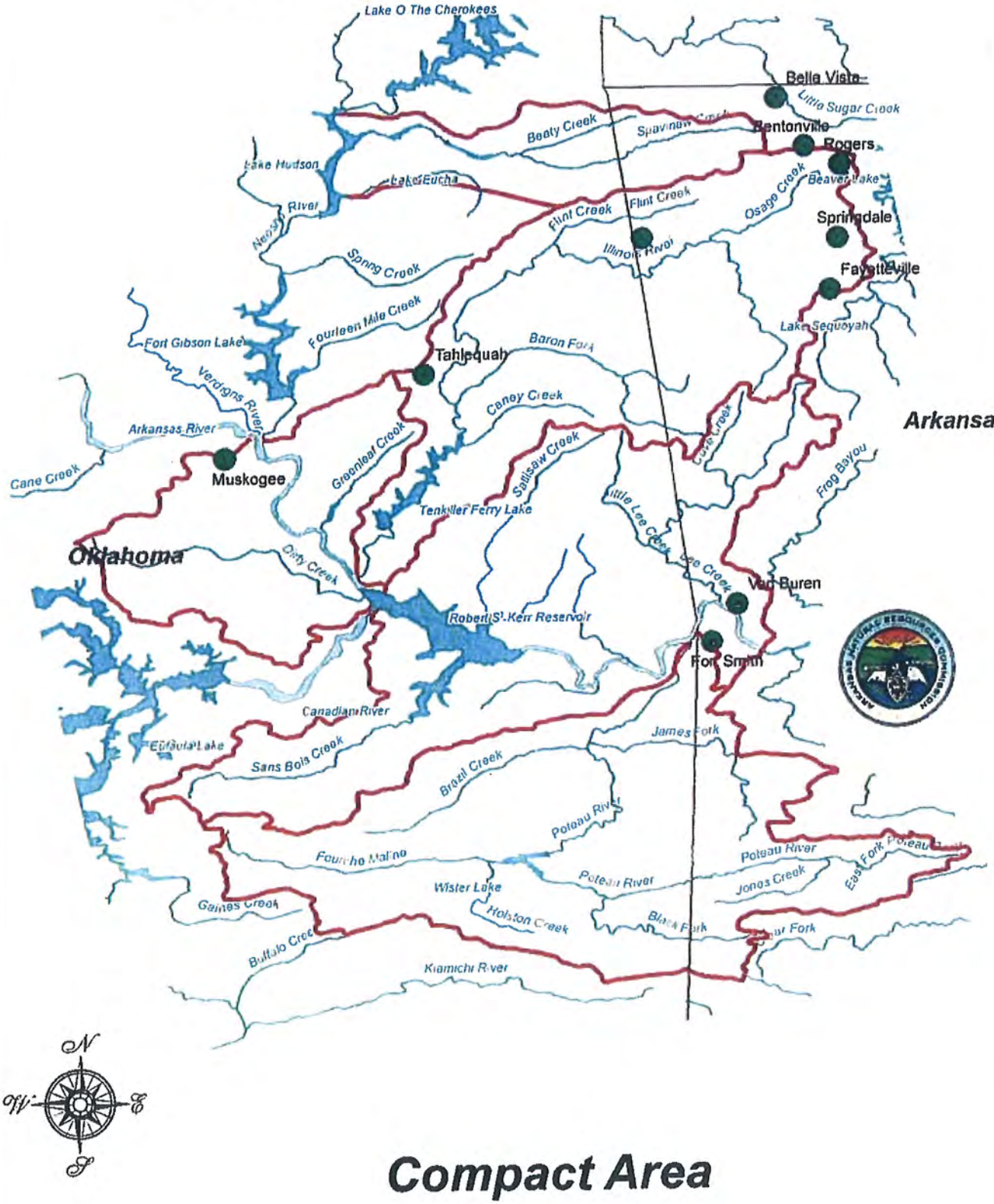
Arkansas River Compact Commission 2014 Report



Compact Area

Arkansas River Compact Commission

ARKANSAS NATURAL RESOURCES COMMISSION
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Little Rock, Arkansas 72201
(501) 682-1611 (501) 683-3991 fax
www.anrc.arkansas.gov

OKLAHOMA WATER RESOURCES BOARD
3800 North Classen Blvd.
Oklahoma City, Oklahoma 73118
(405) 530-8800 (405) 530-8900 fax
www.owrb.state.ok.us

September 25, 2015

The President
United States of America

The Honorable Mary Fallin
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 of the AOARC covering the activities of the Commission for 2014. A budget covering the anticipated expenses of the Commission for July 1, 2013 – June 30, 2014 is also included in the report.

The 2014 Annual meeting was hosted by the State of Arkansas, Reports of the Budget, Engineering, Environmental and Natural Resources, and Legal Committees were made along with the new committee assignments and appointments.

Respectfully submitted.

Delia Haak

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

DH/lab

AOARCC Annual Report 2014

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ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION
2014
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2.

AGENDA

ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION ANNUAL MEETING

October 30, 2014
9:00 AM

Embassy Suites Northwest Arkansas
3303 Pinnacle Hills Parkway
Rogers, AR 72758

A. Call to Order
B. Introductions and Announcements
C. Approval of Agenda
D. Approval of Minutes: September 2013
E. Report of the Chairman – Richard Seybolt, Federal Commissioner
F. Report of the Treasurer – Laura Brown
G. Report of the Commissioners
   1. Oklahoma
   2. Arkansas
H. Committee Reports
   1. Budget Committee
   2. Engineering Committee
   3. Environmental & Natural Resources Committee
      Steve Patterson: Lake Frances
   4. Legal Committee
I. Unfinished Business
J. New Business
   1. Appointments/Assignments to Committees and Selection of Chairs
      a. Budget Committee
      b. Engineering Committee
      c. Environmental & Natural Resources Committee
      d. Legal Committee
   2. Election of Officers
   3. 2015 Annual Meeting
K. Federal and State Government Representatives Reports
L. Public Comment
M. Adjournment

4.

MINUTES
of the
ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION
Regular Meeting

October 30, 2014
9:00 AM
Embassy Suites Northwest Arkansas
3303 Pinnacle Hills Parkway
Rogers, Arkansas 72758

A. CALL TO ORDER

Chairman and Federal Commissioner Richard C. Seybolt called the annual meeting of the Arkansas-Oklahoma Arkansas River Compact Commission (AOARCC) to order at 9:00 a.m. on Thursday, October 30, 2014, in Salons FGH of the Embassy Suites Northwest Arkansas at Rogers, Arkansas. Chairman Seybolt welcomed everyone to the meeting.

B. INTRODUCTIONS AND ANNOUNCEMENTS

Commissioners in attendance were Richard C. Seybolt, Federal Commissioner and Chairman; Oklahoma Commissioners J. D. Strong, Tyler Powell and Scott Thompson; Arkansas Commissioners Randy Young, Michael Menge, and Mike Carter. Chairman Seybolt asked for those in attendance to make self-introductions. (Attachment A.)

C. APPROVAL OF AGENDA

Chairman Seybolt asked for a motion to approve the agenda. There being no additions or deletions to the agenda. Commissioner J. D. Strong moved that the agenda be approved and Commissioner Michael Menge seconded. There was no discussion; the motion carried unanimously. (Attachment B.)

D. APPROVAL OF THE MINUTES - September 26, 2013

Chairman Seybolt stated that the minutes of the September 26, 2013 Annual Meeting had been distributed. Commissioner J. D. Strong approved the minutes of the meeting and Commissioner Randy Young seconded. There was no discussion; the motion carried unanimously.

E. REPORT OF THE CHAIRMAN - Chairman Seybolt saved remarks.

F. REPORT OF THE TREASURER

Treasurer Laura Brown referenced the 2014 Year-end Financial Report covering July 1, 2013 through June 30, 2014 detailing income and expenses. The beginning balance was $123,888.53 with total income $503,715.90 and total expenses $6,041.53 for a net total of $497,674.37.

The bank balance June 30, 2014 was $621,523.83, and the Certificate of Deposit balance June 30, 2014 was $11,021.28 for a total of $632.545.11. The bank balance September 30, 2014 was $610,715.52 and the Certificate of Deposit balance was $11,021.28 for total assets of $612,736.80. (Attachment C.)

Commissioner Randy Young made a motion to accept the Treasurer's Report and Commissioner J. D. Strong seconded. There was no discussion; the motion carried unanimously.

G. REPORT OF THE COMMISSIONERS

Oklahoma: Commissioner J. D. Strong presented the report for the State of Oklahoma. He advised that the drought continues in the fourth year. Dire situations prevail, particularly in western Oklahoma, as cotton farmers have not been able to raise cotton the last four years. The Water for 2060 activities is helped greatly by work on conservation reuse and recycling. A few grants provided by the legislature will assist the one and one-half million drought stricken communities; grant applications are due in November. The Oklahoma Water Resources Board and Oklahoma Department of Environmental Quality (ODEQ) are partnering to work with communities across the state to develop long term (drought proof) planning. The Water for 2060 Advisory Council has one year remaining to craft recommendations on meeting the goal of consuming no more fresh water in 2060 than consumed in 2010 (legislative goal in the 2060 Act.) That initiative is focused on water conservation, reuse, recycling, and water desalination practices; all are alternatives to consuming/using fresh water to meet Oklahoma's needs.

The latest instream flow work group coordinated by Mr. Smithee is looking at the protection of fish and recreation flows in Oklahoma's streams. Oklahoma is preparing to launch a pilot study in the Illinois River watershed in coordination with Mr. Fite and the Scenic Rivers Commission. Numerous technical studies for both monitoring ground water and stream water basin models are necessary to effectively allocate water. Litigation recently began over the ground water basin maximum release and annual yield in the Arbuckle Simpson Aquifer. The Garber Wellington study which is in Central Oklahoma was

recently completed. Mr. Smithee's staff has worked with water quality and the Grand River Dam Authority (GRDA) in Grand Lake and Monkey Island - helping maintain compliance with Federal Energy Regulatory Commission (FERC) requirements on chronic low dissolved oxygen "DO" problems below the dam. The staff has worked with GRDA to develop a real time monitoring system that alerts them of low DO levels and allows modification to dam operations; thereby the levels are raised preventing fish kills downstream. Mr. Smithee's staff continues to contract with GRDA to help meet water quality needs in the Grand River System.

Beneficial Use Monitoring Program – Mr. Smithee's staff was able to report the results of the first full year of comprehensive ground water monitoring as a result of additional appropriations. A good comprehensive ground water monitoring program did not previously exist to match the surface water monitoring. The additional appropriations in 2012 enabled a comprehensive groundwater quality and quantity monitoring program using a network of monitoring sites around the state; the results of the first year are in a final report on Oklahoma Water Resources Board (OWRB) website for the BUMP Program – both surface and groundwater. It was great work with a lot of effort put into the program.

Financing – Commissioner Strong advised that the results of the financial assistance program can be found on Page 6. His office collaborated with ODEQ through loans, clean water SRF and drinking water SRF for over three billion dollars financed at a savings of more than one billion dollars in interest to customers. A triple AAA rated program continues as a result of State Question 764 (passed 2012), a pledge of the State's credit to back the loan program.

The Dam Safety and Flood Plain Management Programs – This program keeps Mr. Sugeng busy and continues to take limited funds to provide breeching inundation maps for high hazard potential dams at no cost to the owners.

Legal matters – Negotiations/mediations with the tribes in Oklahoma City continue; he hoped soon to report a successful conclusion to the lawsuit and avoid further litigation.

There being no further comments by the Oklahoma Commissioners, he thanked the chairman. (Attachment D.)

Arkansas: Commissioner Randy Young presented the report for the State of Arkansas. Commissioner Young stated he would focus on two items. The first item relates to the Non-point Program that addresses impacts to water quality from nonpoint sources. A number of projects in the Illinois River Basin are highlighted. The second item was the progress to date on the Arkansas Water Plan. He advised he was happy to say the plan is on schedule,

within budget and to be completed this year. The technical committee meeting (review comments) is scheduled for November 4 in Little Rock. The Arkansas Natural Resources Commission will address the comments submitted on November 5. Hopefully, the Commission will take action at its December meeting to initiate formal rulemaking in order to adopt the Arkansas Water Plan. The one contentious issue in the plan is in regard to the Commission's ability to issue non-riparian water right permits to use excess surface water. The law currently authorizes the Commission to do that after in-stream needs and minimum stream flows are set and the amount of excess water is quantified. The law arbitrarily limits permits to 25% of what is truly excess water. One of the recommendations in the plan is to remove that arbitrary limitation while many folks want to leave it as it is.

Chairman Seybolt asked if this was a statewide issue or limited to specific rivers or streams and Commissioner Young explained it was statewide; the calculations for determining excess water are on a hydrologic basis. Environmentalists may be less concerned about east Arkansas than west Arkansas as it has heavy areas of irrigation. He was not sure if the Commission would address that issue from a regional standpoint. No further comments were made by the Arkansas commissioners. (Attachment E.)

H. COMMITTEE REPORTS

Budget Committee: Mr. Edward Swaim presented the Budget Committee Report. He explained that there were no recommended changes to the normal budget items; however the budget was titled "Corrected". It was found that the item "Stream Gaging" was inadvertently left off the previously printed budget. It has been re-entered and the committee recommends it be paid in FY 2015 and 2016.

Commissioner Young asked for the rationales as to why the Compact should pick up the costs.

Commissioner Strong advised that there was money built into the budget and approved the Commission to pay the non-federal share of the state-line gauge on the Arkansas River. Payment is tentatively considered on a yearly basis without depleting the budget surplus.

Mr. Smithee pointed out that $600,000 in the budget is encumbered for the stressor study and not available.

Ms. Julie Cunningham stated the budget line item description for "Stream Gaging" was simply missed when the "Stressor Response Study" was added.

Mr. Smithee noted that since Oklahoma did not send a timely bill to the Compact Commission it was forgotten. The Commission paid the bill in 2012, and the Oklahoma Water Board paid it in 2013.

Commissioner Young made a motion to accept the budget with corrections to reflect stream gaging expenses for FY 2014 at $6,550 and FY 2015 at $6,300 (total $12,850 paid in FY 2015) and $6,300 in FY 2016. Commissioner Strong seconded the motion. Chairman Seybolt called for the vote and the motion carried unanimously. (Attachment F.)

Engineering Committee: Mr. Ken Brazil advised that the Engineering Committee had been directed to look at the annual compliance report and transition from a third party to an in-house process in light of the development of an automated system. He presented a draft format of a streamlined and straight-forward compliance report. He advised that Page 2 references annual yield for each of the sub-basins; no deficits were identified in Water Year 2013. All the actual enforcement requirements were met with no problem to annual yields. The additional tables in the report are of interest to the compact yearly. The appendix serves as documentation for the computations. The Engineering Committee was presenting the draft to the Compact as a recommended format.

Commissioners Strong and Young advised they liked the report. Commissioner Young asked about the accuracy of the information.

Brian Breaker, USGS, advised the work achieved a 95% confidence level and explained it was derived from individual gauges and readings from high flow and discharges. Measurement methods are checked and reviewed in their own centers and then on a regional/national scale.

Commissioner Young requested the accuracy information be included in the report. He asked Ken Brazil what action was being requested.

Ken Brazil advised that the committee was satisfied with the process to calculate the tables, etc.

Commissioner Carter referenced Page 9 "Pumpage of ground water from alluvium aquifers" and Ken advised it was not included in the calculations at this point in time.

Commissioner Young asked if Mr. Lamb was to review the report and Mr. Brazil advised that he was not able to establish communications with Mr. Lamb since springtime at which time he had agreed to review the report. Mr. Brazil would continue to try to make contact with Mr. Lamb and ask he review and verify the results for this year.

Ms. Cunningham advised that the Engineering Committee utilized the USGS workbook that generates the data automatically. Information on citations could be included with report accuracy information.

Commissioner Young made a motion to accept the report to reflect the Commission's desire to use the format in future calculations subject to a positive review by Mr. Lamb within a six-month time period. Commissioner Strong seconded the motion. There was no further discussion; the motion carried unanimously.

Mr. Brazil clarified that future reports would include information on confidence level; gage calibration dates; and a section on citations from which the data is pulled. Future Water Quality Reports will come from the Environmental Committee as requested by the Commission.

Mr. Brazil advised that the gage in the Arkansas River was previously discussed in the Budget Committee. There being no further questions, Mr. Brazil concluded the Engineering Committee's Report. (Attachment G.)

Environmental Committee: Mr. Ken Brazil advised there were several issues to report: The Illinois River Water Quality Monitoring; the Stressor Response Study; and the assignment to report on nutrient reduction trends in the Illinois River watershed.

Mr. Brazil advised that there was more water reported this year than the previous year in the Illinois River Watershed. Overall there seems to be downward trends at all of the stations reported in Arkansas. Ms. Chambers would report on the trends in more detail.

Commissioner Carter referenced the report and asked for clarification on the trend for Sager Creek and for total loading.

Mr. Brazil clarified that base loading was significantly larger prior to the implementation of the Siloam Springs waste water treatment plant in 2011.

Ms. Julie Chambers advised that Oklahoma also had an increased flow for calendar year 2013. The report is streamlined and uses the same format as Arkansas. The bar chart shows a five-year rolling low and individual reduction goals are on one page. There is a downward trend toward .037 mg/l.

Commissioner Young stated the report was much more meaningful.

Ms. Chambers advised that the Flint Creek Station was Oklahoma's equivalent to Sager Creek and would require more work.

Commissioner Carter asked if Siloam Springs/West Siloam were included in the chart as there is considerable growth in the area and a casino is expected to be built.

Derek Smithee summarized that Ms. Chambers' report addressed four questions for Oklahoma: (1) Where is Oklahoma and what the trend is; (2) Compliance with the 40% reduction; (3) Achieving the .037mg/L standard; and (4) What else is going on in the compact area that might be of interest regarding impairments, clean lake studies, monitoring, special studies, etc.

Ms. Chambers concurred, adding that her report addressed the Illinois River Basin as well as the Compact area. (Attachment H.)

Chairman Seybolt stated the report was very good and easy for him to understand. Commissioner Strong said the report was great news showing progress and good work effort in content and results on the part of both Arkansas and Oklahoma.

Commissioner Young asked if there was information on the Illinois River total maximum daily load (TMDL) and Ms. Chambers replied there was not.

Commissioner Carter inquired as to impairments on the Poteau River and was advised this would be determined by a TMDL from the Oklahoma Department of Environmental Quality (ODEQ).

Commissioner Young asked if nutrient trading was considered in Oklahoma.

Mr. Derek Smithee stated it was only advantageous when impairment was in play. It is difficult to quantify nutrient reductions in the nonpoint source community and translate that into a National Pollutant Discharge Elimination System (NPDES) permit. It is

necessary to document empirical net reductions at the end of the day. It was on the radar screen but they had not found an elegant way to do it.

Commissioner Young asked to be informed if they implemented nutrient trading.

Mr. Smithee advised that there was interest in the Scenic River Joint Study Committee. The State of Oklahoma promulgated the .037 mg/L phosphorus criteria for all six of the scenic rivers in early 2000 with an amendment that it be fully implemented by 2012. Arkansas and Oklahoma jointly brought up a second statement of principles and actions that direct both states to form a technical study team called the "Scenic River Joint Study Committee" to determine if the .037 mg/L is scientifically sound and an accurate criterion for total phosphorus - specifically on Oklahoma's six scenic rivers. If the number is found between .027 - .047 mg/L, the number is acceptable. Less than .027 or greater than .047mg/L Oklahoma will promulgate number changes. The Governors in each state assigned: Derek Smithee, Shelly McClary with ODEQ and Shannon Phillips with Conservation Commission for Oklahoma; Marty Matlock, Thad Scott and Brian Haggard with the University of Arkansas for Arkansas. They met to determine the threshold response of total phosphorus and algae production, and put together a work plan. The AOARCC is the bank for this work; $600,000 was put into the study fund. Dr. Ryan King of Baylor University was hired; he is a nutrient expert in the United States. The work plan was refined by Dr. King and his team and they have completed the first three of 20 individual sampling events. They are focusing on Flint Creek, the Illinois River, and the Barren Fork with some focus on Lee Creek, Little Creek and the Upper Mountain Fork. Co-chairs are Brian Haggard in Arkansas and Derek Smithee in Oklahoma. The next official meeting, required by the agreement, will be public and it is scheduled for April 14 in Tahlequah.

Ed Fite added that they will be looking at reference reach streams: Neosho, Spavinaw, Spring Creek, and Saline Creek. There are a total of 34 sites to cover in 24 months.

Steve Patterson: Lake Frances

Mr. Patterson thanked the Commission for allowing him to make a presentation on future ecological alternatives being explored for Lake Frances. He advised that three ideas have come out of a workshop held at the University of Arkansas and co-organized by Brian Haggard.

(1) Build a paddling bypass around the dam for kayaks and fish.

(2) Treat the lake with alum (or other flocculent) that improves water quality as phosphorus binds with aluminum in alum and that contains algae growth. One concern (and enough studies have not been done) is that as the phosphorus decreases coming out

of the watershed as it is possible the sediments would increase phosphorus because phosphorus is an equilibrium concentration.

(3) Take the old lake bottom out and build constructed wetlands that treat the Illinois River Water. This would cause a drop in sediments and take out some of the nutrients. At this point there is a lot of interest but no entity has stepped forward to take the lead and fund it.

Mr. Patterson distributed "Ecological Design in the Ozarks May 15-17, 2013, Workshop and Lake Frances Charrette, Arkansas Water Resources Center/Technical Publication MSC 369"; view or download at: http://www.uark.edu/depts/awrc/pubs_msc.html.

Commissioner Thompson asked what it cost to treat Lake Wister. Mr. Patterson advised $100,000 to treat 100 acres. He explained that made an immediate 80% reduction in bacteria. This is a temporary benefit for water resources and may need to be repeated over several years.

Legal Committee: Crystal Phelps stated the Legal Committee had one assignment which dovetails with the Engineering Committee's assignment. The Commissioners approved the new format for showing data as well as the procedures to formulate the calculations of that data by the Engineering Committee. The Legal Committee's assignment was to finalize procedures for resolving disputes regarding these calculations and offer compact rule amendments for 2015. The committee will also offer proposed rule amendments to that effect.

I. **Unfinished Business:** – None

J. **New Business:** Chairman Seybolt advised that Oklahoma would host the 2015 meeting. Committees and Chairs will be:

Budget Committee – Julie Cunningham, Edward Swaim
Engineering Committee - Julie Cunningham, Ken Brazil
Environmental & Natural Resources Committee – Derek Smithee, Ken Brazil
Legal Committee – Sarah Gibson, Crystal Phelps

Commissioner Strong made a motion to appoint members to the Budget, Engineering Environmental and Legal Committees; Mr. Menge seconded the motion. There was no discussion; the motion carried unanimously.

Election of Officers – Vice Chairman, Secretary, and Treasurer
Commissioner Thompson made a motion to appoint J.D. Strong, Vice chairman, Mary Schooley, Secretary, and Laura Brown Treasurer; Commissioner Strong seconded. There was no discussion; the motion carried unanimously.

Chairman Seybolt proposed that the 2015 Annual Meeting be held at Grand Lake, Oklahoma.

K. FEDERAL AND STATE GOVERNMENT REPRESENTATIVE REPORTS

Mr. Jayson Funkhouser, USGS, presented the 2014 report and advised he was representing both Arkansas and Oklahoma. Oklahoma has no new gages as it pertains to Compact stations. They do perform additional water quality sampling in the Basin but not as it relates to the Compact sites. Arkansas is in the same situation with no new changes to the gages or the sampling program. Arkansas invited a colleague from New York to establish surrogate information, utilizing fulltime turbidity meters to determine relationships with sediment and nutrients on one of several Osage Creek sites in NW Arkansas.

L. PUBLIC COMMENT: There was no public comment.

Chairman Seybolt thanked the committees for their work to standardize formats in the reports.

Commissioner Young thanked Chairman Seybolt for his hospitality.

M. ADJOURNMENT: There being no further business, Chairman Seybolt thanked all in attendance and adjourned the meeting at 10:55 AM.

Delia Haak — 9-24-15

Dr. Delia Haak
Federal Commissioner and Chairman — Date

Laura Brown — 9-18-15

Laura Brown
Secretary/Treasurer — Date

MEETING SIGN-IN SHEET

Project: Arkansas Oklahoma Arkansas River Compact Commission	**Meeting Date: October 30, 2014 9:00 AM**
Facilitator	**Place/Room - Embassy Suites, Rogers, AR**

NAME	REPRESENTING	PHONE	MAILING ADDRESS	E-MAIL
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Scott Thompson	ODEQ	405 702 7161	707 N Robinson Oklahoma City OK	Scott.thompson@deq.ok.gov
J.D. Strong	OWRB	405/530 8800	3800 N. Classen OKC, OK 73118	jd.strong@owrb.ok.gov
Dick Seybolt		620-423 2916	56281 E-306 RD Monkey Island 74331	dseybolt@ediinet.Cotech.com
Randy Young	ANRC	501 682 1611	101 East Capitol 5350 LR, Ar 72201	randy.young@arkansas.gov
Michael Menge	Commission	479 331-2821	172 Menge Drive Dover, AR 72837	themenges@Reagan.com
Mike Carter	ANRC & Commission	479 883 -0849	3500 Cliff Drive Fort Smith, Ar 72903	mcarter@stephenspllc.com

MEETING SIGN-IN SHEET

Project: AOARCC Meeting

Meeting Date: October 30, 2014 9:00 AM

Place/Room - Embassy Suites, Rogers, AR

NAME	REPRESENTING	PHONE	MAILING ADDRESS	E-MAIL
Mike Carter	ANRC			
Lorri Hardin	ODAFF	405 637-0781	Rt 2 Box 288 Stilwell OK 74960	lorri.hardin@oag.ok.gov
Edward Swaim	ANRC			
Len Brazil	ANRC			
Derek Smithee	OWRB			Derek.Smithee@owrb.ok.gov
Steve Patterson	Biotx Design	918-839-7084	spatterson@biotxdesign.com	
Brian Breaker	USGS	5015535367	401 Hardin Rd LR AR	bbreaker@usgs.gov
M.L. Menge	Commission	479-331-2821	172 Menge Rd Dover AR	
Randy Young	ANRC	5016821611		
Crystal Phelps	ANRC	501		
Stephanie Burchfield	ADH	(501) 280-4428		Stephanie.Burchfield@arkansas.gov
Yohanes Sugeng	OWRB	405 530 8800		yohanes.sugeng@owrb.ok.gov
Sara Gibson	OWRB	405 530 8800		sara.gibson@owrb.ok.gov

MEETING SIGN-IN SHEET

Project: AOARCC Meeting

Meeting Date: October 30, 2014 9:00 AM

Place/Room - Embassy Suites, Rogers, AR

NAME	REPRESENTING	PHONE	MAILING ADDRESS	E-MAIL
Julie Chambers	OWRB	530-8800	3800 N Classen, OKC, OK	julie.chambers@owrb.ok.gov
Ellen Carpenter	ADEQ	501/682-0655		carpenter@adeq.state.ar.us
Frank Leone	USFWS	877/867-7577		
Julie Cunningham	OWRB	405 530-8800		julia.cunningham@owrb.ok.gov
ED FITE	OSRC	9184563251	PO Box 292 TAHLEQUAH OK 74465-0292	ed.fite@osrc.ok.gov
Jaysson Funkhouser	USGS	501 663 663		jefunkho@usgs.gov
Don Richardson	ANRC	501-592-1341	267 Fayts Ford Rd Clinton AR 72031	dsrenvi@gmail.com

18.

Report of the Treasurer

Arkansas Oklahoma Arkansas River Compact Commission

October 30, 2014

The 2014 Year-end Financial Report covering July 1, 2013 through June 30, 2014 details income and expenses.

Regions Bank Balance on July 1, 2013	$ 123,888.53
Total Income	$ 503,715.90
Total Expenses	$ 6,041.53
NET TOTAL	$ 497,674.37

Regions Bank Balance June 30, 2014	$ 621,523.83
Certificate of Deposit Balance June 30, 2014	$ 11,021.28
	$ 632,545.11

Most Recent Account Balances

Regions Bank Balance September 30, 2014	$ 610,715.52
Certificate of Deposit Balance June 30, 2014	$ 11,021.28
TOTAL	**$ 612,736.80**

Assessments for both states are current.

