

EXPLANATION

- 1 Scenic River; number corresponds to name in text
- 1 Salt Plain; number corresponds to name in text

Table 4. Major lakes and reservoirs in Oklahoma

Lake	Area	Drainage Area*	Capacity	Location
	Normal Pool (acres)	(square miles)	Normal Pool (acre-feet)	County/COUNTIES
Eufaula	105,500	47,522	2,314,600	McIntosh; Pittsburg; Haskell
Texoma	88,000	39,719	2,643,300	Love; Marshall; Bryan; Johnston
Grand Lake O' the Cherokees	46,500	10,298	1,672,000	Delaware; Ottawa; Mayes
Robert S. Kerr	43,800	147,756	525,700	Haskell; Sequoyah; Le Flore
Oologah	29,460	4,339	553,400	Rogers; Nowata
Keystone	23,610	74,506	557,600	Osage; Pawnee; Creek; Tulsa
Fort Gibson	19,900	12,492	365,200	Wagoner; Cherokee; Mayes
Kaw	17,040	46,530	428,600	Kay; Osage
Broken Bow	14,200	754	918,070	McCurtain
Sardis	13,610	275	274,330	Pushmataha; Latimer
Hugo	13,250	1,709	157,600	Choctaw
Tenkiller	12,900	1,610	654,100	Cherokee; Sequoyah
Webbers Falls	11,600	97,033	170,100	Muskogee
Hudson	10,900	11,533	220,300	Mayes
Skiatook	10,190	354	322,700	Osage
Waurika	10,100	562	203,100	Jefferson; Stephens; Cotton
Foss	8,880	1,496	256,220	Custer
Great Salt Plains	8,690	3,200	31,420	Alfalfa
Canton	7,910	12,483	111,310	Blaine; Dewey
Wister	7,333	993	62,360	Le Flore

*Data from the Oklahoma Water Resources Board (1990).

RIVERS, STREAMS, AND LAKES OF OKLAHOMA

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A stream is any body of running water, large or small, that flows under the influence of gravity toward lower elevations in a relatively narrow, clearly defined channel. Each major drainage system in Oklahoma consists of a principal river, with many smaller tributary rivers, streams, and creeks funneling water to the main course.

The condition and flow rates of Oklahoma streams are temporary in terms of geologic time. Stream positions shift as they cut deeper channels into their banks, while their tributaries erode nearby uplands. Major drainage systems of today were established during the Pleistocene (the last 1.6 million years). Streams flowed across Oklahoma for millions of years before finally carving out today's major drainage basins. The positions of earlier streams are marked now by alluvial deposits remaining as stream terraces, high above the flood plains of today's streams that are eroding deeper into underlying rocks.

All major streams in Oklahoma have broad, sand-filled channels with active water courses occupying a small portion of the river bed or flood plain. These broad, sand-filled channels reflect large changes in discharge (floods) that occur from time to time. Many man-made dams on major streams and tributaries, however, have decreased flooding frequency and

magnitude. As a result, active water courses gradually are stabilizing within their broad stream beds.

All Oklahoma streams are within two major drainage basins: the Red River basin, and the Arkansas River basin (see page 14). The two rivers and their many tributaries flow into Oklahoma from neighboring states, while all surface water from Oklahoma flows into Arkansas, via the Red, Arkansas, and Little Rivers, and Lee Creek. Major rivers and tributaries flow mainly east and southeast across Oklahoma.

Six scenic rivers flow in eastern Oklahoma and several natural salt plains and saline rivers are present in the west. Five scenic rivers in the Arkansas River drainage are in Adair, Cherokee, Delaware, and Sequoyah Counties in the Ozark Plateau. They include parts of the Illinois River (1, see map), and Flint (2), Baron Fork (3), Little Lee (4), and Lee (5) Creeks. The upper part of Mountain Fork (6), which flows into Broken Bow Lake in the Ouachita Mountains in McCurtain County, is in the Red River drainage.

