area

Sub-basin	USGS Gauges Required	Drainage Area (mi^2)
Spavinaw Creek	07191220 - Spavinaw Creek near Sycamore, OK	133
Illinois River	07195855 - Flint Creek near West Siloam Springs, OK	59.8
	07195500 - Illinois River near Watts, OK	635
	07196900 - Baron Fork at Dutch Mills, AR	41
Lee Creek	07249985 - Lee Creek near Short OK	420
Poteau River	07247015 - Poteau River at Loving, OK	269[a]
	07247250 - Black Fork below Big Creek nr Page, OK	74.4[b]
	07247250 – James Fork near Hackett, AR	147[c]
Arkansas River	07194500 - Arkansas River near Muskogee, OK	84,133
	07245000 - Canadian River near Whitefield, OK	37,876
	07250550 - AR River at J. W. Trimble L&D nr Van Buren, AR	151,000[d]

[a] Does not include 25.1 sq. miles of ungauged drainage.
[b] Does not include 13.0 sq. miles of ungauged drainage.
[c] Does not include 35.2 sq. miles of ungauged drainage.
[d] Includes 22,200 sq. miles of drainage area in Kansas that "probably is noncontributing".

Data obtained from the eleven (11) above listed gauges is sufficient to accurately compute actual runoff from the Sub-basins, but different gauges could be used for the computation of runoff.

- Review of the Poteau River Sub-basin indicates that there are large portions of runoff that originate in Arkansas but are not included in the gauging. Calculations should be completed to estimate the runoff for these areas using the following equation.

$$R_U = R_M * \left[\frac{A_U}{A_G}\right] \quad \textbf{(Eq. 3)}$$

Where,

R_U= Calculated runoff at the OK-AR state line from ungauged contributing streams

R_M = Measured runoff at the gauge

A_G = Contributing area at the gauge

A_U = Area contributing runoff for ungauged streams

- Actual runoff should be computed on an annual basis, and monthly values should be included in the annual yields report as appendices, instead of the daily time series that has been included in previous reports. Units should be consistent, preferably in acre-feet (AF). Flows from outside the Compact area should not be included in the computation of actual runoff, unless specified in the Compact. Article II of the Compact defines the drainage areas for each Sub-basin as waters originating in the Compact area. In previous reports, return flows from the White River Basin have been removed from the flow originating in the Arkansas River Basin since the water is being transferred in from another basin. The return flow data is obtained from the water departments of the cities of Fayetteville, Rogers, and Springdale, AR.

2. Computation of Total Depletions or Accretions in each of the respective Sub-basins

The total annual depletion in each Sub-basin will be the sum of the following: **(a)** Total stream diversions minus return flows, **(b)** Depletions and/or accretions by major reservoirs, **(c)** Evaporation losses from other than major reservoirs, and **(d)** Pumpage of ground water alluvium aquifers. Data sources and procedures suggested for computation of these items are described as follows:

a) Total stream diversions minus return flows

Diversions from the Oklahoma side of the Compact, i.e. the Arkansas Sub-basin and the Oklahoma portion of the Lee Creek Sub-basin, should be estimated using information from the Oklahoma Water Resources Board (OWRB). Likewise, diversions from the Arkansas side of the Compact should be obtained from the Arkansas Natural Resources Commission (ANRC). These agencies manage the surface water rights in their respective states, and can provide information on the type of uses, allocated amounts, annual reported use, and estimates of return flows. Values of annual diversions for each sub-basin should be included in the report, along with a brief description of the methods and assumptions used in the calculation of return flows.

b) Depletions and/or accretions by major reservoirs

The Compact defines depletion as the difference between the inflow and outflow, using the following equation:

$$I - O = -P + p \pm \Delta S + E + D$$

in which

***I - O** = Depletion in the reservoir.*

***P** = Precipitation on reservoir surface.*

***p** = Runoff that would have occurred from area covered by reservoir, computed by a derived rainfall-runoff factor c times P, or cP.*

***ΔS** = Change in storage volume at beginning and end of period*

***E** = Evaporation from reservoir surface.*

***D** =Direct diversions from reservoir storage, not included in outflow; seepage from reservoir may also be a factor, and if not included in measured outflow as at gauging station below dam, should be estimated.*

The Engineering Committee will obtain monthly data for the reservoirs of the Compact area from the USACE web page, at http://www.swt-wc.usace.army.mil/. Available data includes reservoir contents, as well as evaporation and precipitation measured over the reservoir surface.

- **Precipitation on reservoir surface (P)**

  The Engineering Committee will obtain monthly values of precipitation data measured over the lakes from the USACE webpage.

- **Runoff (p)**

  This component should be estimated as the product of precipitation (P) and a runoff coefficient. A runoff coefficient of 0.18 has been used since 1974 to determine the runoff quantity. It has been noted that the runoff coefficient value can vary depending on publications and that there is no way to know what existed in the area before the reservoirs were built. For these reasons it is agreed upon by the Engineering Committee to continue the use of 0.18 as the runoff coefficient since this is the value that has been used in all of the previous reports.

- **Change in Storage (ΔS)**

  Change in storage is defined in the compact as the *"Change in the storage volume at the beginning and end of a period"*, which for the water year would be computed as the difference between the contents at the end of the period (September 30th) minus the contents at the beginning of the period (October 1, previous calendar year).