ARKANSAS-OKLAHOMA ARKANSAS RIVER COMPACT COMMISSION

CORRECTED BUDGET

7/1/2012 - 6/30/2016

ITEM	(ACTUAL EXPENSES) FY-2013 7/1/2012 6/30/2013	(BUDGET) FY - 2014 7/1/2013 6/30/2014	((ACTUAL EXPENSES) FY - 2014 7/1/2013 ***9/23/2014***	(BUDGET) FY - 2015 7/1/2014 6/30/2015	(PROPOSED) FY - 2016 7/1/2015 6/30/2016
Chairman Hosts Sept 2012	$ 405.00	$ 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	
Meeting Place		$ 800.00		$ 800.00	$800.00
Security Bond		$ 250.00		$ 250.00	$250.00
Contingency		$ 420.00		$ 420.00	$420.00
Computation of Annual Water Yield	$ 4,000.00	$ 2,000.00	$ 4,000.00	$ 2,000.00	
Stressor Response Study - Illinois River		$ 600,000.00 *		$ 600,000.00 *	$600,000.00 *
Stream Gaging FY 14**		$ 6,250.00		$ 6,250.00	$300.00
Stream Gaging FY 15***					$6,300.00
Stream Gaging FY 16					$6,500.00
TOTALS:	**$4,680.00**	**$611,475.00**	**$4,000.00**	**$ 611,750.00**	**$616,325.00**
1/2 Annual budget to be paid by each state		$3,500.00		$3,500.00	$3,500.00

*** This is total study cost**

**** This will pay total invoice cost of $6,550**

***** Line item unintentionally left off printed budget previously provided.**

ARKANSAS - OKLAHOMA
ARKANSAS RIVER COMPACT COMMISSION
Statement of Cash Receipts
and Disbursements
July 1, 2012 through June 30, 2013
and
July 1, 2013 through June 30, 2014

Arkansas - Oklahoma Arkansas River Compact Commission
Statements of Cash Receipts and Disbursements
For the Period July 1, 2012 through June 30, 2013
and
For the Period July 1, 2013 through June 30, 2014

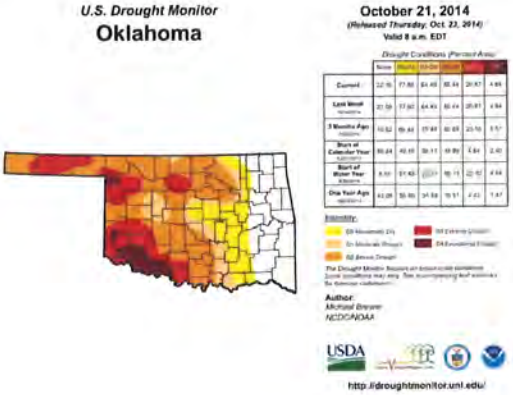
Cash in bank, checking as of July 1, 2012	$	21,549
Cash receipts		
Member assessments		7,000
Special projects		100,000
Interest income		20
Total cash receipts	$	107,020
Cash disbursements		
Accounting		275
Conference expense		405
Yield report		4,000
Total cash disbursements	$	4,680
Cash in bank, checking as of June 30, 2013	$	123,889
Cash in certificate of deposit as of June 30, 2013		10,950
Cash and cash equivalents as of June 30, 2013	$	134,839
Cash in bank, checking as of July 1, 2013	$	123,889
Cash receipts		
Member assessments		3,500
Special projects		500,000
Interest income		216
Total cash receipts	$	503,716
Cash disbursements		
Printing & reproduction		851
Conference expense		488
Postage		57
Bond costs		685
Yield report		4,000
Total cash disbursements	$	6,081
Cash in bank, checking as of June 30, 2014	$	621,524
Cash in certificate of deposit as of July 1, 2012		10,875
Interest income certificate of deposit		146
Cash in certificate of deposit as of June 30, 2014	$	11,021
Cash and cash equivalents as of June 30, 2014	$	632,545

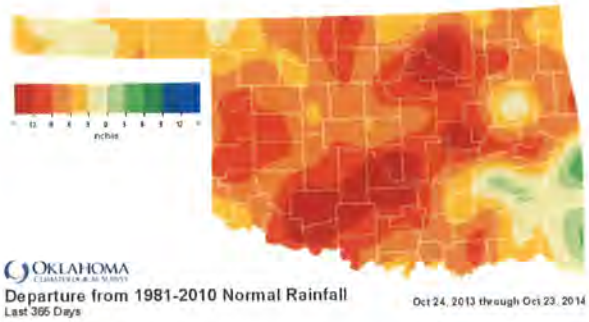
OKLAHOMA COMMISSIONERS' REPORT

Arkansas-Oklahoma
Arkansas River Compact Commission
Rogers, Arkansas
October 29-30, 2014

CLIMATE

Despite the heavy rains that moved through the Plains last week and the improvements in drought conditions that were reflected then, this week was a relatively dry week in the region. According to the latest U.S. Drought Monitor report for Oklahoma, there are 1,973,048 Oklahomans currently affected by the state's on-going 4 year drought. Only 22.15% of the state is currently unaffected by drought, but just over half the state is currently experiencing Severe Drought or worse (D-2-D4). On average, the state is 7.28 inches below normal precipitation, the 19th driest since 1921. The Central Oklahoma region is currently the farthest from normal precipitation of any region at 10.04 inches below making it the 17th driest since 1921. The West Central Oklahoma region's deficit of 8.38 inches ranks as its tenth driest. The National Drought Mitigation Center (NDMC) listed Oklahoma to its list of "biggest increase in drought" during September with a 5.17% increase in the "extreme" category. The NDMC also noted that "most of the South had above-normal temperatures for September, with the greatest departures from normal 1-3 degrees in Texas and Oklahoma."





DROUGHT PREPAREDNESS AND MANAGEMENT

As the state of Oklahoma undergoes its fourth year of consecutive drought conditions, both the Governor and State Legislature have taken a number of steps to help communities and Oklahomans respond to current conditions and prepare for future drought-related issues. These steps have included the passage of legislation to bring grant funding to communities struggling with drought, the creation of multiple drought-related and water planning-related resources for citizens and public water systems, and the implementation of several drought-planning forums to foster better communication and understanding of sound drought preparedness and planning.

Drought Grants

In September 2014, Governor Mary Fallin announced the Water for 2060 Drought Grant Program, which made $1.5 million available in drought grants for cities, counties, water districts and other public entities to help fund projects that highlight responsible use of water. In addition to the Water for 2060 Drought Grant Program, separate legislation was

approved in 2012 to create the Emergency Drought Commission and Relief Fund to provide funding for drought mitigation and related projects in conjunction with a formal gubernatorial drought declaration. As a result of Governor Fallin's drought declaration in the fall of 2013, an additional $1.125 million in emergency drought relief grants were made available to struggling western Oklahoma communities. Specific assistance projects were limited to affected counties and were approved by the Oklahoma Emergency Drought Commission, consisting of the Secretary of Agriculture and Executive Directors of the Oklahoma Water Resources Board and Oklahoma Conservation Commission.

Drought Planning

The Oklahoma Water Resources Board has initiated several drought preparedness and planning programs over the last several months, as well as created several drought-related tools and resources for both citizens and communities in Oklahoma. For example, the OWRB recently finalized the Public Water Supply Planning Guide to assist public water supply systems in developing plans to meet their specific long-term water needs.

The OWRB, in partnership with the U.S. Bureau of Reclamation, hosted Oklahoma's inaugural Drought Challenge on September 17 at the National Weather Center in Norman. The Drought Challenge, also known as the Water Supply Reliability and Management Challenge, was an exciting new approach to promoting comprehensive drought mitigation, preparedness, and planning across Oklahoma. Using an engaging competition format, the Drought Challenge aims to encourage collaboration among water planners and other stakeholders from various backgrounds in Oklahoma by educating participants on the multidisciplinary and multi-sector implications of drought.

OKLAHOMA COMPREHENSIVE WATER PLAN

Considerable progress was made during 2013-2014 toward implementing the priority recommendations included in the 2012 Update of the Oklahoma Comprehensive Water Plan (OCWP), including Water Monitoring; Water Supply Reliability; Water Conservation, Efficiency, Recycling and Reuse; Water Infrastructure Funding; and Instream Flows. The OWRB has enhanced and expanded water monitoring activities and hydrologic studies, as well as revitalized financing of water and wastewater projects to meet the anticipated $82 billion dollar need over the next 50 years. In addition, the OWRB and contractors have facilitated initial meetings of the Water for 2060 Advisory Council and Instream Flow Advisory Group.

Water for 2060 Advisory Council

With passage of House Bill 3055 (the Water For 2060 Act) in 2012, Oklahoma became the first state in the nation to establish a bold, statewide goal of consuming no more fresh water in 2060 than was consumed in 2010. The OWRB has partnered with the U.S. Army Corps of Engineers to begin preliminary work required to support the new Water for 2060 Advisory Council, chaired by OWRB Executive Director, J.D. Strong. The Water for 2060 Advisory Council, a 15-member group appointed to develop recommendations aimed at stabilizing Oklahoma's water use through improved conservation and efficiency, held its first four meetings in 2013-2014. Each successive meeting focused on the major water use sectors and stakeholders in Oklahoma including: public water supply systems, crop irrigation, and the power generation and energy production sectors. The Council's final report of findings and recommendations will be submitted to the Governor, Speaker of the House, and President Pro Tempore by late 2015.

"Hot Spot" Public Meetings and Basin Studies

The OWRB recently held a series of four "Hot Spot" public meetings to share information and obtain feedback on water conservation strategies that could mitigate projected water shortages in Oklahoma's most compromised areas. The goal of the meetings was to offer agriculture producers, water providers, and interested citizens residing in or around twelve "Hot Spot" planning basins—those determined to have the most significant water supply challenges

within the next 50 years—an opportunity to provide input on satisfying future water demands and avoiding substantial water shortages projected in those areas. Subsequent to the public meetings, officials and planning specialists from the OWRB have announced three in-depth studies focused on reviewing specific strategies to prevent future water supply shortages in three of the state's twelve "Hot Spot" basins located in western Oklahoma. The three water basins include the following: Basin 26, part of the Beaver-Cache Watershed Planning Region located near Duncan; Basin 38, part of the Southwest Watershed Planning Region located near Altus; and Basin 51, part of the Central Watershed Planning Region located between Yukon and Watonga (see Figure 1). The three studies will focus on how water conservation, marginal quality water supplies, and public water supply system regionalization strategies might address the needs of hot spot basins on a local implementation level as examples for water users statewide.

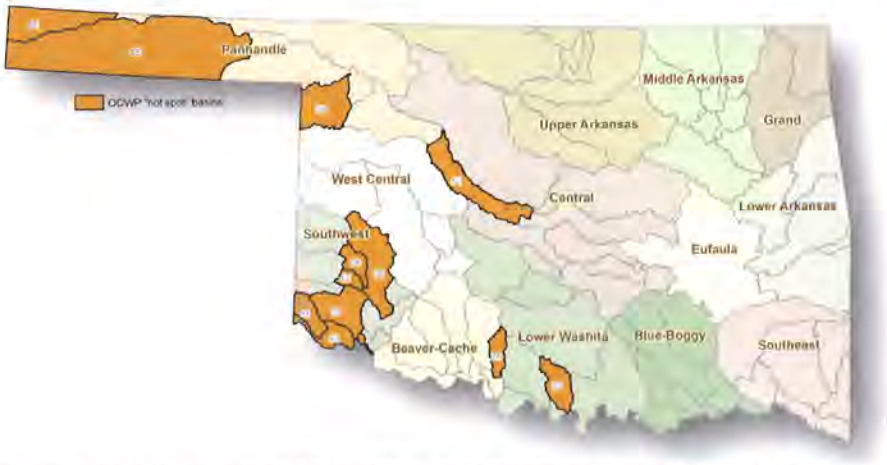


FIGURE 1. *HOT SPOT BASINS*, 2012 UPDATE OF THE OKLAHOMA COMPREHENSIVE WATER PLAN

OCWP Instream Flow Workgroup

The OCWP Instream Flow Workgroup met several times during 2013-2014. Discussion primarily centered on developing a pilot study to incorporate a process for evaluating economic and environmental impacts that could result from establishment of instream flow requirements in Oklahoma. The Workgroup–commissioned during the OCWP update process to conduct an independent technical, legal, and policy analysis of a potential instream flow program in Oklahoma–continues to craft recommendations for the most efficient, feasible method for balancing the water needs of consumptive users with those that rely upon water flowing in streams and lakes for economic development, recreation, and quality of life.

WATER RESOURCES TECHNICAL STUDIES

Hydrologic studies, another primary initiative of the OCWP, are ongoing throughout the state. The Rush Springs Aquifer Study was initiated in 2011-12 in conjunction with a hydrologic investigation and stream water allocation model of the Upper Washita River Basin. The OWRB has launched 20-year updates of hydrologic studies for the Enid Isolated Terrace and Elk City Sandstone aquifers and anticipates their completion in late 2014 and mid-year 2015, respectively. Under contract with the USGS, the OWRB will conduct a 20-year update of the groundwater study for the North Canadian River Alluvium and Terrace Groundwater Basin from the Beaver-Harper County line to Lake Overholser at the Canadian-Oklahoma County line. The USGS has also been contracted to conduct a 20-year update on the North Fork of the Red River Alluvium and Terrace aquifer and an investigation on the Canadian River Alluvium and Terrace aquifer.

Surface Water Studies

The OWRB continues developing stream water allocation models as a supporting tool for the appropriation, allocation, distribution, and management of stream water in Oklahoma. The agency recently contracted with AMEC for the development of models for the Verdigris River, Red River, and North Canadian River watersheds. Three models are currently being developed in-house, including the Washita River watershed, which is part of a cooperative study with the Bureau of Reclamation, and two additional models for Walnut Bayou and Mud Creek basins. Updates of three previously built models in Southeast Oklahoma are also underway.

Groundwater Studies

The Garber-Wellington Water Management Study was initiated in June 2008 to address growing concerns about the future of water availability in central Oklahoma. The study was completed and a USGS Scientific Investigations Report has been published entitled "Hydrology and simulation of groundwater flow in the Central Oklahoma (Garber-Wellington) Aquifer, Oklahoma, 1987 to 2009, and simulation of available water in storage, 2010-2059." While the OWRB will use information obtained from the investigation to determine the Maximum Annual Yield of the aquifer, the groundwater-flow model will also be used to anticipate the impacts of long-term groundwater withdrawals on the aquifer, as well as to simulate various water management strategies. The study was funded through a combination of state Oklahoma Comprehensive Water Plan funding and federal funds through the Bureau of Reclamation and U.S. Geological Survey.

The OWRB initiated a study on the Rush Springs aquifer in west-central Oklahoma in October 2011 and will be collecting groundwater and surface water information to better understand the groundwater-flow system. The major goals of the project are to: (1) better define the aquifer properties and boundaries; (2) develop a groundwater-flow model to simulate the flow system; and (3) determine the Maximum Annual Yield of the aquifer. The groundwater-flow model will be used to simulate water management scenarios, project current use impacts, and assess climate variability utilizing available climate modeling information. The OWRB will be working with the Bureau of Reclamation's WaterSMART Program as part of the Bureau's Washita Basin River Basin Water Supply Study. The project is scheduled to be complete by the end of 2015.

The OWRB entered into a cooperative agreement with the USGS to fund a 20-year Maximum Annual Yield update on the North Canadian River Alluvium and Terrace Groundwater Basin Reach I and II. The objective of this project is to update the 1981 (Reach I) and 1983 (Reach II) hydrologic survey from the Oklahoma Panhandle to Lake Overholser and to develop new groundwater-flow models that will be used to simulate the effects of groundwater withdrawals. The simulations will be used to evaluate the allocation of water rights within the groundwater basin. Initially a two-year project, work was extended one year due to the amount of additional data required to complete the project, -Completion is anticipated by the end of 2014. Similar agreements have been made with the USGS to complete work on the 20-year update of the North Fork of the Red River alluvium and terrace, to be finished by the end of 2015, as well as the Canadian River alluvium and terrace, to be completed by the end of 2016.

Arbuckle-Simpson Maximum Annual Yield

The nine-member OWRB Board approved the Final Order for the Arbuckle-Simpson Maximum Annual Yield (MAY) in October 2013. The long-awaited decision was prompted by a 2003 law change and informed by more than a decade of study, numerous public meetings involving citizens and stakeholders, and a meticulous hearing process. The new MAY sets a 0.2 acre-feet per acre per year (AFY) equal proportionate share (EPS) withdrawal rate for the Arbuckle-Simpson aquifer. The Final Order is currently under appeal by numerous protesting parties in the Oklahoma County District Court. There are no noteworthy developments in the appeal to report at this time.

In addition to the Final Order for the Arbuckle-Simpson Maximum Annual Yield, the OWRB also finalized and approved new well spacing regulations applicable to sole source groundwater basins such as the Arbuckle-Simpson aquifer. The updates were submitted by the OWRB to the Governor and State Legislature in the spring of 2014, and were subsequently approved.

WATER QUALITY PROJECTS & MONITORING

OWRB staff continue to work cooperatively with the Central Oklahoma Master Conservancy District to monitor and improve water quality in Lake Thunderbird where a new system to oxygenate lake water was implemented. The OWRB and other agencies are also finalizing cooperative development of a total maximum daily load (TMDL) calculation to address Thunderbird water quality impairments, including high turbidity, algae, and low dissolved oxygen. Lake re-

vegetation projects included the establishment of wetland plants at Fort Cobb and floating islands consisting of recycled plastic and aquatic plants at Eucha. Staff completed the bathymetric mapping of the Ardmore City lakes and firm yield monitoring for inclusion into their long range planning process. OWRB staff has also collected data needed to determine the feasibility of dredging the intake water supply channel in Lake Waurika to ensure access to raw water during extreme drought conditions. The OWRB also works to educate lake managers on the many benefits of restoring lake water quality to water supply.

In response to the potential for severe impacts resulting from toxin-producing algae, OWRB staff is working with various federal, state, and local entities to assess the risk from harmful algae blooms.

The OWRB has completed work on the National Lakes Assessment Study and is beginning work on the National Rivers and Streams Assessment Study. Sampling on numerous lakes across Oklahoma provided data to assess environmental integrity of the waters. 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.

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). Staff also acquired a wealth of historical groundwater quality data—now available to the public—to support the Garber-Wellington aquifer study.

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;
- Completing cooperative work for ODAFF to investigate pesticides in certain Oklahoma streams.

BENEFICIAL USE MONITORING PROGRAM

OWRB staff continue to monitor water quality conditions and trends statewide through the Beneficial Use Monitoring Program (BUMP). The BUMP, recognized by EPA as one of the finest state-run monitoring programs in the nation, facilitates science-based decision-making concerning impaired waters. In 2011, BUMP lake sampling underwent a thorough reevaluation and modification to incorporate a probabilistic sampling approach to maximize benefits and efficiencies in the program while reducing expenses. Monitoring staff partnered with EPA to conduct the National Lakes Assessment and are currently partnering with EPA on the National Rivers and Streams Assessment with field work initiating this summer. These national studies are designed to establish comparable lake, river and stream parameters between states to facilitate standardized assessment.

OKLAHOMA WATER QUALITY STANDARDS

Revision topics for 2014-2015 Interim Rulemaking going to the OWRB Board will include revisions to OAC 785:45 and OAC 785:46 that are associated with the effort to develop wetland-specific Water Quality Standards (WQS) beneficial uses and criteria (being funded under a CWA §104(b)(3) wetlands program grant), revisions to the dissolved oxygen provision to clarify and streamline the current provision, a Water Effects Ratio (WER) for the City of Broken Bow Public Works Authority for site-specific criteria for copper and zinc.

A Joint Phosphorus Criteria Study is also underway to determine the Total Phosphorus threshold response level at which any statistically significant shift occurs in algal species composition or algal biomass production resulting in undesirable aesthetic or water quality conditions in Oklahoma's designated Scenic Rivers. The study committee of six individuals appointed by the Governors of Oklahoma and Arkansas include Brian Haggard, Thad Scott and Marty

Matlock with the University of Arkansas, and Derek Smithee, Shanon Philips and Shellie Chard McClary with OWRB, OCC and ODEQ respectively. Several meetings have occurred over the last year to pull together a Scope of Work and hire a contractor. Ultimately the Committee hired Dr. Ryan King with Baylor University. The first semi-annual update meeting was held Oct. 9th in Tulsa. Three sampling trips have been completed. Sample collection will end the summer of 2016 and the final report is due out from the Committee to the Governors by the end of 2016.

All products and meeting minutes, etc. are available at the ODEQ, OWRB or Oklahoma Conservation Commission websites. Derek Smithee and Brian Haggard Co-chair this effort, and can be contacted with any questions.

WATER RESOURCES 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 billion in financing has been provided for water and sewer projects in Oklahoma with a total estimated savings of more than $1 billion to Oklahoma communities.

PROGRAM	NUMBER AND AMOUNT
FAP Loans	364 for $932,425,000
CWSRF Loans	283 for $1,289,784,409
DWSRF Loans	170 for $874,585,300
REAP Grants	618 for $54,805,938
Emergency Grants	568 for $33,882,821
Drought Response Grants	10 for $1,543,848
TOTAL	2,013 for $ $3,187,902,316

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.

DAM SAFETY PROGRAM

In 2013, and again in 2014, the OWRB introduced a free inspection program for low hazard-potential dams in Oklahoma. In addition, inspection and maintenance training was conducted for private and municipal dam owners, and breach inundation maps were developed for 15 high hazard-potential dams (provided to dam owners at no cost) and integrated into site-specific Emergency Action Plans to assist emergency managers in the event of dam failure. Staff has also been generating hydrologic and hydraulic reports for these dams, if not in existence, to ensure that the design flood requirements are met. OWRB's Dam Safety Program has also conducted free Emergency Action Plan (EAP) in 2014 to emphasize the importance of the EAP and its regular maintenance, defining emergency processes and related actions, roles of NRSC and NWS in improving or simplifying the emergency action plan, and reviewing OWRB rules and regulations.

FLOODPLAIN MANAGEMENT

The OWRB continues to participate in FEMA's RiskMAP program, an innovative approach to fostering working partnerships between FEMA and participating National Flood Insurance Program (NFIP) communities, regional agencies, state agencies, tribes, and universities in identifying and communicating risk throughout local watersheds. To date, the OWRB has initiated seven FEMA RiskMAP Discovery projects throughout Oklahoma. The OWRB continues to train and accredit floodplain administrators in Oklahoma's 396 participating NFIP member communities.

LEGAL MATTERS

Chickasaw and Choctaw Nations v. Gov. Fallin, OWRB, and Oklahoma City

On August 18, 2011, the Chickasaw Nation and Choctaw Nation of Oklahoma filed a lawsuit in the U.S. District Court for the Western District of Oklahoma. The lawsuit names as defendants Gov. Mary Fallin, the members and Executive Director of the OWRB, the City of Oklahoma City and the Oklahoma City Water Utility Trust (OCWUT). The lawsuit alleges the Indian Nations have federally-protected rights to the water within a 22-county territory in southeastern Oklahoma. Among other things, the lawsuit seeks: (1) declaratory judgments against any action by the OWRB on a pending application by Oklahoma City and OCWUT for a permit to use stream water from Sardis Reservoir in southeastern Oklahoma, or any other withdrawal or export of water from the area at issue, unless and until there is initiated a general stream adjudication that satisfies the requirements of the federal law known as the McCarran Amendment; and (2) permanent injunctions against any such action unless and until a general stream adjudication that satisfies the McCarran Amendment is completed. On February 10, 2012, the Oklahoma Attorney General filed on behalf of the OWRB to initiate such McCarran Amendment adjudication proceedings to protect and accurately determine all rights to the use of water in the Kiamichi, Clear Boggy, and Muddy Boggy stream systems and moved to dismiss the Tribes' federal court action as a premature effort to have federal courts usurp Oklahoma's management of waters of the State. However, on March 12, 2012, the United States filed a Notice of Removal with the federal district court in Oklahoma City. Since that time, a joint motion to stay proceedings has been granted for both cases (Chickasaw Nation and Choctaw Nation v. Fallin and OWRB v. United States) and has been renewed on a continual basis to allow further efforts in mediation. The stay currently has been extended until January 12, 2015.

2014
Report of Arkansas Commissioners
To
Arkansas-Oklahoma Arkansas River Compact Commission

Nonpoint Source Management Program

The Arkansas Natural Resources Commission continues to utilize 319(h) program to fund water quality projects in the Illinois and Upper White River watersheds. The Illinois River Watershed Partnership (IRWP) developed a 9 element watershed management plan (WMP) that was accepted by EPA. The IRWP continues to develop and implement projects to meet the goals of the WMP. Projects updates and of interest include:

The Illinois River Watershed Partnership (IRWP) – development and implementation of Rain Gardens - The IRWP in cooperation with the Beaver Water District developed 60 rain gardens within the Illinois River and Beaver watersheds. Each watershed implemented 30 rain gardens. Monitoring (in-flow and out flow) occurred in 2 rain garden in each watershed. The monitoring assessed the functionality of the gardens relative to reducing pollutant loads, both sediment and nutrients. Collectively the rain garden implemented in the Illinois River watershed had the following pollutant reduction effects*:

Total solids	3,189 pounds/year
Total suspended solids	1702 pounds/year
Total Phosphorous	8.5 pounds/ year
Total Nitrogen	31 pounds/year

*only two rain gardens were monitored for one year and runoff from storm events was minimal

The project began in July 2011 and was completed June 2014.

IRWP – Greenway development and enhancement – The IRWP is continuing to implement recommendations from the WMP to include green infrastructure applications such as porous pavers, tree wells, rain gardens, and phosphorous removal structures to include vegetated swales, native grasses, riparian buffers and filter strips, to improve water quality along the Razorback Greenway trail. The sites selected for green of low impact development (LID) are in highly visible public areas along the trail access points. Applicable informational signage is placed at each site to educate the public. The project time period is July 2013 – June 2016.

IRWP – Green infrastructure (GI) and LID at the Cave Springs Watershed Sanctuary – The IRWP purchased property in Cave Springs, AR for the purpose of developing the Illinois River watershed sanctuary. The site encompasses Lake Keith, buildings and the discharge of spring and the entrance of the Cave Springs cave. The

Cave is home to 2 endangered species, the Ozark Cave fish and the Gray bat. The sanctuary site will serve as an educational and a resource center.

The GI/LID project will demonstrate various methods of GI/LID applications such as porous pavers, tree wells, rain gardens, and phosphorous removal structures to include vegetated swales, native grasses, riparian buffers and filter strips. The project and its implementation demonstrations are designed and are applicable for children and adults. A primary goal of the project is to demonstrate the ease of implementation and environmental benefits to individuals, thus individuals perpetuate implementation at their home business or community.

The project time period is July 2013 – June 2016.

Washington County Cooperative Extension - Lake Fayetteville Outreach and Education – The project centers around identifying and engaging watershed landowners to increase their knowledge and understanding of best management practices and their associated benefits for improving and maintaining water quality. This is being done by the WCCES jointly conducting property assessments with the landowner. Once assessments are completed the WCCES recommends various best management practices and options to protect/improve the runoff water quality and encourages each landowner to consider implementation on their property. This project serves two primary functions; 1) the joint assessments provides a collaborative process that engages the landowner to recognize potential issues that may affect water quality, 2) allows the landowner based upon the collaborative assessment to choose the BMPs or options to address the identified issue(s)

The project timeline is July 2013 June 2015.

Illinois River Watershed Stressor Response Study
Sampling on the stressor response study began in the summer of 2014 and is continuing as scheduled. The stressor response study team met in early October 2014 in Tulsa, OK to discuss progress on the study. Approximately 15% of the sampling by Baylor University has been completed as scheduled. Too early in the study to draw any conclusions from the sampling data at this time.

IL River Conservation Reserve Enhancement Program (CREP)
There have been no sign-ups and landowner participation during the past year. There have been several public outreach and educational activities during 2013. The farm bill was not active from September 30, 2013 till June 9, 2014. To date, the ANRC has paid out $24,249 in state incentives for completed projects and outreach activities. The project acreage is 10,000 acres. The state incentive payment is $400.00 an acre for the first thousand acres enrolled.

The ANRC Groundwater Section

USGS and NRCS, continue to monitor approximately 1,500 groundwater wells around Arkansas annually. The ANRC also has installed and monitors forty-six (46) monitoring wells designated for the sole purpose of monitoring 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.

Arkansas Water Plan
2014 Update

Since 1969, the Arkansas Natural Resources Commission (ANRC), formerly Soil and Water Conservation Commission, has been responsible for the Arkansas Water Plan. When it was created by the General Assembly, the Plan was defined as a comprehensive plan for the orderly development and management of our water resources. This is a very broad definition, but, over the years, the Plan evolved into a thorough examination of water data and policy with recommendations for improvements.

There are four essential questions to be answered by this update:

- How much water do we need?
- How much do we have?
- Where will we have "gaps" between demand and supply?
- What tools will we use to address those gaps?

The first official Arkansas Water Plan was finished in 1975. Following that work, the Plan was updated in the wake of the severe 1980 drought. That work resulted in a series of reports published in the 1980s, culminating in the Executive Summary published in 1990. That Summary included 28 specific issues and recommendations that we have been implementing for over 20 years.

In 2011, the General Assembly directed ANRC to update the Plan. After the legislature appropriated the money, ANRC engaged CDM Smith, a national engineering firm, and FTN Associates, an Arkansas engineering and environmental consulting firm to complete the update.

The Arkansas Department of Health, Game and Fish Commission, and Department of Environmental Quality were involved from the beginning. They helped with the scoping process to design the update and they participated in the contractor interviews done as we assessed the qualifications of consulting firms to engage to update the Plan.

Public involvement

The 1990 update was drafted by state and federal agencies, and then presented to the public. Our current update is completely the opposite. We have engaged over 1,000 people in the process, from deciding the best sources of data, to identifying issues and

formulating recommendations. This has been the most rewarding and productive part of the update process. We hope to build on this engagement as we implement the Plan and for future updates.

Major goals

The Water Plan update has several goals. First and foremost, to meet our drinking water needs. We also seek to meet all our other water needs, including agriculture, recreation, fish and wildlife, power generation, navigation, and industry.

Issues and Recommendations

The Executive Summary is the main Water Plan report. It contains an overview of the data and forecasts found in the supporting reports. It describes major issues and recommended actions to address them. Implementation of these recommendations will be the real work of the Plan.

Groundwater/conjunctive water management

We continue to withdraw over twice the groundwater from our alluvial and Sparta aquifers than is naturally recharged. Over eighty percent of the water use in Arkansas is for crop irrigation. It is of utmost importance to take advantage of our abundant surface water to supplement groundwater use and sustain agriculture into the future. It is also vital to protect the Sparta aquifer for future public and industrial use. Improved measurement of withdrawals using flow meters is recommended.

Incentives for water conservation

In addition to meeting more of our needs with surface water, technological and scientific advances are increasing efficiency. Every drop we save is a drop we do not pump out of the ground or a surface source. There is a lot of opportunity to conserve water, from reducing domestic consumption to improved irrigation. Tax credits, outreach, and education are the suggested incentive tools.

Infrastructure condition

Water and wastewater infrastructure is very important to Arkansas, but it is expensive and difficult to maintain. The Plan addresses deteriorating infrastructure (including public water systems, wastewater treatment, levees, and dams) by promoting better planning and maintenance. The Plan encourages training programs for boards of directors of systems operating any type of infrastructure to maintain, repair, and replace infrastructure. If we take care of what we have, we can stretch the public investment further.