Natural salt plains occur along some rivers where natural brines seep to the surface. In the Arkansas River drainage, Great Salt Plains (1) on

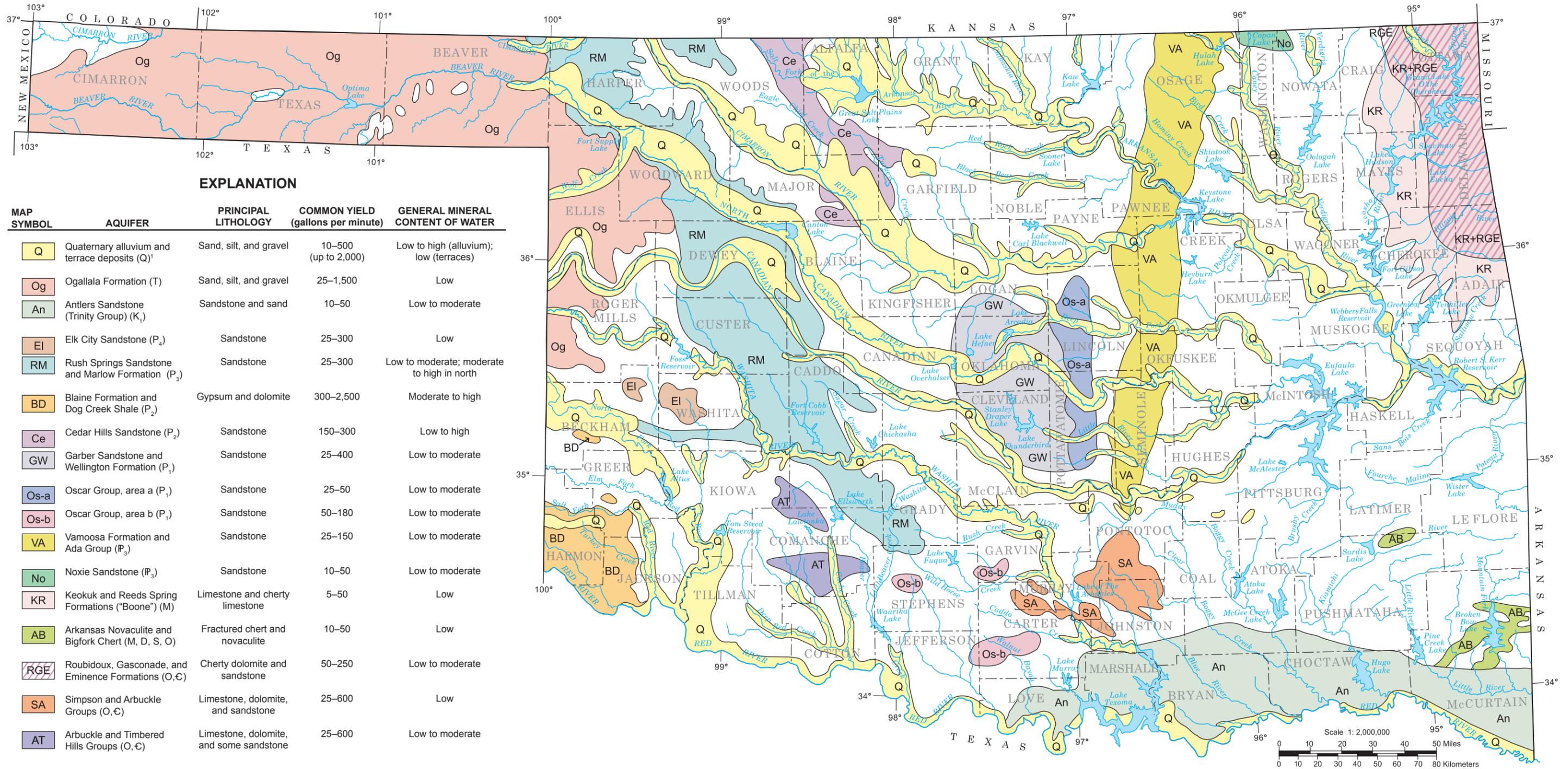
Salt Fork is the largest salt flat covering about 25 square miles. Others in northwestern Oklahoma are Big Salt Plain (2) and Little Salt Plain (3) on the Cimarron River, and Ferguson Salt Plain (4) in Blaine County. Salt plains in the Red River drainage are Boggy Creek Salt Plain (5) on North Fork Red River; Kiser (6), Robinson (7), and Chaney (Salton) (8) Salt Plains on Elm Fork in north Harmon County; and Jackson County Salt Plain (9). Downstream in both drainage basins, fresh-water inflow dilutes saline river waters, making the water usable for municipalities, livestock, and industrial purposes before reaching Keystone Lake or Lake Texoma.

