State of Oklahoma
OWRB
WATER RESOURCES BOARD
the water agency

Oklahoma Comprehensive Water Plan 2012 Update

Water Supply Permit Availability Report

Revised October 2011

This study was funded through an agreement with the Oklahoma Water Resources Board under its authority to update the Oklahoma Comprehensive Water Plan, the state's long-range water planning strategy, due for submittal to the State Legislature in 2012. Results from this and other studies have been incorporated where appropriate in the OCWP's technical and policy considerations. The general goal of the OCWP is to ensure reliable water supplies for all Oklahomans through integrated and coordinated water resources planning and to provide information so that water providers, policy-makers, and water users can make informed decisions concerning the use and management of Oklahoma's water resources.

Oklahoma Comprehensive Water Plan
OCWP

Prepared by CDM under a cooperative agreement between the United States Army Corps of Engineers and the Oklahoma Water Resources Board

Contents

Section 1 - Water Supply Permit Availability Analyses

Section 2 - Analysis of Water Available for Current and Future Permitting

2.1 Water Use Permitting in Oklahoma 2-1
2.2 Groundwater Permitting Availability 2-2
2.2.1 Methodology 2-2
2.2.2 Results 2-5
2.3 Surface Water Permitting Availability 2-10
2.3.1 Methodology 2-10
2.3.2 Difference in USACE Reservoir Contracts and Permitting 2-12
2.3.3 Protecting Yield above Federal Reservoirs 2-12
2.3.4 Results 2-12

Section 3 - Interstate River Compacts

3.1 Introduction 3-1
3.2 Canadian River Compact (1950) 3-2
3.2.1 Purposes 3-2
3.2.2 Geographical Area of Influence 3-3
3.2.3 Apportionment of Water 3-3
3.2.4 Compact Operation and Accounting 3-4
3.2.5 Water Availability 3-4
3.3 Arkansas River Basin Compact, Kansas-Oklahoma (1965) 3-5
3.3.1 Purposes 3-5
3.3.2 Geographical Area of Influence 3-5
3.3.3 Apportionment of Water 3-5
3.3.4 Compact Operation and Accounting 3-7
3.3.5 Water Availability 3-7
3.4 Arkansas River Basin Compact, Arkansas-Oklahoma (1972) 3-8
3.4.1 Purposes 3-8
3.4.2 Geographical Area of Influence 3-8
3.4.3 Apportionment of Water 3-9
3.4.4 Compact Operation and Accounting 3-9
3.4.5 Water Availability 3-10
3.5 Red River Compact, Arkansas-Louisiana-Oklahoma-Texas (1978) 3-11
3.5.1 Purposes 3-11
3.5.2 Geographical Area of Influence 3-11
3.5.3 Apportionment of Water 3-12
3.5.4 Compact Operation and Accounting 3-14
3.5.5 Water Availability 3-15
3.6 Conclusions 3-15

Section 4 - References

Figures

2-1	Aquifer Equal Proportionate Share	2-4
2-2	Estimated Available Groundwater in 2060 for New Permits	2-9
2-3	Estimated Surface Water Permit Availability Gaps in 2010	2-16
2-4	Estimated Available Surface Water in 2060 for New Permits	2-17
3-1	Oklahoma's Interstate River Compacts	3-2

Tables

2-1	Permit Availability of Groundwater in 2060	2-5
2-2	Projected Permit Availability of Surface Water in 2060	2-13
2-3	Source of Permitted Withdrawals for Projected 2060 Surface Water Permit Availability Gaps	2-18
3-1	Long-Term Average Streamflow from Kansas to Oklahoma	3-7

Acronyms

AF	acre-feet
AFY	acre-feet per year
cfs	cubic feet per second
EPS	equal proportionate share
GIS	geographic information system
GRDA	Grand River Dam Authority
GW	groundwater
M&I	municipal and industrial
OCWP	Oklahoma Comprehensive Water Plan
OWRB	Oklahoma Water Resources Board
SW	surface water
TDS	total dissolved solids
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey

Section 1
Water Supply Permit Availability Analyses

The Oklahoma Comprehensive Water Plan (OCWP) is being updated to assess and plan for the water needs of all water uses and users in Oklahoma through 2060. A reliable water supply is contingent on all of the following aspects:

- Physical water supply availability or "wet water"
- The right to divert water from surface water (SW) or groundwater (GW) sources
- Infrastructure to divert, treat, and convey the water to its intended use
- Adequate water quality for the intended use

A reliable source of supply must not only have the water physically present for diversion and use, the user must have the rights and the infrastructure to deliver the water, and the water must be of adequate quality. Absent any one of these elements, the supply is not reliable.

For example, the right to divert water has no value if the water is not physically present due to hydrologic or other conditions. Conversely, having water physically available for diversion does not by itself satisfy a user's need if the water is obligated to other users.

Each of these elements is being examined at both a statewide and a basin level of analysis as part of the development of the OCWP. This report focuses on the permit availability of water in Oklahoma. The other supply aspects are being investigated and documented separately.

Specifically, the permit availability analyses consisted of the following aspects:

- Identification of the maximum amounts of SW and GW that could be permitted using Oklahoma's existing statutory requirements and water rights permitting protocol

- Documentation of interstate river compact agreements and obligations

The maximum amount of SW and GW available for permitting may change if statutory or rule changes occur in the future.

The maximum amount of water that could be permitted was compared to demand forecasts for 2060, for each of the 82 OCWP basins, to check for constraints of the current permitting system on meeting future demands. Interstate river compacts were also summarized as part of this effort, and Oklahoma's anticipated SW development was compared to interstate river compact obligations to check whether interstate river compact requirements are likely to constrain the use of supplies to meet anticipated demand for SW in Oklahoma. These analyses are described in the following sections.

Section 2
Analysis of Water Available for Current and Future Permitting

This section summarizes the results of analyses of the permit availability of water supplies in Oklahoma relative to water permits, sometimes referred to as "water rights." A water right can be a permit, prior right (groundwater), or vested right (surface water). As noted in Section 1, the permit availability was evaluated in parallel with the physical water supply, water quality, and infrastructure constraints. Physical water availability, water quality, and infrastructure constraints are analyzed and discussed in separate OCWP documents.

2.1 Water Use Permitting in Oklahoma

Oklahoma water law considers SW and GW separately. Stream water, the term used for SW permits, is "water in a definite stream and includes but is not limited to water in ponds, lakes, reservoirs, and playa lakes" (Oklahoma Administrative Code 785:20-1-2. Definitions). SW is a public resource that is subject to appropriation by the Oklahoma Water Resources Board (OWRB) for all SW basins except the Grand River in northeast Oklahoma, where the Grand River Dam Authority (GRDA) has authority for water allocation. GRDA was created by the Oklahoma Legislature in 1935. As defined by the enabling legislation, the waters of the Grand River serve citizens and industrial customers for both their general electrical and public consumption purposes. Waters of the Grand River were fully appropriated to the authority with the initial enabling legislation. This act of appropriation resulted in the eventual formation of water contracting agreements between GRDA and its water users. The administration of water use contracts is solely the responsibility of the GRDA and does not fall under the purview of the OWRB. Permitting in the Grand River basin is therefore not analyzed in this report.

Oklahoma SW laws are based on riparian and prior appropriation doctrines. OWRB issues a permit, also referred to as a water right, to divert water from a stream for beneficial use. Domestic use of GW or SW by individuals for household purposes, lawns, orchards, and cattle watering up to the normal grazing capacity, plus use of up to 5 acre-feet per year (AFY) for agriculture by natural individuals, firefighting, and use by non-individuals for drinking water, restrooms, and lawn watering does not require a permit. New SW permits may not interfere with existing permitted withdrawals, domestic users, and reservoir yields. If the beneficial use of the diversion is not maintained, the law specifies that permitted withdrawal amounts are forfeited.

GW is considered a property right in Oklahoma. GW is defined as "fresh water [less than 5,000 parts per million total dissolved solids (TDS)] under the surface of the earth regardless of the geologic structure in which it is standing or moving outside the cut bank of any definite stream." The amount of GW that may be withdrawn is based on the number of acres of land overlying the groundwater basin. OWRB permits the withdrawal of GW providing that the following are satisfied:

- The party requesting the permit owns or leases the land (or has right to the water under the land)
- The land lies atop a groundwater basin or sub-basin
- The use will be beneficial
- No unauthorized use of wells or GW (waste by depletion)
- No pollution to the basin or aquifer (waste by pollution) (82 O.S., §1020.9)

In addition to the merits of the GW permit, the potential for interference with existing wells may be examined. Well pumping can be curtailed to less than the permitted amount if interference with existing wells occurs. New wells in aquifers where an equal proportionate share (EPS) has been established are required to be located at least a 1/4 mile away from the next nearest existing well to avoid such interference, unless otherwise proven in a hearing before the OWRB.

Two major types of GW permits are issued by the OWRB—regular and temporary. Regular GW permits are issued for aquifers that have been studied and an EPS defined. An EPS is the portion of maximum annual yield of GW in a given GW basin allocated to each acre of overlying land. The GW basins with an EPS, which currently vary from 0.5 to 2.1 AFY per acre, are shown in Figure 2-1. In all areas with no defined EPS, a temporary permit of 2.0 AFY per acre may be issued. If the land overlies more than one aquifer, separate permits are issued for each aquifer that is used in studied basins. Pumping of GW for domestic uses is exempt from the OWRB GW permitting process, but domestic users are not allowed to waste GW.

Tribal issues are being investigated separately and are not included in this evaluation. The results of the tribal investigations could affect this analysis and should be considered upon their completion, and/or as part of OCWP implementation activities. Additionally, the riparian rights doctrine, which is not evaluated in this report, could affect the findings of these analyses. Results could also vary as additional aquifers are studied and temporary permits are converted to regular permits.

2.2 Groundwater Permitting Availability

2.2.1 Methodology

The permit availability of GW was determined for each of the 82 OCWP basins, including areas with and without studied GW basins. The OCWP basins were defined based on surface watersheds. Therefore, Oklahoma's GW aquifers typically span multiple OCWP basins.