Infrastructure financing

The State of Arkansas issues general obligation bonds based on its credit, and the Natural Resources Commission lends the proceeds to public water and wastewater entities at low interest rates. The Water Plan suggests continuing to use this financing tool to meet local and state needs.

Surface water use

The Plan quantifies the amount of surface water that can be used to meet our future needs. Thankfully, as a "water rich" state, we have sufficient water to meet all our in-stream and out-of-stream needs. Constructing intake, storage, and delivery facilities is promoted by the Plan as a long-term supply strategy.

Nonpoint source pollution management

Reducing unregulated nutrient and sediment runoff was a major goal of the 1990 Plan and is in the current update. Voluntary, incentive based programs, rather than permitting or regulatory systems are recommended to build on our success. With continued work on reduction of polluted runoff, we can greatly improve the quality of our lakes and streams.

Drought contingency response

The operation of public water systems when surface supplies are suffering and making sure we have dispute resolution tools in place for shortages are two of the ways we must prepare better for drought. We also have to maintain our streamgauging network to collect data to monitor drought conditions. The updated Plan recommends the formation of a drought task force composed of public and private partners *before* droughts occur.

Water education

The need to educate the public on the importance of water is a long-standing issue. It has been a part of every previous water planning effort in Arkansas, going back to the 1930s. To appreciate the work and expense of providing clean drinking water, to know how much our economy depends on water for industry, crops, navigation, etc., and to encourage good stewardship of the quality of our water, it is essential that the public stay informed.

Reallocation of federal reservoir water

One of the major themes of the Water Plan is to take advantage of currently available resources. We are fortunate to have so many federal reservoirs in Arkansas to provide recreation, flood control, power generation, and public water. Since these are federally authorized, built, and operated, the Congress is responsible for deciding how they are to be used. However, there are administrative procedures within Corps of Engineers jurisdiction to "reallocate" portions of the stored water. The Plan encourages the use of this procedure when public water providers are planning to meet their long-term needs. With such a recommendation, we hope to have a positive influence on federal water policy.

Data and science

The foundation for water planning is data. We need to know how much water we use and look for usage trends. The Plan suggests making improvements to our water use reporting system, especially for crop irrigation—our number one water use. Metering more water wells and surface pumps is recommended to improve the certainty of the

numbers that we rely on. The Plan also includes a science and engineering advisory committee to assist in the development and collection of water data.

Stay involved in the process

Please view the Water Plan and supporting documents at www.arwaterplan.arkansas.gov.

38.

Foreword

Water is vital to the prosperity and health of Arkansas's people and their natural surroundings. As such, water must be managed in a sustainable manner to support local and state economies, protect public health and natural resources, and enhance the quality of life for all citizens by applying appropriate policies and best practices with limited regulation and preservation of private property rights.

Extensive public participation, interagency cooperation, and detailed technical evaluations were the hallmarks of this 2014 Update of the Arkansas Water Plan (AWP). The plan recognizes that while we continue to struggle with known water issues, the recommendations in this plan, when implemented, can meet the water demands of the citizens of the State of Arkansas (State) through 2050. We have identified six critical initiatives that are essential to securing Arkansas's water future—

1. **Groundwater Declines:** Critical groundwater areas in eastern Arkansas continue to experience declining groundwater levels and a groundwater gap as large as 7 million acre-feet per year (AFY) is projected for 2050. Adopting on-farm application efficiency and other conservation measures can reduce the magnitude of this projected groundwater gap; it will be necessary to develop infrastructure-based solutions to convert more irrigated acres currently supplied by groundwater to surface water.
2. **Insufficient Infrastructure:** Arkansas needs to construct and maintain water and sewer systems that furnish safe, clean, and reliable water supplies for its citizens and communities. The State's future viability and growth, especially with respect to the State's smaller rural communities, is threatened by the failure to provide these basic services. Resolution of this problem will require the combined commitment and actions of citizens and elected officials who must identify creative financing solutions and take advantage of regional infrastructure opportunities and shared sources of supply.
3. **Maintenance of Critical Infrastructure:** The safety of Arkansas's citizens and protection of property depends on maintaining and replacing, as necessary, flood and drainage infrastructure. Navigation and dams are another type of critical infrastructure that are necessary for economic health. We will encourage the federal government to complete projects that have been started and provide adequate operations and maintenance funding for this critical infrastructure.
4. **Proactive Management:** We have initiated proactive, systematic, and measured evaluation of existing water laws and procedures involving relevant agencies and appropriate stakeholders. The steps taken in this direction will help to maintain the stable and orderly use of water that is so critical to Arkansas's economic welfare and quality of life.
5. **Regional Planning:** Integral to the AWP was the recognition of regional issues and priorities identified by citizens, water users, and stakeholders. Statewide water planning will continue to provide the direction for water management. Engaging local citizens who are more in touch with their unique needs, challenges, and potential solutions is critical to regional water planning.
6. **Reliable Data:** The combined efforts of elected officials and the agencies and entities associated with managing and protecting the State's water must be informed by quality information to justify extremely consequential and potentially costly decisions. Sound planning and decision-making regarding Arkansas's water resources requires data, information, and analysis of water uses and water availability. Acquiring this data means the expansion of the network of stream gages, monitoring wells, water quality monitoring sites, and improved information on water use as well as the tools necessary to quantify, manage, and allocate surface and groundwater resources confidently.

The 2014 AWP is the strategy for making meaningful progress on each of these initiatives as described in the priority issues and recommendations and their respective implementation plans.

J. Randy Young, P.E.
Executive Director
Arkansas Natural Resources Commission

Introduction

Arkansas is a state of distinct regions, from the low lying areas along the eastern and southern edges of the State to the mountains above the fall line that adorn the western edge. The occupations of the people of Arkansas are similarly varied – crop production, livestock production, aquaculture, silviculture, mining, industry, tourism, and recreation. What binds the people and regions of Arkansas together is the need for water – for living and working. As the Natural State, the importance of clean water to support healthy ecosystems cannot be understated. Quite simply, water is crucially important for Arkansas. Water is the common denominator that underlies the quality of life and economic well-being of Arkansas.

Arkansas is a water-rich state. Surface water is abundant, with over 44 million acre-feet (AF) of water flowing through nine major river basins every year (Figure 1). This amount of surface water alone would provide about 4 acre-feet per year (AFY) of water for every person in Arkansas. However, surface water supplies are subject to seasonal fluctuations so that supplies are frequently at their lowest when demand is the highest. In some areas of the State, groundwater supplies have been easy to access through shallow wells and have been a plentiful source of water. As a result of over a century of agricultural reliance on groundwater for crop irrigation, the water levels in these aquifers have been declining and our projections suggest that by 2050, there will be demand for about 7 million AFY of groundwater that cannot be met with groundwater supplies.

Despite the relative abundance of water, many citizens lack access to dependable water and wastewater services due to distance to supplies, insufficient infrastructure or storage, water quality constraints, and other limiting factors. A fundamental conclusion of this AWP is that investments in infrastructure, drinking water, wastewater service, and irrigation will be required to support growth and economic development for the next 40 years.

The 2014 AWP Update is the culmination of 2 years of data analysis and synthesis to understand the complexity of sources, available supply, and demand for water in Arkansas. The AWP is based on planning level projections of water demand and availability developed using consistent methodology on a statewide basis. The demand and availability analytical methodology was reviewed and concurred upon by stakeholder workgroups. The workgroups were created by inviting recognized experts throughout the State to assist in developing the 2014 AWP.

The State was divided into five water resource planning regions (Regions) comprised of areas with distinct geographic, topographic, ecologic, and sociologic characteristics (Figure 1).

Water-related issues were identified and prioritized by stakeholders in the planning regions of the State. This 2014 AWP Update is founded on the best available data, the knowledge and experience of a wide range of agency experts, and the critique of stakeholders and the public throughout the process.

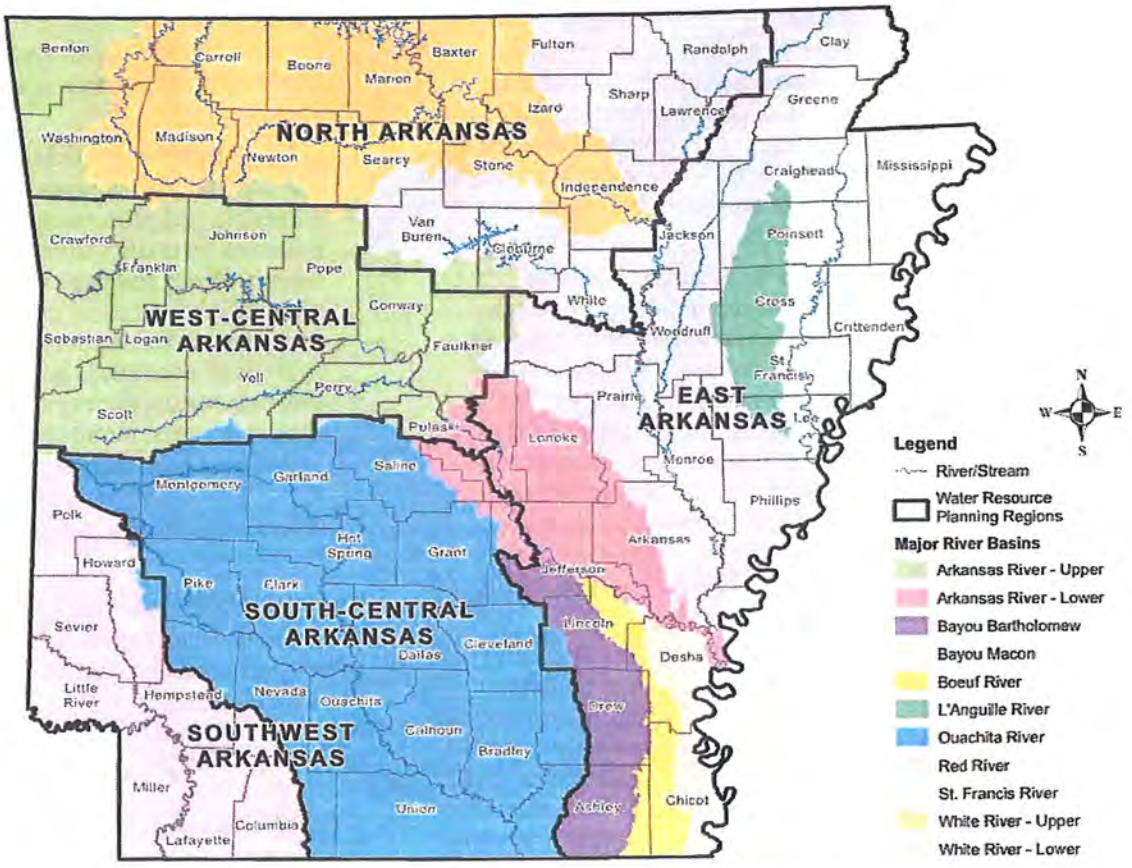


Figure 1. Overlay of Water Resources Planning Regions on Major Surface Water Basins

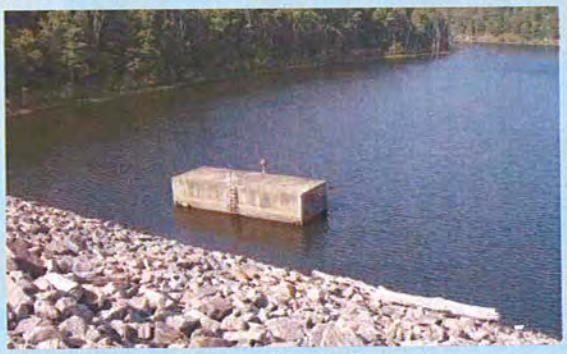
Arkansas Water Plan Goals

Goals for the AWP were developed as part of an initial mission, vision, and goals workshop by a multi-agency group. The goals are:

- First and foremost, meet the drinking water needs of the State.
- Optimize the use of surface and groundwater for the differing economies of the unique regions of the State.
- Reliably meet agricultural water needs.
- Reliably meet industrial water needs.
- Manage water resources in a manner that protects the ecological needs of fish and wildlife.
- Reliably meet the water quantity and quality needs to help support navigation, recreation, and tourism.
- Use the best available science, data, tools, and technologies to support water resource decisions.
- Employ the latest supply management and water efficiency technologies among the different sectors of use including residential, commercial, industry, natural resources, and agriculture.

Mammoth Spring Lake - *Photo courtesy of ANRC*

- Identify and address emerging water resource management needs as identified through the water planning process.
- Use best available science and data to update and implement the AWP, and identify and address data gaps and needs.
- Optimize existing water, wastewater, and flood control infrastructure, including identifying opportunities to cooperatively address regional water and wastewater needs.
- Maximize the current infrastructure reliability including dams, levees, and treatment and conveyance facilities.
- Plan for changing demographics and related infrastructure maintenance and operation implications.
- Improve and update existing infrastructure and address aging infrastructure.
- Sustainably use surface and groundwater sources for the multiple intrastate uses while complying with interstate compacts.
- Refine criteria for declaring drought, water shortages and excess water, and advance policies and procedures for allocating water during times of shortage or drought.
- Identify and recommend procedures and criteria to improve upon existing instream flow methodologies taking into consideration water quality, fish and wildlife needs, aquifer recharge, and navigation needs at the statewide and basin-specific level.



Watershed - *Photo courtesy of USDA-NRCS*

- Include recreation and tourism as nonconsumptive water uses.
- Identify opportunities to manage water, wastewater, and stormwater to improve the quantity and quality of water, while providing for wise land management, wetland, and riparian protection for fish and wildlife sustainability.
- Identify implementable water resources alternatives that are socially, fiscally, technically, and environmentally feasible to protect, enhance, and wisely use surface and groundwater.
- Identify and implement alternatives that are fair and equitable.
- Allow for adaptability with changing technology, water uses, and socioeconomic conditions.
- Provide education and open communication about the AWP and its implementation.
- Work cooperatively with other regions and states, and among agencies and entities responsible for stewardship of the State's natural resources.

Key Findings

Demand Projections

- Statewide water demand is expected to increase 14 percent from the current 12 million AFY (11 billion gallons per day [gpd]) up to about 14 million AFY (12.5 billion gpd) by 2050.
- Overall, about 71 percent of statewide water demand is supplied from groundwater sources and that is assumed for planning forecasts to remain the same through the 40-year planning horizon. Reduction of groundwater use depends on successful implementation of conservation, surface water use, and delivery of excess surface water. Water demand for crop irrigation is about 80 percent of the total statewide water demand, primarily in the East Arkansas Region.

White River - *Photo courtesy of USDA-NRCS*

- One factor in estimating the projected demand for crop irrigation is the water application rate for each crop. While the best available data was used for the 2014 AWP analysis, stakeholder input suggests that the reported application rate, particularly for rice, is too high. The alternatives analysis suggests that increasing the accuracy of water use reporting could decrease the crop irrigation water demand figures by about 1.3 million AFY.
- Livestock water demands are projected to increase approximately 9 percent to about 33,600 AFY in 2050. Future water demands for aquaculture are held constant at baseline period levels of 115,300 AFY for planning purposes.
- Industrial water demand (both municipally-supplied and self-supplied) are projected to decrease by 31 percent from 325,945 AFY in 2010 to 226,300 AFY in 2050. The decrease is attributed to a downward trend in water intensive manufacturing.
- Mining water demand for silica sand, construction sand and gravel, and crushed stone mining are forecasted to increase by 132 percent from 6,825 AFY in 2010 to 15,658 AFY in 2050.
- Water demand for shale gas exploration and production is met with surface water. The demand for water for shale gas extraction in nine counties is projected to decrease by 26 percent from 11,680 AFY in 2010 to 8,395 AFY in 2026, depending on the price of gas and innovations in production technologies.
- Statewide municipal and self-supplied drinking water supply demand is projected to increase by about 25 percent from 462,500 AFY in 2010 to 578,000 AFY in 2050, assuming "passive conservation" (federally-required installation of low-flow plumbing fixtures).

Ouachita River Alternative Water Supply Project intake structure in Union County near El Dorado - *Photo courtesy of Union County Water Conservation Board*

- Total surface water withdrawals for thermoelectric power production is projected to increase 15 percent from 1.3 million AFY in 2010 to 1.5 million AFY in 2050. However, the majority of water withdrawn for thermoelectric power production is returned, so the consumptive use is 0.09 million AFY in 2010 and is projected to increase to 0.1 million AFY in 2050.
- Water needed to maintain ecosystem viability is estimated using the Arkansas Method (Filipek et al. 1987) for the 2014 AWP. However, there is a recognized need to shift to using empirical, risk-based ecological response/flow relationships as the foundation for determining fish and wildlife flows in the future.
- Improved methodologies for estimating fish and wildlife flows, if adopted by ANRC, could be used to evaluate permits for nonriparian withdrawals, pre-allocation studies, and allocation in times of water shortages, as well as in future updates of the AWP.

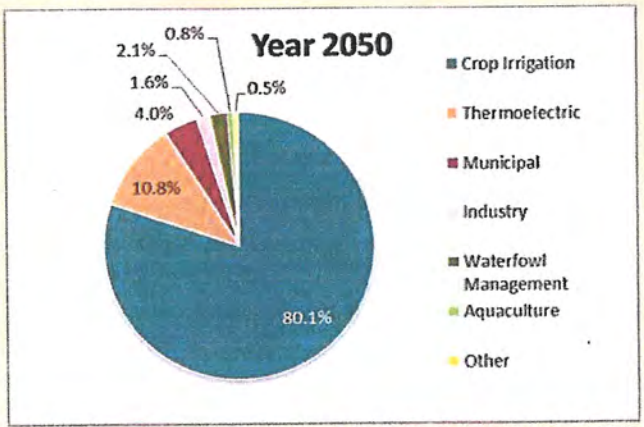


Figure 2. AWP Water Demand Forecast by Sector for the Year 2050

Water Availability

- For the State of Arkansas, on an average annual basis, there is estimated to be 8.7 million AFY of excess surface water available for interbasin transfer or use by nonriparians. It is important to note that, although there is an abundance of water available on an average annual basis, demands for that water do not necessarily occur during the times of year when that water is available in a stream.
- Groundwater modeling of the Mississippi Embayment aquifers (primarily the East Arkansas Region) suggests that, under sustainable pumping conditions, only a fraction of the water demand can be met with groundwater in 2050. Groundwater availability in Regions outside the Mississippi Embayment model is assessed in the U.S. Geological Survey (USGS) report "Aquifers of Arkansas" (Kresse et al. in review). The general conclusions are that water supplies are limited by low yield and water quality concerns.

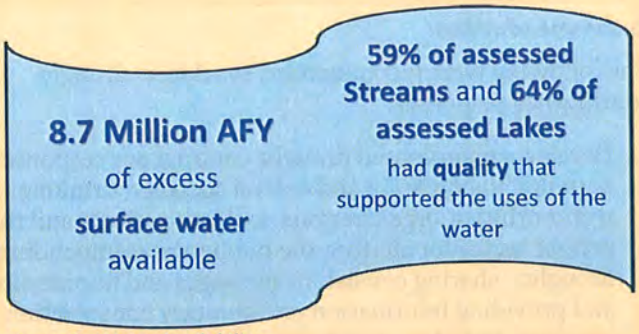


Figure 3. Water Availability

Water Quality

- Surface water quality assessments in 2008 showed that the quality of some streams and lakes is not adequate. There is no statewide pattern of use impairment or causes of impairment, except fish consumption (mercury).
- In surface water, there have been declining trends in suspended solids across most Regions from 1990 to 2008.
- Groundwater quality in the Mississippi Embayment sedimentary aquifers in the East Arkansas and South-central Arkansas Regions is generally good in the recharge areas and deteriorates to the southeast where the aquifers are deeper.
- Groundwater quality in the Interior Highlands of Arkansas is generally good, except where impacted by human activities.

Gap Analysis

- The projected annual average 2050 groundwater gap (the difference between supply and demand) across the State is approximately 8.2 million AFY assuming sustainable groundwater pumping. The groundwater supply gap is projected to occur primarily in the East Arkansas Region. Once complete, the Grand Prairie and Bayou Meto Projects will reduce this gap by providing surface water to 15 percent of the farmed acreage in east Arkansas.
- There is sufficient excess surface water in four major river basins to close the projected groundwater gap: Arkansas River, Ouachita River, Red River, and White River. However, the appropriate infrastructure may not be in place to use all of the excess surface water supply.
- Three major river basins are projected to have a water supply gap in 2050 taking into account both groundwater and surface water supplies: Bayou Macon, Boeuf River, and L'Anguille.
- The Boeuf River Basin is projected to experience a surface water gap (supply less than demand) in June, July, and August based on average flow conditions over the period of record.

Water and Wastewater Infrastructure

- The cost of infrastructure to deliver excess surface water to farms where groundwater has declined is high, but must be considered in the context of the $9.7 billion annual market value of agricultural products in Arkansas.
- The Grand Prairie Area Demonstration Project and Bayou Meto Water Management Project, when complete, will provide surface water sources for irrigation to 15 percent of the farmed acreage in East Arkansas with projected groundwater gaps.
- Arkansas water providers will need to spend $5.74 billion and wastewater providers will need to spend $3.76 billion to build, maintain, and replace required infrastructure through 2024.
- Small water and wastewater providers pose a unique challenge when planning at the statewide level.
- Many of these providers also face the challenge of shrinking population and resulting in reduced revenue streams, following the national trend of increased urban dwelling.

Issues and Recommendations

The Regional Issues and Recommendations (I&R) Workgroups were first asked to identify issues and prioritize those issues using a voting process. The Workgroups were then asked to develop recommendations to address the issues. The recommendations were also prioritized using a voting process. All of the I&Rs identified by the I&R Workgroups are presented in the *Issues and Recommendations Workgroup Process and Outputs Technical Memo*.

The final step in the I&R process was the ANRC selection of priority issues. The Commissioners considered all of the I&Rs identified and prioritized by the I&R Workgroups and selected nine priority issues and one supporting issue. Each of the priority issues are presented here along with the prioritized recommendations and an implementation strategy.

Issues and Recommendations Workgroup Meeting - *Photo courtesy of Terry Horton*

Conjunctive Water Management and Groundwater Decline Priority Issue

Issue: Declining groundwater levels in the aquifers and the need to move toward sustainable use of the groundwater.

Recommendations:

The following were recommended to address groundwater decline:

1. ANRC will seek authority to purchase, install, and read meters on selected alluvial wells including the authority to lease or condemn sites for meter installation.
2. Develop and implement conjunctive water management strategies based on storing surface water, during months when excess water is available, for use during the summer irrigation months when excess surface water is not available (**Figure 4**). Groundwater use would supplement surface water use, rather than being the primary irrigation water source.
3. Encourage and increase irrigation water use efficiency through integrated irrigation water management and conservation practices over the next decade.

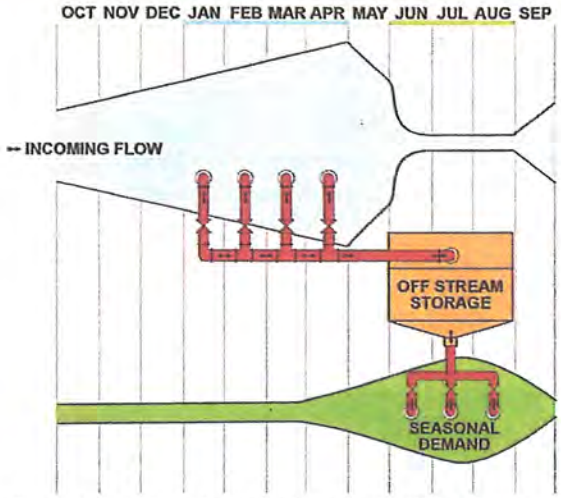


Figure 4. Operational Example of Conjunctive Water Management
Original Illustration by Bill McMurry

Drought Contingency Response Priority Issue

Issue: Planning for allocation during drought is needed before droughts occur.

Recommendations:

The following were recommended to address drought contingency responses:

1. Develop a coordinated drought contingency response network among State and federal agencies; drinking water utilities, organizations, and institutions; and the private sector for alerting the public about impending droughts, sharing consistent messages and information, and providing information on voluntary conservation measures to reduce water use.
2. Seek funding and ensure stream gaging networks throughout the State are adequate to provide streamflow information needed to make informed decisions about impending or advancing droughts statewide and within each planning region.

Identifying issues - *Photo courtesy of Terry Horton*

Excess Water for Nonriparian Withdrawal and Use Priority Issue

Issue: The statutory definition of excess water should be based on sound science.

Recommendations:

The following are recommended to address the excess water issues:

1. Remove the 25 percent limitation for estimating excess water available for nonriparian transfer and conduct scientific studies to determine what proportion of the total available water is seasonally appropriate to satisfy the required uses specified in statute by major basins and subbasins in each planning region, beginning with the East Arkansas Region, and followed by, in order, South-central, West-central, North, and Southwest Arkansas Regions. This study should be conducted in consultation with the AGFC and ADEQ.
2. Continue to use the Arkansas Method in estimating the proportion of total available water needed to satisfy fish and wildlife flow needs in estimating excess water for nonriparian withdrawals and transfers. Through adaptive management, the ANRC will evaluate and assess alternative methods for estimating fish and wildlife flows, or other instream needs and uses, as more accurate, scientifically reviewed, and defensible methods become available.
3. Engage stakeholders in the planning regions through an open and transparent process as the scientific study is being conducted by ANRC and as better scientific approaches become available and are proposed for use.

Funding Water Resources Development Projects Priority Issue

Issue: State-issued general obligation bonds are vital to finance and refinance the development of water; waste disposal; pollution control, abatement, and prevention; drainage, irrigation, flood control, wetlands, and aquatic resources projects to serve the citizens of the State of Arkansas.

Recommendations:

The following were recommended to address additional funding for water resources development projects:

1. As an initial step, authorize an additional $300 million under the Water, Waste Disposal, and Pollution Abatement Facilities General Obligation Bond Program at the appropriate time. Additional authorization will be requested as needed to finance and refinance the development of these water resources projects.
2. ANRC will seek the authority to merge water and sewer systems where necessary in order to bring them into economic viability.

Improving Water Quality through Nonpoint Source Management Priority Issue

Issue: Water quality is affected by nonpoint sources of pollutants and nonpoint source management projects need State funding in addition to federal funding.

Recommendations:

Recommendations for improving water quality include:

1. Propose legislation to designate funding specifically for financing NPS pollution management programs and implementing NPS management practices.
2. ANRC will collaborate with ADEQ and AGFC through the biennial Clean Water Act (CWA) water quality review processes, and the water quality criteria review to determine attainment or nonattainment of water quality standards in streams and identify the sources and causes of nonattainment:
   a. Streams impaired because of NPS pollution will be considered as priority streams for restoration through the NPS management program.
   b. Streams currently attaining water quality standards in priority watersheds will be considered for protection through the NPS management program.
3. Study whether nutrient management plans should be required outside current nutrient surplus areas.
4. Leverage funding from multiple sources such as Source Water Protection under the Safe Drinking Water Act, administered through the ADH, to address NPS pollution in watersheds with drinking water sources.

Public Awareness and Education Priority Issue

Issue: Public awareness and education are critical for water planning in Arkansas.

Recommendations:

The following is recommended to address the need for public awareness and education:

1. The ANRC will collaborate with the Arkansas Water Foundation, the Arkansas Association of Conservation Districts, the University of Arkansas (U of A) Cooperative Extension Service, and others to develop and disseminate public information. This information should focus on water conservation practices being implemented by agriculture in Arkansas, the contributions of agriculture to the economy, food security, the quality of life in Arkansas, advances in water conservation technology, and trends in groundwater and surface water use.

Public Water and Wastewater Infrastructure Priority Issue

Issue: Public water and wastewater infrastructure is failing, and in need of repair and replacement throughout Arkansas.

Recommendations:

The following are recommended to address the infrastructure issues:

1. Public entities operating water and wastewater infrastructure or flood control and drainage projects should develop sustainability plans that evaluate:
   a. Current infrastructure status and historical trends in status;
   b. Needed infrastructure repairs, replacement, and maintenance and associated schedules;
   c. Federal and State programs available to support infrastructure projects; and
   d. Contingency plans, including the potential for regionalization or privatization (private water wells, septic systems, decentralized systems, etc.), if the utilities are assessed to be unsustainable.
2. Receivership proceedings should be initiated for public water and wastewater providers that have defaulted on loans.
3. Training programs should be developed for utility boards of directors on sustainability planning and how these plans relate to the operation of their facilities and infrastructure. Utilities that submit a sustainability plan with funding applications could receive lower rates on loans.

Reallocation of Water Storage in Federal Reservoirs Priority Issue

Issue: Reallocation of water storage in USACE reservoirs is needed to increase available water for existing and new uses.

Recommendations:

Reallocation of water storage in USACE reservoirs, based on the revised 1977 Water Supply Act guidance manual, should be sought if there is a documented need for additional water for domestic, municipal, or industrial water supply.

Tax Incentives and Credits for Integrated Irrigation Water Conservation Priority Issue

Issue: Tax incentives and credits are needed to encourage the implementation and management of integrated irrigation water conservation practices.