There are many lakes and reservoirs in Oklahoma; most are man-made, created by damming streams for flood control, water supply, recreation, fish, wildlife, and hydroelectric power. Lakes on the Arkansas and Verdigris Rivers aid in navigation along the McClellan-Kerr Navigation System. Major lakes are formed behind dams built by the U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, and the Grand River Dam Authority. Various state and federal agencies, cities, and other entities own and operate large lakes. Farmers and landowners have built

many smaller lakes and ponds. Table 4 lists the 20 Oklahoma lakes with the largest surface areas.

A series of oxbow and playa lakes are the only natural lakes in Oklahoma (Oklahoma Water Resources Board, 1990). Typically crescent-shaped, oxbow lakes occupy abandoned channels of meandering streams and occur mainly in flood plains of the Red, Arkansas, Washita, North Canadian, and Verdigris Rivers in central and eastern Oklahoma. Oklahoma has 62 oxbow lakes covering at least 10 acres each; the largest, near Red River in McCurtain County, covers 272 acres (Oklahoma Water Resources Board, 1990).

Playa lakes form in shallow, saucer-like depressions scattered across the semiarid High Plains in northwestern Oklahoma and the Panhandle. Playa lakes have no outflow, holding water during and after rainy seasons before evaporating, or losing water by infiltrating into the ground. Oklahoma has about 600 of these intermittent or ephemeral playa lakes, but only a few persist year-round (Oklahoma Water Resources Board, 1990).



PRINCIPAL GROUND-WATER RESOURCES OF OKLAHOMA

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An "aquifer" consists of rocks and sediments saturated with good- to fair-quality water, and that is sufficiently permeable to yield water from wells at rates greater than 25 gal/min (gallons per minute). This map shows the distribution of the principal aquifers in Oklahoma and was modified from Marcher (1969), Marcher and Bingham (1971), Hart (1974), Bingham and Moore (1975), Carr and Bergman (1976), Havens (1977), Bingham and Bergman (1980), Morton (1981), Marcher and Bergman (1983), and Johnson (1983).

Bedrock aquifers in Oklahoma consist of sandstone, sand, limestone, dolomite, gypsum, or fractured novaculite and chert. Aquifer thicknesses range from 100 ft to several thousand feet. Depth to fresh water ranges from a few feet to more than 1,000 ft; most wells are 100–400 ft deep. Wells in

these aquifers yield 25–300 gal/min, although some wells yield as much as 600–2,500 gal/min. Water in most bedrock aquifers has low to moderate mineral content, about 300–1,500 milligrams per liter dissolved solids.

Ground water is also present in Quaternary alluvium and terrace deposits that consist mainly of unconsolidated sand, silt, clay, and gravel. "Alluvium" refers to sediments in present-day stream channels or flood plains, whereas "terrace deposits" refer to older alluvium that remains (usually at an elevation above the present-day flood plain) after a stream shifts its position or cuts a deeper channel. Alluvium and terrace deposits are among the most recent geologic deposits; therefore, they overlie bedrock aquifers where the two are mapped together. The thickness of Quaternary deposits ranges from 10 to 50 ft (locally up to 100 ft). Wells in alluvium and terrace

deposits yield 10–500 gal/min of water (locally several thousand gal/min); most of this ground water has less than 1,000 milligrams per liter dissolved solids.