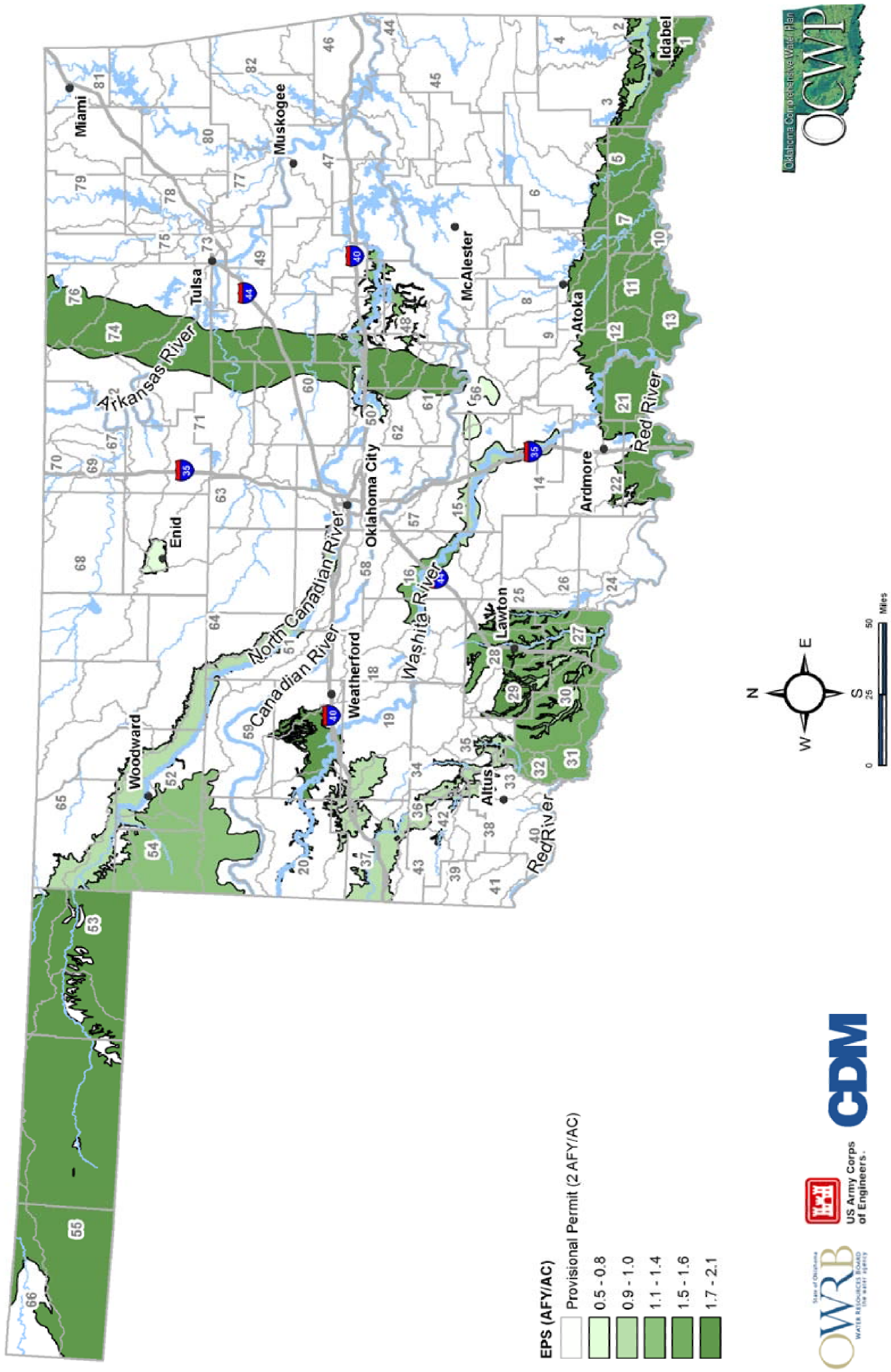

Figure 2-1 - Aquifer Equal Proportionate Share

To calculate the maximum permit GW availability (quantity that could be permitted), a hypothetical regular or temporary permit was assigned to the entire state. Areas with regular permits were determined from the OWRB major and minor aquifer geographic information system (GIS) data files as shown in Figure 2-1. EPS GW withdrawals were calculated by multiplying the area of the GW basin in each OCWP basin by the EPS. Temporary permit withdrawals were calculated by multiplying the remaining area of each OCWP basin (i.e., the area not covered by a GW basin with a defined EPS) by 2 AFY per acre. The total permit availability was determined by summing the temporary and EPS withdrawal volumes. The total permit availability therefore effectively includes amounts that could be authorized by the two major types of permits. The current permit availability was estimated by subtracting the existing active GW rights from the total permit availability. The estimated current GW permits were developed using the 2007 records, which were available at the time of the analysis, and the OCWP demand projections. The portion of demand met by SW was calculated using the current (2010) SW and GW supply proportions. Since forfeiture of existing groundwater permits is rare, all existing active rights were used to conservatively represent the current portion of each basin that is not available for permits.

To address overlying aquifers (shown in Figure 2-1), the following simplifying assumptions were made:

- In areas with overlapping aquifers, the GW permit availability was based on the aquifer with an EPS.
- If more than one aquifer with an EPS was present, then the larger EPS was used.
- Only one GW permit was assigned for a given acre. OWRB protocol allows more than one permit to be assigned per acre, but this is a rare occurrence. Therefore, to be conservative, it was assumed that only one permit authorizing use of GW underlying each acre could be issued.

The quantity of GW that would need to be permitted by 2060 was estimated for each OCWP basin by summing the existing active GW rights and the increase in projected GW demand from 2010 to 2060. Demand increases were calculated using the future (2060) SW and GW supply proportions in each OCWP basin.

A GW permit availability was estimated for the current (2010) and long-term (2060). The permit availability gap was calculated by subtracting the projected 2060 estimated GW permits from the total quantity that could be permitted in each OCWP basin. Since some existing rights are not currently 100 percent utilized, the projected 2060 GW permits used in this analysis may be greater than the projected future GW demand and thus provides a conservative forecast.

2.2.2 Results

The GW permit availability analyses identified no GW permitting gaps in the state in the near-term or long-term (2060) timeframe. As shown in Table 2-1, the projected increase in GW demands from 2010 to 2060 (assuming the continued use of the current supply proportions of SW and GW sources), is less in each OCWP basin than the amount of GW available for new permits in 2010 under current law and permitting protocol. The estimated amount of groundwater that will be available for new permits in 2060 in each basin is shown graphically in Figure 2-2. As the remaining aquifers are studied and assigned an EPS, the available water for permits may increase or decrease relative to the temporary permit value of 2.0 AFY per acre. As a reminder, the available GW for permits does not consider the physical ability to extract GW (i.e., "wet water") in a given basin and does not distinguish between alluvial and bedrock GW. Physical supply availability is evaluated and documented separately from this analysis.

Table 2-1 Permit Availability of Groundwater in 2060

OCWP Basin #	Basin ID	Basin Name	Maximum Potential GW Permits (AFY)[1]	Total Available Water for New Permits in 2010 (AFY)[2]	Projected Increase in GW Use 2010-2060 (AFY)	Remaining Available Water for New Permits in 2060 (AFY)
1	10100	Red River Mainstem (To Kiamichi River)	544,100	543,800	100	543,700
2	10201	Little River (McCurtain County) - 1	417,600	417,600	100	417,500
3	10202	Little River (McCurtain County) - 2	1,615,300	1,615,100	100	1,615,000
4	10203	Little River (McCurtain County) - 3	708,300	708,400	100	708,300
5	10301	Kiamichi River - 1	506,100	502,300	100	502,200
6	10302	Kiamichi River - 2	1,853,000	1,852,600	100	1,852,500
7	10411	Muddy Boggy River - 1	466,600	463,100	100	463,000
8	10412	Muddy Boggy River - 2	1,394,700	1,390,300	400	1,389,900
9	10420	Clear Boggy Creek	1,310,400	1,304,900	100	1,304,800
10	10500	Red River Mainstem (To Blue River)	293,600	290,100	100	290,000
11	10601	Blue River - 1	295,300	293,500	100	293,400
12	10602	Blue River - 2	613,900	546,600	200	546,400
13	10700	Red River Mainstem (To Washita)	439,900	432,400	100	432,300
14	10810	Lower Washita	2,283,500	2,250,800	500	2,250,300
15	10821	Middle Washita - 1	579,400	566,500	200	566,300

Table 2-1 Permit Availability of Groundwater in 2060

OCWP Basin #	Basin ID	Basin Name	Maximum Potential GW Permits (AFY)[1]	Total Available Water for New Permits in 2010 (AFY)[2]	Projected Increase in GW Use 2010-2060 (AFY)	Remaining Available Water for New Permits in 2060 (AFY)
16	10822	Middle Washita - 2	1,366,800	1,325,900	400	1,325,500
17	10831	Upper Washita - 1	288,400	259,100	300	258,800
18	10832	Upper Washita - 2	393,800	263,000	500	262,500
19	10833	Upper Washita - 3	1,999,300	1,887,700	300	1,887,400
20	10840	Washita Headwaters	1,342,700	1,230,800	400	1,230,400
21	10900	Red River Mainstem (To Walnut Bayou)	2,228,400	2,182,700	500	2,182,200
22	11000	Walnut Bayou	435,600	417,300	400	416,900
23	11100	Mud Creek	831,200	821,400	100	821,300
24	11201	Beaver Creek - 1	136,100	134,500	100	134,400
25	11202	Beaver Creek - 2	642,400	624,100	200	623,900
26	11203	Beaver Creek - 3	248,800	247,200	100	247,100
27	11311	Cache Creek - 1	97,500	97,200	100	97,100
28	11312	Cache Creek - 2	771,900	762,500	200	762,300
29	11321	Deep Red River And West Cache Creek - 1	515,700	510,000	200	509,800
30	11322	Deep Red River And West Cache Creek - 2	593,700	592,700	100	592,600
31	11400	Red River Mainstem (To North Fork of Red)	552,700	536,200	100	536,100
32	11511	Lower North Fork Red River - 1	132,600	109,600	100	109,500
33	11512	Lower North Fork Red River - 2	371,800	352,400	100	352,300
34	11513	Lower North Fork Red River - 3	851,200	838,200	200	838,000
35	11514	Lower North Fork Red River - 4	153,900	153,300	100	153,200
36	11521	Upper North Fork Red River - 1	167,900	148,400	200	148,200
37	11522	Upper North Fork Red River - 2	649,100	582,700	200	582,500
38	11601	Salt Fork Red River - 1	674,800	635,400	300	635,100

Table 2-1 Permit Availability of Groundwater in 2060

OCWP Basin #	Basin ID	Basin Name	Maximum Potential GW Permits (AFY)[1]	Total Available Water for New Permits in 2010 (AFY)[2]	Projected Increase in GW Use 2010-2060 (AFY)	Remaining Available Water for New Permits in 2060 (AFY)
39	11602	Salt Fork Red River - 2	222,200	217,600	100	217,500
40	11701	Prairie Dog Town Fork Red River - 1	361,400	352,300	200	352,100
41	11702	Prairie Dog Town Fork Red River - 2	309,600	242,300	300	242,000
42	11801	Elm Fork Red River - 1	126,100	118,300	300	118,000
43	11802	Elm Fork Red River - 2	568,700	567,800	100	567,700
44	20101	Poteau River - 1	125,600	125,600	100	125,500
45	20102	Poteau River - 2	1,600,700	1,598,400	100	1,598,300
46	20201	Lower Arkansas River - 1	1,833,500	1,818,400	300	1,818,100
47	20202	Lower Arkansas River - 1	1,253,100	1,242,000	200	1,241,800
48	20300	Canadian River (To North Canadian River)	4,054,500	4,042,700	500	4,042,200
49	20400	Middle Arkansas River	1,692,600	1,676,900	300	1,676,600
50	20510	Lower North Canadian River	1,239,400	1,143,500	1,000	1,142,500
51	20520	Middle North Canadian River	708,400	633,600	600	633,000
52	20531	Upper North Canadian River - 1	860,700	805,900	100	805,800
53	20532	Upper North Canadian River - 2	1,686,000	1,477,800	700	1,477,100
54	20533	Upper North Canadian River - 3	581,600	498,900	700	498,200
55	20540	North Canadian Headwaters	4,642,600	3,698,900	2,500	3,696,400
56	20611	Lower Canadian River - 1	1,132,500	1,089,800	400	1,089,400
57	20612	Lower Canadian River - 2	259,700	255,900	100	255,800
58	20620	Middle Canadian River	876,000	810,500	500	810,000
59	20630	Upper Canadian River	2,484,900	2,324,300	600	2,323,700
60	20700	Deep Fork River	2,572,100	2,527,700	600	2,527,100
61	20801	Little River - 1	368,200	365,900	100	365,800
62	20802	Little River - 2	768,900	728,600	400	728,200
63	20910	Lower Cimarron River	1,332,200	1,322,900	300	1,322,600