- **Evaporation from reservoir surface (E)**

  The Engineering Committee will obtain monthly values of evaporation strictly measured over the lakes from the USACE webpage. Pan evaporation is used to estimate the evaporation from lakes. There is a correlation between lake evaporation and pan evaporation. Evaporation from a natural body of water is usually at a lower rate because the body of water does not have metal sides that get hot with the sun, and while light penetration in a pan is essentially uniform, light penetration in natural bodies of water will decrease as depth increases. Pan coefficients can vary depending on a number of different variables, including ground cover, levels of relative humidity, and 24 hour wind speed. Previous reports have used a pan coefficient of 0.70 for correlation between reservoir evaporation and pan evaporation.

  Further discussion as to the coefficient value that should be used is required by the engineering committee.

- **Direct Diversions from reservoir surface (D)**

  Direct diversions from reservoir storage, not included in the outflow, should be computed using information from the OWRB water rights database. Previous reports only used data from the USACE, but did not include details such as the type of use, the year of the data, and if any return flows had been included in the computation.

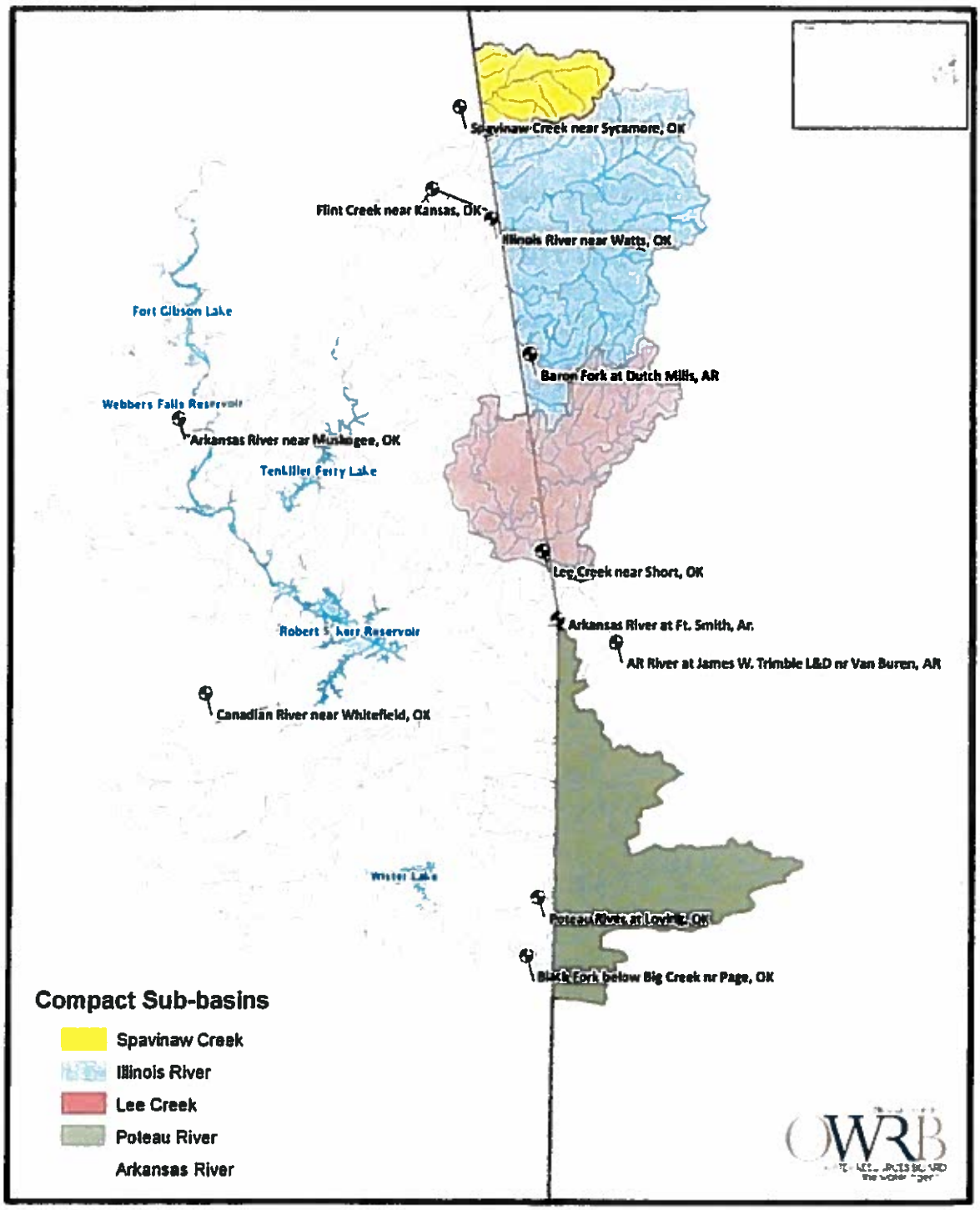
c) Evaporation losses from other than major reservoirs

This item has not been addressed in previous reports. The Compact states that *"Evaporation from small lakes, such as those not designed for water supply, including flood-detentions structures, farm ponds, and recreation lakes, may be estimated on basis of average water surface area and appropriate data from evaporation-pan records"* (Appendix I, Item 2).

Further discussion about the data sources and feasibility of including this item in the computation of depletions needs to be discussed by the Engineering Committee. Inclusion of this item in the computation of depletions will be determined by the Engineering Committee.

d) Pumpage of ground water from alluvium aquifers

This item has not been included in previous reports. The Compact states that *Pumpage from stream alluviums may cause appreciable depletions in the stream flow. This is not believed to be a factor at the present (1969) time, but could conceivably be in the future for some stream reaches"* (Appendix I, Item 2).



Oklahoma-Arkansas River Compact

Figure 1. Map of the Oklahoma-Arkansas River Compact Area