Fresh water stored in Oklahoma aquifers results from the downward movement of meteoric (precipitation) and surface waters that enter each aquifer at its recharge area. Fresh water may displace saline water that originally may have occupied parts of the aquifer. The system is dynamic; water percolating downward to the water table recharges the aquifer continuously. The vertical or horizontal rate of ground-water flow in the aquifers probably ranges from 5 to 100 ft per year; under certain geologic and hydrologic conditions, such as in cavernous or highly fractured rocks, flow can range up to more than 1,000 ft per year.

Large areas of Oklahoma, shown uncolored on the map, are underlain mostly by shale or other low-permeability rocks that typically yield only enough water for household use (about 1–5 gal/min). Highly mineralized (saline) water, unfit for most uses, is present beneath fresh-water zones in these rocks, and beneath fresh-water aquifers. The depth to the top of this saline water ranges from less than 100 ft in some places, up to 3,000 ft in the Arbuckle Mountains.

The Oklahoma Water Resources Board (1990) estimated that Oklahoma's principal aquifers contain 320 million acre-feet of fresh water, perhaps half of which is recoverable for beneficial use. Wells and springs tapping these aquifers currently supply more than 60% of the water used in Oklahoma, chiefly in the west where surface-water is less abundant.

¹Symbols in parentheses indicate geologic age, as shown on the Geologic Map of Oklahoma on page 6.



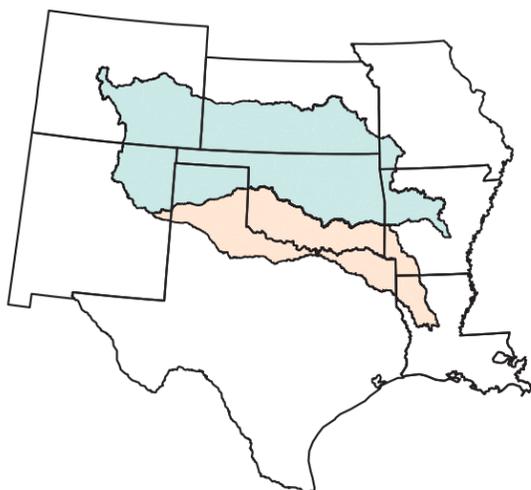
Table 5. Total estimated available water for each stream system or subsystem in the Red River and Arkansas River drainage basins within Oklahoma.

Stream System	Red River and Tributaries ^a	Drainage Area (sq mi)	Total Estimated Available Water (acre-ft)	Stream System	Arkansas River and Tributaries ^a	Drainage Area (sq mi)	Total Estimated Available Water (acre-ft)
1-1	Main stem of Red River (Kiamichi River to Arkansas state line)	410	415,467	2-1	Poteau River	1,345	2,412,968
1-2	Little River	2,204	2,814,296	2-2	Main stem of Arkansas River (Canadian River to Arkansas state line)	1,448	1,028,272
1-3	Kiamichi River	1,821	2,048,652	2-3	Canadian River (to North Canadian River)	410	2,174,741
1-4	Muddy Boggy Creek	2,551	1,957,143	2-4	Main stem of Arkansas River (Keystone Dam to Canadian River)	2,161	1,485,317
1-5	Main stem of Red River (Blue River to Kiamichi River)	111	88,800	2-5-1	Lower North Canadian River	1,865	537,546
1-6	Blue River	678	349,130	2-5-2	Middle North Canadian River	758	55,529
1-7	Main stem of Red River (Lake Texoma Dam to Blue River)	332	194,773	2-5-3	Upper North Canadian River	3,080	114,257
1-8-1	Lower Washita River	2,642	422,488	2-5-4	North Canadian River headwaters	3,660	8,839
1-8-2	Middle Washita River	1,660	299,240	2-6-1	Lower Canadian River	2,456	516,610
1-8-3	Upper Washita River	2,264	329,389	2-6-2	Middle Canadian River	948	367,792
1-8-4	Washita River headwaters	1,027	34,420	2-6-3	Upper Canadian River	1,994	214,851
1-9	Main stem of Red River (Walnut Bayou to Lake Texoma Dam)	650	208,000	2-7	Deep Fork River	2,537	862,965
1-10	Walnut Bayou	337	71,893	2-8	Little River	980	321,192
1-11	Mud Creek	938	248,044	2-9-1	Lower Cimarron River	2,021	1,053,665
1-12	Beaver Creek	862	227,144	2-9-2	Middle Cimarron River	3,837	566,065
1-13-1	East Cache Creek	931	246,003	2-9-3	Upper Cimarron River	1,795	195,508
1-13-2	Deep Red Creek and West Cache Creek	1,101	231,467	2-9-4	Cimarron River headwaters	697	27,298
1-14	Main stem of Red River (Cache Creek to North Fork of Red River)	380	44,587	2-10	Salt Fork Arkansas River	2,413	648,260
1-15-1	Lower North Fork of Red River	1,396	156,995	2-11	Chikaskia River	375	429,335
1-15-2	Upper North Fork of Red River	860	90,636	2-12	Main stem of Arkansas River (Kansas state line to Keystone Dam)	2,588	3,310,370
1-16	Salt Fork of Red River	714	192,887	2-13	Bird Creek	1,136	894,284
1-17	Main stem of Red River (Salt Fork of Red River to Texas state line)	492	19,680	2-14	Caney Creek	1,177	947,012
1-18	Elm Fork of Red River	567	69,332	2-15-1	Verdigris River (to Oologah Dam)	716	378,532
				2-15-2	Verdigris River (to Kansas state line)	823	2,391,316
				2-16	Grand (Neosho) River	53	25,324
				2-17	Illinois River	895	1,173,017
		24,928 ^b	10,760,466			42,168 ^b	22,140,865