Table 2-1 Permit Availability of Groundwater in 2060

OCWP Basin #	Basin ID	Basin Name	Maximum Potential GW Permits (AFY)[1]	Total Available Water for New Permits in 2010 (AFY)[2]	Projected Increase in GW Use 2010-2060 (AFY)	Remaining Available Water for New Permits in 2060 (AFY)
64	20920	Middle Cimarron River	4,586,200	4,390,800	1,300	4,389,500
65	20930	Upper Cimarron River	2,506,400	2,380,700	600	2,380,100
66	20940	Cimarron Headwaters	893,700	850,800	400	850,400
67	21011	Lower Salt Fork of the Arkansas River - 2	299,400	292,300	100	292,200
68	21012	Lower Salt Fork of the Arkansas River - 2	2,857,500	2,815,900	100	2,815,800
69	21013	Lower Salt Fork of the Arkansas River - 3	190,500	188,300	100	188,200
70	21020	Upper Salt Fork of the Arkansas River	286,100	281,500	300	281,200
71	21100	Arkansas River - Cimarron Rivers to Keystone Lake	2,596,600	2,575,800	300	2,575,500
72	21200	Arkansas River Mainstem (To Kansas State Line)	1,908,000	1,868,600	300	1,868,300
73	21301	Bird Creek - 1	229,900	229,900	100	229,800
74	21302	Bird Creek - 2	1,226,000	1,224,900	100	1,224,800
75	21401	Caney River - 1	206,200	206,300	100	206,200
76	21402	Caney River - 2	1,300,200	1,300,200	100	1,300,100
77	21511	Verdigris River (To Oologah Dam) - 1	502,600	502,600	100	502,500
78	21512	Verdigris River (To Oologah Dam) - 2	411,500	411,600	100	411,500
79	21520	Verdigris River (To Kansas State Line)	1,052,500	1,052,500	100	1,052,400
80	21601	Grand (Nesho) River - 1	2,638,300	2,628,100	400	2,627,700
81	21602	Grand (Nesho) River - 2	1,155,900	1,137,100	400	1,136,700
82	21700	Illinois River	1,147,800	1,143,700	100	1,143,600

[1] Maximum potential permits includes overall total permit capacity based on EPS and temporary permits before considering any existing permits. A portion of the maximum potential permits is already allocated to existing permits.

[2] Available water for new permits is the maximum potential permits minus 2010 GW permits in the basin (2010 permits were estimated as 2007 actual permits plus estimated increase in GW use from 2007 to 2010).

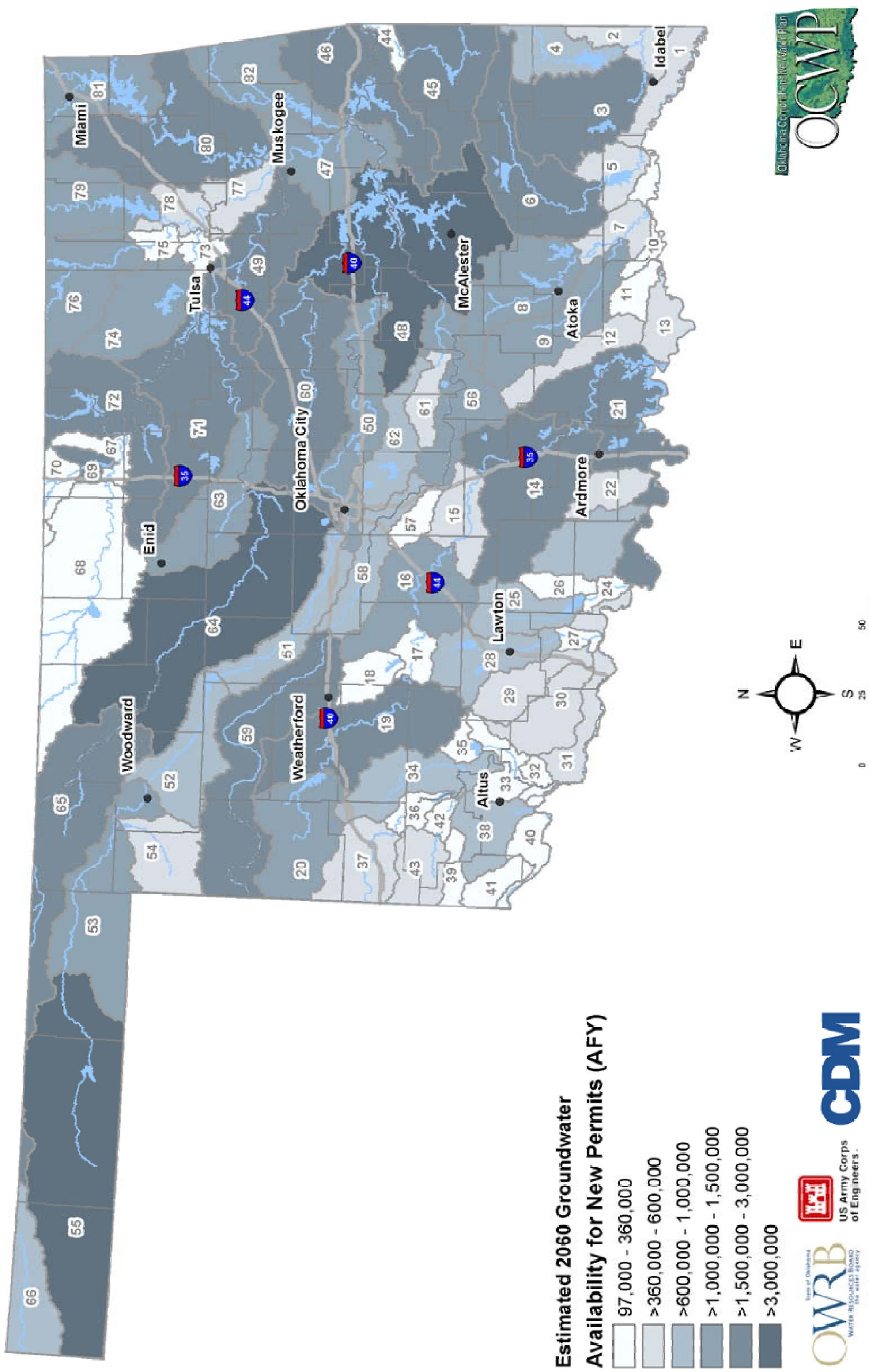

Figure 2-2 – Estimated Available Groundwater in 2060 for New Permits

2.3 Surface Water Permitting Availability

2.3.1 Methodology

The SW permitting availability was determined for each of the 82 OCWP basins. Future SW withdrawals may not impact existing SW rights as they would be junior to existing water rights. Therefore, the obligations both upstream and downstream were considered. Those obligations include existing active rights, potential future permits defined by the demand projections, domestic water use, interstate river compact obligations, and reservoir dependable yields.

The quantity of SW that would need to be permitted by 2060 was estimated for each OCWP basin using the following methodologies that follow OWRB SW permitting protocol:

- Existing active rights were allocated to each basin by the location of the SW withdrawal, which was available from the OWRB water rights database.

- The estimated SW permits that will be needed in 2060 were determined by summing the existing active SW rights (annual quantity) and the increase in total SW permit need from 2010 to 2060, which was calculated based on existing schedules of use and SW demand projections. Since some existing permits are not currently 100 percent utilized, the estimated 2060 SW permit need that was estimated for this analysis may be greater than the projected total future demands and thus provides a conservative forecast.

- The estimated current SW permits were developed using 2007 records, which were available at the time of the analysis, and the OCWP demand projections. The portion of demand met by SW was calculated using the current (2010) SW and GW supply proportions.

- Existing active SW rights were used to represent the current SW that is unavailable for new permits. The unavailable water includes the amount of permitted water listed in schedules of use for the given analysis year. OWRB undertakes systematic reviews of permits to assure beneficial use of the water, and portions of permits that are not used for beneficial use or covered in a schedule of use may be forfeited.

- The increase in total SW permit need was calculated in two parts: projected increases in non-municipal and industrial (M&I) demands, such as Crop Irrigation, and projected increases in M&I demands or existing schedules of use. Future SW permits from non-M&I demands were calculated as the increase in non-M&I demand from 2010 to 2060 using the future (2060) SW and GW supply proportions. Future SW permits from M&I demands were calculated as the larger of (1) the increase in active permitted diversions due to schedules of use from 2010 to 2060, or (2) the increase in M&I demand from 2010 to 2060 using the future (2060) SW and GW supply proportions for each basin.

- Oil and Gas users currently use 90-day temporary permits for well drilling and development activities. Oil and gas activities were assigned a general permit for consistency in the analysis, where the general permit amount is equal to the sum of the 90 day permits for the year.

- Upstream and downstream permits were included as permit obligations for each basin. OWRB applies case by case analyses when permitting on the mainstem of a river, which includes the OCWP basin's outlet. To systematically account for mainstem permitting on a statewide basis, all upstream basins were taken into account. The immediate downstream basin was included in the basin's permit obligation. Permit availability gaps due to downstream basin's estimated future permits were flagged as a mainstem restriction.

- Domestic uses were calculated as 6 AFY per quarter section (160 acres) of the total basin area. Non-consumptive uses were not incorporated in the analysis, consistent with current law and permitting practice.

- Consistent with OWRB methodology and assumptions to recognize typical compact apportionment provisions, upstream states are typically recognized to be able to use 60 percent of the measured historical stream flow at the Oklahoma border; however, actual compact provisions are reviewed on an ad hoc basis for potential availability issues. The presumed reduction in flow is then accounted for in all downstream basins within Oklahoma.

- Arkansas was allocated (for purposes of this report) 40 percent of runoff generated in OCWP basins 44, 45, 46, 47, and 82 based on the Arkansas River Basin Compact between Arkansas and Oklahoma. Runoff is defined for purposes of this report only as the measured stream flow. This is a conservative assumption because return flows from uses in the basin will result in higher measured flows.

- Downstream states on the Red River were allocated (for purposes of this report only) 40 percent of runoff generated in basins 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13. Runoff was defined as the measured stream flow. Note, the above methodology is a simplification of the compact apportionment provisions. The Red River Compact has a different definition of runoff, and "undesignated flow" is separately defined in the Red River Compact for the apportionment provisions.

- Reservoir dependable yields from the OWRB water rights database were used. The yields reflect all reservoir conservation pool allocations (irrigation, water quality, water storage, etc.). Reservoir dependable yields and associated permits were not double counted.

- NRCS reservoirs without dependable yields were included based on their normal storage volume. NRCS reservoirs and associated permits were not double counted. Permits were associated with NRCS reservoirs based on being within a half mile of the reservoir dam location.

- Upstream estimated future permits were accounted for in all downstream basins.

- Permit availability was not analyzed for GRDA's area of responsibility (Basins 80 and 81).

For each basin, the estimated 2060 SW permit need was subtracted from average annual measured historical stream flow (adjusted based on the presumed compact constraints) to determine the SW permit availability gap. Average annual stream flow (using data from 1951 through 1980 per OWRB protocol at the time of this analysis) was determined from the monthly SW supplies calculated separately in the physical supply availability analysis. Average annual stream flows were used in this analysis, following OWRB permitting protocol.

2.3.2 Differences in USACE Reservoir Contracts and Permitting

Differences in accounting between state and federal agencies can require additional consideration when obtaining permits for water from U.S. Army Corps of Engineers (USACE) reservoirs. OWRB permitting allows for permits with schedule of use to be applied to reservoirs, including federal reservoirs. The USACE issues storage contracts based on the amount of water currently used by an entity. A State of Oklahoma permit is required by the USACE before a contract will be issued. Therefore, it is possible for the USACE to have available storage to contract and the reservoir yield to be fully permitted, since some portion of the permit may be based on a schedule of use. When investigating a possibility of obtaining water from a USACE reservoir, it is best to first confirm the permit availability with OWRB.

These accounting issues do not arise with Bureau of Reclamation reservoirs and the associated master conservancy or irrigation districts.