Recommendations:

The following were recommended for tax incentives and credits to encourage increased water use efficiency and conservation:

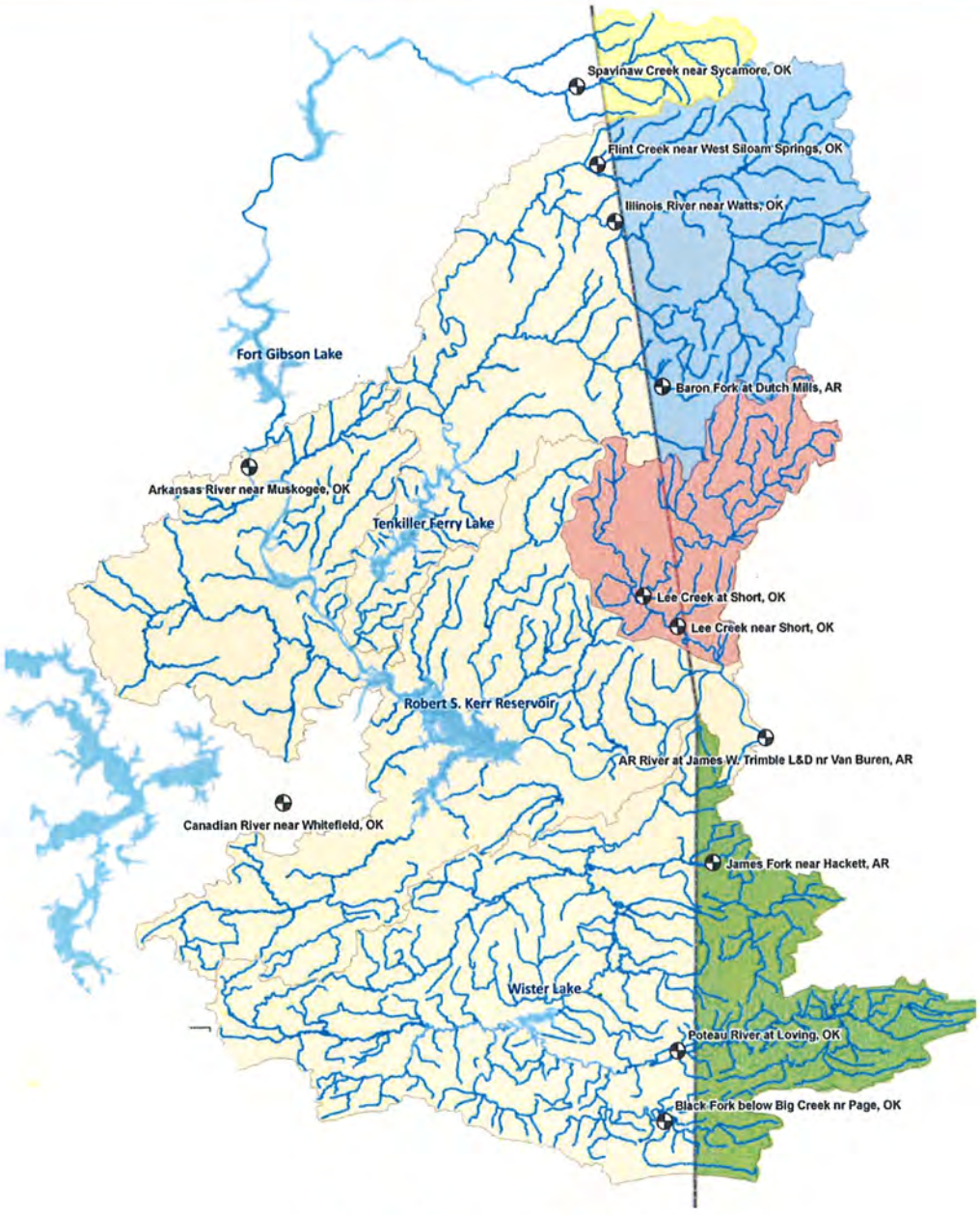
1. Determine the current irrigation water use efficiency for various crops and subwatersheds in the East Arkansas Region and establish a goal or target efficiency to be achieved for integrated irrigation water management and conservation practices.
2. Evaluate the effectiveness of the existing tax credits and incentives and, based on this assessment, consider:
   a. Increasing the percentage of the total project cost available for tax credits based on applicants improving their irrigation water use efficiency compared with the goal or target efficiency,
   b. Extending the period for claiming tax credits for implementing water conservation practices,
   c. Increasing the annual cap on tax credits so additional tax credits can be claimed, and
   d. Tracking the acreage on which water conservation practices have been implemented along with the tax credits.

On-farm reservoirs increase water security and mitigate the impact of drought - *Photo courtesy of USDA-NRCS*

For more information please visit the following website:
ArkansasWaterPlan.Arkansas.gov
If you would like to send comments please email them to ArkansasWater@CDMSmith.com or by mail to:
Arkansas Natural Resources Commission, Attn: Arkansas Water Plan
101 East Capitol, Suite 350, Little Rock, Arkansas

Arkansas River Basin Compact

Annual Compliance Report



October 2014

Submitted to the Arkansas-Oklahoma Arkansas River Basin Compact Commission

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 2013, 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
2013 Computations Summary

Summary of Results for Water Year 2013

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 (ρ)	EVAPORATION (E)	PERMITTED DIVERSIONS (D)	RELEASES (O)	INFLOW (I)	DEPLETIONS (X)
Webber Falls	2,160	33,282	5,991	46,230	-	6,849,130	6,870,228	21,098
Tenkiller Ferry	99,644	39,474	7,105	43,976	3,022	696,790	811,063	114,273
Robert S. Kerr	(2,154)	119,031	21,426	166,961	1,149	17,160,851	17,229,202	68,351
Wister	5,144	32,667	5,880	26,281	11,982	752,960	769,580	16,620
						ANNUAL DEPLETIONS:		220,342

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	79,528	1	79,529	AR	50	39,764	79,528
Illinois River	457,475	(23,956)	433,519	AR	40	173,408	457,475
Lee Creek	112,745	1,795	114,540	AR	0	-	112,745
Poteau River	378,081	695	378,776	AR	40	151,510	378,081
Arkansas River	1,958,517	283,543	2,242,060	OK	40	896,824	1,958,517

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

Arkansas River Basin Compact
2013 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	166,582	2.23	2,156		4.43	3.10	2,998		66,872	132,641		
			Nov		0.90	870		3.97	2.78	2,686		18,928	37,544		
			Dec		0.66	638		2.65	1.86	1,793		16,762	33,247		
			Jan		1.72	1,663		1.95	1.37	1,320		45,812	90,868		
			Feb		2.65	2,562		2.84	1.99	1,922		121,225	240,450		
			Mar		3.51	3,393		4.80	3.36	3,248		223,951	444,207		
			Apr		4.30	4,157		5.56	3.89	3,762		814,996	1,616,545		
			May		5.48	5,297		6.99	4.89	4,730		856,119	1,698,112		
			Jun		4.61	4,456		9.42	6.59	6,374		1,455,145	2,886,280		
			Jul		2.61	2,523		9.48	6.64	6,415		276,182	547,807		
			Aug		2.89	2,794		8.34	5.84	5,643		2,398,333	4,757,094		
			Sep	168,742	2.87	2,774		7.89	5.52	5,339		554,805	1,100,456		
			TOTAL	2,160	34.43	33,282	5,991	68.32	47.82	46,230	-		6,849,130	6,870,228	21,098
Tenkiller Ferry	627,467	12,900	Oct	552,044	3.1	3,365		2.53	1.77	1,904		5,226	10,366		
			Nov		0.7	785		2.34	1.64	1,761		10,278	20,386		
			Dec		0.8	817		1.45	1.02	1,091		11,034	21,886		
			Jan		2.2	2,397		1.84	1.29	1,385		9,869	19,575		
			Feb		3.4	3,623		2.63	1.84	1,979		1,183	2,346		
			Mar		3.8	4,128		4.19	2.93	3,153		2,528	5,014		
			Apr		3.9	4,236		5.39	3.77	4,056		97,951	194,286		
			May		6.3	6,719		6.56	4.59	4,936		105,580	209,418		
			Jun		3.1	3,333		8.68	6.08	6,532		36,710	72,814		
			Jul		3.0	3,268		8.81	6.17	6,630		21,725	43,092		
			Aug		3.6	3,870		7.09	4.96	5,335		27,407	54,362		
			Sep	651,688	2.7	2,935		6.93	4.85	5,215		21,802	43,244		
			TOTAL	99,644	36.72	39,474	7,105	58.44	40.91	43,976	3,022		696,790	811,063	114,273
Robert S. Kerr	525,700	41,900	Oct	519,653	2.44	8,520		4.52	3.16	11,048		77,196	153,118		
			Nov		0.19	663		3.72	2.60	9,092		42,311	83,924		
			Dec		1.00	3,492		2.42	1.69	5,915		41,250	81,819		
			Jan		2.83	9,881		1.65	1.16	4,033		79,952	158,585		
			Feb		2.56	8,939		2.72	1.90	6,648		146,202	289,992		
			Mar		3.48	12,151		4.47	3.13	10,925		260,441	516,585		
			Apr		4.18	14,595		5.36	3.75	13,101		1,115,732	2,213,054		
			May		5.78	20,182		6.77	4.74	16,547		1,212,636	2,405,264		
			Jun		3.77	13,164		9.93	6.95	24,271		2,202,938	4,369,528		
			Jul		3.86	13,478		9.85	6.90	24,075		359,931	713,923		
			Aug		3.12	10,894		8.73	6.11	21,338		2,499,347	4,957,455		
			Sep	517,499	0.88	3,073		8.17	5.72	19,969		613,867	1,217,605		
			TOTAL	(2,154)	34.09	119,031	21,426	68.31	47.82	166,961	1,149		17,160,851	17,229,202	68,351
Wister	48,850	7,700	Oct	42,062	2.39	1,534		3.73	2.61	1,675		-	-		
			Nov		1.28	821		2.87	2.01	1,289		159	315		
			Dec		1.77	1,136		2.15	1.51	966		490	972		
			Jan		3.56	2,284		1.38	0.97	620		2,233	4,429		
			Feb		3.07	1,970		2.19	1.53	984		23,438	46,489		
			Mar		5.52	3,542		3.79	2.65	1,702		37,709	74,796		
			Apr		5.56	3,568		5.05	3.54	2,268		102,547	203,402		
			May		10.15	6,513		6.50	4.55	2,920		34,228	67,891		
			Jun		4.55	2,920		8.50	5.95	3,818		136,670	271,085		
			Jul		8.02	5,146		7.78	5.45	3,495		16,106	31,946		
			Aug		3.33	2,137		8.24	5.77	3,701		24,421	48,439		
			Sep	47,206	1.71	1,097		6.33	4.43	2,843		1,611	3,195		
			TOTAL	5,144	50.91	32,667	5,880	58.51	40.96	26,281	11,982		752,960	769,580	16,620

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

Arkansas River Basin Compact
Subbasin Drainage Areas

Water Year 2013 - Additional Tables (refer to Drainage Areas for adjustment of flows)

USGS 07191220		
Spavinaw Creek near Sycamore, OK		
Drainage area:	133	sq.mi
Measured	43,948	cfs
	87,170	acre-feet
Adjusted to State Line		
Drainage Area:	121.34	sq.mi
Estimated	40,095	cfs
	79,528	**acre-feet**

USGS 07195855		
Flint Creek near West Siloam Springs		
Drainage area:	60	sq.mi
Measured	16,456	cfs
	32,641	acre-feet
Adjusted to StateLine		
Drainage Area:	55	sq.mi
Estimated	15,017	cfs
	29,787	acre-feet

USGS 07195500		
Illinois River near Watts, OK		
Drainage area:	635	sq.mi
Measured	202,435	cfs
	401,530	acre-feet
Adjusted to StateLine		
Drainage Area:	630	sq.mi
Estimated	200,701	cfs
	398,090	**acre-feet**

USGS 07196900		
Baron Fork at Dutch Mills, AR		
Drainage area:	41	sq.mi
Measured	9,611	cfs
	19,063	acre-feet
Adjusted to StateLine		
Drainage Area:	63	sq.mi
Estimated	14,922	cfs
	29,599	acre-feet

USGS 07249985		
Lee Creek near Short, OK		
Drainage area:	420	sq.mi
Measured	97,602	cfs
	193,593	acre-feet
Adjusted to StateLine		
Drainage Area:	245	sq.mi
Estimated	56,841	cfs
	112,745	acre-feet

USGS 07247015		
Poteau River at Loving, OK		
Drainage area:	269	sq.mi
Measured	138,524	cfs
	274,763	acre-feet
Adjusted to StateLine		
Drainage Area:	262	sq.mi
Estimated	134,714	cfs
	267,204	**acre-feet**

USGS 07247250		
Black Fork below Big Creek nr Page, OK		
Drainage area:	74	sq.mi
Measured	95,241	cfs
	188,910	acre-feet
Adjusted to StateLine		
Drainage Area:	18	sq.mi
Estimated	22,568	cfs
	44,765	**acre-feet**

USGS 07247250		
James Fork near Hackett, AR		
Drainage area:	147	sq.mi
Measured	31,360	cfs
	62,202	acre-feet
Adjusted to StateLine		
Drainage Area:	156	sq.mi
Estimated	33,331	cfs
	66,112	**acre-feet**

USGS 07250550		
AR River at James W Trimble L&D nr Van Buren		
Drainage area:	151,000	sq.mi
Measured	9,650,814	cfs
	19,142,390	acre-feet
Adjusted to StateLine		
Drainage Area:	149,954	sq.mi
Estimated	9,583,979	cfs
	19,009,823	**acre-feet**

USGS 07194500		
Arkansas River near Muskogee, OK		
Drainage area:	84,133	sq.mi
Measured	6,676,121	cfs
	13,242,086	**acre-feet**

USGS 07245000		
Askansas River near Whitefield, OK		
Drainage area:	37,876	sq.mi
Measured	1,442,359	cfs
	2,860,919	**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.

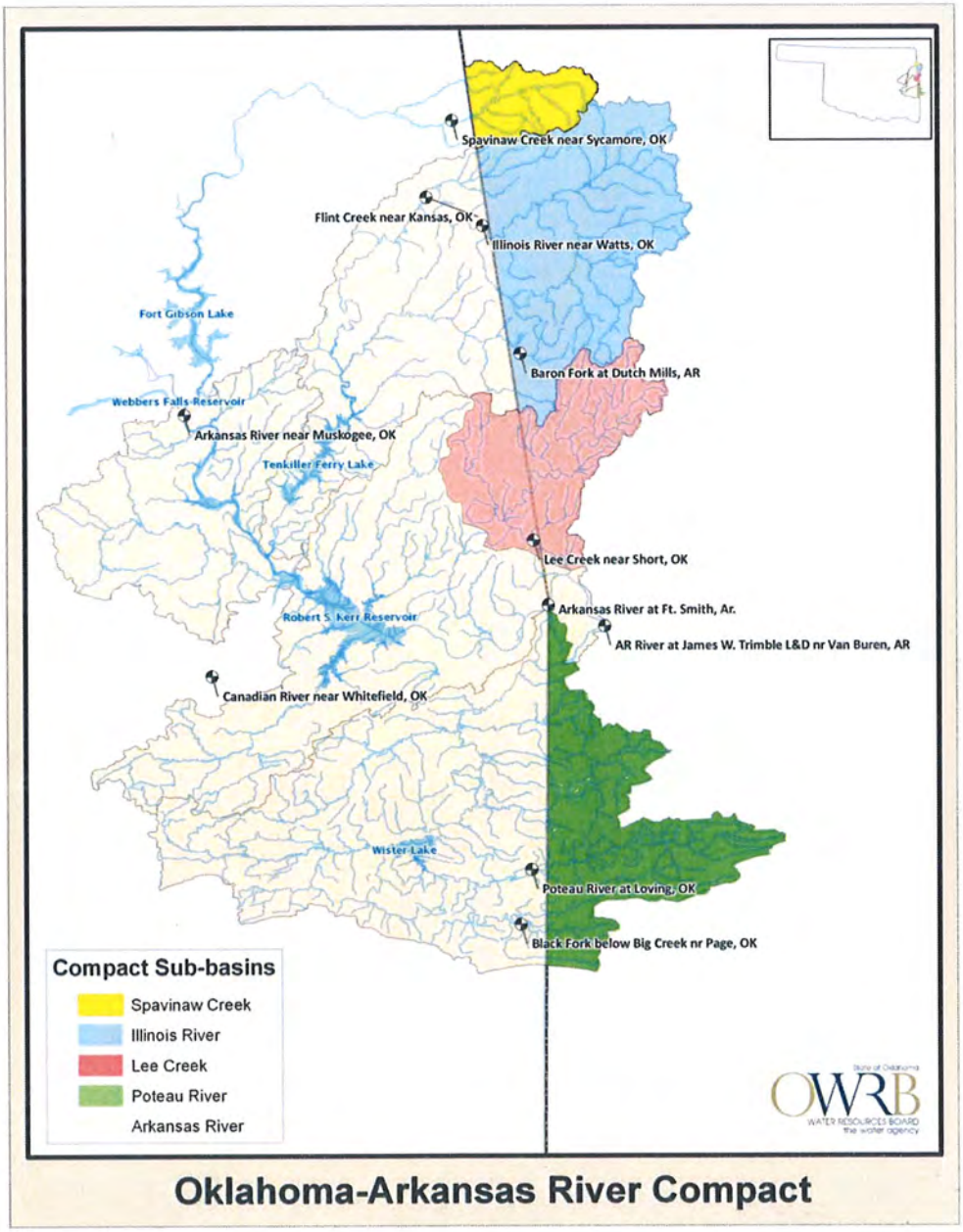
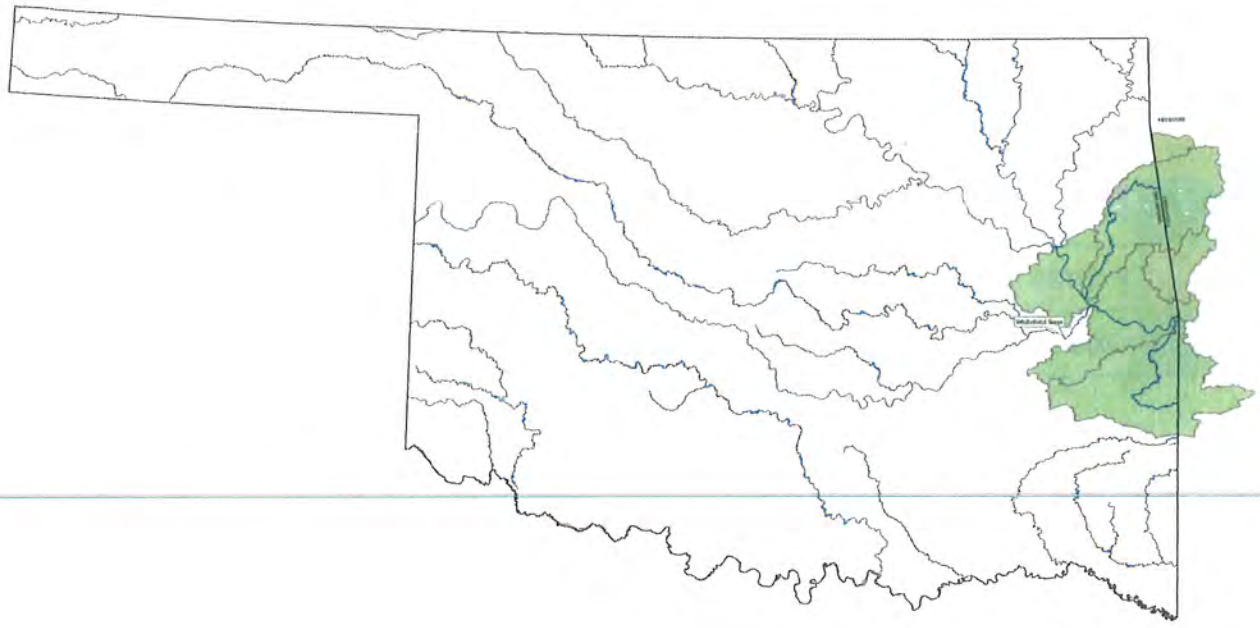


Figure 1. Map of the Oklahoma-Arkansas River Compact Area

Arkansas-Oklahoma Arkansas River Compact Commission

Draft

Environmental Committee Report



October 30, 2014

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 1999-2013[1] and 2009-2013.

Station (see footnotes)	1999-2013 (3-month GM'S)			2009-2013 (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]	273	6	98%	83	6	93%
Illinois River near Tahlequah[2]	273	12	96%	81	7	91%
Flint Creek near Kansas[2]	264	0	100%	75	0	100%
Barren Fork near Eldon[2]	261	143	45%	75	51	32%
Little Lee Creek near Nicut[1]	66	64	3%	57	55	4%
Lee Creek near Short	178	179	<1%	79	79	0%
Mountain Fork River near Smithville	151	125	17%	57	47	18%

[1]Little Lee Creek near Nicut Period of Record Dataset from 2008-2013
[2]Dataset meets USAP data requirements

Table 2. Waters Listed on Oklahoma's 2012 303(d) List

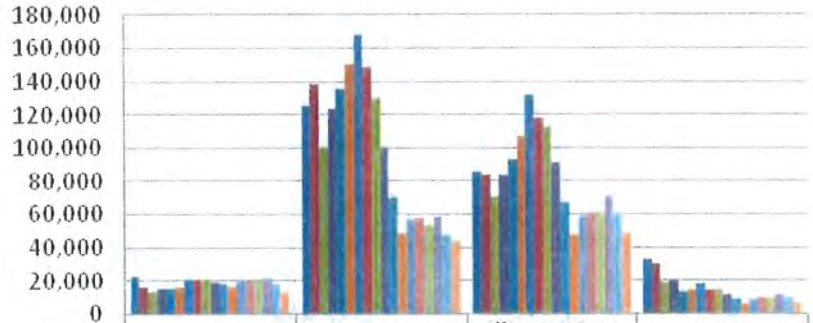
Impaired Waters in the Illinois River Basin

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, Turbidity, 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
121700050170	Illinois River - Baron Fork	Enterococcus
121700060010	Flint Creek	TP,Enterococcus
121700060040	Battle Creek (Battle Branch)	Enterococcus
121700060080	Sager Creek	Enterococcus

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, Color, listed as an NLW in the OWQS
220200050010	Lee Creek	Lead, Enterococcus
220200050040	Little Lee Creek	Enterococcus

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	15,705	138,508	83,799	29,482
Total P 94-98	12,986	99,898	70,546	19,163
Total P 95-99	14,949	123,581	83,632	19,257
Total P 96-00	15,103	134,986	92,876	13,163
Total P 97-01	15,992	149,927	106,797	14,548
Total P 98-02	19,259	167,987	131,491	17,603
Total P 99-03	20,620	148,151	117,524	14,059
Total P 00-04	21,004	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	57,275	60,827	9,195
Total P 06-10	19,818	53,127	61,131	9,335
Total P 07-11	21,672	58,371	70,241	11,256
Total P 08-12	17,473	47,785	60,776	9,894
Total P 09-13	13,515	43,489	48,349	6,989

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 for total phosphorus concentrations use 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 1993-2013 and 1999-2013, total phosphorus concentrations measured at both higher and lower flows from 1999-2013, and use assessment geometric means from 1999-2013. 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, only Flint Creek demonstrated a highly significant upward trend for both tests. Conversely, the Illinois River had a highly significant downward trend at Watts and Tahlequah. The Barren Fork River demonstrated no significant trend.
2. When all data from 1999-2013 are analyzed, all stations demonstrate a highly significant downward trend. The unadjusted Flint Creek data still show no significant trend.
3. All stations show a highly significant downward trend when only higher flow total phosphorus concentrations are considered. Data from the Barren Fork River and Flint Creek show no significant trend in unadjusted total phosphorus concentrations.
4. Both Illinois River stations and the Barren Fork demonstrate a highly significant downward trend in total phosphorus when only lower, or base flow data, are considered. Flint Creek data show no significant trend.
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 (1993-2013)		All Data (1999-2013)		Higher Flow Data (1999-2013)		Lower Flow Data (1999-2013)		Geomtric Mean For Assessment (1999-2013)
	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	↓↓$^{(NT)}$	NT	↓↓↓$^{(NT)}$	NT$^{(↑)}$	NT$^{(↑)}$	↓↓↓$^{(NT)}$
Barren Fork near Eldon	NT	NT	↓↓↓	↓↓↓	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 95% Confidence Level
↑ = Increasing Trend at the 80% Confidence Level
NT = No Signficant Trend

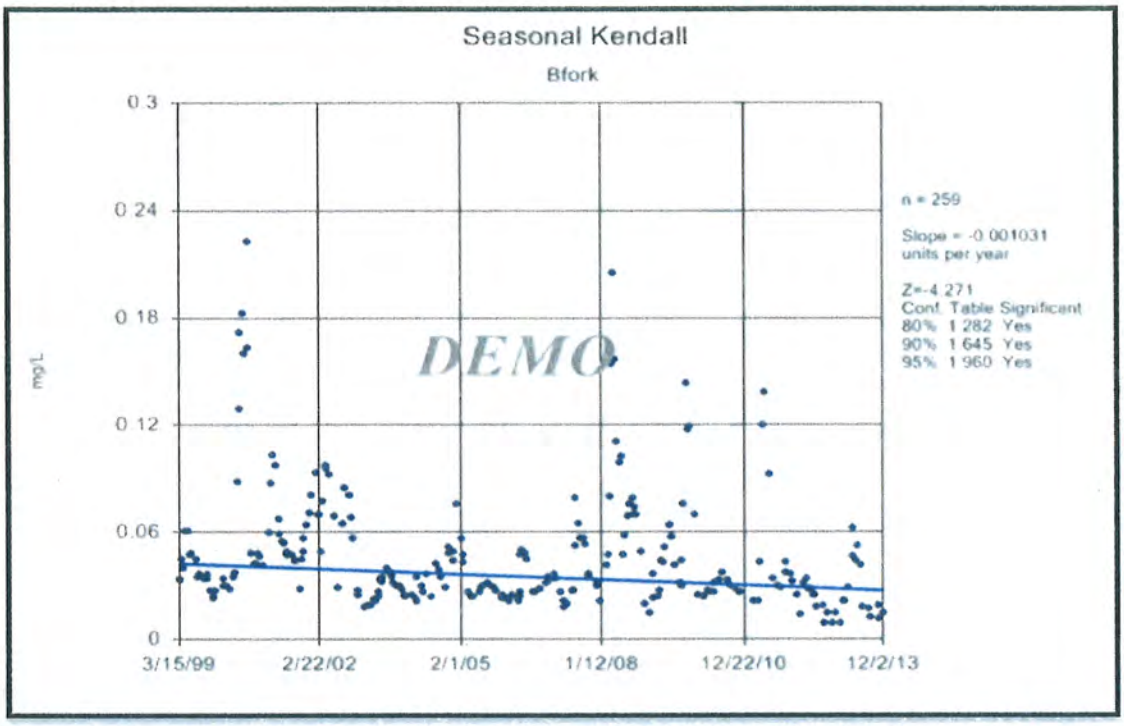


Figure 1. Trend for use assessment geometric means (1999-2013) on the Barren Fork River near Eldon.

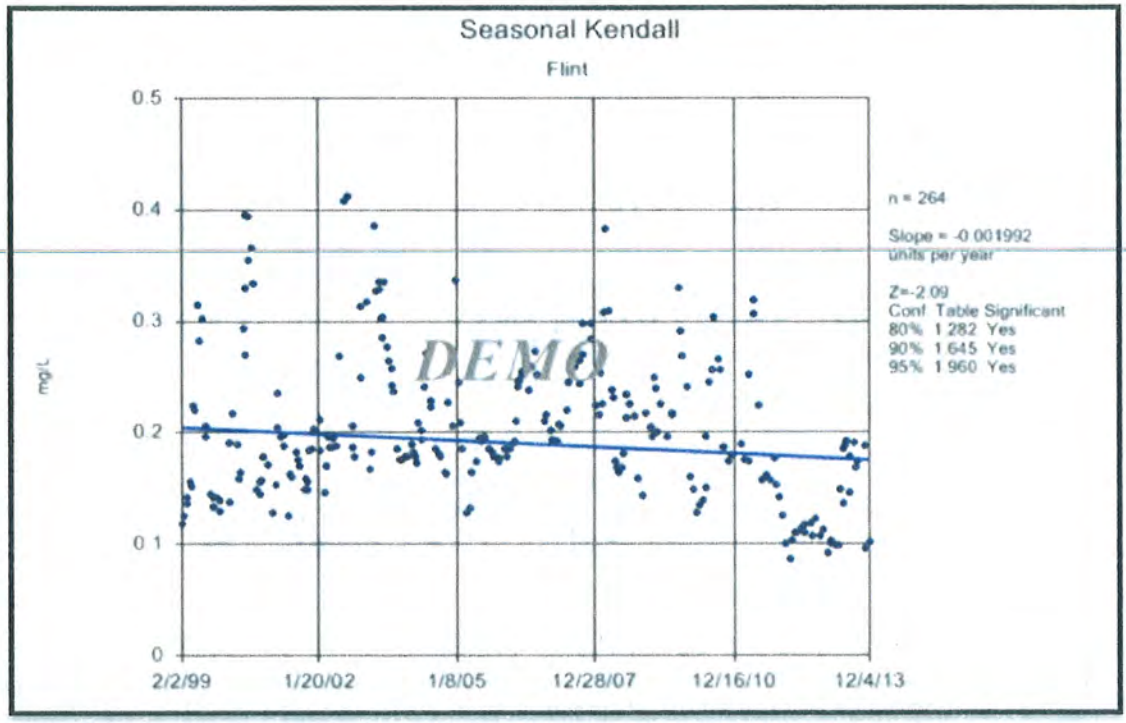


Figure 2. Trend for use assessment geometric means (1999-2013) on Flint Creek near Kansas.

