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HYDROLOGY OF THE ARBUCKLE MOUNTAINS AREA, SOUTH-CENTRAL OKLAHOMA

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TABLE 19.—RECOMMENDED OR REQUIRED QUALITY STANDARDS FOR PUBLIC WATER SUPPLIES

Physical or chemical property	Limit not to be exceeded
Color	75 platinum–cobalt units
Odor	Unobjectionable
pH	5.0–9.0
Common ions (mg/L):	
Chloride	250
Fluoride*	1.4–2.4
Sulfate	250
Nitrate (as N)	10**
Trace metals (μg/L):	
Arsenic	0.05**
Cadmium	0.010**
Chromium	0.05**
Copper	1
Iron	0.3
Lead	0.05**
Manganese	0.05
Mercury	0.002**
Zinc	5

*The concentration of fluoride should be between limits expressed, depending on annual average of maximum daily air temperatures at a location being considered.
**Maximum contaminant level as set by U.S. Environmental Protection Agency (1976); primary drinking-water regulations.

Early work by Dott and Ginter (1930) and Case (1934) dealt with the characteristics of waters in Ordovician rocks in a broad area that included the area in this report. Dott and Ginter (1930, p. 1217) found that the concentration of dissolved solids increased rapidly in a downdip direction, at a rate of 10,000 mg/L/mi.

Water from several wells that produce from the Simpson Group contains various amounts of oily residue (asphalt) or gas. Many well owners report that an oily film is visible on the water surface and that the water has an oily taste or odor. Although the water generally is of adequate quality for most domestic purposes, attempts to remove the oil by filtering have had limited success. In a small area ~2 mi south of Sulphur in secs. 14, 15, 22, and 23, T. 1 S., R. 3 E., most wells are no longer used for domestic supplies, and city water from wells that tap the Arbuckle Group is treated and piped to that area.

Water from 12 perennial springs in this area was analyzed for comparison with water from wells that tap the Arbuckle–Simpson aquifer and streams that drain the area. The spring water is chemically similar to water in the Arbuckle–Simpson aquifer. The temperature of water from springs varies slightly with the seasons, averaging ~16.5°C.

The chemical characteristics of water in streams vary seasonally and reflect mineral concentrations lower during rainy seasons than during dry seasons. The base flow of streams in the area is derived from springs discharging from rocks of the Arbuckle–Simpson aquifer. As a result, the quality characteristics of water in streams during low-flow periods is similar to water in springs that discharge from the aquifer.

The maximum, average, and minimum concentrations of some common chemical constituents and physical characteristics of water from streams in the area are listed in Table 18. As shown in the table, the dissolved-solids concentration in stream water is generally less than that in water from wells and springs.

The temperature of water in streams varies seasonally and ranges from 2.0°C to 33.0°C. Streams fed by springs seldom freeze over completely during the winter, although a thin ice sheet may form over the surface of ponded water.

Travertine (calcium carbonate, $CaCO_3$) deposits occur in most stream beds, especially downstream from springs. Precipitation of the travertine suggests that the water is saturated with respect to calcium carbonate and that as water discharges from springs, CO_2 (carbon dioxide) is released and $CaCO_3$ is precipitated on the stream bed materials. Deposition of travertine probably results in a small decrease of dissolved chemical constituents in stream water. This is consistent with the increase in pH observed for the streams.

A prime example of travertine precipitation from stream water is a large deposit in Honey Creek at Turner Falls. Johnson and McCasland (1971) described the deposit and indicated that blue-green algae assist in precipitating the calcium carbonate.

Another large deposit of travertine occurs in Honey Creek about a mile west (upstream) of Turner Falls, on the west side of the East Timbered Hills. The creek flows through a chasm in this deposit, which probably has a depositional history similar to that of the Turner Falls deposit. Several springs are upstream from the Turner Falls deposit. Above the springs, the stream bed material is coated with travertine, although no flow occurs in this reach of the stream during the summer dry season.

WATER USE

Water from the Arbuckle–Simpson aquifer, although used only in small amounts, serves domestic, industrial, commercial, and agricultural purposes. Most of the withdrawn water is used for stock supplies—primarily for dairy and beef

and assistance in supplying information on wells, use of water, and other pertinent data.

Especially appreciated are the cooperation and assistance extended by members of the Oklahoma Geological Survey, who provided sources of literature and many helpful suggestions.