2.3.3 Protecting Yield above Federal Reservoirs

The yield of all conservation pools (water supply, thermo-electric power, navigation, etc.) of federal reservoirs must be protected from future development. Many federal reservoirs provide multiple years of water supply; therefore, withdrawals above these reservoirs may be curtailed even when there is ample flowing water in the stream.

2.3.4 Results

The results of the SW permit availability analyses are presented in Table 2-2. The estimated gaps in SW permits in 2010 are presented in Figure 2-2. The estimated available streamflow for new permits in 2060 is presented in Figure 2-3. This represents the SW that could be permitted in a given basin after satisfying existing permits and schedules of use, and after satisfying the amount of new permits that would be needed to accommodate the basin's projected growth in SW use from 2010 through 2060. New permits to accommodate the projected growth in SW use were assumed to be needed only to the degree that existing permits and schedules of use cannot accommodate the projected 2060 SW use.

The results show that there is sufficient available SW permit capacity in the majority of the OCWP basins in 2060. That is, projected SW demands in 2060 (assuming continued use of the current supply proportions of SW and GW sources) could be fully permitted using current law and permitting protocol. Shortages in available water permits (insufficient permitted water availability for projected 2060 demands) are projected in 22 of the 82 OCWP basins across the state. The shortages begin in the first year of the analysis (2010) in 19 of these 22 basins. Shortages in Basin 32 (Lower North Fork of the Red River - 1) start in 2060 and shortages in Basin 33 (Lower North Fork of the Red River - 2) start in 2020. A summary of the permit obligations on each basin with a gap is presented for the 2060 results in Table 2-3. As stated in the methodology, basins with permit availability gaps that are smaller than the estimated SW permits in the immediate downstream basin were flagged as mainstem restrictions. The SW permit availability gaps tend to occur in the western half of the state.

Table 2-2 Projected Permit Availability of Surface Water in 2010 and 2060

OCWP Basin #	Basin ID	Basin Name	Average Annual Stream Flow 1951 - 1980 (AFY)	Estimated Available Water for Permits in 2010 (AFY)[2]	Estimated Gaps in Available Water for Permits in 2010 (AFY)[3]	Remaining Water for Permits (or Gaps in Available Water for Permits) in 2060 (AFY)[3]	Potential Restrictions to Permitting on Mainstem of Creek or River
10100	1	Red River Mainstem (To Kiamichi River)	368,800	207,100	0	205,300	No
10201	2	Little River (McCurtain County) - 1	2,439,900	1,939,200	0	1,929,300	No
10202	3	Little River (McCurtain County) - 2	1,150,000	958,000	0	952,400	No
10203	4	Little River (McCurtain County) - 3	896,500	488,600	0	483,700	No
10301	5	Kiamichi River - 1	1,528,000	1,285,600	0	1,258,600	No
10302	6	Kiamichi River - 2	1,205,300	894,800	0	867,900	No
10411	7	Muddy Boggy River - 1	1,170,900	925,000	0	897,500	No
10412	8	Muddy Boggy River - 2	584,600	388,800	0	364,000	No
10420	9	Clear Boggy Creek	435,400	319,300	0	316,400	No
10500	10	Red River Mainstem (To Blue River)	87,800	43,900	0	43,600	No
10601	11	Blue River - 1	275,800	200,300	0	196,200	No
10602	12	Blue River - 2	191,800	144,700	0	140,600	No
10700	13	Red River Mainstem (To Washita)	131,500	79,900	0	78,600	No
10810	14	Lower Washita	830,300	303,800	0	260,500	No
10821	15	Middle Washita - 1	426,100	62,900	0	27,200	No
10822	16	Middle Washita - 2	321,100	22,700	0	Gap (-700)	No
10831	17	Upper Washita - 1	217,000	0	-14,900	Gap (-36,500)	Yes
10832	18	Upper Washita - 2	16,400	0	-21,100	Gap (-28,400)	No
10833	19	Upper Washita - 3	183,300	0	-13,100	Gap (-27,000)	Yes
10840	20	Washita Headwaters	89,300	0	-87,900	Gap (-99,000)	Yes
10900	21	Red River Mainstem (To Walnut Bayou)	1,509,400	909,900	0	866,700	No
11000	22	Walnut Bayou	22,700	5,500	0	4,500	No
11100	23	Mud Creek	99,500	82,400	0	82,200	No
11201	24	Beaver Creek - 1	122,400	78,800	0	49,800	No
11202	25	Beaver Creek - 2	71,000	33,100	0	4,500	No
11203	26	Beaver Creek - 3	33,200	16,100	0	6,800	No
11311	27	Cache Creek - 1	262,000	171,300	0	156,500	No
11312	28	Cache Creek - 2	101,300	43,900	0	30,600	No

Table 2-2 Projected Permit Availability of Surface Water in 2010 and 2060

OCWP Basin #	Basin ID	Basin Name	Average Annual Stream Flow 1951 - 1980 (AFY)	Estimated Available Water for Permits in 2010 (AFY)[2]	Estimated Gaps in Available Water for Permits in 2010 (AFY)[3]	Remaining Water for Permits (or Gaps in Available Water for Permits) in 2060 (AFY)[3]	Potential Restrictions to Permitting on Mainstem of Creek or River
11321	29	Deep Red River And West Cache Creek - 1	145,200	107,700	0	106,000	No
11322	30	Deep Red River And West Cache Creek - 2	79,600	35,100	0	33,500	No
11400	31	Red River Mainstem (To North Fork of Red)	69,100	55,100	0	55,000	No
11511	32	Lower North Fork Red River - 1	254,700	7,400	0	Gap (-2,600)	No
11512	33	Lower North Fork Red River - 2	248,700	600	0	Gap (-9,300)	Yes
11513	34	Lower North Fork Red River - 3	200,000	0	-40,400	Gap (-48,100)	No
11514	35	Lower North Fork Red River - 4	13,000	0	-16,100	Gap (-19,600)	Yes
11521	36	Upper North Fork Red River - 1	49,300	0	-133,300	Gap (-139,100)	No
11522	37	Upper North Fork Red River - 2	85,300	0	-67,400	Gap (-67,600)	Yes
11601	38	Salt Fork Red River - 1	113,600	15,000	0	8,800	No
11602	39	Salt Fork Red River - 2	61,800	0	-33,700	Gap (-39,900)	Yes
11701	40	Prairie Dog Town Fork Red River - 1	11,400	0	-6,700	Gap (-6,900)	No
11702	41	Prairie Dog Town Fork Red River - 2	12,800	0	-5,300	Gap (-5,500)	Yes
11801	42	Elm Fork Red River - 1	77,300	12,900	0	6,700	No
11802	43	Elm Fork Red River - 2	67,700	35,100	0	34,600	No
20101	44	Poteau River - 1	1,411,100	987,900	0	962,400	No
20102	45	Poteau River - 2	1,340,400	995,800	0	979,400	No
20201	46	Lower Arkansas River - 1	21,496,800	11,211,200	0	10,606,700	No
20202	47	Lower Arkansas River - 2	18,750,200	9,466,300	0	8,878,300	No
20300	48	Canadian River (To North Canadian River)	3,264,500	2,019,300	0	1,802,400	No
20400	49	Middle Arkansas River	5,515,700	3,179,600	0	2,952,400	No
20510	50	Lower North Canadian River	409,400	0	-174,900	Gap (-243,000)	Yes
20520	51	Middle North Canadian River	112,400	0	-292,400	Gap (-317,300)	No
20531	52	Upper North Canadian River - 1	111,600	0	-242,000	Gap (-247,100)	No
20532	53	Upper North Canadian River - 2	118,400	0	-115,500	Gap (-118,600)	No
20533	54	Upper North Canadian River - 3	38,900	0	-35,300	Gap (-38,100)	Yes
20540	55	North Canadian Headwaters	64,500	0	-108,800	Gap (-109,200)	No
20611	56	Lower Canadian River - 1	874,800	376,500	0	301,300	No
20612	57	Lower Canadian River - 2	39,100	32,400	0	31,500	No
20620	58	Middle Canadian River	475,200	202,400	0	178,300	No
20630	59	Upper Canadian River	242,600	39,700	0	30,500	No
20700	60	Deep Fork River	483,900	188,200	0	126,700	No
20801	61	Little River - 1	197,500	77,300	0	55,400	No
20802	62	Little River - 2	97,700	51,400	0	44,500	No
20910	63	Lower Cimarron River	833,300	473,500	0	455,100	No
20920	64	Middle Cimarron River	624,900	342,500	0	331,200	No

Table 2-2 Projected Permit Availability of Surface Water in 2010 and 2060

OCWP Basin #	Basin ID	Basin Name	Average Annual Stream Flow 1951 - 1980 (AFY)	Estimated Available Water for Permits in 2010 (AFY)[2]	Estimated Gaps in Available Water for Permits in 2010 (AFY)[3]	Remaining Water for Permits (or Gaps in Available Water for Permits) in 2060 (AFY)[3]	Potential Restrictions to Permitting on Mainstem of Creek or River
20930	65	Upper Cimarron River	110,300	0	-129,600	Gap (-137,000)	No
20940	66	Cimarron Headwaters	16,300	0	-71,100	Gap (-72,600)	No
21011	67	Lower Salt Fork of the Arkansas River - 1	918,400	337,300	0	249,000	No
21012	68	Lower Salt Fork of the Arkansas River - 2	490,400	275,000	0	274,500	No
21013	69	Lower Salt Fork of the Arkansas River - 3	383,600	168,400	0	165,500	No
21020	70	Upper Salt Fork of the Arkansas River	355,600	148,800	0	146,200	No
21100	71	Arkansas River - Cimarron Rivers to Keystone Lake	5,171,900	3,041,200	0	2,912,600	No
21200	72	Arkansas River Mainstem (To Kansas State Line)	3,636,800	1,938,600	0	1,846,200	No
21301	73	Bird Creek - 1	404,100	195,600	0	90,000	No
21302	74	Bird Creek - 2	340,600	224,500	0	208,500	No
21401	75	Caney River - 1	761,700	391,700	0	261,100	No
21402	76	Caney River - 2	704,800	433,500	0	392,400	No
21511	77	Verdigris River (To Oologah Dam) - 1	3,186,800	1,508,600	0	1,234,600	No
21512	78	Verdigris River (To Oologah Dam) - 2	3,034,700	1,573,600	0	1,398,200	No
21520	79	Verdigris River (To Kansas State Line)	1,827,100	721,200	0	623,200	No
21601	80	Grand (Neosho) River - 1	5,688,900	Under GRDA Authority			
21602	81	Grand (Neosho) River - 2	4,703,300	Under GRDA Authority			
21700	82	Illinois River	968,500	317,500	0	170,200	No

[1] Values may include both runoff and undesignated flow for basins under the Red River Compact. Additionally, in basin number 53, Upper North Canadian River – 2, it is not clear how the Palo Duro Reservoir and dispute under the Canadian River Compact may affect the streamflow available for new permits.

[2] A portion of the Estimated Available Water for Permits in 2010 will be used to satisfy schedules of use for years beyond 2010. The amount of water available for new permits is the amount shown minus the difference between the ultimate maximum AFY indicated in the schedule of use and the 2010 AFY value shown in the schedule of use.

[3] Gaps in Permit Availability in 2010 and 2060 include existing SW rights, schedules of use for the subject year, and the projected increase in SW demands. The increase in SW demand was calculated using the existing SW/GW supply proportions for each basin.