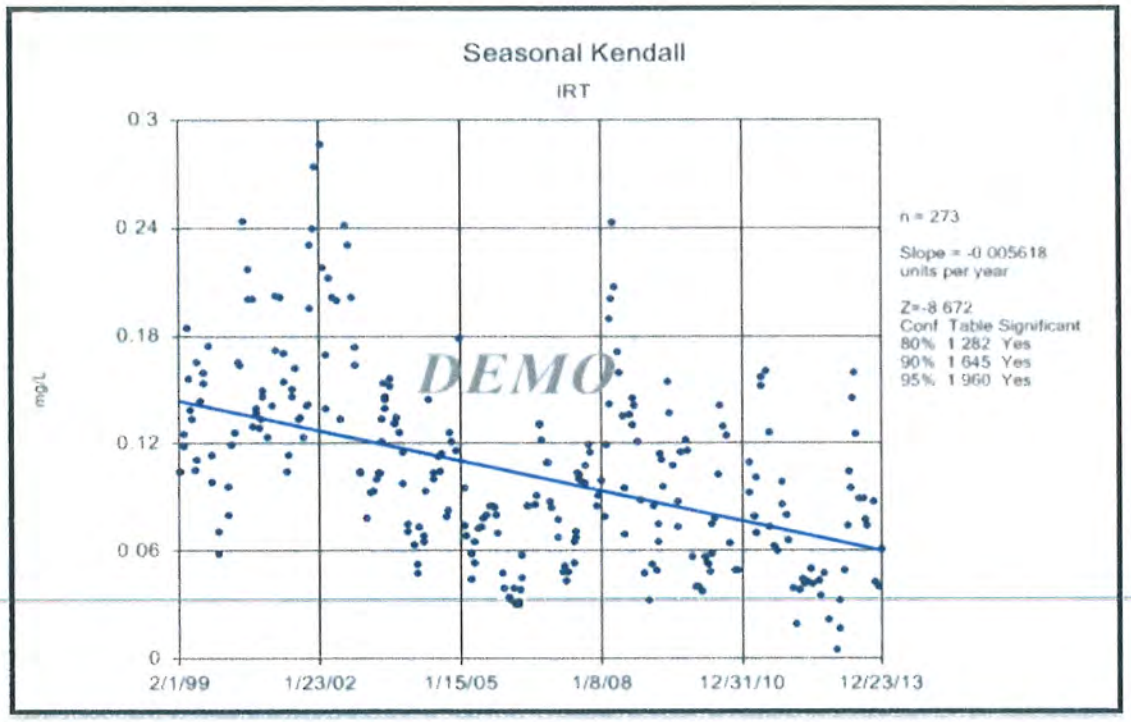


Figure 3. Trend for use assessment geometric means (1999-2013) on Illinois River near Tahlequah.

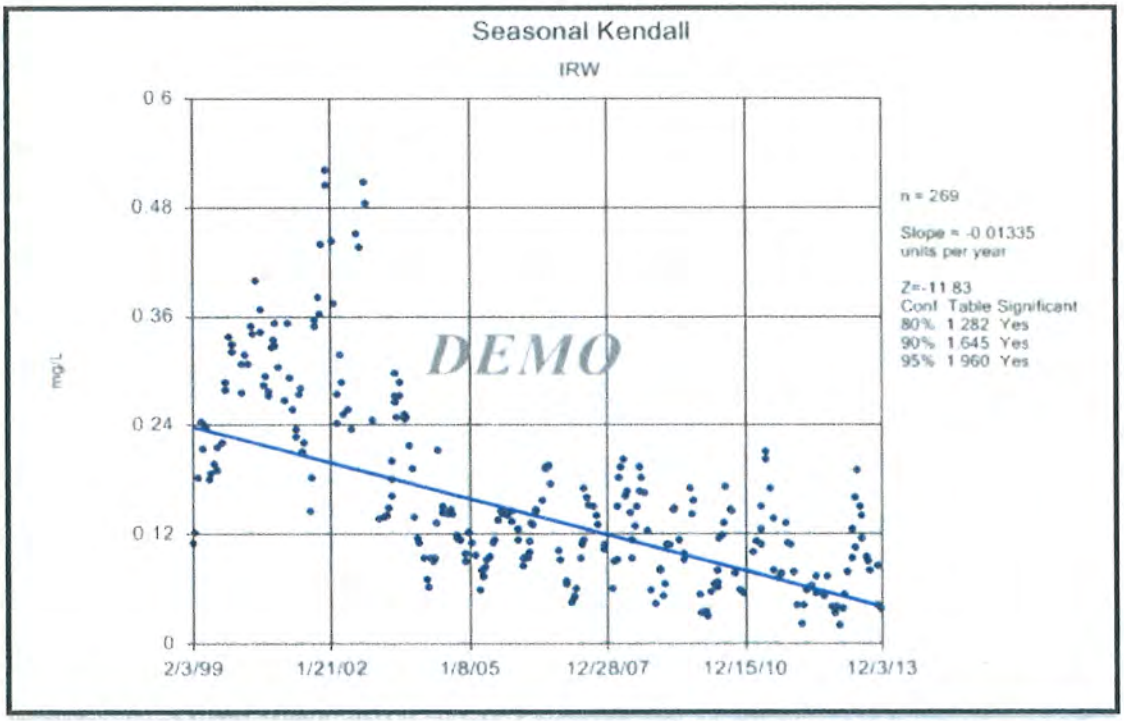


Figure 4. Trend for use assessment geometric means (1999-2013) on Illinois River near Watts.

Arkansas River at Moffett

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

Stream Data

County	Sequoyah [View Site Data]
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)	57	19.6	20.1	5.4/30.9	13.1/27.1	
	Turbidity (NTU)	60	37	22	7/194	15/45	
	pH (units)	57	7.87	7.85	6.87/8.79	7.70/8.09	
	Dissolved Oxygen (mg/L)	57	8.89	8.74	5.35/13.58	7.32/10.22	
Minerals	Hardness (mg/L)	57	170	142	39/658	126/186	
	Total Dissolved Solids (mg/L)	59	386.4	342.7	127.0/833.1	282.0/472.5	
	Specific Conductivity (uS/cm)	56	620.8	575.9	195.0/1333.0	481.0/736.2	
	Chloride (mg/L)	60	107.9	98.7	13.4/293.0	65.0/139.5	
	Sulfate (mg/L)	60	56.4	52.5	22.3/116.0	36.5/71.4	
Nutrients	Total Phosphorus (mg/L)	60	0.125	0.114	0.054/0.330	0.095/0.139	
	Total Nitrogen (mg/L)	59	0.954	0.880	0.450/2.820	0.645/1.130	
	Nitrate/Nitrite (mg/L)	60	0.321	0.253	<0.050/1.145	0.136/0.489	
Bacteria	Chlorophyll A (mg/m^3)	18	10.9	10.5	0.1/34.7	5.4/14.2	TSI=63.0
	Enterococcus (cfu/100ml)(*-Geo. Mn.)	23	997.9	10.0	4.1/12000.0	10.0/35.9	Mean> OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	23	146.4	10.0	1.0/2035.0	10.0/20.0	

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												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

Arkansas River at Muskogee

Sample Record	Times Visited	Station ID
November 1998 - Current	156	121400010260-001AT

Stream Data

County	Muskogee — View Site Data
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)	106	17.8	17.6	3.5/32.4	10.9/24.9	
	Turbidity (NTU)	107	45	24	6/387	16/46	
	pH (units)	104	8.04	8.01	7.22/9.48	7.73/8.32	
Minerals	Dissolved Oxygen (mg/L)	106	8.72	8.53	4.20/13.88	7.08/10.38	
	Hardness (mg/L)	104	189	174	92/418	144/220	
	Total Dissolved Solids (mg/L)	111	562.2	478.4	155.0/1759.0	307.0/690.0	35.7% of values> OWQS
	Specific Conductivity (uS/cm)	106	935.8	797.8	215.0/2746.0	469.8/1224.8	
	Chloride (mg/L)	95	172.6	140.0	11.3/713.0	83.3/210.0	40.0% of values> OWQS
	Sulfate (mg/L)	96	76.8	72.9	28.3/202.0	45.1/100.8	
Nutrients	Total Phosphorus (mg/L)	109	0.165	0.144	0.053/0.705	0.114/0.177	
	Total Nitrogen (mg/L)	109	1.142	1.080	<0.150/3.875	0.890/1.335	
	Nitrate/Nitrite (mg/L)	105	0.461	0.435	<0.050/1.210	0.233/0.655	
	Chlorophyll A (mg/m^3)	31	18.9	13.7	<0.1/90.0	8.9/25.7	TSI=60.3
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	30	3837.0	38.5	<10.0/75000.0	<10.0/200.0	Mean> OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	30	409.5	20.0	<10.0/5492.0	<10.0/65.0	

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		NS	NS				
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

Barren Fork at Eldon

Sample Record	Times Visited	Station ID
November 1998 - Current	228	121700050010-001AT

Stream Data

County	Cherokee — View Site Data
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)	113	17.3	17.7	6.1/28.6	11.5/22.3	
	Turbidity (NTU)	112	4	3	1/45	2/3	
	pH (units)	112	7.60	7.55	6.37/8.82	7.34/7.88	
	Dissolved Oxygen (mg/L)	113	9.39	9.55	4.40/13.93	7.88/10.98	
Minerals	Hardness (mg/L)	114	98	96	46/159	89/104	
	Total Dissolved Solids (mg/L)	110	124.3	121.0	12.9/545.0	106.2/134.5	
	Specific Conductivity (uS/cm)	113	195.9	197.1	20.2/713.0	172.5/212.8	
	Chloride (mg/L)	99	10.3	<10.0	<10.0/43.7	<10.0/<10.0	
	Sulfate (mg/L)	99	11.1	<10.0	<10.0/40.0	<10.0/<10.0	
Nutrients	Total Phosphorus (mg/L)	119	0.034	0.028	<0.005/0.217	0.021/0.035	See Notes
	Total Nitrogen (mg/L)	121	1.393	1.295	<0.150/4.200	0.795/1.833	
	Nitrate/Nitrite (mg/L)	122	1.226	1.198	<0.050/3.830	0.667/1.635	
Bacteria	Chlorophyll A (mg/m^3)	52	1.5	1.1	<0.1/11.7	0.6/1.7	TSI=36.3
	Enterococcus (cfu/100ml)(*-Geo. Mn.)	70	233.0	20.0	<10.0/3900.0	<10.0/85.5	Geo. Mean> OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	70	82.4	11.8	<10.0/2419.6	<10.0/52.0	

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												NS	NS
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: *44%(28 of 64) of 3-month rolling Geo. Mean exceed OWQS criterion of 0.037 ppm*

Caney Creek at Barber

Sample Record	Times Visited	Station ID
September 1999 - 2012	202	121700040010-001AT

Stream Data

County	Cherokee	View Site Data
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)	98	4	2	1/103	1/3	
	pH (units)	97	7.77	7.76	6.46/9.06	7.56/8.02	
Minerals	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	
	Total Dissolved Solids (mg/L)	102	140.7	139.8	78.4/254.0	128.0/155.9	
	Specific Conductivity (uS/cm)	99	219.0	218.1	122.6/391.0	200.0/243.0	
	Chloride (mg/L)	90	10.3	<10.0	<10.0/36.8	<10.0/<10.0	
	Sulfate (mg/L)	90	10.5	<10.0	<10.0/32.5	<10.0/<10.0	
Nutrients	Total Phosphorus (mg/L)	105	0.060	0.037	<0.005/1.532	0.030/0.047	
	Total Nitrogen (mg/L)	107	1.091	1.015	<0.150/7.035	0.640/1.360	
	Nitrate/Nitrite (mg/L)	108	0.920	0.858	<0.050/6.655	0.490/1.135	
	Chlorophyll A (mg/m^3)	46	1.3	0.8	<0.1/12.1	0.5/1.2	TSI=34.03
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	46	94.3	20.0	<10.0/1408.0	<10.0/52.0	Mean> OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	46	123.9	15.0	<10.0/2382.0	<10.0/41.0	

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	S	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

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

Flint Creek at Flint

Sample Record	Times Visited	Station ID
November 1998 - Current	223	121700060010-001AT

Stream Data

County	Delaware — View Site Data
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)	113	16.9	16.4	5.3/28.7	11.1/22.6	
	Turbidity (NTU)	112	3	1	1/58	1/2	
	pH (units)	112	7.65	7.66	6.44/8.79	7.40/7.87	
	Dissolved Oxygen (mg/L)	113	9.30	9.12	4.97/14.94	7.84/10.65	
Minerals	Hardness (mg/L)	114	113	114	<10/218	102/124	
	Total Dissolved Solids (mg/L)	109	187.6	188.0	97.5/552.0	158.0/211.0	
	Specific Conductivity (uS/cm)	111	289.2	290.3	152.3/452.2	250.0/323.0	
	Chloride (mg/L)	100	15.2	13.7	<10.0/43.3	<10.0/18.0	
	Sulfate (mg/L)	100	17.5	15.1	<10.0/69.0	11.4/19.9	
Nutrients	Total Phosphorus (mg/L)	120	0.206	0.165	0.070/1.450	0.136/0.197	
	Total Nitrogen (mg/L)	122	2.987	2.933	<0.050/7.925	2.323/3.695	
	Nitrate/Nitrite (mg/L)	123	2.755	2.685	<0.050/7.525	2.170/3.385	
	Chlorophyll A (mg/m^3)	52	1.0	0.7	<0.1/4.2	0.5/1.4	TSI=29.9
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	61	590.1	60.0	<10.0/18000.0	14.0/133.0	Mean> OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	61	203.5	30.0	<10.0/4611.0	13.3/74.0	

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%(67 of 67) 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	154	220100040020-001AT

Stream Data

County	Latimer [View Site Data]
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)	124	17.5	18.7	1.0/31.6	10.1/24.2	
	Turbidity (NTU)	125	38	28	5/390	17/43	
	pH (units)	125	7.14	7.03	5.77/8.74	6.82/7.48	
Minerals	Dissolved Oxygen (mg/L)	124	6.06	6.09	0.84/15.69	3.08/8.53	35% of values< OWQS
	Hardness (mg/L)	125	52	46	<10/212	32/63	
	Total Dissolved Solids (mg/L)	120	98.6	91.5	<10.0/307.0	68.1/123.8	
	Specific Conductivity (uS/cm)	123	155.6	133.0	11.0/760.0	98.0/196.0	
	Chloride (mg/L)	101	10.7	<10.0	<10.0/22.3	<10.0/<10.0	
	Sulfate (mg/L)	102	21.6	21.2	<10.0/48.5	15.5/25.0	
Nutrients	Total Phosphorus (mg/L)	125	0.086	0.068	<0.005/0.867	0.047/0.096	
	Total Nitrogen (mg/L)	126	0.754	0.703	<0.150/3.460	0.504/0.934	
	Nitrate/Nitrite (mg/L)	124	0.136	0.118	<0.050/0.560	<0.050/0.195	
	Chlorophyll A (mg/m^3)	9	10.1	2.7	0.7/34.0	0.9/21.3	
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	29	466.8	95.0	<10.0/8000.0	50.0/228.0	Mean> OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	29	154.3	74.0	<10.0/1396.0	20.0/147.0	

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	S	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 *Fish and 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

Illinois River at Tahlequah

Sample Record	Times Visited	Station ID
November 1998 - Current	212	121700030010-001AT

Stream Data

County	Cherokee — View Site Data
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)	114	17.6	17.3	5.0/31.7	11.0/23.9	
	Turbidity (NTU)	114	8	4	1/84	3/6	
	pH (units)	112	7.86	7.81	6.47/9.29	7.57/8.10	
	Dissolved Oxygen (mg/L)	114	9.78	9.87	4.66/15.88	7.64/11.62	
Minerals	Hardness (mg/L)	114	114	113	69/161	105/121	
	Total Dissolved Solids (mg/L)	111	167.0	167.0	42.0/565.0	140.0/185.0	
	Specific Conductivity (uS/cm)	113	258.6	265.0	66.0/441.0	235.6/288.6	
	Chloride (mg/L)	100	12.1	10.3	<10.0/23.5	<10.0/13.5	
	Sulfate (mg/L)	100	14.1	12.5	<10.0/47.9	10.7/14.8	
Nutrients	Total Phosphorus (mg/L)	121	0.088	0.079	<0.005/0.438	0.048/0.119	
	Total Nitrogen (mg/L)	123	1.661	1.560	<0.150/4.320	1.050/2.245	
	Nitrate/Nitrite (mg/L)	124	1.419	1.443	<0.050/3.610	0.884/1.904	
	Chlorophyll A (mg/m^3)	52	3.6	2.0	0.2/46.4	1.3/3.1	TSI=42.1
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	60	161.7	20.0	<10.0/2500.0	<10.0/106.8	
	E. Coli (cfu/100ml)(*-Geo. Mn.)	60	66.1	<10.0	<10.0/884.0	<10.0/41.0	

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									S				
Public & Private Water Supply				S									
Fish Consumption				S									

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

Notes: *99%(67 of 68) 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	221	121700030350-001AT

Stream Data

County	Adair [View Site Data]
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)	114	17.2	16.1	4.3/31.5	10.8/23.6	
	Turbidity (NTU)	114	11	7	2/95	4/13	17% of values> OWQS
	pH (units)	113	7.89	7.92	6.51/9.03	7.67/8.11	
Minerals	Dissolved Oxygen (mg/L)	114	10.40	9.95	4.51/18.88	8.61/11.76	
	Hardness (mg/L)	115	125	126	10/215	113/136	
	Total Dissolved Solids (mg/L)	111	192.7	195.0	95.4/566.0	168.0/212.0	
	Specific Conductivity (uS/cm)	114	302.1	306.6	149.1/713.0	267.9/335.1	
	Chloride (mg/L)	99	14.1	12.6	10.0/28.3	10.0/16.8	
	Sulfate (mg/L)	99	16.2	14.1	10.0/96.8	11.7/17.9	
Nutrients	Total Phosphorus (mg/L)	119	0.163	0.119	<0.005/1.153	0.065/0.226	
	Total Nitrogen (mg/L)	121	2.361	2.390	<0.150/5.035	1.923/2.838	
	Nitrate/Nitrite (mg/L)	122	2.026	2.060	<0.050/4.615	1.579/2.493	
	Chlorophyll A (mg/m^3)	52	3.1	2.3	<0.1/15.3	1.5/3.4	TSI=39.8
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	61	595.8	20.0	8.5/15531.0	<10.0/104.0	Mean> OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	61	391.4	20.0	<10.0/12997.0	<10.0/63.0	Mean> OWQS

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	NS	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 *95%(63 of 66) of rolling Geo. Mean exceed OWQS criterion of 0.037 ppm*

Lee Creek at Short

Sample Record	Times Visited	Station ID
January 2003 - Present	218	220200050010-001AT

Stream Data

County	Sequoyah [View Site Data]
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)	114	17.2	16.1	0.2/32.5	10.1/24.5	
In-Situ	Turbidity (NTU)	111	8	5	1/93	4/8	
In-Situ	pH (units)	114	7.56	7.59	6.31/8.48	7.30/7.84	
In-Situ	Dissolved Oxygen (mg/L)	114	9.26	9.07	5.23/13.94	7.45/11.04	
Minerals	Hardness (mg/L)	112	47	44	21/130	36/55	
Minerals	Total Dissolved Solids (mg/L)	103	58.4	57.0	4.0/173.0	42.9/67.0	
Minerals	Specific Conductivity (uS/cm)	114	91.9	90.0	6.3/266.0	68.0/105.3	
Minerals	Chloride (mg/L)	73	<10.0	<10.0	<10.0/<10.0	<10.0/<10.0	
Minerals	Sulfate (mg/L)	73	10.9	<10.0	<10.0/49.0	<10.0/<10.0	
Nutrients	Total Phosphorus (mg/L)	115	0.013	0.010	<0.005/0.149	<0.005/0.015	
Nutrients	Total Nitrogen (mg/L)	121	0.320	0.220	<0.150/2.240	<0.150/0.350	
Nutrients	Nitrate/Nitrite (mg/L)	118	0.151	0.055	<0.050/1.620	<0.050/0.180	
Bacteria	Chlorophyll A (mg/m^3)	72	2.9	0.9	<0.1/92.0	0.5/1.6	TSI=41.5
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	48	473.6	<10.0	<10.0/7100.0	<10.0/61.5	
Bacteria	E. Coli (cfu/100ml)(*-Geo. Mn.)	48	136.5	<10.0	<10.0/2359.0	<10.0/49.3	

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	NS						S	S	S	
Aesthetics												S	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

0.0%(0 of 54) of 3-month rolling Geo. Mean exceed OWQS of 0.037 ppm
Fish & Wildlife Propagation not supporting for Copper and 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

Little Lee Creek at Nicut

Sample Record	Times Visited	Station ID
February 2008 - Current	103	220200050040-001AT

Stream Data

County	Sequoyah [View Site Data]
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)	69	16.6	15.8	0.3/31.4	9.3/23.2	
	Turbidity (NTU)	69	10	4	1/168	2/5	
	pH (units)	70	7.54	7.56	6.30/8.35	7.43/7.83	
Minerals	Dissolved Oxygen (mg/L)	70	9.71	9.70	5.01/13.80	8.22/11.28	
	Hardness (mg/L)	69	64	63	36/140	53/72	
	Total Dissolved Solids (mg/L)	63	87.0	80.0	50.0/204.0	72.0/97.0	
	Specific Conductivity (uS/cm)	69	137.9	129.0	74.8/314.0	113.5/153.0	
	Chloride (mg/L)	33	<10.0	<10.0	<10.0/<10.0	<10.0/<10.0	
	Sulfate (mg/L)	33	10.2	<10.0	<10.0/15.4	<10.0/<10.0	
Nutrients	Total Phosphorus (mg/L)	69	0.017	<0.005	<0.005/0.259	<0.005/0.010	
	Total Nitrogen (mg/L)	75	0.307	0.190	<0.150/1.490	<0.150/0.350	
	Nitrate/Nitrite (mg/L)	68	0.168	0.055	<0.050/1.490	<0.050/0.153	
	Chlorophyll A (mg/m^3)	35	0.8	0.6	<0.1/4.4	0.3/0.9	TSI=26.0
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	10	306.0	12.8	<10.0/2419.6	<10.0/159.6	
	E. Coli (cfu/100ml)(*-Geo. Mn.)	10	754.2	26.7	<10.0/6488.0	<10.0/287.0	

Beneficial Uses

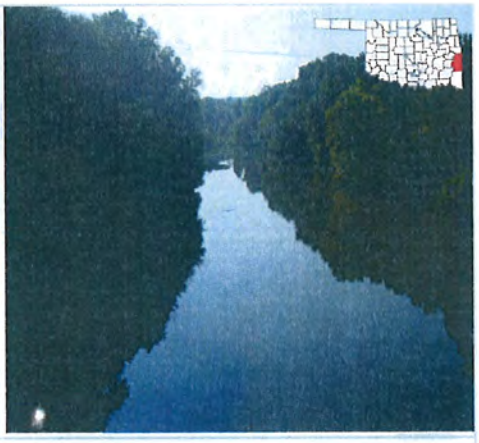
Click to learn more about Beneficial Uses	Turbidity	pH	Dissolved Oxygen	Metals	Sulfates	Nitrates	Chlorides	Total Dissolved Solids	Bacteria	Bio. Fish	Bio. BMI	Sediment	Total Phosphorus
Fish & Wildlife Propagation	S	S	S	NEI						S	S	S	
Aesthetics												S	NEI
Agriculture					S		S	S					
Primary Body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

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

Notes

5%(2 of 40) of 3-month rolling Geo. Mean exceed OWQS of 0.037 ppm

Poteau River at Heavener



Sample Record	Times Visited	Station ID
November 1998 – December 2012	158	220100020010-001AT

Stream Data

County	LeFlore — View Site Data
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)	117	23	16	3/152	10/24	
	pH (units)	118	7.27	7.25	5.96/8.97	6.92/7.63	
	Dissolved Oxygen (mg/L)	118	8.19	7.80	3.77/16.00	6.58/9.79	
Minerals	Hardness (mg/L)	118	48.0	35.0	<10.0/188.0	21.4/62.3	
	Total Dissolved Solids (mg/L)	119	88.3	67.0	<0.10/311.0	41.0/117.0	
	Specific Conductivity (uS/cm)	118	135.7	102.2	0.1/486.0	56.8/180.0	
	Chloride (mg/L)	77	11.8	<10.0	<10.0/105.0	<10.0/<10.0	
	Sulfate (mg/L)	78	35.5	21.4	10.2/146.0	15.8/40.7	
Nutrients	Total Phosphorus (mg/L)	114	0.075	0.054	0.008/0.430	0.038/0.087	
	Total Nitrogen (mg/L)	115	0.764	0.605	<0.150/5.870	0.450/0.780	
	Nitrate/Nitrite (mg/L)	116	0.255	0.163	<0.050/4.230	<0.050/0.285	
Bacteria	Chlorophyll A (mg/m^3)	16	12.1	3.2	<0.1/29.7	0.9/11.8	TSI=48.9
	Enterococcus (cfu/100ml)(*-Geo. Mn.)	28	64.5	20.0	<10.0/400.0	<10.0/80.0	Mean>OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	28	58.4	31.0	<10.0/393.0	12.5/51.8	

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												NEI
Agriculture					S		S	S				
Primary Body Contact Recreation									NS			
Public & Private Water Supply				S		S			S			
Fish Consumption				NS								

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

Notes *Fish Consumption not supporting for Lead*

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Poteau River at Pocola

Sample Record	Times Visited	Station ID
November 1998 - Current	213	220100010010-001AT

Stream Data

County	LeFlore [View Site Data]
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)	141	18.3	18.2	1.5/34.6	10.9/26.1	
In-Situ	Turbidity (NTU)	144	78	59	12/476	36/90	23% of values> OWQS
In-Situ	pH (units)	142	7.21	7.21	4.86/8.99	6.86/7.62	
Minerals	Dissolved Oxygen (mg/L)	143	7.80	7.43	3.31/15.94	5.84/9.58	
Minerals	Hardness (mg/L)	145	51	45	8/414	31/58	
Minerals	Total Dissolved Solids (mg/L)	135	86.4	75.5	<0.10/345.0	45.0/122.0	
Minerals	Specific Conductivity (uS/cm)	139	129.0	103.0	0.1/530.0	64.0/175.0	
Minerals	Chloride (mg/L)	84	11.2	10.0	<10.0/33.2	<10.0/<10.0	
Minerals	Sulfate (mg/L)	84	36.8	34.1	<10.0/87.7	24.6/46.1	
Nutrients	Total Phosphorus (mg/L)	149	0.149	0.118	0.017/1.010	0.088/0.174	
Nutrients	Total Nitrogen (mg/L)	149	1.044	0.910	<0.150/6.450	0.703/1.205	
Nutrients	Nitrate/Nitrite (mg/L)	151	0.396	0.220	<0.050/4.960	0.085/0.430	
Nutrients	Chlorophyll A (mg/m^3)	36	15.7	10.6	4.0/77.3	7.0/17.3	TSI=58.0
Bacteria	Enterococcus (cfu/100ml)(*-Geo. Mn.)	50	1130.4	40.1	<10.0/46000.0	17.5/107.5	
Bacteria	E. Coli (cfu/100ml)(*-Geo. Mn.)	50	218.3	31.0	8.5/3873.0	10.0/84.5	

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												NEI
Agriculture					S		S	S				
Primary Body Contact Recreation									S			
Public & Private Water Supply				S		S			S			
Fish Consumption				NS								

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

Notes

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

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Sager Creek at West Siloam Springs

Sample Record	Times Visited	Station ID
November 1998 – December 2012	218	121700060080-001AT

Stream Data

County	Delaware — View Site Data
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)	107	17.4	17.2	5.9/29.2	12.0/22.1	
	Turbidity (NTU)	106	3	1	1/55	1/2	
	pH (units)	106	7.70	7.71	6.59/8.65	7.45/7.95	
	Dissolved Oxygen (mg/L)	107	9.07	8.72	4.66/15.35	8.04/10.19	
Minerals	Hardness (mg/L)	107	132	134	<10/198	120/146	
	Total Dissolved Solids (mg/L)	110	272.8	271.0	118.0/657.0	222.0/317.3	
	Specific Conductivity (uS/cm)	107	425.1	427.0	164.0/713.0	355.0/496.0	
	Chloride (mg/L)	100	36.4	34.0	<10.0/95.1	23.0/47.2	
	Sulfate (mg/L)	100	24.7	21.3	<10.0/63.7	15.6/29.5	
Nutrients	Total Phosphorus (mg/L)	114	1.117	1.040	0.012/3.965	0.644/1.501	
	Total Nitrogen (mg/L)	116	7.066	7.163	<0.150/17.550	4.599/8.961	
	Nitrate/Nitrite (mg/L)	117	6.634	6.300	<0.050/17.500	4.113/8.585	
Bacteria	Chlorophyll A (mg/m^3)	47	1.8	0.9	<0.1/8.3	0.4/2.4	TSI=35.2
	Enterococcus (cfu/100ml)(*-Geo. Mn.)	56	512.3	109.0	<10.0/9700.0	33.5/475.0	Mean> OWQS
	E. Coli (cfu/100ml)(*-Geo. Mn.)	56	217.9	31.0	<10.0/4360.0	<10.0/98.0	

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												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

Brushy Creek

Sample Period	Times Visited	Sampling Sites
October 2007 - July 2008	4	5

General

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

Click map for site data

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
	Average Turbidity	10 nephelometric turbidity units (NTU)	25% of values > 25 NTU
	Average True Color	41 units	25% of values > OWQS of 70
	Average Secchi Disk Depth	103 cm	
	Water Clarity Rating	good	
	Trophic State Index	53	Previous value = 51
	Trophic Class	eutrophic	
Profile	Salinity	0.00 - 0.10 ppt	
Profile	Specific Conductivity	36.3 - 605 µS/cm	
Profile	pH	6.02 - 8.12 pH units	Only 7 values < 6.5 units
Profile	Oxidation-Reduction Potential	33 to 606 mV	
Profile	Dissolved Oxygen	Up to 69% of water column < 2 mg/L in July	Occurred at site 1, the dam
Nutrients	Surface Total Nitrogen	0.38 mg/L to 0.72 mg/L	
Nutrients	Surface Total Phosphorus	0.016 mg/L to 0.050 mg/L	
Nutrients	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	S	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

Precipitation data suggests the peak in color & turbidity are likely due to runoff, therefore the uses are considered supporting.