GEOGRAPHIC AND GEOLOGIC SETTING

The Arbuckle–Simpson aquifer underlies an area of ~500 mi² in the Arbuckle Mountains physiographic province of south-central Oklahoma (Fig. 1). The term "mountains" is misleading, because the topography of the area consists of gently rolling hills separated from plains by the Washita River. The river follows part of the Washita Valley fault zone. The topography reflects the degree of structural deformation of the underlying rocks. The western part of the mountains, referred to as the Arbuckle Hills, is characterized by a series of northwest-trending ridges formed on resistant rocks that are intensely folded and faulted. The eastern part of the mountains, referred to as the Arbuckle Plains, is characterized by a gently rolling topography formed on relatively flat-lying, intensely faulted limestone beds. Neither the eastern nor the western part of the area has a well-developed karst topography, but a few small karst features have developed in the western part of the area as a result of solution of the underlying carbonate rocks.

Blue River, Pennington Creek, Mill Creek, Rock Creek, Delaware Creek, Oil Creek and Sycamore Creek are the principal streams draining the eastern part of the area and flow generally toward the south–southeast into the Washita River and Red River. Colbert, Hickory, Honey, Falls, Henryhouse, Cool, and Spring Creeks are the principal streams draining the western Arbuckle Mountains (Fig. 3). These streams are sustained throughout the year by springflow. Many of the small tributary streams are intermittent and cease to flow in late summer.

Bedrock geology is portrayed on Plate 1 (adapted from Ham, McKinley, and others, 1954).

CLIMATE

The study area is in a moist, subhumid zone. Most precipitation occurs as rainfall, with some light snow or sleet during the winter.

Long-term precipitation data from National Weather Service stations in and adjacent to the

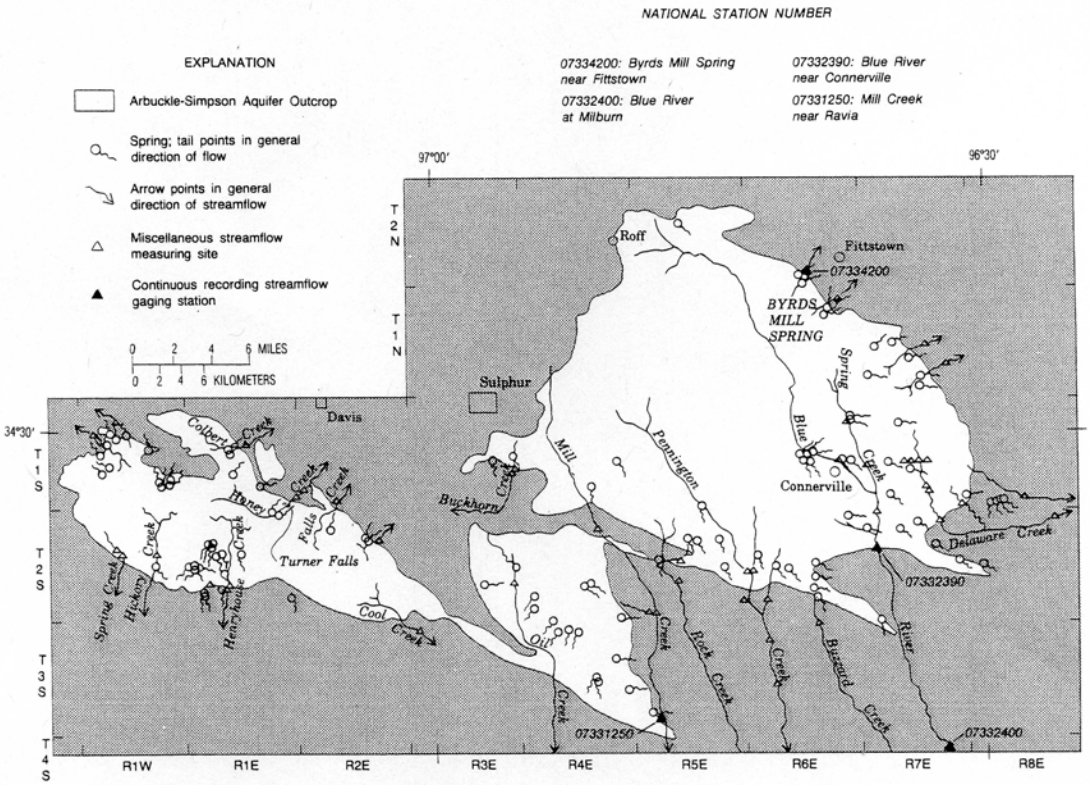

Figure 3. Principal streams, streamflow gaging sites and springs in the study area.