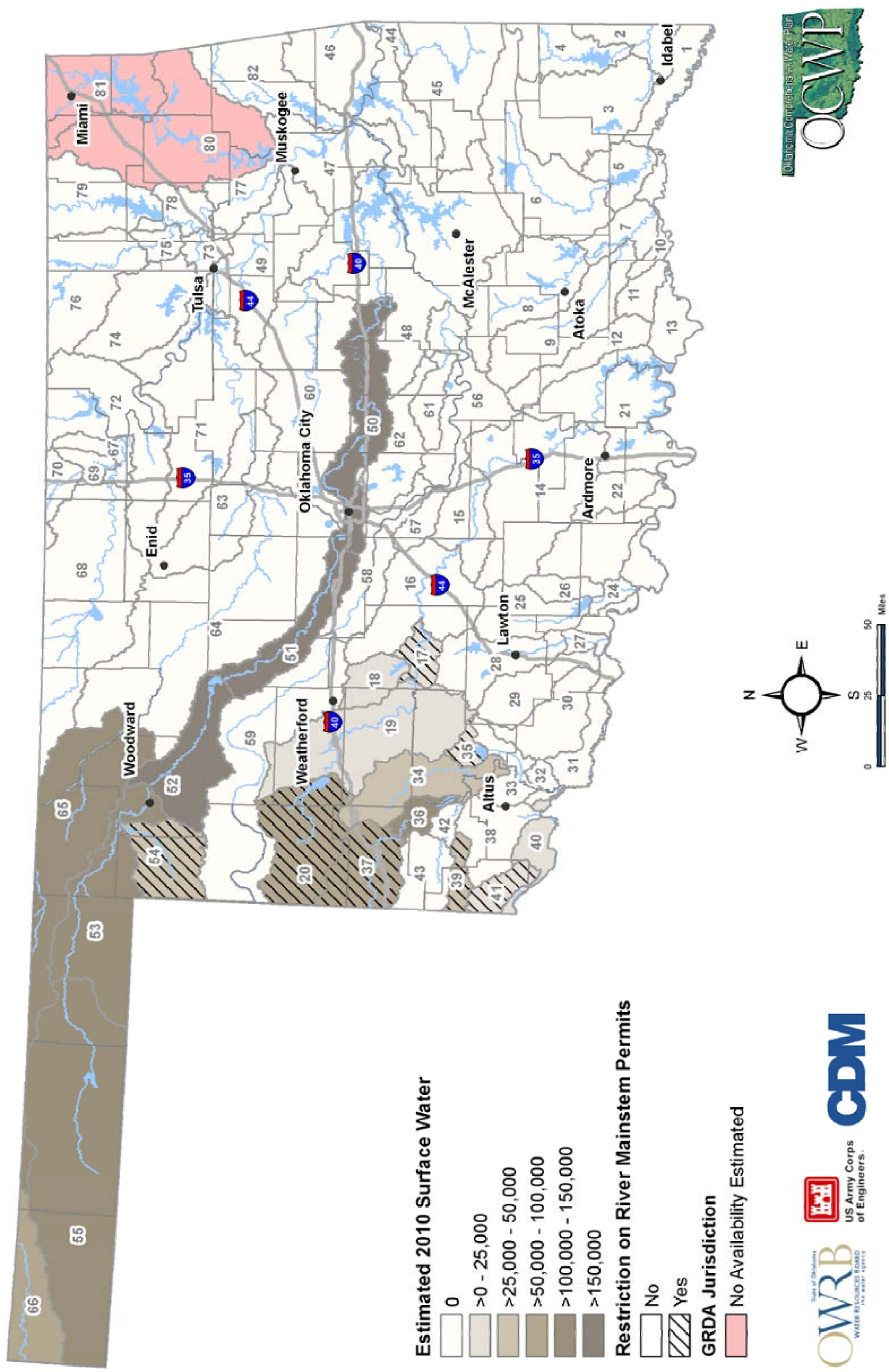

Figure 2-3 - Estimated Surface Water Permit Availability Gaps in 2010

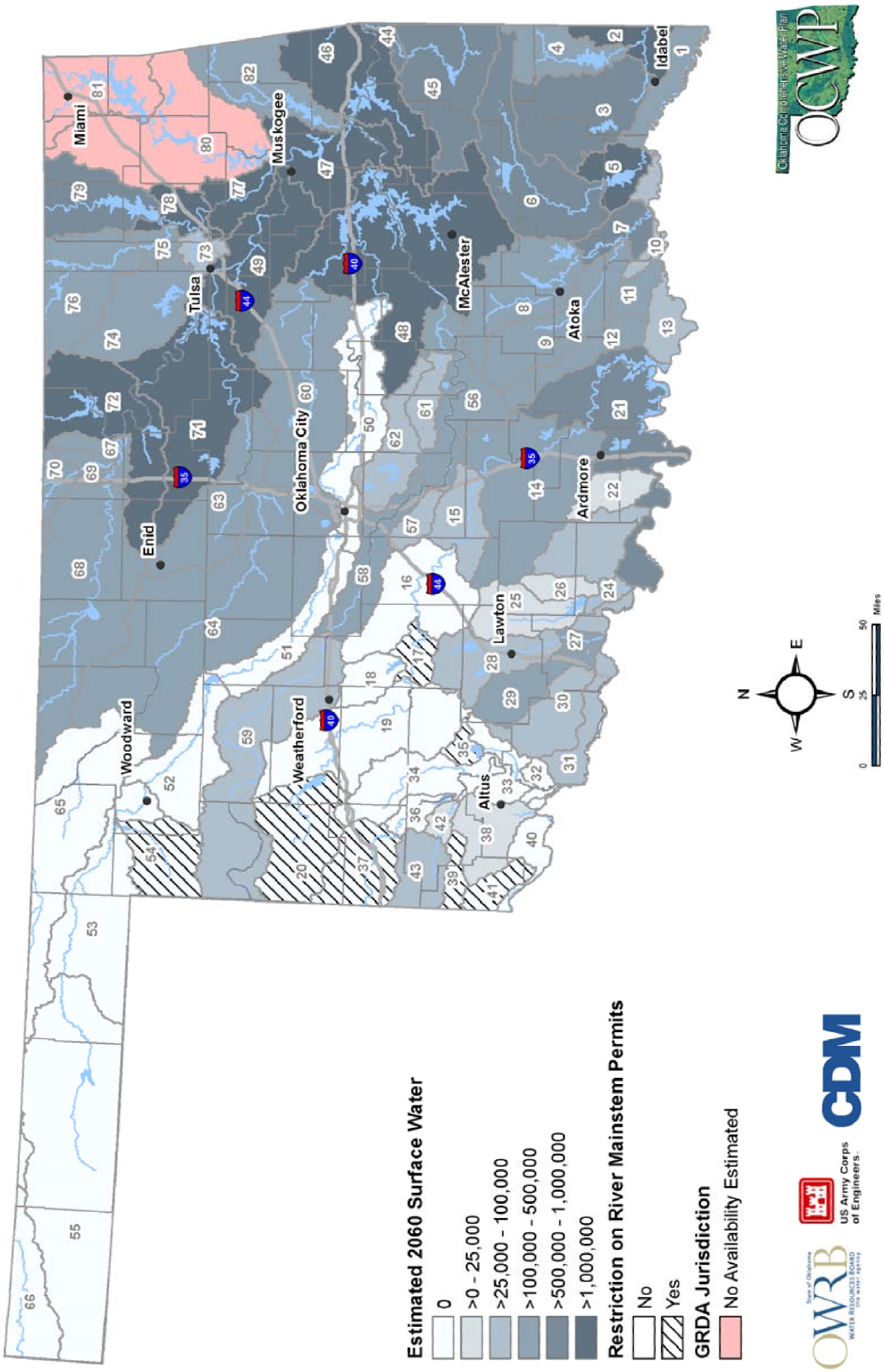

Figure 2-4 - Estimated Available Surface Water in 2060 for New Permits

Table 2-3 Source of Permitted Withdrawals for Projected 2060 Surface Water Permit Availability Gaps

OCWP Basin #	Basin ID	Basin Name	Average Annual Stream Flow (AFY)	Projected Permitted Demands in 2060 (AFY)		Reservoir Dependable Yield (AFY)	Reservoir Dependable Yield That is Not Currently Permitted (AFY)[1]	NRCS Reservoir Storage (AF)[2]	Upstream Compact Obligations (AFY)	Downstream Compact Obligations (AFY)	Total Projected Permitted Demands in 2060 (AFY)	Annual Permit Availability Gaps in 2060 (AFY)[3]	Potential Restrictions to Permitting on Mainstem of Creek or River
				2060 Permits and Domestic Use for Current and Upstream Basins (AFY)	2060 Permits and Domestic Use for Downstream Basin (AFY)								
16	10822	Middle Washita - 2	321,100	244,700	23,000	0	0	46,900	7,100	0	321,700	-700	Yes
17	10831	Upper Washita - 1	217,000	188,500	53,500	0	0	1,700	7,100	0	250,800	-33,800	Yes
18	10832	Upper Washita - 2	16,400	26,600	15,000	18,000	0	2,300	0	0	43,900	-27,500	No
19	10833	Upper Washita - 3	183,300	146,800	15,000	0	0	39,300	7,100	0	208,200	-25,000	No
20	10840	Washita Headwaters	89,300	32,400	114,400	18,000	400	32,900	7,100	0	187,200	-97,900	Yes
32	11511	Lower North Fork Red River - 1	254,700	199,400	0	0	0	0	56,600	0	256,000	-1,300	No
33	11512	Lower North Fork Red River - 2	248,700	195,700	3,700	0	0	700	56,600	0	256,700	-8,100	No
34	11513	Lower North Fork Red River - 3	200,000	164,200	20,400	0	0	5,600	56,600	0	246,800	-46,800	No
35	11514	Lower North Fork Red River - 4	13,000	11,100	20,400	16,000	0	600	0	0	32,100	-19,100	Yes
36	11521	Upper North Fork Red River - 1	49,300	112,800	36,200	47,100	0	0	38,100	0	187,100	-137,800	No
37	11522	Upper North Fork Red River - 2	85,300	17,700	95,100	0	0	1,900	38,100	0	152,800	-67,500	Yes
39	11602	Salt Fork Red River - 2	61,800	4,400	64,400	0	0	0	32,700	0	101,500	-39,700	Yes
40	11701	Prairie Dog Town Fork Red River - 1	11,400	16,400	0	0	0	0	1,800	0	18,200	-6,800	No
41	11702	Prairie Dog Town Fork Red River - 2	12,800	8,200	8,200	0	0	0	1,800	0	18,200	-5,400	Yes
50	20510	Lower North Canadian River	409,400	368,300	219,200	4,400	0	9,300	59,800	0	656,600	-247,200	No
51	20520	Middle North Canadian River	112,400	280,100	88,100	5,000	0	700	59,800	0	428,700	-316,300	No
52	20531	Upper North Canadian River - 1	111,600	177,400	102,700	18,500	0	0	59,800	0	339,900	-246,700	No
53	20532	Upper North Canadian River - 2	118,400	154,900	22,500	0	0	0	59,800	0	237,200	-118,800	No
54	20533	Upper North Canadian River - 3	38,900	22,700	39,300	200	0	0	15,300	0	77,300	-38,300	Yes
55	20540	North Canadian Headwaters	64,500	92,900	39,300	0	0	0	41,900	0	174,100	-109,500	No
65	20930	Upper Cimarron River	110,300	81,600	112,300	0	0	0	49,400	0	243,300	-133,000	No
66	20940	Cimarron Headwaters	16,300	21,600	60,000	0	0	0	6,900	0	88,500	-72,300	No

[1] Reservoir Dependable Yield was included in the calculation as permits and the portion of the yield that was not permitted.
[2] NRCS Reservoir Storage were included in the calculation as permits and the portion of the normal storage that was not permitted.
[3] Minor differences may occur when comparing the input data and the Annual Permit Availability Gaps in 2060 due to rounding.