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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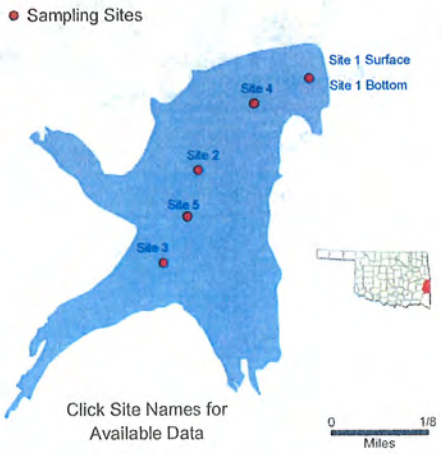
Cedar

Sample Period	Times Visited	Sampling Sites
February 2011 - July 2011	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	6 NTU	100% of values < OWQS of 25 NTU
	Average Secchi Disk Depth	99 cm	
	Water Clarity Rating	Excellent	
	Chlorophyll-a	13 mg/m3	
	Trophic State Index	56	Previous Value=53
	Trophic Class	Eutrophic	
Profile	Salinity	0.0– 0.04 ppt	
	Specific Conductivity	32.8 – 106.4 µS/cm	
	pH	5.6 - 8.94 pH units	51.56% < 6.5
	Oxidation-Reduction Potential	-12 - 509 mV	
	Dissolved Oxygen	Up to 70% of water column < 2 mg/L in summer	
Nutrients	Surface Total Nitrogen	0.18 mg/L to 0.97 mg/L	
	Surface Total Phosphorus	0.016 mg/L to 0.057 mg/L	
	Nitrogen to Phosphorus Ratio	18:1	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	NEI	NS	S	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

*Did not collect for these parameters. Although all turbidity values are <25 NTU, The FWP beneficial use cannot be assessed for this sample year as minimum data requirements were not met.

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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Greenleaf

Sample Period	Times Visited	Sampling Sites
November 2011 – August. 2012	4	5

General

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

Click Site Names for Available Data

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	12 NTU	8% of values > OWQS of 25 NTU (n=12)
	Average Secchi Disk Depth	67 cm	
	Water Clarity Rating	Good	
	Chlorophyll-a	11 mg/m3	
	Trophic State Index	54	Previous value = 52
	Trophic Class	Eutrophic	
Profile	Salinity	0.06– 0.12 ppt	
	Specific Conductivity	146 – 243 µS/cm	
	pH	6.89 – 8.65 pH units	
	Oxidation-Reduction Potential	22 – 427 mV	
	Dissolved Oxygen	Up to 57% of water column < 2 mg/L in May	
Nutrients	Surface Total Nitrogen	0.45 mg/L to 1.28 mg/L	
	Surface Total Phosphorus	0.006 mg/L to 0.030 mg/L	
	Nitrogen to Phosphorus Ratio	42:1	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	•	S							
Aesthetics					S	N/A					
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

**N/A – parameters not collected in current sample year.*
* 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

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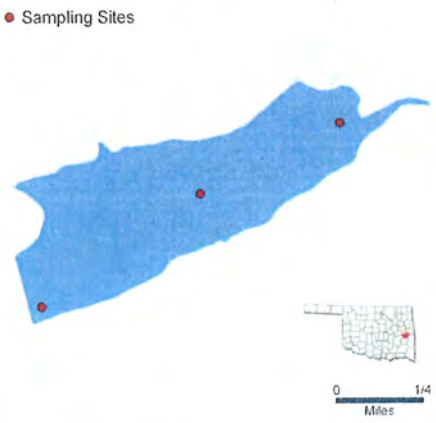
John Wells

Sample Period	Times Visited	Sampling Sites
October 2008 – July 2009	4	3



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
	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	
Profile	Specific Conductivity	73 – 207.5 µS/cm	
Profile	pH	6.3 – 9.13 pH units	1% of values < 6.50 and 2.38% > 9.00 pH units
Profile	Oxidation-Reduction Potential	-35 – 503 mV	
Profile	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	
Nutrients	Surface Total Phosphorus	0.005 mg/L to 0.014 mg/L	
Nutrients	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	*							
Aesthetics					S	*					
Agriculture							*	*	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											

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

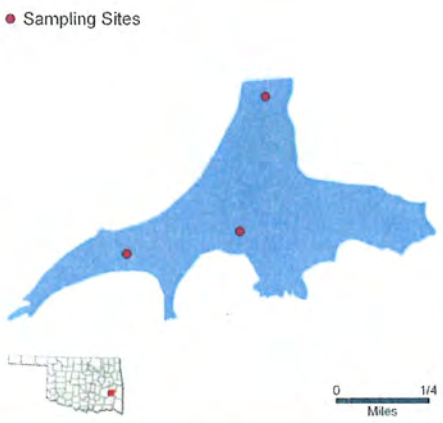
Notes

*Did not collect for these parameters

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

Lloyd Church (Wilburton)

Sample Period	Times Visited	Sampling Sites
November 2005 – August 2006	4	3



General

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

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
	Average Turbidity	14 NTU	25% of values > OWQS of 25 NTU
	Average True Color	79 units	75% of values > OWQS of 70
	Average Secchi Disk Depth	64 cm	
	Water Clarity Rating	good	
	Trophic State Index	45	
	Trophic Class	mesotrophic	
Profile	Salinity	0.0 – 0.01 ppt	
Profile	Specific Conductivity	25.4 – 71.9 µS/cm	
Profile	pH	5.9 – 7.51 pH units	26% of values <6.5 pH units
Profile	Oxidation-Reduction Potential	79 -503 mV	
Profile	Dissolved Oxygen	Up to 62% of water column < 2 mg/L in August	
Nutrients	Surface Total Nitrogen	0.15 mg/L to 0.57 mg/L	
Nutrients	Surface Total Phosphorus	0.020 mg/L to 0.043 mg/L	
Nutrients	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	Enterro. & E. coli	Chlor-a
Fish & Wildlife Propagation	S	NS	NS	S							
Aesthetics				-	S	NS					
Agriculture							S	S	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											

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

Notes

Available flow and rainfall data suggest that the peak in turbidity, which occurred in March is likely due to seasonal storm events, therefore Lloyd Church Lake will be listed as supporting its Fish & Wildlife Propagation (FWP) beneficial use

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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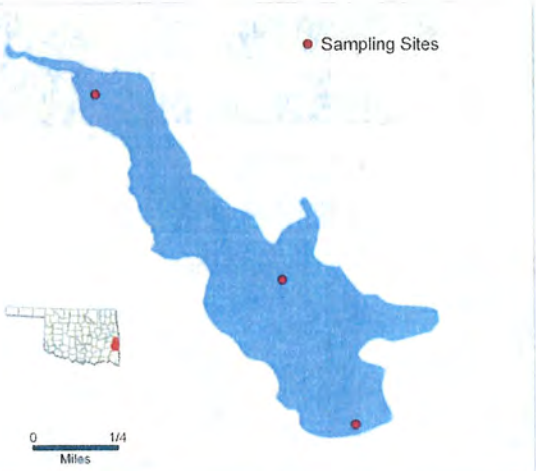
New Spiro

Sample Period	Times Visited	Sampling Sites
October 2005 – July 2006	4	3



General

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

Click map for site data

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
	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	
Profile	Specific Conductivity	106.8 – 155.4 µS/cm	
Profile	pH	7.09 – 9.24 pH units	10% of values > 9.0 pH units
Profile	Oxidation-Reduction Potential	121 - 483 mV	
Profile	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	
Nutrients	Surface Total Phosphorus	0.076 mg/L to 0.170 mg/L	
Nutrients	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	NS	S	S							
Aesthetics					NS*	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

*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

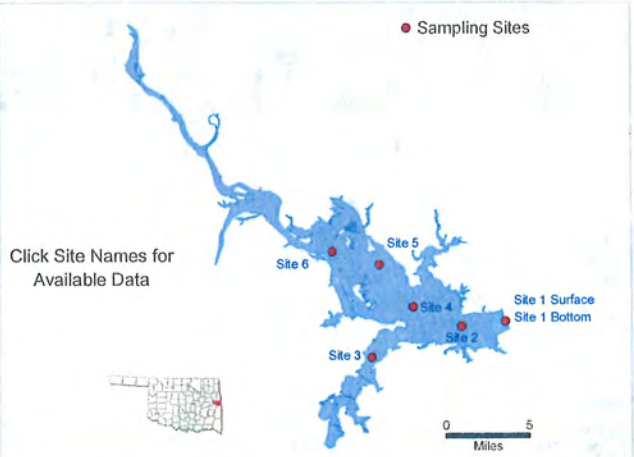
NTU = nephelometric turbidity units
µS/cm = microsiemens per centimeter
E. coli = Escherichia coli
OWQS = Oklahoma Water Quality Standards
mV = millivolts
Chlor-a = Chlorophyll-a
mg/L = milligrams per liter
µS/cm = microsiemens/cm
ppt = parts per thousand
En = Enterococci

Robert S. Kerr

Sample Period	Times Visited	Sampling Sites
November 2010 – June 2011	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	30 NTU	63% of values > 25 NTU (n=24)
	Average Secchi Depth	57 cm	All values > OWQS of 70
	Water Clarity Rating	Fair	
	Chlorophyll-a	11 mg/m3	
	Trophic State Index	54	Previous value = 50
	Trophic Class	Eutrophic	
Profile	Salinity	0.09– 0.93 ppt	
	Specific Conductivity	190.2 – 1754 µS/cm	
	pH	7.25 – 8.52 pH units	Neutral to slightly alkaline
	Oxidation-Reduction Potential	301 to 448 mV	
	Dissolved Oxygen	All data are above screening level of 2.0 mg/L	
Nutrients	Surface Total Nitrogen	0.26 mg/L to 1.12 mg/L	
	Surface Total Phosphorus	0.048 mg/L to 0.124mg/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	NS	S	S	S							
Aesthetics					S	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										NEI	
Public & Private Water Supply											

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

Notes

**Did not collect for this parameter.The PBCR cannot be assessed as minimum data requirements were not met due to QA/QC issues for E. coli and fecal coliform.*

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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Stilwell City

Sample Period	Times Visited	Sampling Sites
October 2005 – August 2006	3	3

General

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

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
	Average Turbidity	6 NTU	100% of values < OWQS of 25 NTU
	Average True Color	14 units	100% of values < OWQS of 70
	Average Secchi Disk Depth	161 cm	
	Water Clarity Rating	excellent	
	Trophic State Index	54	
	Trophic Class	eutrophic	
Profile	Salinity	0.07 – 0.14 ppt	
Profile	Specific Conductivity	159.1 – 297.2 µS/cm	
Profile	pH	6.87 – 8.53 pH units	
Profile	Oxidation-Reduction Potential	88 – 452 mV	
Profile	Dissolved Oxygen	Up to 64% of water column < 2 mg/L in August	Occurred at site 1, the dam
Nutrients	Surface Total Nitrogen	0.32 mg/L to 0.88 mg/L	
Nutrients	Surface Total Phosphorus	0.019 mg/L to 0.044 mg/L	
Nutrients	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	S	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

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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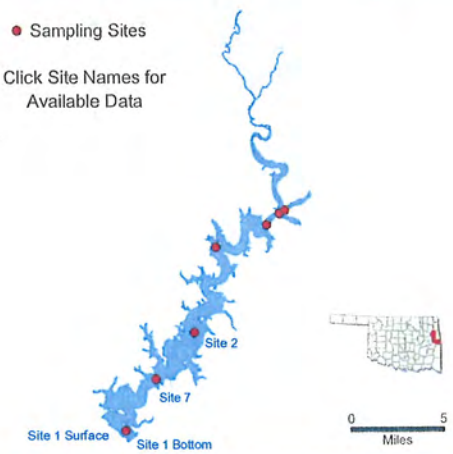
Tenkiller (1,2,7)

Sample Period	Times Visited	Sampling Sites
November 2011 – August 2012	4	7



General

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

Click map for site data

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In Situ	Average Turbidity	5 NTU	100% of values < OWQS of 25 NTU (n=11)
	Average Secchi Disk Depth	138 cm	
	Water Clarity Rating	Excellent	
	Chlorophyll-a	8 mg/m3	
	Trophic State Index	51	Previous value = 53
	Trophic Class	Eutrophic	
Profile	Salinity	0.08 – 0.13 ppt	
	Specific Conductivity	177 – 278 µS/cm	
	pH	6.56 – 9.02 pH units	Only 0.54% of recorded values > 9 pH units
	Oxidation-Reduction Potential	124-574mV	
	Dissolved Oxygen	Up to 73% of water column < 2 mg/L in August	
Nutrients	Surface Total Nitrogen	0.40 mg/L to 1.46 mg/L	
	Surface Total Phosphorus	0.005 mg/L to 0.016 mg/L	
	Nitrogen to Phosphorus Ratio	124:1	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					NS	N/A					
Agriculture							N/A	N/A	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											S

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
November 2011 – August 2012	4	7

General

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

Click map for site data

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
	Average Turbidity	14 NTU	14% of values < OWQS of 25 NTU (n=16)
	Average Secchi Disk Depth	56 cm	
	Water Clarity Rating	Average	
	Chlorophyll-a	16 mg/m3	
	Trophic State Index	58	Previous value = 59
	Trophic Class	Eutrophic	
Profile	Salinity	0.09 – 0.13 ppt	
Profile	Specific Conductivity	197 – 275 µS/cm	
Profile	pH	7.47 – 9.01 pH units	Only 0.66% of recorded values are > 9 pH units
Profile	Oxidation-Reduction Potential	86-567mV	
Profile	Dissolved Oxygen	Up to 50% of water column < 2 mg/L in August	
Nutrients	Surface Total Nitrogen	0.50 mg/L to 3.43 mg/L	
Nutrients	Surface Total Phosphorus	0.005 mg/L to 0.097 mg/L	
Nutrients	Nitrogen to Phosphorus Ratio	51:1	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	S	S	S							
Aesthetics					NS	N/A					
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

*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

Click map for site data

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	*	S							
Aesthetics					NS	N/A					
Agriculture							N/A	N/A	S		
Primary Body Contact Recreation										S	
Public & Private Water Supply											

S = Fully Supporting
NS = Not Supporting
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. * 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

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Webbers Falls

Sample Period	Times Visited	Sampling Sites
November 2010 – August 2011	4	6

General

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

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In-Situ	Average Turbidity	13 NTU	100% of values < OWQS of 25 NTU (n=17)
	Average Secchi Disk Depth	63 cm	
	Water Clarity Rating	Average	
	Chlorophyll-a	27 mg/m3	
	Trophic State Index	63	Previous value = 55
	Trophic Class	Hypereutrophic	
Profile	Salinity	0.21 – 0.79 ppt	
	Specific Conductivity	422.1 - 1490 µS/cm	
	pH	7.52 – 9.07 pH units	0.45% of Values > 9 pH units
	Oxidation-Reduction Potential	276 - 458 mV	
	Dissolved Oxygen	All data are above screening level of 2.0 mg/L	
Nutrients	Surface Total Nitrogen	0.38 mg/L to 1.3 mg/L	
	Surface Total Phosphorus	0.101 mg/L to 0.166 mg/L	
	Nitrogen to Phosphorus Ratio	7:1	Phosphorus limited, 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	NEI	S	S	S							
Aesthetics					S	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										NEI	
Public & Private Water Supply											

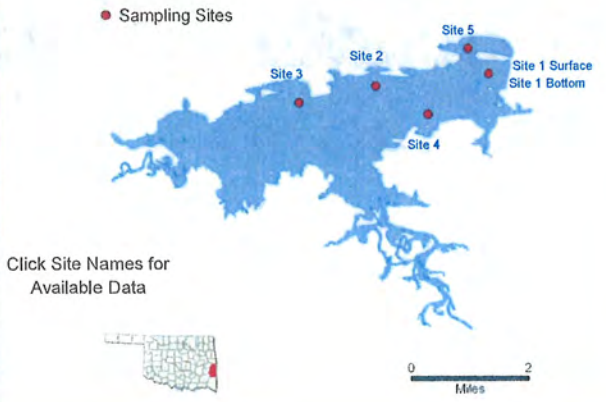
S = Fully Supporting
NS = Not Supporting
NEI = Not Enough Information

Notes Although 100% of the turbidity values are < 25 NTU, an assessment of the FWP beneficial use cannot be made for this sample year as minimum data requirements were not met.

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

Wister

Sample Period	Times Visited	Sampling Sites
November 2012 – July 2013	4	5



General

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

Parameters

	Parameter (Descriptions)	Result	Notes/Comments
In-Situ	Average Turbidity	23 NTU	50% of values < OWQS 25 NTU
	Average Secchi Disk Depth	39 cm	
	Water Clarity Rating	Fair	
	Chlorophyll-a	19 mg/m3	
	Trophic State Index	60	Previous value = 57
	Trophic Class	Eutrophic	
Profile	Salinity	0.04 – 0.09 ppt	
	Specific Conductivity	94 – 191 µS/cm	
	pH	5.80 – 8.63 pH units	24.1 % of Values < 6.5 pH units
	Oxidation-Reduction Potential	15 to 450 mV	
	Dissolved Oxygen	Up to 50% of water column < 2.0 mg/L in spring	
Nutrients	Surface Total Nitrogen	0.45 mg/L to 1.24 mg/L	
	Surface Total Phosphorus	0.008 mg/L to 0.065 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	En & E. coli	Chlor-a
Fish & Wildlife Propagation	NS	NS	NS	S							
Aesthetics					NS*	*					
Agriculture							S	S	S		
Primary Body Contact Recreation										NEI	
Public & Private Water Supply											NS

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

Notes

*Did not collect for these parameters. *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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Oklahoma 2012 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

2012 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	2016
OK120400010130_00	Greenleaf Lake	920.0	ACRES	413	140	2013
OK120400010260_00	Arkansas River	14.7	MILES	399	34, 49, 62, 85,102, 133, 136, 140	2013
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	2016
OK120400020030_00	Dirty Creek, South Fork	15.5	MILES	322, 385	84, 140, 46, 85, 87, 92, 108, 111, 133, 136,59 ,	2019
OK120400020110_00	Dirty Creek, Georges Fork	10.0	MILES	230, 322	46, 87, 92, 108, 111, 133, 136, 140	2016
OK120400020160_00	Butler Creek	10.3	MILES	322	46, 59, 92, 87, 108, 111, 133, 136, 140	2019
OK120400020190_00	Elk Creek	13.9	MILES	385, 322	46, 49,62, 85, 87, 92, 108, 136, 111, 133, 140 ,97	2019
OK120400020240_00	Shady Grove Creek	10.8	MILES	441, 385, 399	49, 140	2019
OK121700020020_00	Tenkiller Ferry Lake	8440.0	ACRES	322, 462	4, 59, 108, 136, 146, 140	2010
OK121700020110_00	Chicken Creek	4.9	MILES	230	140	2010
OK121700020220_00	Tenkiller Ferry Lake, Illinois River Arm	5030.0	ACRES	462, 150	4, 46, 59, 92, 108, 136, 146, 140	2010
OK121700030010_00	Illinois River	7.7	MILES	462, 215	4,46,59,85,92,100,108,136,146,140	2010
OK121700030040_00	Tahlequah Creek (Town Branch)	6.2	MILES	217	46, 92, 108, 133, 136, 140	2010
OK121700030080_00	Illinois River	32.0	MILES	462, 217, 267	4,46,59,92,108,133,136,140	2010
OK121700030280_00	Illinois River	15.2	MILES	462 ,215, 217, 413	4,46,59,92,108,133,136,146,140	2010
OK121700030290_00	Flint Creek	1.6	MILES	322, 462	4,46,59,92,108,133,136,146,140	2010
OK121700030350_00	Illinois River	5.2	MILES	462, 413, 215, 217	4,34,46,59,92,100,108,133,136,146,140	2013
OK121700030370_00	Ballard Creek	12.6	MILES	215	4,46,59,92,108,111,133,136,140	2013
OK121700040010_00	Caney Creek	20.9	MILES	215	4,46,59,62,92,108,111,133,136,140	2016
OK121700050010_00	Illinois River, Baron Fork	23.3	MILES	462, 215	4,34,46,59,92,100,108,133,136,146,140	2013
OK121700050090_00	Tyner Creek	14.8	MILES	215	4,46,59,92,108,136,140	2013
OK121700050120_00	Peacheater Creek	10.3	MILES	215	4,46,59,92,100,108,128,136,140	2013
OK121700060010_00	Flint Creek	7.8	MILES	462, 215	4,46,59,92,100,108,111,133,136,146,140	2010
OK121700060040_00	Battle Creek (Battle Branch)	5.4	MILES	215	4,46,59,92,108,111,133,136,140	2010
OK121700060080_00	Sager Creek	4.2	MILES	215	4,46,59,85,92,108,133,136,146,140	2010
OK220100010010_00	Poteau River	23.9	MILES	267, 413	46,49,59,62,85,108,133,136,140	2013
OK220100010010_30	Poteau River	1.6	MILES	127, 163, 267, 372, 375	140	2019
OK220100010010_40	Poteau River	21.4	MILES	163, 267, 413	140	2016
OK220100010050_00	New Spiro Lake	254.0	ACRES	150, 322, 160	46,92,108,133,136,140	2013
OK220100010180_00	Caston Creek	14.4	MILES			
OK220100020010_10	Poteau River	27.0	MILES	215, 267		

OK220100020020_00	Wister Lake	7333.0	ACRES	160, 150, 462, 413, 441, 274	46,92,108,133,136,140	2013
OK220100020040_00	Poteau River, Black Fork	30.2	MILES	441	140	2013
OK220100020060_00	Cedar Lake	78.0	ACRES	322, 441	46,92,108,133,136,140	2013
OK220100030010_00	Brazil Creek	17.8	MILES	215	4, 46, 59, 92, 108, 133, 136, 140	2016
OK220100040020_00	Fourche Maline Creek	36.9	MILES	267, 322	140, 46, 62, 69, 85, 87, 92, 108, 111, 133, 136	2013
OK220100040050_00	Red Oak Creek	11.0	MILES	441, 322	46,,85, 92, 108, 133, 136, 140	2013
OK220100040080_00	Bandy Creek	12.5	MILES	413,105,230	140	2013
OK220100040100_00	Lloyd Church Lake (Wilburton City)	160.0	ACRES	413, 441	46,92,108,133,136,140	2013
OK220100040150_00	Wayne Wallace Lake	94.0	ACRES	160, 322, 441	46,92,108,133,136,140	2013
OK220200010010_00	Arkansas River	20.7	MILES	215	49, 102, 140	2016
OK220200010060_00	Cache Creek	20.8	MILES	105		
OK220200020020_00	Robert S. Kerr Lake	43380.0	ACRES	160, 413	140	2013
OK220200020040_00	Little Salisaw Creek	17.6	MILES	163		
OK220200030010_10	Sallisaw Creek	9.0	MILES	215	49, 140	2013
OK220200030010_20	Sallisaw Creek	13.3	MILES	215	4,46,59,92,10,111,128,133,136,140	2013
OK220200030040_00	Brushy Creek Lake	358.0	ACRES	150, 441	46,92,108,133,136,140	2013
OK220200030120_00	Stilwell City Lake	188.0	ACRES	322	46,108,133,136,140	2013
OK220200040010_00	Sans Bois Creek	9.2	MILES	215, 385	85, 92, 140, 156	2015
OK220200040010_10	Sans Bois Creek	10.8	MILES	385, 399, 322, 215	49, 103, 140, 46, 85, 87, 92, 108, 111, 133, 136	2015
OK220200040010_40	Sans Bois Creek	27.8	MILES	322, 413	4,46,59,85,92,108,133,136,140	2019
OK220200040030_00	John Wells Lake (Stigler)	194.0	ACRES	322	46,92,108,133,136,140	2019
OK220200040050_00	Sans Bois Creek, Mountain Fork	18.8	MILES	441	46,92,108,133,136,156,140	2019
OK220200050010_00	Lee Creek	1.9	MILES	215,267	46,92,108,133,136,146,140	2013
OK220200050040_10	Lee Creek	15.7	MILES	163,267	46,92,108,133,136,146,140	2013
OK220200050040_00	Little Lee Creek	23.6	MILES	215	46,92,108,133,136,146,140	2013

Water Quality Standards Update

September 23, 2014

Revision topics for 2014-2015 Interim Rulemaking going to the OWRB Board will include revisions to OAC 785:45 and OAC 785:46 that are associated with the effort to develop wetland-specific Water Quality Standards (WQS) beneficial uses and criteria (being funded under a CWA §104(b)(3) wetlands program grant), revisions to the dissolved oxygen provision to clarify and streamline the current provision, a Water Effects Ratio (WER) for the City of Broken Bow Public Works Authority for site-specific criteria for copper and zinc, and the addition of two remediated groundwater contamination sites to be listed in Appendix H.

Preparation work will continue on revision topics slated for fall of 2016. Topics to be considered for incorporation into the OWQS as part of the 2015 – 2016 Triennial WQS Revision and review for rulemaking will include updates to Oklahoma's Aquatic Life Criteria (ALC) and Human Health Criteria (HHC).

The Oklahoma Water Resources Board will be reviewing a listing of Oklahoma aquatic life criteria and adoption of updates to these criteria that reflect the most current CWA §304(a) national aquatic life criteria recommendations and recalculations procedures, or based on other scientifically defensible methods, as appropriate, for the state.

Continued progress in updating Oklahoma's HHC may be adoption by OWRB of EPA's current CWA §304(a) water quality criterion for methylmercury. Review of both EPA's 2001 methylmercury criterion document and 2010 published companion implementation guidance will be used. This criterion is expressed as a fish tissue concentration value. Oklahoma will have completed all necessary calculations using OK's fish consumption and risk levels and appropriate justification documents, as part of the FY 14 preparation for this triennial revision project.