^aTributaries not shown on the map of stream systems are shown on page 12 (Rivers, Streams, and Lakes of Oklahoma).
^bWhere watersheds extend into nearby states, the drainage area for Oklahoma was estimated. Therefore, the combined total drainage area for the Arkansas and Red Rivers is slightly less than the total area for Oklahoma.

STREAM SYSTEMS OF OKLAHOMA

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Arkansas River drainage basin
 Red River drainage basin

Figure 20. Arkansas River and Red River drainage basins as defined by the U.S. Geological Survey (Seaber and others, 1987).

Oklahoma is within the Red River and Arkansas River basins (Fig. 20); about one-third is within the Red River drainage basin. Two small tributaries in eastern New Mexico join to form the Red River. The Red River flows east through the Texas Panhandle, along the Oklahoma-Texas border, and through Arkansas and Louisiana to its confluence with the Atchafalaya River near the Mississippi River. The Arkansas River originates near Leadville, Colorado, flows east to Great Bend, Kansas, then southeast entering Oklahoma in Kay County, and then flows into Arkansas near Fort Smith before eventually entering the Mississippi River in southeastern Arkansas. The Oklahoma Water Resources Board (OWRB) divides Oklahoma into stream systems and subsystems to manage surface water resources

better (Table 5). OWRB matches stream-system boundaries and drainage areas to the hydrologic boundaries developed by the U.S. Geological Survey (U.S. Geological Survey, 1976; Seaber and others, 1987; and Rea and Becker, 1997). The Red River drainage basin in Oklahoma is subdivided into 18 stream systems; three (1-8, 1-13, and 1-15) are divided further into stream subsystems (Varghese, 1998). The Arkansas River basin in Oklahoma is subdivided into 17 stream systems; four (2-5, 2-6, 2-9, and 2-15) are divided further into stream subsystems (Fabian and Kennedy, 1998).

Table 5 summarizes the total estimated available water for each stream system or subsystem. The Red River basin contains about 10,750,000 acre-feet of available water; the

Arkansas River basin contains about 22,150,000 acre-feet of available water. The totals must be adjusted by subtracting the sediment pool storage (the portion of a lake or reservoir reserved for sediment accumulation during the lifetime of the impoundment) and the volume of water necessary to accommodate dependable yields in other reservoirs and lakes. Since 1997, the adjusted total estimated available water was 9,450,000 acre-feet for the Red River basin, and 21,350,000 acre-feet for the Arkansas River basin (Fabian and Kennedy, 1998; Varghese, 1998). The adjusted total estimated available water is used to allocate water for municipal, industrial, and agricultural uses.