Section 3
Interstate River Compacts

3.1 Introduction

The purpose of this section is to review the four interstate river compacts that Oklahoma has entered into, to discuss their purposes and apportionments of water between the signatory states, and water availability under current and future conditions. The interstate river compacts Oklahoma has entered into were evaluated to assess the potential for projected water needs and water development in Oklahoma through the 50-year OCWP planning period relative to compact conditions.

To provide background on the subject, this section first describes what an interstate river compact is and discusses the benefits and obligations of an interstate river compact as well as the consequences of not complying with the compact.

An interstate river compact is a formal written agreement between two or more states to divide or share the waters of a river that flows in each of the states. The compact must be approved by the legislatures of each state and approved by the U.S. Congress so that it becomes an enforceable statute in each state as well as federal law.

The benefits of entering into a compact vary between them but the overriding benefit is to reduce future disagreements and possible litigation between states over the waters of an interstate river. It also provides certainty to each state on what it can do under the compact to develop and use the waters of the compacted river including future development as the increase in demand may dictate.

An interstate river compact also has obligations on each state as to how water may be diverted and stored for use in the state while allowing remaining flows to pass downstream to other signatory states that may also have diversion or storage provisions imposed by the compact. Often, annual accounting by a compact commission is required to determine the amount of water used under the compact and if each state complied with the compact.

An interstate river compact, if not complied with, can result in litigation between the signatory states before the U. S. Supreme Court. These lawsuits begin in the U.S. Supreme Court, which has original jurisdiction over disputes between states. When Oklahoma and Texas brought suit against New Mexico under the Canadian River Compact, it was assigned No. 109, Original as the case number. In the Oklahoma and Texas vs. New Mexico (No. 109 Original) litigation, the lawsuit was settled in a stipulated judgment and New Mexico was required to release about 170,000 acre-feet (AF) from storage spread over 9 years and pay attorney costs of $200,000 to each state. Thus, it can be seen that compliance with the provisions of interstate river compacts is an important obligation for each signatory state.

Oklahoma has entered into four interstate river compacts, including two compacts on the Arkansas River; one with Kansas and one with Arkansas. It also is a signatory state with

New Mexico and Texas on the Canadian River Compact, and has entered into a compact with Texas, Arkansas, and Louisiana on the Red River. The figure below depicts the river basins associated with these compacts.

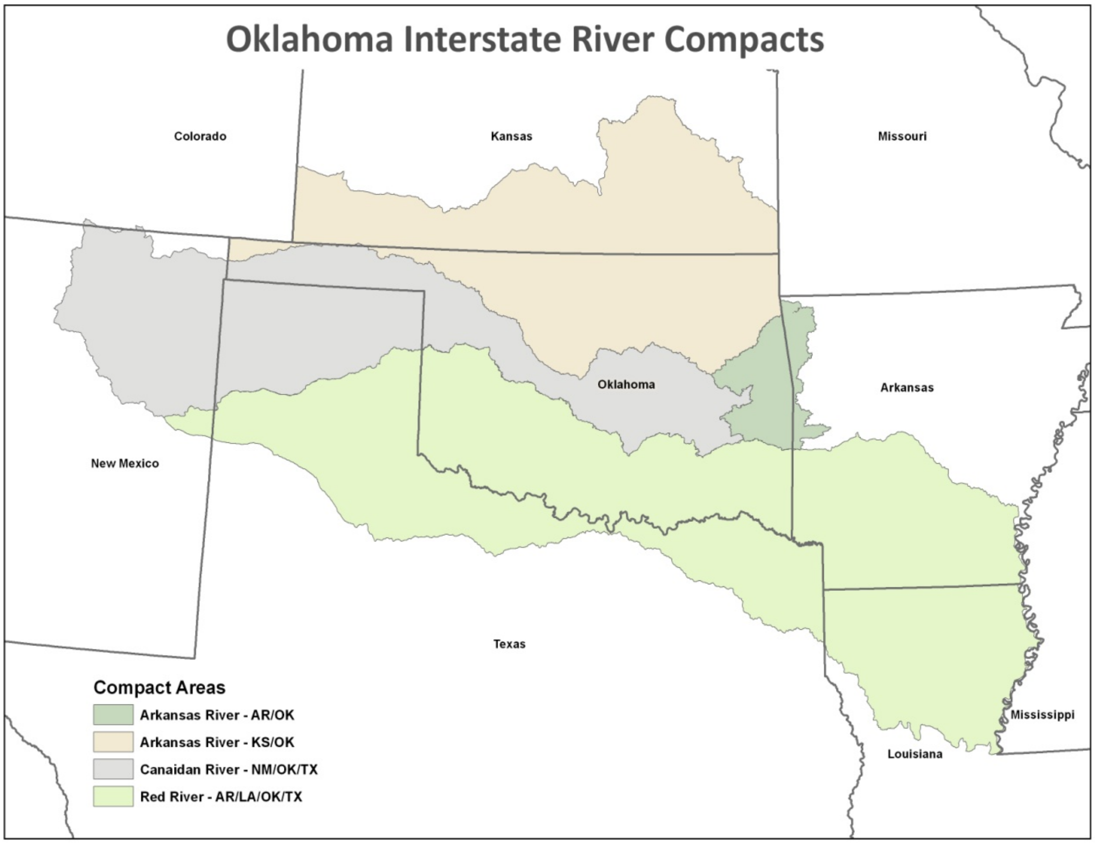

Figure 3-1 Oklahoma's Interstate River Compacts

The remainder of this section discusses each of the four compacts in more detail and presents the apportionment to each state, the operation and accounting under the compact commission, the commission duties, meeting and reports, and water supply conditions, both current and possible additional uses that may be possible under the compact to meet future demand.

3.2 Canadian River Compact (1950)

3.2.1 Purposes

The Canadian River Compact was signed on December 6, 1950 in Santa Fe, New Mexico by the representatives of New Mexico, Texas, Oklahoma, and the United States. In addition to removing causes for present and future controversies, the compact intent was to make secure and protect present developments within the states and to provide for the construction of additional works for the conservation of the waters of the Canadian River (Article I).

3.2.2 Geographical Area of Influence

The Canadian River Compact covers the entire area of the Canadian River basin from its headwaters in New Mexico to its confluence with the Arkansas River in Oklahoma on the Canadian River. The compact uses the term "Canadian River" to represent the Canadian River and its tributaries with the exception of the "North Canadian River," which is used to designate waters from that tributary independently of the Canadian River.

3.2.3 Apportionment of Water

The compact provides free and unrestricted use to all waters in the respective states, as described above, with limitations on the total amount of conservation storage in each state. Conservation storage excludes any reservoir capacity allocated solely for flood control, power production, or sediment control (Article II).

New Mexico has free and unrestricted use of all waters originating above Conchas Dam (Article IV), which was developed in 1938 before the compact (1950). Free and unrestricted uses of waters originating below Conchas Dam are also provided to New Mexico with two caveats:

- New Mexico's conservation storage on the Canadian River is limited to an aggregate of 200,000 AF annually even though maximum storage content may exceed this amount.
- New Mexico conservation storage on the North Canadian River is "limited to the storage of such water as at the time may be unappropriated under the laws of New Mexico and of Oklahoma." (Article IV)

Texas has free and unrestricted use of all Canadian River waters in Texas (Article V), subject to the following limitations upon storage of water:

- Texas can impound water in tributaries of the North Canadian River for municipal, household and domestic uses, livestock watering, and irrigation, which are used to provide food or feed to householders and domestic livestock kept on the property.
- Texas can impound 500,000 AF of conservation storage in the Canadian River basin, until Oklahoma achieves 300,000 AF of conservation storage in the Canadian River basin. Once Oklahoma achieves 300,000 AF of storage, Texas is entitled to store no more than 200,000 AF of conservation storage plus "whatever amount of water shall be at the same time in conservation storage in reservoirs in the drainage basin of the Canadian River in Oklahoma." All storage calculations exclude:
  - Reservoirs on the North Canadian River in Texas
  - Waters of the North Canadian River in Oklahoma
  - Reservoirs east of the 97th meridian on the Canadian River [in Oklahoma]

Oklahoma is entitled to all Canadian River water originating in Oklahoma (Article VI).

3.2.4 Compact Operation and Accounting

The Canadian River Commission consists of one representative of each state and one from the federal government who is the chair of the commission and is a non-voting member. The commission requires a unanimous vote of the three states to approve any action. The commission meets annually and submits a report to the President of the United States and the Governors of each state (Article IX).

The commission's annual report includes an inventory of reservoirs with maximum capacity in the Canadian River basin, in each state, as well as maximum conservation storage for the compact year. New Mexico has constructed 10 reservoirs with a maximum capacity of 235,655 AF (March 1, 2004 Annual Report, Canadian River Compact Commission) below Conchas Reservoir.

Texas has constructed reservoirs with a maximum storage capacity of 828,049 AF in the Canadian River basin. The main reservoir for Texas is Lake Meredith with a maximum capacity of 817,970 AF. It is the primary water supply for 11 cities in Texas according to Herman Settemeyer, Engineer Advisor for Texas, Texas Commission on Environmental Quality, in a phone interview on February 2, 2009. Lake Meredith is extremely low in conservation storage due to drought over the last 10 years and water is being pumped from the dead pool. On the North Canadian River, Texas has constructed reservoirs with a storage capacity of 62,563 AF with the major reservoir being Palo Duro with a capacity of 60,900 AF and maximum conservation storage in 2003 of 4,759 AF.

East of the 97th Meridian, Oklahoma has constructed 38 reservoirs (over 100 AF in capacity) with a maximum storage capacity of 2,612,831 AF. The largest reservoir is Lake Eufaula, with a capacity of 2,330,000 AF (March 1, 2004 Annual Report). Oklahoma has constructed 11,875 AF of storage west of the 97th Meridian. On the North Canadian River, Oklahoma has constructed 94 reservoirs (over 100 AF in capacity) that have a total of 428,766 AF of capacity. Currently, the conservation storage is much less than this due to drought conditions and Lake Optima is dry, which is the largest reservoir on the North Canadian River in Oklahoma with a capacity of 129,000 AF. According to Dean Couch, OWRB, in a phone interview on February 5, 2009, the USACE has determined that the yield of Optima Reservoir is 0 AF due to drought and the presumed impact of Ogallala aquifer pumping.

3.2.5 Water Availability

It appears that the water supply available to Oklahoma from the North Canadian River has been fully appropriated below Canton Lake and the flows of the Canadian River west of the 97th Meridian are such that additional development is not contemplated (Dean Couch, February 5, 2009). The Canadian River east of the 97th Meridian has more reliable flows due to increased precipitation and the flows below Lake Eufaula average over 6,500 cubic feet per second (cfs) for the last 41 years, which is 4,745,000 AFY. However, during the 2006 drought, the flow averaged 357 cfs or 260,610 AF for the year. Lake Eufaula is used for many purposes. The storage pool has been designated for use to generate hydropower electricity. A change in use to allow additional municipal use from the hydropower pool would require USACE approval. The cost per acre-foot to purchase this water could discourage such a change. Lake Eufaula has 56,000 AF allocated to water supply, not solely for municipal use, and 50,000 AF is under contract through the USACE. It would appear that the ability to develop additional water supplies in the Canadian River basin above Lake Eufaula is constrained by the physical supply and by the water rights issued and contracted from Lake Eufaula. The Canadian River Compact does not appear to impact water use east of the 97th Meridian.

It may be possible to divert water from the Canadian River below Lake Eufaula after the water has passed through the hydroelectric facilities. Water quality does not appear to be a significant issue (Personal Communication, Dean Couch).

3.3 Arkansas River Basin Compact, Kansas-Oklahoma (1965)

3.3.1 Purposes

The major purposes of the Kansas-Oklahoma Arkansas River Compact, as it is referred to by the states, are to promote interstate comity (civility), to divide and apportion equitably between the two states the waters of the Arkansas River basin and to promote the orderly development thereof, to provide for an agency for administering the water apportionment agreed to, and to encourage the maintenance of an active pollution-abatement program in each of the states.