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		
OK121600050070_00	Lake Eucha	Phosphorus	462		
OK121600010430_00	Chouteau Creek	Enterococcus, E. coli	215,217		
OK121600010440_00	Crutchfield Branch	Enterococcus, E. coli	215,217		
OK121600010060_00	Ranger Creek	Enterococcus	215		
OK121600010100_00	Fourteenmile Creek	Enterococcus	215		
OK121600010010_00	Neosho River	Enterococcus	215		
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					
None					
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
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

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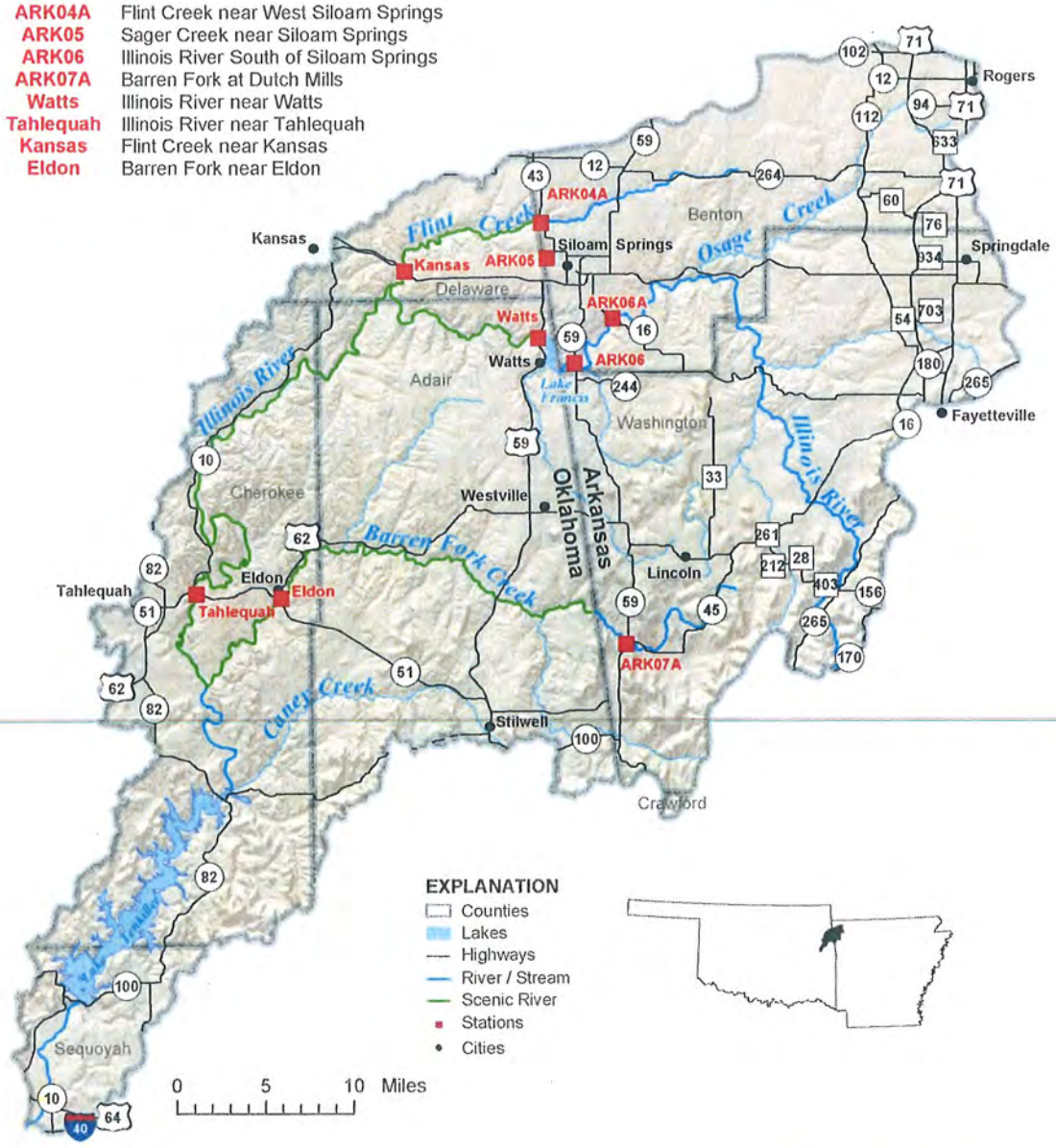
Water Quality Monitoring Report for the Illinois River Basin

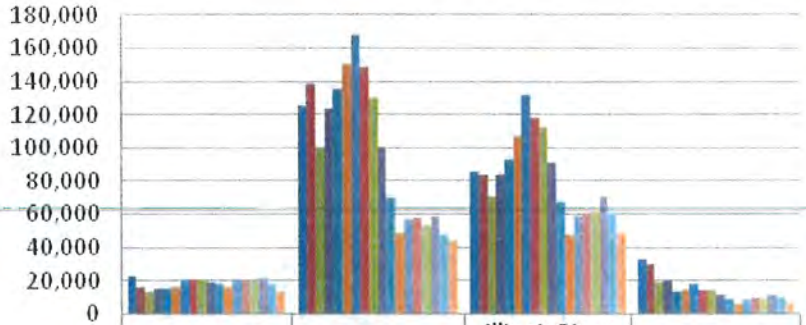
Illinois River Basin

Arkansas – Oklahoma Compact



CY 2013

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



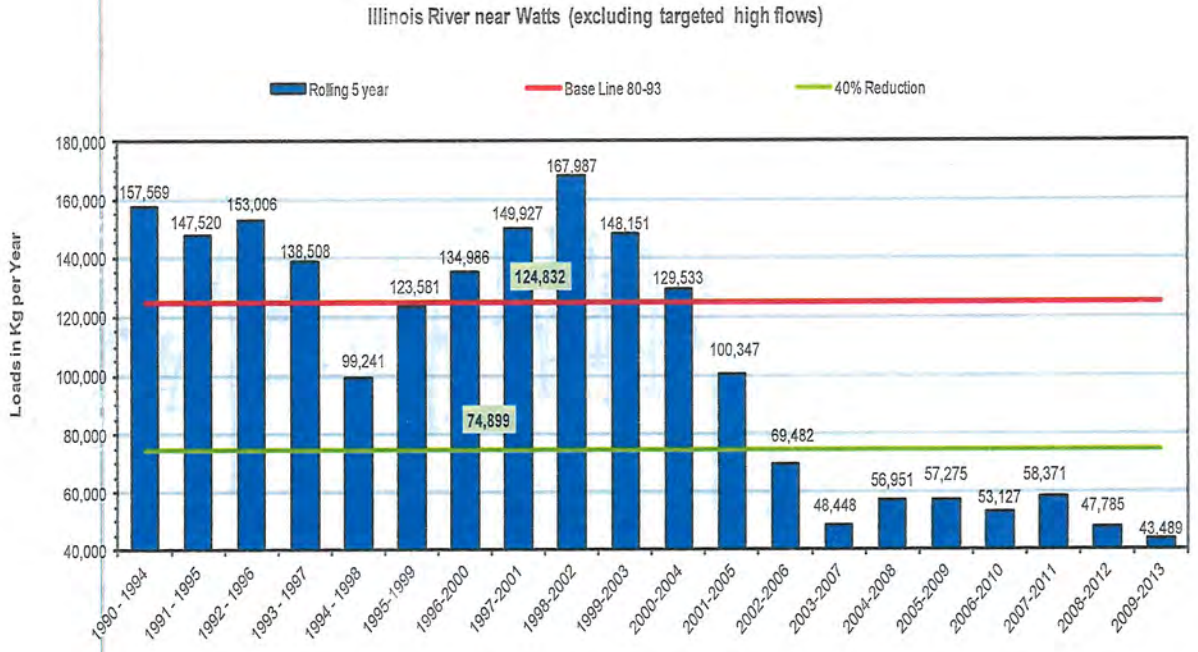
	Flint Creek near Kansas	Illinois River near Watts	Illinois River near Tahlequah	Barren Fork near Eldon
Total P 80-93	22,279	124,832	85,235	33,001
Total P 93-97	15,705	138,508	83,799	29,482
Total P 94-98	12,986	99,898	70,546	19,163
Total P 95-99	14,949	123,581	83,632	19,257
Total P 96-00	15,103	134,986	92,876	13,163
Total P 97-01	15,992	149,927	106,797	14,548
Total P 98-02	19,259	167,987	131,491	17,603
Total P 99-03	20,620	148,151	117,524	14,059
Total P 00-04	21,004	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	57,275	60,827	9,195
Total P 06-10	19,818	53,127	61,131	9,335
Total P 07-11	21,672	58,371	70,241	11,256
Total P 08-12	17,473	47,785	60,776	9,894
Total P 09-13	13,515	43,489	48,349	6,989

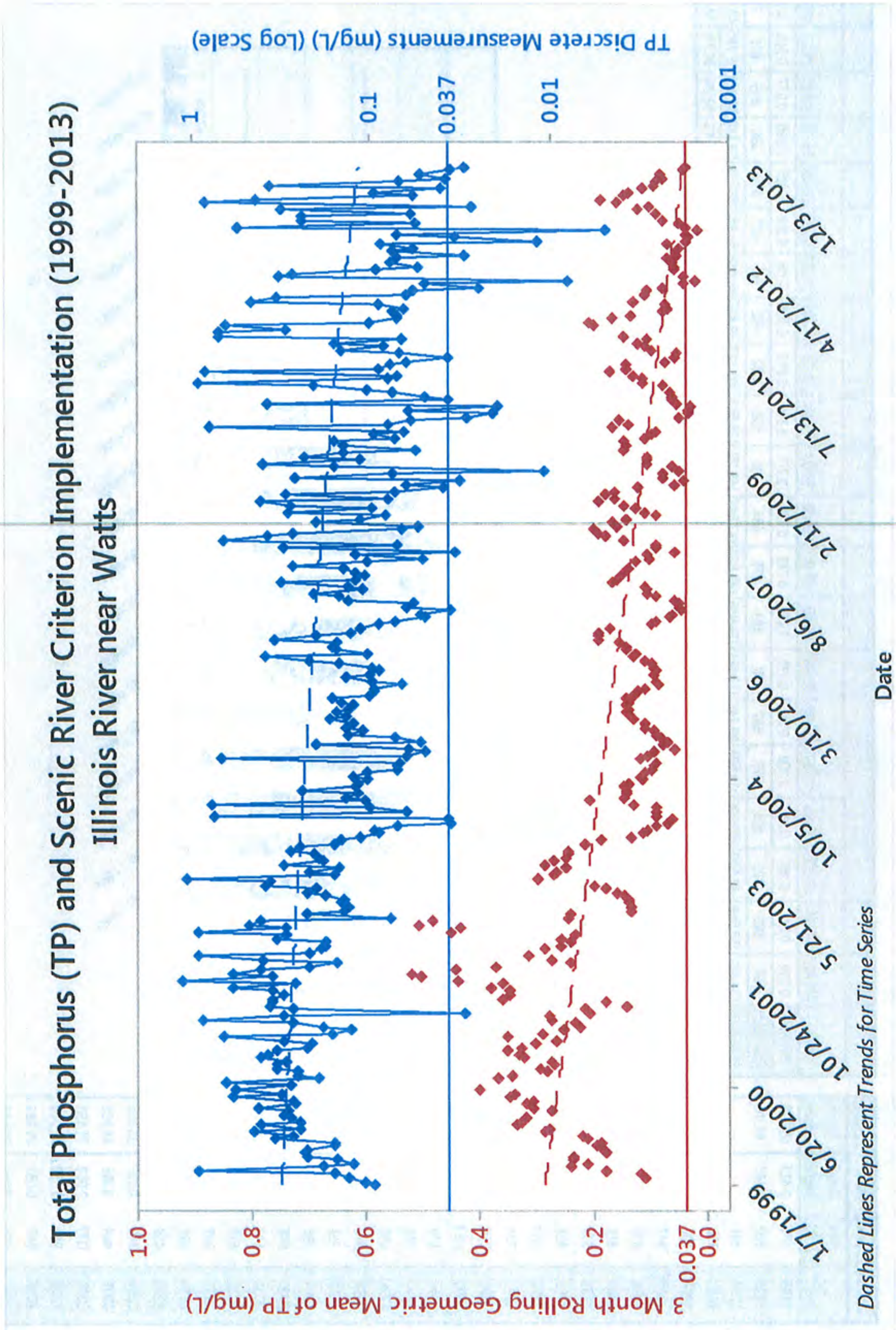
Values represent all available data, which is routinely collected and excludes targeted high flow events.

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
Average	670	0.171	102,483

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
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
Flow (cfs)	685	890	821	815	777	687	711	684	675	684	611	590	552	492	461	627	673	698	849	823	716
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	58,371	47,785	43,489
% 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%	53.2%	61.7%	65.2%

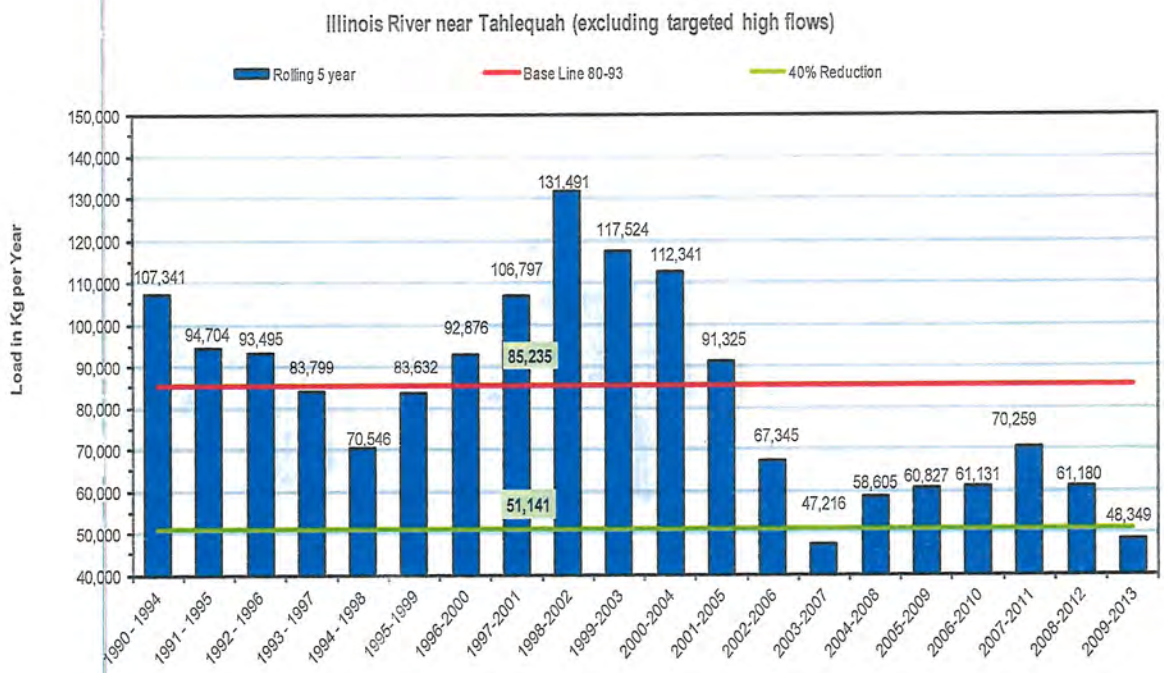


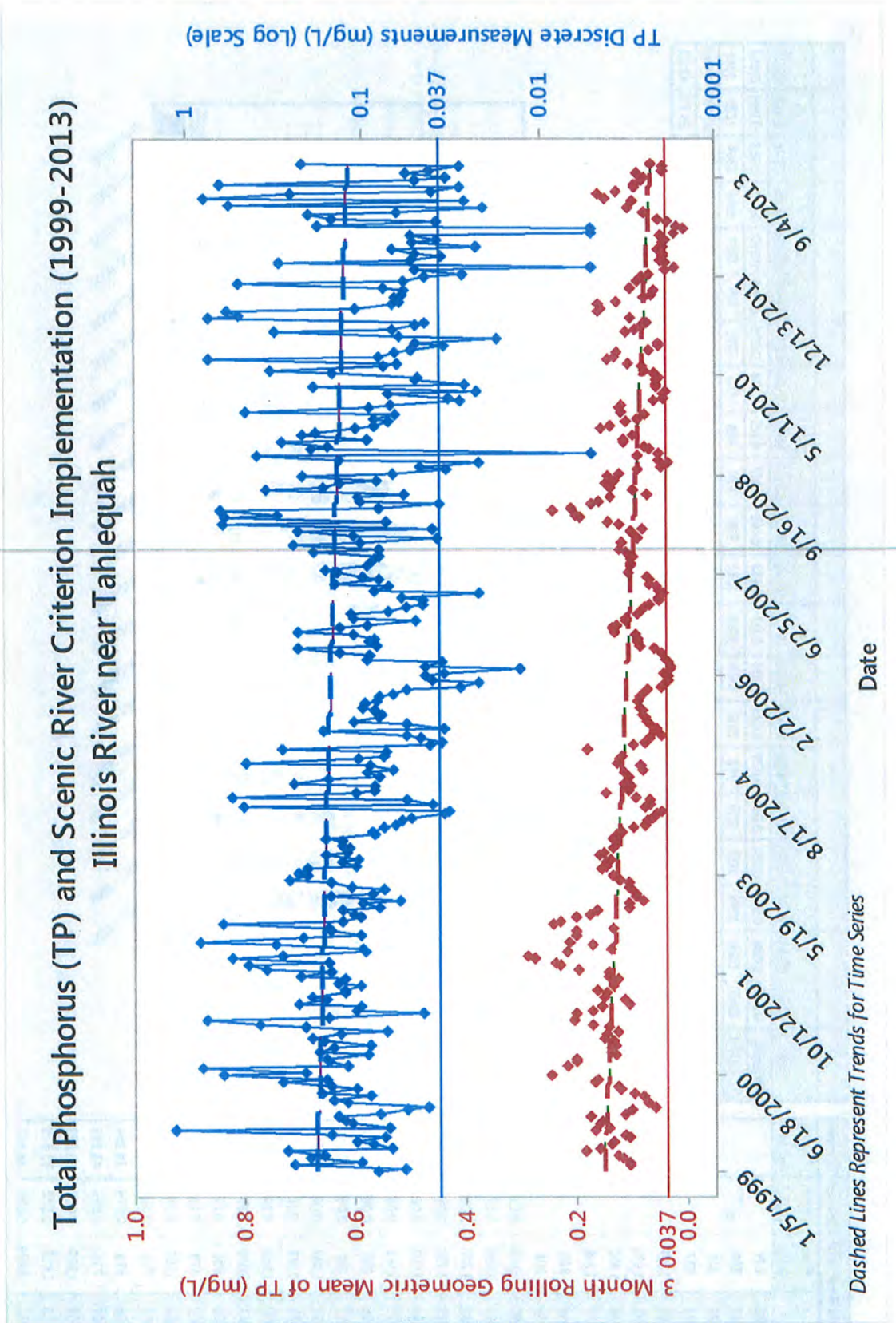

Total Phosphorus (TP) and Scenic River Criterion Implementation (1999-2013)
Illinois River near Watts
TP Discrete Measurements (mg/L) (Log Scale)
1
0.1
0.037
0.01
0.001
3 Month Rolling Geometric Mean of TP (mg/L)
1.0
0.8
0.6
0.4
0.2
0.037
0.0
1/7/1999
6/20/2000
10/24/2001
5/21/2003
10/5/2004
3/10/2006
8/6/2007
2/17/2009
7/13/2010
4/17/2012
12/3/2013
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	820	0.050	36,617
2011	1,541	0.058	79,813
2012	492	0.038	16,689
2013	946	0.043	36,331
Average	1,014	0.087	78,416

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
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
Flow (cfs)	1060	1364	1249	1218	1139	998	1012	1004	1023	1031	918	920	846	725	702	974	1024	1046	1269	1220	1041
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	91,323	67,345	47,216	58,605	60,827	61,131	70,259	60,776	48,349
% 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%	28.7%	43.3%

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Illinois River near Tahlequah
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)
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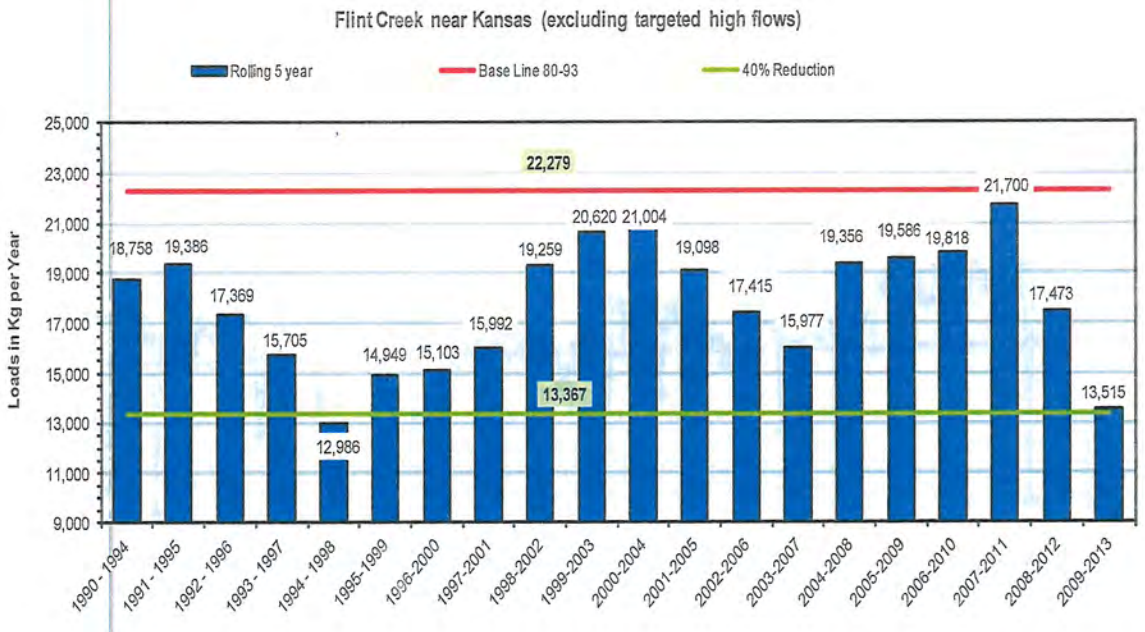
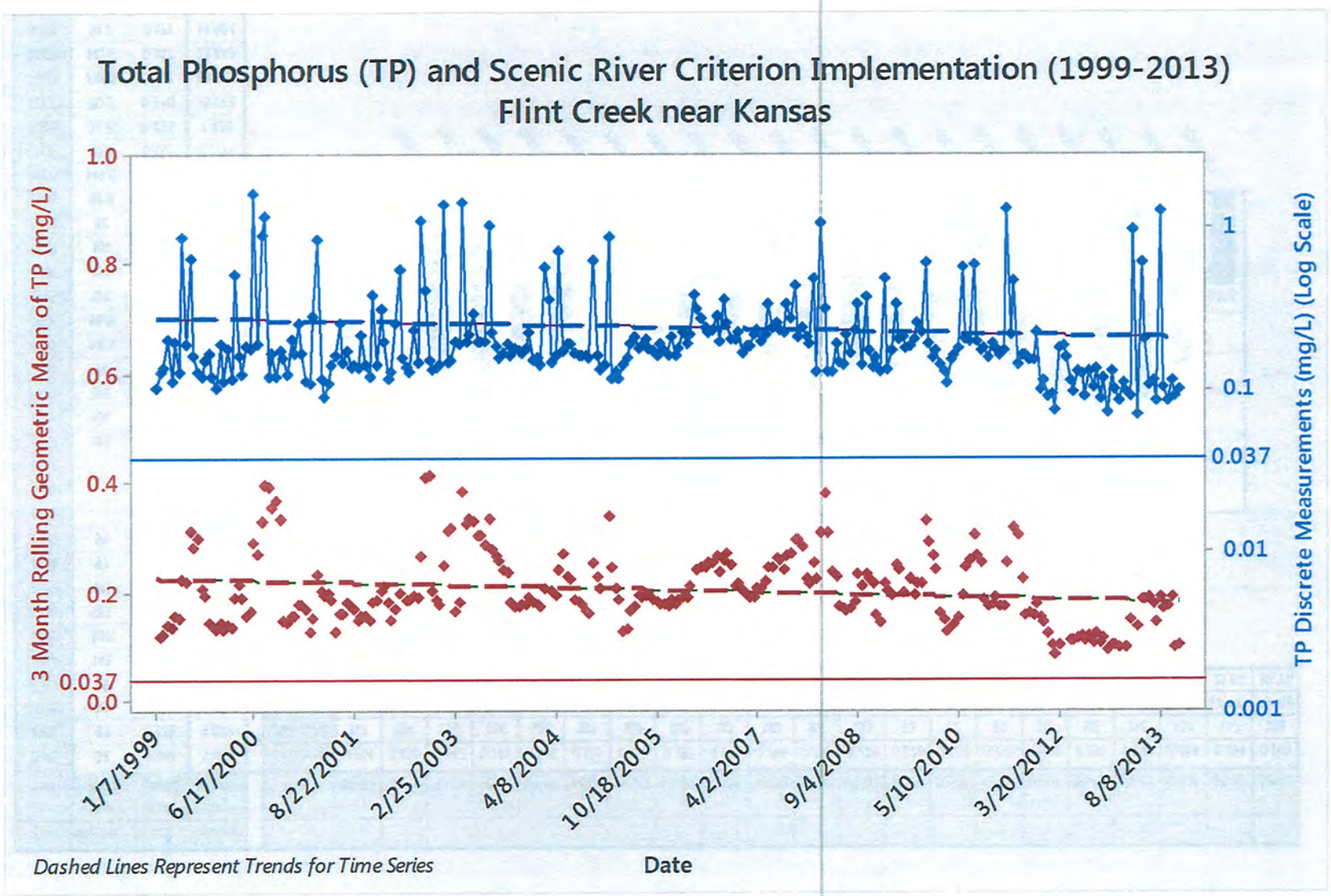
0.8
0.6
0.4
0.2
0.037
0.0
1/5/1999
6/18/2000
10/12/2001
5/19/2003
8/17/2004
2/2/2006
6/25/2007
9/16/2008
5/11/2010
12/13/2011
9/4/2013
Date
Dashed Lines Represent Trends for Time Series

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	
1991		0.120	
1992		0.118	
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	94.8	0.117	9,871
1998	96.5	0.127	10,945
1999	137	0.186	22,758
2000	133	0.178	21,143
2001	101	0.164	14,793
2002	82	0.310	22,703
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
Average	111	0.192	19,028

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
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
Flow (cfs)	117	159	153	134	126	109	109	107	112	110	101	103	95	82	80	113	112	112	132	127	108
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	13,515
% 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%	39.3%

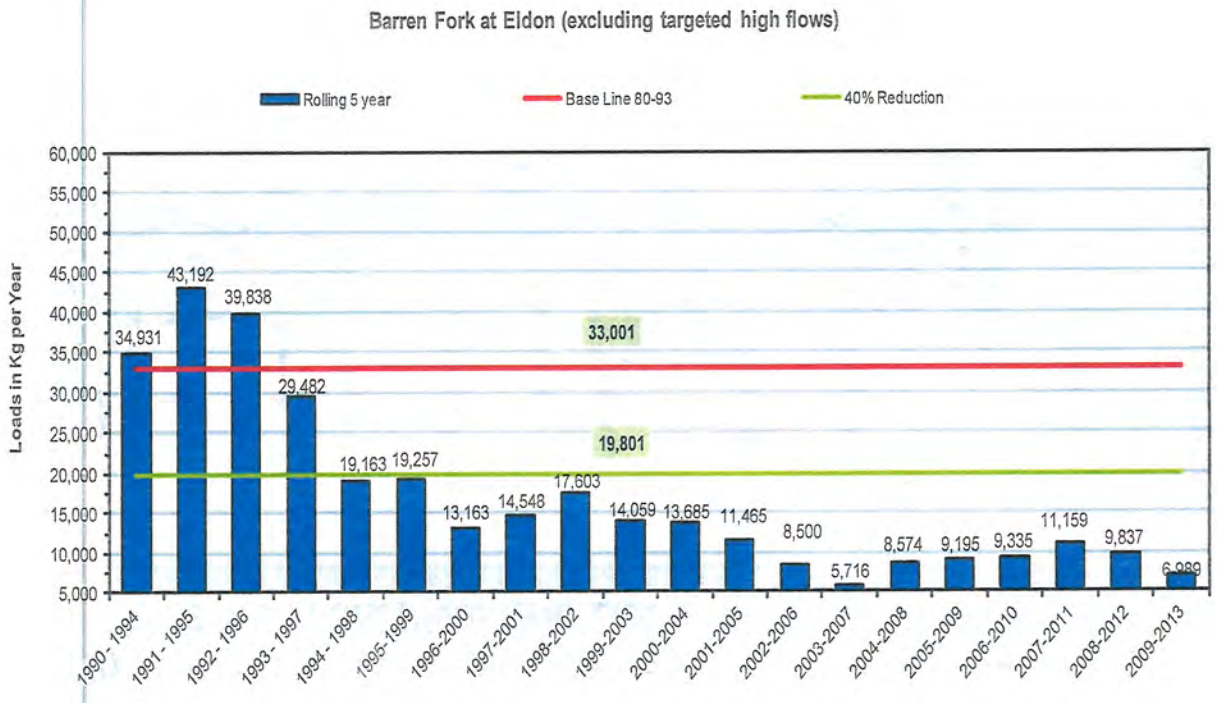


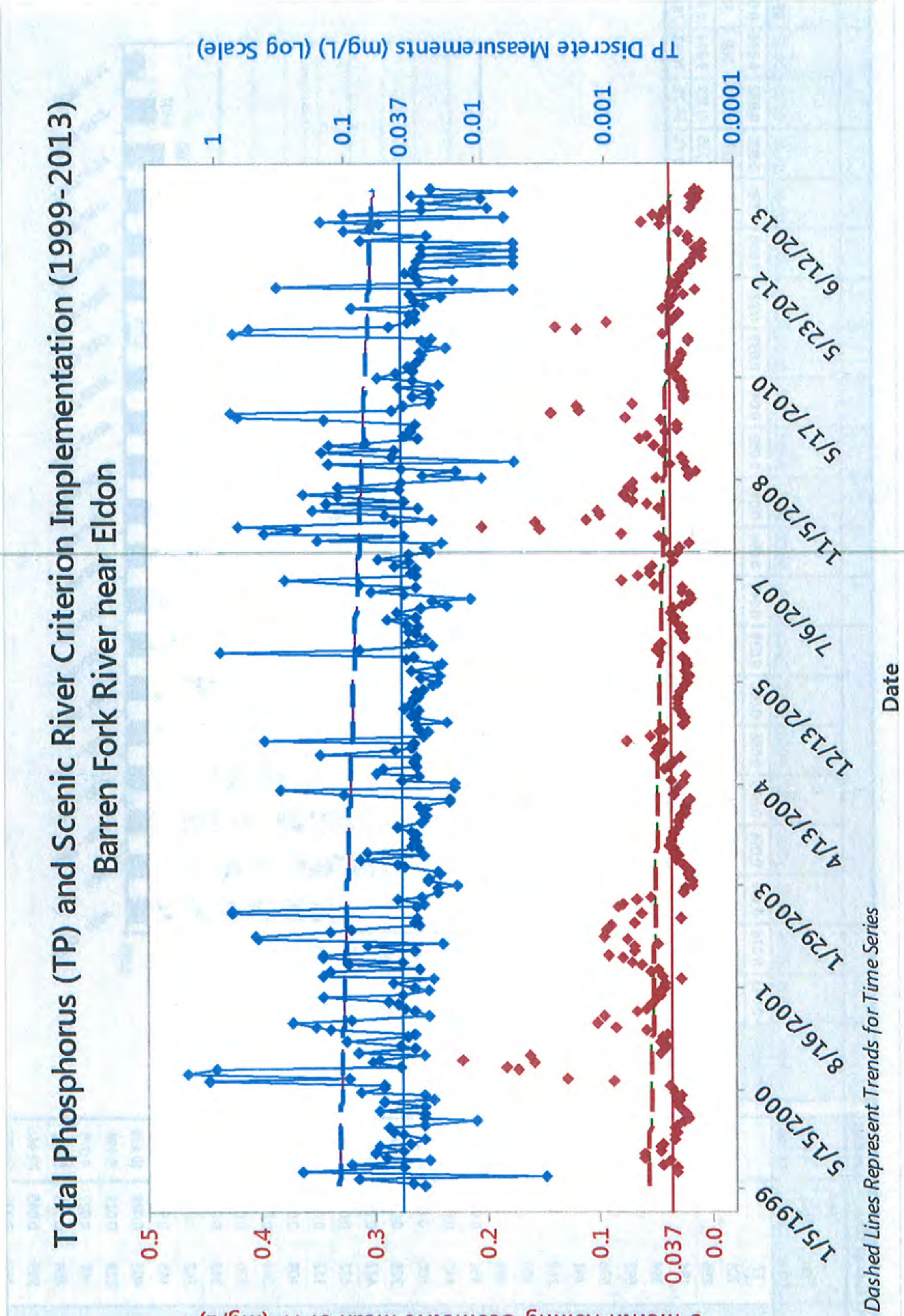

Total Phosphorus (TP) and Scenic River Criterion Implementation (1999-2013)
Flint Creek near Kansas
3 Month Rolling Geometric Mean of TP (mg/L)
1.0
0.8
0.6
0.4
0.2
0.037
0.0
TP Discrete Measurements (mg/L) (Log Scale)
1
0.1
0.037
0.01
0.001
1/7/1999
6/17/2000
8/22/2001
2/25/2003
4/8/2004
10/18/2005
4/2/2007
9/4/2008
5/10/2010
3/20/2012
8/8/2013
Dashed Lines Represent Trends for Time Series
Date

Barren Fork at Eldon

Baron 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
Average	356	0.052	16,572

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
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
Flow (cfs)	399	517	468	464	443	384	391	382	364	350	297	306	276	241	24	323	334	333	394	369	301
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	9,894	6,989
% 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%	70.0%	78.8%




Total Phosphorus (TP) and Scenic River Criterion Implementation (1999-2013)
Barren Fork River near Eldon
3 Month Rolling Geometric Mean of TP (mg/L)
TP Discrete Measurements (mg/L) (Log Scale)
0.5
0.4
0.3
0.2
0.1
0.037
0.0
1
0.1
0.037
0.01
0.001
0.0001
1/5/1999
5/15/2000
8/16/2001
1/29/2003
4/13/2004
12/13/2005
7/6/2007
11/5/2008
5/17/2010
5/23/2012
6/12/2013
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

AppID	OldSystemID	LGAName	County	ClosedAmt	ApprovedDate	AppType	ShortProjectDesc
1628	FAP-00-0058-R	Adair County Rural Water District #5	Adair	$99,500.00	7/10/2001	REAP	constructing a new 200,000-gallon water storage ta
2488	FAP-83-0033-G	Cherry Tree Rural Water District	Adair	$10,000.00	1/10/1984	Emergency	
2556	FAP-85-0129-G	Watts Public Works Authority	Adair	$10,000.00	2/12/1985	Emergency	
2565	FAP-85-0155-G	Adair County RWS & SWMD #2	Adair	$100,000.00	6/11/1985	Emergency	
2631	FAP-88-0053-G	Watts Public Works Authority	Adair	$85,000.00	7/16/1990	Emergency	WATER SYSTEM REPAIRS
2653	FAP-89-0062-G	Adair County Rural Water District #5	Adair	$50,000.00	9/10/1991	Emergency	NEW WATER SYSTEM
1268	FAP-93-0073-L	Stilwell Area Development Authority	Adair	$1,000,000.00	12/12/1995	FA Loan	WATER & SEWER SYSTEM IMPROVEMENTS
2131	FAP-97-0125-R	Watts Public Works Authority	Adair	$149,750.00	2/10/1998	REAP	WATER IMPROVEMENTS
2130	FAP-97-0124-R	Adair County Rural Water District #5	Adair	$75,000.00	6/8/1999	REAP	Water system improvements
1371	ORF-98-0010-CW	Stilwell Area Development Authority	Adair	$4,000,000.00	8/10/1999	CWSRF	WASTEWATER SYSTEM IMPROVEMENTS
2331	FAP-99-0080-R	Watts Public Works Authority	Adair	$99,800.00	11/16/1999	REAP	installing a 6" altitude valve with box and access
1460	FAP-01-0013-L	Stilwell Area Development Authority	Adair	$2,760,000.00	3/12/2002	FA Loan	WATER SYSTEM IMPROVEMENTS
1641	FAP-00-0071-R	Adair County Rural Water District #6	Adair	$146,875.00	4/9/2002	REAP	drilling a production-test well with casing, insta
3195	FAP-06-0015-R	Adair County RWS & SWMD #2	Adair	$99,999.00	3/11/2008	REAP	Line repair and water line extension
2478	FAP-83-0019-G	Burnt Cabin Rural Water District Incorporated	Cherokee	$24,000.00	11/2/1983	Emergency	
2479	FAP-83-0021-G	Cherokee County Rural Water District #8 -- Briggs	Cherokee	$53,000.00	1/10/1984	Emergency	
2686	FAP-90-0055-G	Cherokee County Rural Water District #10	Cherokee	$27,000.00	3/12/1991	Emergency	CONSTRUCTING NEW WATER SYSTEM
2739	FAP-91-0057-G	Cherokee County Rural Water District #7 -- Welling	Cherokee	$23,180.00	9/10/1991	Emergency	REPLACE TEMPORARY BRIDGE CROSSING WITH PERMANENT R
2740	FAP-91-0058-G	Cherokee County Rural Water District #8 -- Briggs	Cherokee	$23,180.00	9/10/1991	Emergency	REPLACE TEMPORARY BRIDGE CROSSINGS.
2563	FAP-85-0152-G	Cherokee County Rural Water District #9	Cherokee	$13,465.00	10/16/1991	Emergency	
2847	FAP-95-0060-G	Cherokee County Rural Water District #13	Cherokee	$100,000.00	1/9/1996	Emergency	CONSTRUCT 12' 9 X 110' STAND PIPE AND BACKWASH LAG
1278	FAP-95-0031-L	Cherokee County Rural Water District #13	Cherokee	$170,000.00	1/9/1996	FA Loan	CONSTRUCT A STANDPIPE & REPLACE WATER MAINS
2132	FAP-97-0126-R	Cherokee County Rural Water District #9	Cherokee	$99,900.00	1/13/1998	REAP	WATER TREATMENT IMPROVEMENTS
2179	FAP-98-0011-R	Burnt Cabin Rural Water District Incorporated	Cherokee	$65,427.00	6/9/1998	REAP	WATER LINE EXTENSION
2242	FAP-98-0081-R	Cherokee County Rural Water District #14	Cherokee	$54,000.00	2/10/1999	REAP	GROUND STORAGE
2897	FAP-98-0052-G	Cherokee County Rural Water District #3	Cherokee	$45,000.00	2/10/1999	Emergency	WATER DISTRIBUTION SYSTEM EXTENSION
2120	FAP-97-0110-R	Cherokee County Rural Water District #1	Cherokee	$100,000.00	12/14/1999	REAP	constructing a new treatment plant, new backwater
2109	FAP-97-0098-R	Cherokee County Rural Water District #13	Cherokee	$80,000.00	3/14/2000	REAP	constructing a new intake platform, access structu
2323	FAP-99-0072-R	Cherokee County Rural Water District #9	Cherokee	$69,900.00	11/14/2000	REAP	constructing about 7,000 feet of 2-inch PVC water
1404	FAP-98-0029-L	Cherokee County Rural Water District #1	Cherokee	$380,000.00	12/12/2000	FA Loan	CONSTRUCT NEW WATER TREATMENT PLANT
1476	FAP-02-0001-L	Cherokee County Rural Water District #8 -- Briggs	Cherokee	$285,000.00	6/11/2002	FA Loan	WATER SYSTEM IMPROVEMENTS
1477	FAP-00-0007-L	Cherokee County Rural Water District #13	Cherokee	$1,810,000.00	6/11/2002	FA Loan	INSTALL A MICROFILTRATION WATER PLANT
1493	FAP-02-0004-L	Cherokee County Rural Water District #2	Cherokee	$645,000.00	8/13/2002	FA Loan	WATER SYSTEM IMPROVEMENTS
1764	FAP-02-0026-R	Cherokee County Rural Water District #13	Cherokee	$135,000.00	6/8/2004	REAP	installing approximately 4000 L.F. of 6-inch PVC w
3191	FAP-06-0011-R	Cherokee County Rural Water District #8 -- Briggs	Cherokee	$99,999.00	6/12/2007	REAP	water line
3419	FAP-08-0033-R	Cherokee County Rural Water District #7 -- Welling	Cherokee	$39,069.00	12/9/2008	REAP	Replace river crossing
3388	FAP-08-0005-R	Cherokee County Rural Water District #12	Cherokee	$70,000.00	6/9/2009	REAP	Installing meters
3530	ORF-09-0040-DW	Tahlequah Public Works Authority	Cherokee	$16,320,000.00	12/8/2009	DWSRF	Construct new water plant & appurtenances
3568	FAP-09-0034-R	Cherokee County Rural Water District #8 -- Briggs	Cherokee	$34,914.00	4/13/2010	REAP	Tap fee for connection to Tahlequah
3703	ORF-11-0002-DW	Cherokee County Rural Water District #3	Cherokee	$3,110,000.00	7/12/2011	DWSRF	Refinance bond issue used to construct WTP
3782	ORF-11-0010-DW	Tahlequah Public Works Authority	Cherokee	$1,680,000.00	12/13/2011	DWSRF	Automated water meter reading eqpt
3801	FAP-12-0010-L	Cherokee County Rural Water District #13	Cherokee	$1,600,000.00	3/13/2012	FA Loan	Refi 2 FAP loans and one Lease Purchase Obligation
3846	FAP-12-0002-D	Cherokee County Rural Water District #3	Cherokee	$26,870.00	9/18/2012	Drought	Extend service
2472	FAP-83-0012-G	Kansas	Delaware	$92,516.00	3/13/1984	Emergency	
2517	FAP-84-0015-G	Colcord	Delaware	$95,816.00	4/10/1984	Emergency	
2582	FAP-86-0002-G	Kansas Public Works Authority	Delaware	$65,000.00	1/12/1988	Emergency	
2066	FAP-97-0040-R	Kansas Public Works Authority	Delaware	$139,270.00	3/10/1998	REAP	ADDITIONAL WELL AND WATER SYSTEM IMPROVEMENTS
2117	FAP-97-0107-R	Colcord Public Works Authority	Delaware	$94,800.00	1/12/1999	REAP	UPGRADE & ENLARGEMENT OF SEWER LAGOONS.
2108	FAP-97-0097-R	Kansas Public Works Authority	Delaware	$109,500.00	11/16/1999	REAP	rehabilitating two water storage tanks, filters an
1742	FAP-02-0003-R	Kansas Public Works Authority	Delaware	$67,000.00	11/12/2002	REAP	installing two (2) vertical in-line centrifugal pu
3385	FAP-08-0004-R	Oaks Public Works Authority	Delaware	$0.00	6/18/2013	REAP	Lagoon rehab
2493	FAP-83-0041-G	Muskogee County Rural Water District #7	Muskogee	$90,000.00	4/10/1984	Emergency	
1111	FAP-88-0040-L	Porum Public Works Authority	Muskogee	$730,000.00	1/10/1989	FA Loan	REFINANCE EXISTING DEBT
2714	FAP-90-0100-G	Braggs Public Works Authority	Muskogee	$70,000.00	2/12/1991	Emergency	Sanitary sewage collection and treatment plant imp
1242	FAP-94-0042-L	Porum Public Works Authority	Muskogee	$350,000.00	11/1/1994	FA Loan	EXTENSION OF WATER LINES
1963	FAP-96-0077-R	Braggs	Muskogee	$36,995.00	1/14/1997	REAP	WATER PLANT IMPROVEMENTS--SOURCE WATER WELL AND PU
2056	FAP-97-0021-R	East Central OK Water	Muskogee	$59,700.00	3/11/1997	REAP	SEWER LINE EXTENSION
2864	FAP-96-0045-G	East Central OK Water	Muskogee	$97,750.00	4/14/1998	Emergency	WATER LINE EXTENSION
1523	FAP-02-0011-L	Muskogee County Rural Water District #5	Muskogee	$1,390,000.00	5/13/2003	FA Loan	WATER SYSTEM IMPROVEMENTS
2416	FAP-02-0011-G	Muskogee County Rural Water District #5	Muskogee	$100,000.00	6/8/2004	Emergency	installing approximately 42,000 L.F. of 4-inch PVC
2471	FAP-83-0008-G	Marble City	Sequoyah	$100,000.00	2/14/1984	Emergency	
2594	FAP-86-0050-G	Sequoyah County Rural Water District #5	Sequoyah	$75,000.00	5/8/1990	Emergency	WATER TREATMENT PLANT, RAW WATER INTAKE, RAW WATER
2181	FAP-98-0013-R	Sequoyah County Rural Water District #5	Sequoyah	$99,883.00	1/12/1999	REAP	constructing approximately 2 miles of 6-inch water
2332	FAP-99-0081-R	Vian	Sequoyah	$59,500.00	11/16/1999	REAP	SEWER SYSTEM INFLOW/INFILTRATION EVALUATION SURVEY
1391	ORF-98-0017-CW	Vian Public Works Authority	Sequoyah	$1,100,000.00	2/8/2000	CWSRF	WASTEWATER TREATMENT PLANT RENOVATIONS
1653	FAP-01-0005-R	Gore Public Works Authority	Sequoyah	$60,000.00	11/13/2001	REAP	conducting a public information notification progr
2429	FAP-02-0025-G	Sequoyah County Rural Water District #5	Sequoyah	$49,384.91	11/12/2002	Emergency	installing approximately 5,860 L.F. of 4-inch and
2102	FAP-97-0089-R	Vian Public Works Authority	Sequoyah	$150,000.00	6/10/2003	REAP	replacing approximately 1,150 LF of 12-inch line,
3281	FAP-07-0006-G	Vian Public Works Authority	Sequoyah	$75,000.00	1/8/2008	Emergency	Water main repair
3664	FAP-10-0004-R	Vian Public Works Authority	Sequoyah	$99,999.00	2/8/2011	REAP	Rehab lift station
1713	FAP-01-0067-R	Sequoyah County Rural Water District #5	Sequoyah	$80,000.00	7/12/2011	REAP	New water line
3716	ORF-11-0006-CW	Vian Public Works Authority	Sequoyah	$1,655,000.00	2/13/2012	CWSRF	Construct flow equalization basin at wwtp

Permits for Water Rights in the Illinois River Watershed Issued by the OWRB's Planning and Management Division in CY 2013

Permits Issued within the Illinois River Basin for Calendar Year 2012

Permit #	LASTNAME	FIRSTNAME	Diversion Point Legal 1/4	1/4	1/4	SECT	TWP	RNG	COUNTY	RATE	STREAM SYSTEM	DATE FILED	DATE ISSUED	PURPOSE	AMT (af/yr)
20120053	Fain	Tommy	SE	SW	NE	16	19N	25EI	Adair	130GPM	2-17	2012-08-06	2012-12-18	Irrigation	40.0

Only 1new permit has been issued for either surface water use or groundwater use since 2007.

OKLAHOMA CONSERVATION COMMISSION

OKLAHOMA CONSERVATION COMMISSION
Program Activities in the Illinois River Watershed
for the period of October 2013 through September 2014

1.) **Illinois River Implementation** - The OCC began an Illinois River implementation project, the *Illinois River Watershed Riparian Protection Program*, in July of 2007 on the heels of many years of similar work in the watershed. In March, 2011 OCC obtained an additional $2,500,000 in federal money via §319(h) of the Clean Water Act matched by $1,666,667 to continue implementation in northeast Oklahoma watersheds which includes the Illinois River through 2015. In 2012 OCC was awarded an additional $431,855 federal §319(h) monies, matched by $287,903 for implementation work in these watersheds. The intent of these projects extends and complements ongoing programs in the Illinois River watershed to reduce nonpoint source pollution and restore beneficial use support to waterbodies in the watershed. Objectives of these projects are to:

- Implement practices in the Illinois River watershed that will reduce nutrient loading to help meet load reduction goals set out in OCC's Watershed Based Plan. The Watershed Based Plan was officially accepted by EPA in January, 2011. The Plan sets an interim goal of 40% phosphorus load reduction (132,000 kg), followed by a long-term load reduction goal of 70 - 80%;
- Support the Oklahoma Conservation Reserve Enhancement Program (CREP) to protect riparian areas with the greatest potential to reduce nutrient loading;
- Provide technical assistance to producers in the development of total resource conservation plans; and
- Determine the effectiveness of the projects through water quality monitoring and computer modeling to document current changes and predict the long-term effects of best management practice implementation.

Project Coordinator, Tashina Kirk, is a long time resident of the watershed and very familiar with its challenges. She conducts producer meetings promoting the project and signing up cooperators for priority cost-share of best management practice (BMP) implementation.

As of August 2014, a total of $1,970,004 has been spent on installation of conservation practices, with $1,200,071 from federal §319(h) funding. In addition, a total of $3,047,667 has been obligated for further implementation of BMPs by 267 applicants.

Major BMPs implemented include riparian area exclusion fencing, alternative watering facilities, animal feeding/waste storage facilities, heavy use areas, and septic system

replacement. Practices installed as of August 2014 include:

- 1796.7 acres of riparian area exclusion including 128,100 linear feet of exclusion fencing
- 115 watering facilities, 20 water wells, 13 ponds, and 57,671 feet of pipeline
- 10 winter feeding facilities/ waste storage facilities
- 105 heavy use areas
- 92 septic system replacements
- 129,971 feet of cross fencing for pasture improvement
- 100 acres of pasture establishment
- 1 solar pump and storage tank

For more information concerning these projects, please contact Tashina Kirk at 918-696-3563.

2.) Illinois River CREP - In April 2007, Oklahoma and the Farm Services Agency (FSA) signed an agreement for a $20,652,500 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 provides incentives to farmers and ranchers to remove streamside pasture or cropland from production activities for ten to fifteen years. In return, the landowners are reimbursed for the cost of installing practices such as alternative water supplies for livestock, fencing, grass planting, stream crossings, and winter feeding facilities. The landowners also receive an annual rental payment for the ten/fifteen-year period based on the average area rental rate for marginal pasture land, a signing bonus payment, and an annual practice maintenance payment.

The program employs two conservation plan writers. Monitoring and sampling is performed by an OCC Monitoring Specialist. Producer sign-ups for the Oklahoma CREP began June 1, 2007 and were facilitated by conservation district outreach meetings in the counties where the program operates, including Adair, Cherokee, Delaware, Mayes, and Sequoyah Counties. As of July 2014, CREP has a total of 65 contracts, of which 53 of these contracts are in the Illinois River Watershed. Currently, CREP has a total of 656 acres contracted. A total of 548 acres are contracted in the Illinois River watershed, and 108 acres are contracted in the Eucha-Spavinaw Watershed. (Some readers may notice that these numbers have not changed since the previous report. The reason is that CREP was unable to take applications from October 1 through June 5 due to lack of a Farm Bill. We are now actively pursuing contracts again.)

CREP has installed approximately 96,096 linear feet of riparian fencing with an additional 19,039 scheduled in the Illinois River watershed. In addition, 107,773 bare root seedling trees have been planted and an additional 28,021 scheduled for planting. Other best management practices completed in the Illinois River watershed include two ponds, seven wells and four more scheduled, ten watering tanks and

seven scheduled and one heavy use area. As of July 2014, $1,214,663 is scheduled to be spent, which includes $148,056 in landowner contributions.

For more information concerning the CREP program, please contact Gina Levesque, CREP Program Coordinator, at 918-456-1919.

3.) **Streambank Stabilization** - OCC applied for and was granted $300,000 in federal §319(h) funds from EPA to continue streambank stabilization work in this sensitive watershed. OCC is seeking additional funding through Conservation Incentive Grants to supplement the §319(h) funding which will allow more sites to be addressed. In a previous ARRA funded project extensive criteria screening delineated impaired sites; eleven of those sites were totally reconfigured with fluvial geomorphological solutions. The amount of additional funding will determine how many of those impaired sites can be addressed in this go-around. Contractor bids will be accepted later this year. We will again be using the design/build concept in which the same company does both the design and the construction. This method has proven very beneficial.

OCC has partnered with ODOT for a stabilization project to protect a portion of Highway 10 where the Illinois River is threatening to undermine the highway and private property. This project will allow ODOT to better leverage their planned funds through a design-build scenario with one contractor. The general goal of this project will be to demonstrate contemporary streambank stabilization design and implementation techniques to protect the threatened reach with more effective and environmentally sound methods than the traditional engineering approaches previously planned. The project will be a collaborative effort of several partners to include in addition to OCC staff, the Cherokee County Conservation District, Oklahoma Scenic Rivers Commission, and the property owners whose land will be improved. Construction will commence October 2014 and be completed by December 2014.

4.) **TMDL Development & Maintenance Support** - With state budgets severely challenged, available state funding to help support United States Geological Survey (USGS) monitoring stations in the watershed has lessened. Uninterrupted continuation of this monitoring is critical for TMDL development in the watershed and for monitoring water quality improvement due to implementation measures currently ongoing. In particular, this monitoring is critical toward long-term evaluation of NPS related load reduction because it includes targeted high flow sampling to help

estimate long-term trends in NPS loading. The USGS monitoring is used to help calibrate loading estimates from additional sampling efforts in the watershed that focus on measuring water quality impacts from OCC's EPA Nonpoint Source Priority Watershed Projects and the USDA Conservation Reserve Enhancement Program.

Along with the loss of funding for monitoring, the Oklahoma Scenic Rivers Commission (OSRC) lost funding to support its maintenance of restroom facilities and cleanup of public access areas along the river corridor. Proper maintenance of these facilities is essential to ensure that the 500,000+ people who utilize the river each year for swimming, fishing, floating, hunting, hiking, and bird watching leave a minimal impact on the river corridor. OSRC maintenance of these facilities ensures that human waste is captured at these facilities and then sent to an NPDES permitted waste treatment facility for processing. This treatment reduces total phosphorus concentrations in the waste from approx. 4,500 mg/L (Portable Sanitation Association, 2003) to less than 1 mg/L, based on the City of Tahlequah NPDES permit limits.

OCC has contracted with OSRC using §319(h) funding to allow these TMDL-critical activities to continue through 2014. The funding will also be used to replace twelve watershed signs. Oversight of these contracts is the responsibility of the Oklahoma Scenic Rivers Commission, with cooperation from the OCC as needed.

5.) Monitoring

CREP and Illinois River Implementation

To evaluate the effects of BMP implementation on stream water quality resulting from CREP and the Illinois River Watershed Projects, OCC initiated an automated water sampling monitoring plan in the spring of 2007 at key locations in the program area (Figure 1 and Table 1). A paired watershed monitoring design has been implemented. Use of autosamplers allows for a continuous assessment of both a true average concentration of constituents in the stream water and continuous discharge data, both crucial to accurate calculation of loading estimates necessary to account for changes in the water quality brought about in relatively short project timeframes. Routine physico-chemical, instream habitat, and biological sampling are also conducted at monitoring sites. Data from this monitoring program will be used to evaluate changes in key parameters (particularly nutrients) over time throughout the fifteen year lifespan of the CREP program.

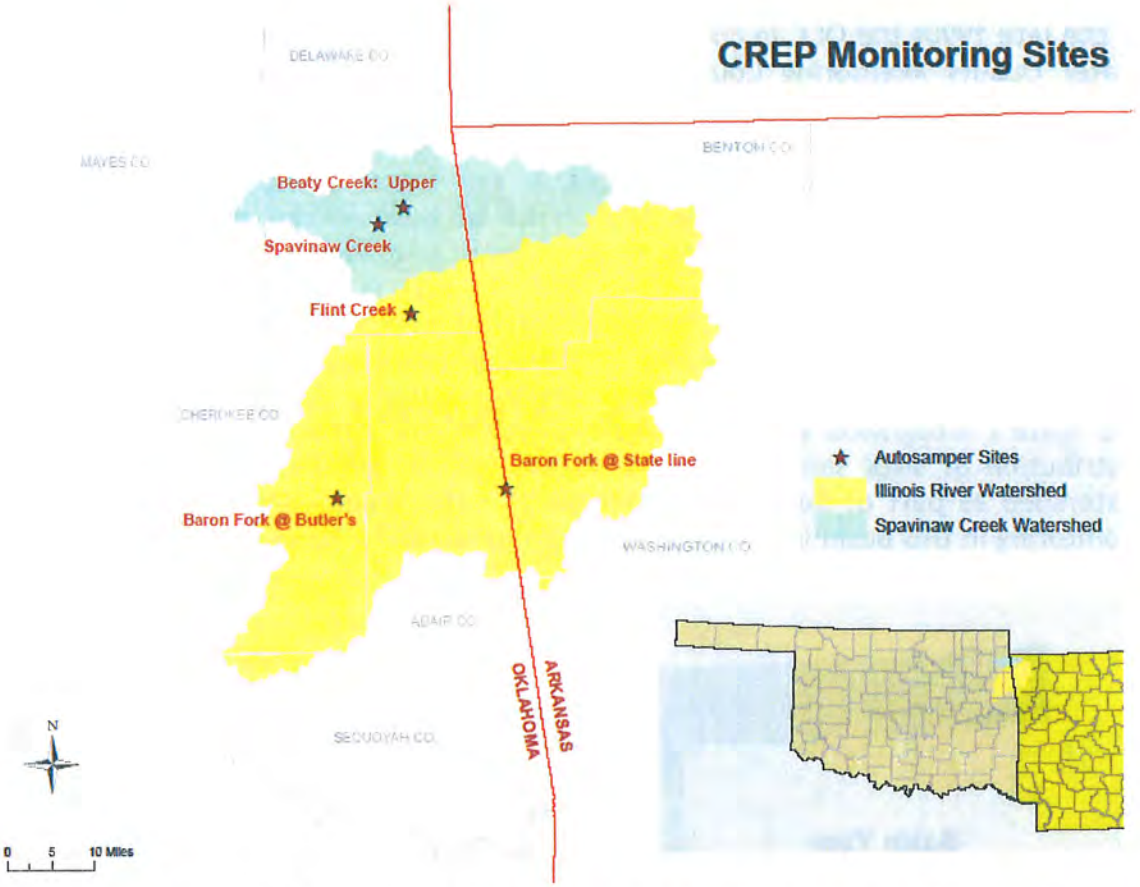


Figure 1. *Auto sampler installation sites within the Eucha/Spavinaw and Illinois River Watersheds in Oklahoma.*

OKLAHOMA CONSERVATION COMMISSION
EFFORTS IN THE ILLINOIS RIVER WATERSHED

Site Name	Watershed	Latitude	Longitude	County	Legal Description
Beaty Creek: Upper	Spavinaw	36.3704	-94.7191	Delaware	SW¼ NE¼ SW¼ Section 23-22N-24E
Spavinaw Creek	Spavinaw	36.3437	-94.7716	Delaware	NW¼ NW¼ SW¼ Section 32-22N-24E
Flint Creek	Illinois	36.1961	-94.7078	Delaware	NW¼ NW¼ SW¼ Section 24-20N-24E
Baron Fork: Lower	Illinois	35.86286	-94.8991	Cherokee	$SE^{1/4}$ $SE^{1/4}$ $NE^{1/4}$ 18, 16N, 23E
Baron Fork @ State line	Illinois	35.9062	-94.5191	Adair	34 7N 26E

Table 1. *Site names and locations of auto samplers used in the Eucha/Spavinaw and Illinois River §319 Program*

Rotating Basin Monitoring Program

In the late 1990s the OCC in cooperation with sister agencies and working through the Water Quality Monitoring Council agreed to coordinate efforts to ensure that all complete USGS eleven digit (i.e., HUC 11) watersheds across the state were monitored in a five year rotation. This endeavor, known as the Rotating Basin Monitoring Program (RBMP), comprises a significant component of Oklahoma's ambient monitoring effort for streams. The purpose of this program is to collect routine water samples for physical and chemical analysis, instream habitat, and biological (fish and benthic macroinvertebrates) data in support of federal mandates to assess state waters regarding their attainment/nonattainment of water quality standards. It serves a dualistic role in fulfilling requirements for an *NPS Assessment Report*, as data are analyzed and submitted biannually to the ODEQ for compilation in the state's Integrated Report. Figure 2 shows the basin schedule and statewide distribution of sites sampled for the RBMP, two of which fall in the Illinois River watershed as part of Basin Year 3 (Table 2). OCC completed the second cycle of monitoring in this basin in April 2010 and commenced the third cycle this year.

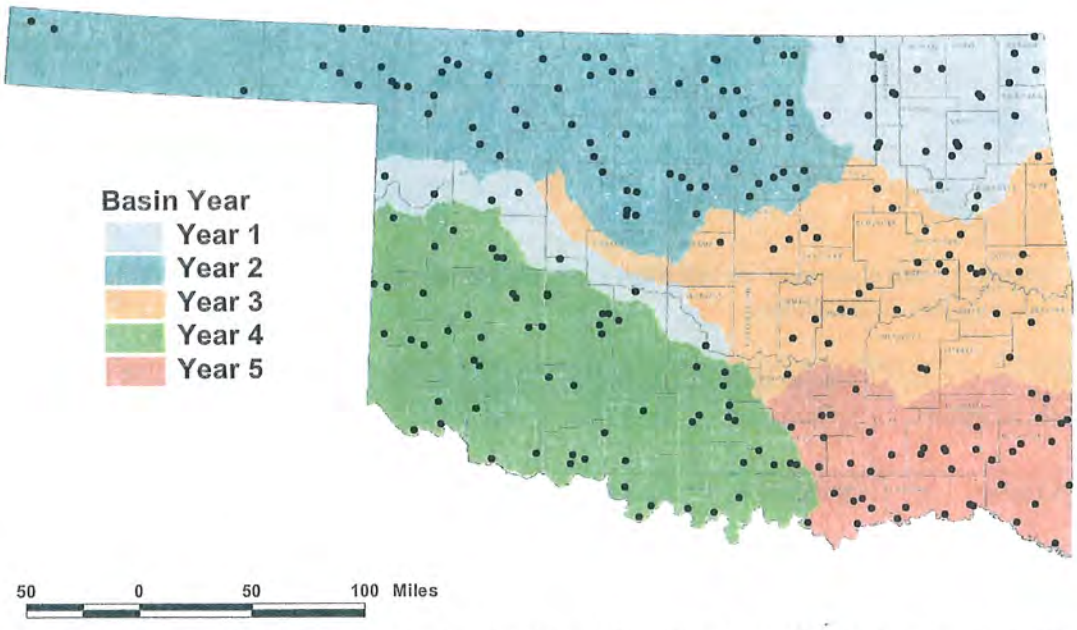


Figure 2. Basin schedule and statewide distribution of Rotating Basin Monitoring Program sites

Table 2. RBMP monitoring sites in the Illinois River watershed

Basin Year	Site Name	Lat	Long	Legal Description	County
RB Year 3	Ballard Creek: Lower	36.10627778	-94.56463889	NW¼ SW¼ SW¼ Section 20 19N 26E	Adair
RB Year 3	Battle Creek: Battle Branch	36.2104167	-94.68436111	SW¼ NE¼ SW¼ Section 18 20N 25E	Delaware

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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