3.3.2 Geographical Area of Influence

The compact defines the Arkansas River basin as the Arkansas River from a point immediately below the confluence of the Arkansas and Little Arkansas Rivers near Wichita, Kansas to a point immediately below the confluence of the Arkansas River with the Grand-Neosho River near Muskogee, Oklahoma and the tributaries that empty into this reach of the Arkansas River (Article I).

3.3.3 Apportionment of Water

Like the Canadian River compact, the compact provides free and unrestricted use of water in each state, while limiting the amount of conservation storage that Kansas can develop. The water of the Arkansas River and its tributaries means the water originating in the Arkansas River basin as defined above. The compact divides the watershed into five sub-basins where limits to conservation storage have been agreed to. Conservation storage capacity is defined as storage in excess of 100 AF for subsequent use, but not for "flood control, sediment control, and inactive storage capacity allocated to other uses." New conservation storage capacity is defined as conservation storage capacity for which construction is initiated after July 1, 1963 and storage capacity not presently allocated for conservation storage that is converted to conservation storage capacity after July 1, 1963 in excess of the quantities of declared conservation storage capacity as set forth in the storage table attached to the minutes of the Twenty-fourth meeting of the Compact Committee dated September 1, 1964 (Article II).

The apportionment of waters for storage in Kansas is as set forth below (Article V):

- Grand-Neosho River Sub-basin
  - Kansas can develop 650,000 AF of storage plus an additional capacity equal to the new conservation storage in Oklahoma.
  - Spavinaw Creek is excluded from reciprocal storage volume in Oklahoma under Article V(B) of the compact.
- Verdigris River Sub-basin
  - Kansas can develop 300,000 AF of storage plus an additional capacity equal to the new conservation storage in Oklahoma.
  - The navigation capacity allocated in the Oologah Reservoir is excluded from the compact.
- Salt Fork River Sub-basin
  - Kansas can develop 300,000 AF of storage plus an additional capacity equal to the new conservation storage in Oklahoma.
- Cimarron River Sub-basin
  - Kansas can develop 5,000 AF of conservation storage.
  - New conservation storage in excess of 5,000 AF requires approval of the commission.
- Mainstem of the Arkansas River Sub-basin
  - Kansas can develop 600,000 AF of storage plus an additional capacity equal to the new conservation storage in Oklahoma.

Oklahoma shall have free and unrestricted use of the waters of the Arkansas River basin in Oklahoma except that new conservation storage in the Cimarron River sub-basin shall not exceed 5,000 AF, provided that new conservation storage capacity in excess of this amount must be approved by the commission (Article VI).

The compact assigns exclusive use of any waters imported into the Arkansas River basin, where any storage used for the imported water is excluded from new conservation storage. Waters exported from the Arkansas River basin will be counted as new conservation storage. The amount of new conservation storage will be equal to the actual storage capacity used for the diversion or 5 AF of conservation storage for each average annual acre-foot of water diverted with no storage (Article VIII).

Article IX discusses the pollution abatement responsibilities of the states to reduce pollution within each state and to investigate and abate sources of alleged interstate pollution. It further states that providing water for purpose of water quality control as a substitute for adequate waste treatment is not acceptable.

3.3.4 Compact Operation and Accounting

Article X creates the Kansas-Oklahoma Arkansas River Commission, which consists of three commissioners from each state with one representative being the water official responsible for administering water law in that state. The chairman of the commission is a federal appointee who is a non-voting member of the commission. Each state shall have one vote based on the majority opinion of that state's commissioners and a unanimous vote is required for approval of any commission action.

The powers of the commission are set forth in Article XI and are very broad, covering 14 separate duties and powers. The commission is responsible for administration of the compact including ensuring that adequate stream and reservoir gaging stations are maintained and that data from these stations are collected and analyzed to determine compact accounting and compliance.

The annual report published by the commission contains useful information on storage constructed in each state from July 1, 1963 to the end of the current year, June 30. It also contains any new conservation storage constructed in the current compact year, which is from July 1 to June 30 of the following year. The annual report also contains a table of Apportionment of New Conservation Storage Capacity based on the compact allocation and increased allocations of storage in Kansas based on storage constructed in Oklahoma and a reduction for storage constructed in Kansas.

The annual report also contains data and graphs on long term stream flow at gages near the Stateline. The flows are significant and indicate considerable flow into Oklahoma from Kansas. The long-term averages for the reported gages are shown in Table 3-1 (Thirty-Ninth Annual Report, Kansas-Oklahoma Arkansas River Compact Commission, Fiscal 2006).

Table 3-1 Long-Term Average Streamflow from Kansas to Oklahoma

USGS Gage Name	Long-Term Average Flow (AFY)[1]
Neosho River near Commerce, Oklahoma	2,743,000 AFY
Verdigris River at Independence, Kansas	1,582,000 AFY
Caney River at Ramona, Oklahoma	1,096,000 AFY
Arkansas River at Arkansas City, Kansas	1,404,000 AFY
Chikaskia River near Blackwell, Oklahoma	435,100 AFY
Salt Fork Arkansas River at Tonkawa, Oklahoma	681,500 AFY
Cimarron River near Waynoka, Oklahoma	212,600 AFY
Total	**8,154,200 AFY**

Notes:
[1] The period of record of flow measurements varies between 22 years and 89 years based on gage.

3.3.5 Water Availability

The above flows merit additional analysis from a compact and feasibility basis. The remaining allocation of storage that could be developed in Kansas as set forth in the 2006 annual report is shown to be 2,627,935 AF, which could reduce the availability of water to Oklahoma if the storage is constructed but the likelihood of this should be discussed with commission officials.

Clearly, some additional water storage could be constructed in Oklahoma based on the large inflows from Kansas. However, there has been considerable pre-compact storage constructed on the Grand-Neosho River basins so the feasibility of additional storage in this basin may be questionable in Oklahoma. Likewise, on the Verdigris River, Oklahoma has constructed over 978,000 AF of storage at Oologah Lake so additional storage may not be feasible. The flows of the Caney River below the Osage County could be used for potential water storage without creating compact obligations.

The water quality of the waters on the Cimarron and Salt Fork Rivers is not sufficient for municipal use without treatment to remove the salts and to reduce to the TDS (Phone interview with Dean Couch, February 5, 2009).

3.4 Arkansas River Basin Compact, Arkansas-Oklahoma (1972)

3.4.1 Purposes

The compact was originally approved on March 16, 1970 and was revised on March 3, 1972 in Tulsa, Oklahoma by the representatives of Arkansas, Oklahoma, and the U.S. The major purposes of the compact are to promote interstate comity, to provide for the equitable apportionment of the waters of the Arkansas River between the two states and promote the orderly development thereof, to provide for an agency for administering the water apportionment agreed to herein, to encourage the maintenance of an active pollution abatement program in each state, and to facilitate the cooperation of the water administration agencies of each state in the total development and management of the water resources of the Arkansas River Basin (Article I).

3.4.2 Geographical Area of Influence

The compact defines the Arkansas River basin as the drainage basin of the Arkansas River and its tributaries from a point immediately below the confluence of the Grand-Neosho River with the Arkansas River near Muskogee, Oklahoma to a point immediately below the confluence of Lee Creek with the Arkansas River near Van Buren, Arkansas, together with the drainage basin of Spavinaw Creek in Arkansas but excluding the portion of the Spavinaw Creek drainage basin in Oklahoma and excluding that portion of the Arkansas River drainage basin of the Canadian River below Eufaula Dam. The compact establishes five sub-basins for which depletion of annual yield is apportioned and these are: Spavinaw Creek sub-basin in Arkansas, Illinois River sub-basin in Arkansas, Lee Creek sub-basin in Arkansas and Oklahoma, Poteau River sub-basin in Arkansas, and the Arkansas River sub-basin, which includes all areas of the Arkansas River basin except the four other sub-basins described. The inflows from the Arkansas River above Muskogee, Oklahoma and the Canadian River above Lake Eufaula are not considered a part of the Arkansas River sub-basin yield that is apportioned by the compact.

3.4.3 Apportionment of Water

This compact apportions "annual yield," which means the computed annual gross runoff from any specified sub-basin that would have passed any certain point on a stream and would have originated within any specified area under natural conditions, without any man-made depletion or accretion during any water year (October 1 to September 30 of the following calendar year). The allocation of annual yield is as follows:

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

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

- The State of Arkansas shall have the right to develop and use all waters originating within the Lee Creek sub-basin in the State of Arkansas, or the equivalent thereof, and the State of Oklahoma has the right to develop and use all waters originating in the Lee Creek sub-basin in Oklahoma, provided that neither state has the power of eminent domain in the other state, for instance, to build a reservoir in the other state to store water from this stream that meanders across the state line.

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

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

3.4.4 Compact Operation and Accounting

The Arkansas-Oklahoma Arkansas River Compact Commission is established in Article VIII as the interstate agency responsible for the administration of the compact. The commission consists of three members from each state plus one commissioner representing the United States. One commissioner from Oklahoma must be the Director of the Oklahoma Water Resources Board and one commissioner from Arkansas must be the Director of the Arkansas Natural Resources Commission. The federal commissioner is the chairman of the commission but does not have a vote.

Each state has one vote representing the majority vote of the commissioners of that state. In case of a tie vote on any of the commission's actions, a majority of the commissioners for either state may submit a written request to the chairman to submit the question to arbitration using three arbitrators selected under the compact's procedures. Arbitration is not compulsory on tie votes.

Under Article V of the compact, on or before December 31 of each year, the commission shall determine state line yields of the Arkansas River Basin for the previous water year. Any depletion in excess of that allowed by the compact shall, subject to the control of the commission, be delivered to the downstream state. The methods for determining the annual yield of each of the sub-basins shall be those developed and approved by the commission.

The powers of the commission are set forth in Article IX and are very broad covering 19 separate duties and powers. The commission is responsible for administration of the compact including ensuring that adequate stream and reservoir gaging stations are maintained and that data from these stations are collected and analyzed to determine compact accounting and compliance.

The annual report published by the commission is very comprehensive and contains much useful information and data. It includes a section titled "Annual Yield and Selected Hydrologic Data for the Arkansas River Basin Compact, Arkansas-Oklahoma for the Water Year" and is prepared by Hydrologic Information Services of Little Rock, Arkansas. It includes computation of annual yields and deficiency for each of the five sub-basins in cfs. It also computes depletions from major reservoirs in the basin, which is significant, on the order of 180,000 AF in water year 2005 (Arkansas River Commission 2006 Report). It also contains daily flow data from 20 gaging stations in the basin prepared by the U.S. Geological Survey (USGS) as well as considerable water quality data. The runoff from the five sub-basins in the 2005 water year was computed as 2,655,200 AF, which is a significant amount of water. The computed annual depletion in the 2005 water year including reservoir evaporation was 244,400 AF. There is a downstream obligation on how much stream water can be consumed by Oklahoma (Oklahoma can use 60 percent of flows originating in the Arkansas River sub-basin).

3.4.5 Water Availability

The apparent significant unused flows in the basin may merit additional analysis if there are projected future water demand needs in Oklahoma. Although no known deficiencies by use in Arkansas have been computed as part of the compact accounting, some daily flows have been sufficiently low that there were reported shortages in Oklahoma (Dean Couch, February 5, 2009). Oklahoma water officials notified Arkansas water officials of concerns related to the shortages, and it was suggested that the 60 to 40 percent split of flows on an annual basis as set forth in the compact be applied on a daily basis. This would require Arkansas to regulate water diversions and use to cause the flow to increase into Oklahoma. This discussion has not resulted in any agreement to operate in this manner in the future.

The water flowing from Lake Eufaula in the Canadian River is water not originating within the Arkansas River basin and is not subject to the Arkansas-Oklahoma Arkansas River Compact, but is subject to the Canadian River Compact, giving Oklahoma free and unrestricted use of that water. It would appear that Oklahoma could develop the significant flow available in most years by a diversion from the Canadian River below

Eufaula Dam. This would require an analysis of the yield for M&I uses at this location under historical flow conditions. To this end, a pipeline to pump water to Oklahoma City and surrounding areas has been discussed by private developers.

3.5 Red River Compact, Arkansas-Louisiana-Oklahoma-Texas (1978)

3.5.1 Purposes

The Red River Compact was signed on May 12, 1978 after several years of negotiations. The major purposes of the compact are to promote interstate comity and remove causes of controversy over the use, control, and distribution of the interstate water of the Red River, to provide an equitable apportionment of the water of the Red River and its tributaries, to promote an active program for the control and alleviation of natural deterioration and pollution of the water of the Red River, to provide for an active program for the conservation of water, protection of lives and property from floods, improvement of water quality, development of navigation and regulation of flows in the Red River basin, and to provide a basis for state and joint state planning and action by ascertaining and identifying each state's share in the interstate water of the Red River basin (Article I).

3.5.2 Geographical Area of Influence

The compact operates from the point where the Red River crosses the New Mexico-Texas Stateline to the confluence of the Red River above the junction with the Atchafalaya and Old Rivers near the Mississippi River in Louisiana. The Red River comprises a significant portion of Oklahoma's border with Texas. The compact divides the Red River Basin into five major reaches:

- Reach I – the Red River and tributaries from the New Mexico-Texas state boundary to Denison Dam.

- Reach II – the Red River from Denison Dam to the point where it crosses the Arkansas-Louisiana state boundary and all tributaries which contribute to the flow of the river within this reach.

- Reach III – the tributaries west of the Red River which cross the Texas-Louisiana state boundary, the Arkansas-Louisiana state boundary, and those which cross both the Texas-Arkansas state boundary and the Arkansas-Louisiana state boundary.

- Reach IV – the tributaries east of the Red river in Arkansas which cross the Arkansas-Louisiana state boundary.

- Reach V – that portion of the Red River and tributaries in Louisiana not included in Reach III or in Reach IV.

3.5.3 Apportionment of Water

The compact allocates annual flow and storage for each of the five reaches above. Oklahoma is affected by the allocations in Reach I and II. The annual flow is not defined in the compact but subsequent rules of the compact commission define annual flow as the measured flow plus upstream manmade depletions. The compact also defines designated water as water released from storage, paid for by non-federal interests, for delivery to a specific point of use or diversion. Undesignated water is all water released from storage that is other than designated water.

Apportionment of Water – Reach I (Article IV)

Reach I is divided into four sub-basins and the water therein allocated as follows:

Sub-basin 1- Interstate Streams - Texas

- Buck Creek, Sand (Lebos) Creek, Salt Fork Red River, Elm Creek, North Fork Red River, Sweetwater Creek, and Washita River, together with all their tributaries in Texas that lie west of the 100th Meridian
- 60 percent of annual flow to Texas, 40 percent to Oklahoma

Sub-basin 2 – Intrastate and Interstate Streams-Oklahoma

- All Red River tributaries in Oklahoma from Denison Dam (Lake Texoma Dam) upstream northwestward to Oklahoma-Texas state boundary, including the Washita River basin in Oklahoma and Buck Creek
- 100 percent free and unrestricted use for Oklahoma

Sub-basin 3 – Intrastate Streams - Texas

- All Red River tributaries in Texas from Denison Dam (Lake Texoma Dam) to Oklahoma-Texas boundary, including Prairie Dog Town Fork Red River in Texas
- 100 percent free and unrestricted use for Texas

Sub-basin 4 – Main stem of the Red River and Lake Texoma

- Mainstem of Red River and all of Lake Texoma from Denison Dam upstream to Oklahoma-Texas state boundary (Unrestricted use by Oklahoma)
- The storage of Lake Texoma and flow from the main stem of the Red River is apportioned 200,000 AF to each state
- Additional quantities allocated 50 percent to Oklahoma and 50 percent to Texas

Apportionment of Water – Reach II (Article V)

Reach II is subdivided into five sub-basins and the water therein is allocated as follows:

Sub-basin 1 – Intrastate Streams – Oklahoma

On these intrastate streams and tributaries, Oklahoma has 100 percent free and unrestricted use. The available flow is determined by the runoff in a stream upstream of an existing or proposed reservoir site. The streams are:

- Island-Bayou at Albany
- Blue River at Durant
- Boggy River at Boswell
- Kiamichi River at Hugo

A review of these basins shows that in some cases reservoirs have not been built. The delineation of sub-basins will still occur at these locations at the latitude and longitude specified in the compact.

Sub-basins 2 and 4

Sub-basins 2 and 4 of Reach II do not include waters of Oklahoma.

Sub-basin 3 –Interstate Streams Oklahoma and Arkansas

This sub-basin includes the Little River and its tributaries above Millwood Dam. The states of Oklahoma and Arkansas shall have free and unrestricted use of the water in this sub-basin within their respective states, subject, however, to the limitation that Oklahoma shall allow a quantity of water equal to 40 percent of the total runoff originating below existing or authorized last downstream major damsites in Oklahoma to flow into Arkansas at the following locations:

- Little River at Pine Creek
- Glover Creek at Lukfata
- Mountain Fork River at Broken Bow

Sub-basin 5 – Mainstem of the Red River and tributaries

This sub-basin includes that portion of the Red River and its tributaries from Denison Dam (Lake Texoma outfall) to the Arkansas-Louisiana state boundary and involves all signatory states. Each state's water allocation is controlled by the flow at the Arkansas-Louisiana state boundary.

- If flow is greater than 3,000 cfs, then each state shall have equal rights to runoff originating in the sub-basin and undesignated water flowing into the sub-basin, and as long as the flow is above 3,000 cfs, no state is entitled to more than 25 percent of the water in excess of 3000 cfs.

- If flow is less than 3,000 cfs but more than 1,000 cfs, then Oklahoma, Arkansas, and Texas must deliver 40 percent of the total weekly runoff originating in sub-basin 5 and 40 percent of the undesignated water flowing into the sub-basin 5 to Louisiana. However, the states do not need to release stored water to achieve this goal.

- If flow is less than 1,000 cfs, then Oklahoma, Arkansas, and Texas must allow all weekly runoff originating in sub-basin 5 and all undesignated water flowing into sub-basin 5 as required to flow into Louisiana to maintain 1,000 cfs.

- When the flow is less than 526 cfs at Index, Arkansas, the states of Oklahoma and Texas must allow a quantity of water equal to 40 percent of the total weekly runoff originating in sub-basin 5 within their respective states to flow into the Red River, provided, however, this provision shall be invoked only at the request of Arkansas. This will only apply if Arkansas has ceased all diversions from the Red River itself above Index and only if the previous restrictions have not caused a limitation on diversions in this subbasin.

- Reservoirs less than 1,000 AF that are in existence or authorized at the time of the compact are exempt from the previous provisions.

3.5.4 Compact Operation and Accounting

The Red River Compact Commission is established in Article IX as the interstate administrative agency for the compact. The commission is composed of two representatives from each of the signatory states and one commissioner representing the United States. The federal commissioner shall be the Chairman of the commission but shall not have a right to vote. Each of the two commissioners from each state shall have one vote. Any action concerned with the administration of the compact shall require six concurring votes. If a proposed action affects existing water rights in a state, and that action is not expressly provided for in the compact, eight concurring votes shall be required.

The commission has 16 broad powers and duties set out in Article X of the compact. The commission may make a finding that a signatory state is or is not in violation of any provisions of the compact, and may make such investigations and studies to support any findings. The commission publishes an annual report and submits it to the Governor of each signatory state and to the President of the United States.

The commission has not to date had to do any accounting under the compact since no state has deemed it necessary (Article II). The commission has promulgated rules for the Internal Organization of the commission and has promulgated rules to compute and enforce compact compliance in Reach I, Sub-basin 1 (April 30, 1987) and for Reach III, Sub-basin 3 (amended April 25, 1989). The commission has also promulgated interim rules to compute and enforce compact compliance in Reach II, Sub-basin 5 (April 30, 1987). All of these rules are in the annual report.

The annual report contains considerable information on stream flow in the basin including long-term average flows and daily flows for the compact water year provided by the USGS. The flows in the basin are significant. The flow of the Red River at Denison, Texas averages 3,448,700 AFY over the 53 years of record as shown in the 2006 annual report. The Red River at Index, Arkansas is shown to average 9,322,800 AFY over the 62 year period of record in the 2006 report.

Water quality monitoring stations are identified but the data is not published in the annual report. According to both Herman Settemeyer and Dean Couch, the water quality of the waters of the mainstem upstream of Denison Dam is high in chlorides and TDS so that additional development of the waters of the mainstem for municipal uses are not very likely unless reverse osmosis membrane treatment systems become economically feasible in the future. There are existing and proposed federal Chloride Control Projects on the Red River above Denison Dam that have and could reduce the chloride content of the water.

3.5.5 Water Availability

The Red River basin and its tributaries appear to have significant flows that may merit additional analyses for feasibility for future water projects provided the poor water quality issues on the mainstem can be overcome. The tributaries in Reach II that flow into the Red River from Oklahoma have good quality water and water from the Kiamichi River is being evaluated by Oklahoma City as a source for future water needs. The Kiamichi River basin is mountainous, has little development, and produces runoff of significant yield and quality.

A Texas entity has also filed applications for water rights on Kiamichi River below Lake Hugo and this application is under federal litigation. The Texas entity has also filed applications for water rights in Reach I above Lake Texoma in Oklahoma on Cache Creek and Beaver Creek near the confluence with the Red River where water quality is better than the quality of the mainstem water (Dean Couch phone interview, February 5, 2009).

There are downstream delivery obligations as set forth for Reach II, sub-basin 5 that must be considered in any possible development of Red River main stem flows in Oklahoma.

3.6 Conclusions

Development of additional water supplies to meet current and future demand does not appear to be constrained by the four interstate river compacts in Oklahoma. Additional development in Western Oklahoma is constrained by the limited physical water supply in the Canadian River and North Canadian River due to the low precipitation, extended drought, and potential impacts of Ogallala aquifer pumping. Likewise, the potential for additional development in Southwestern Oklahoma on the Red River appears to be more limited by the water quality and by some degree to the physical supply and not by the Red River Compact.

In Central and Eastern Oklahoma, where the precipitation is greater causing more runoff and where considerable water flows into the state from Kansas and Arkansas, the compacts on the Arkansas and Red River do not impose any apparent limitations on developing additional water supply projects to meet current or future water demand. The constraint to development of additional water supply projects would appear to be more related to the water quality of the rivers, especially related to salts and TDS and the cost of removing these from the water supply by membrane treatment.

Section 4
References

Arkansas River Compact Commission 2006 Report

Arkansas-Oklahoma Arkansas River Commission Report 2005

Canadian Compact Commission, Agency Strategic Plan for the 2005 – 2009 Period

Kansas-Oklahoma Arkansas River Commission, Thirty-Ninth Annual Report Fiscal 2006

Kansas-Oklahoma Arkansas River Commission, Thirty-Eighth Annual Report Fiscal 2005

Report of the Canadian River Commission 2000, Internal Printing.

Report of the Canadian River Commission March 1, 2004, Internal Printing.

Report of the Red River Compact Commission 2006

Report of the Red River Compact Commission 2005

Red River Compact Commission, Agency Strategic Plan for the 2005 – 2009 Period