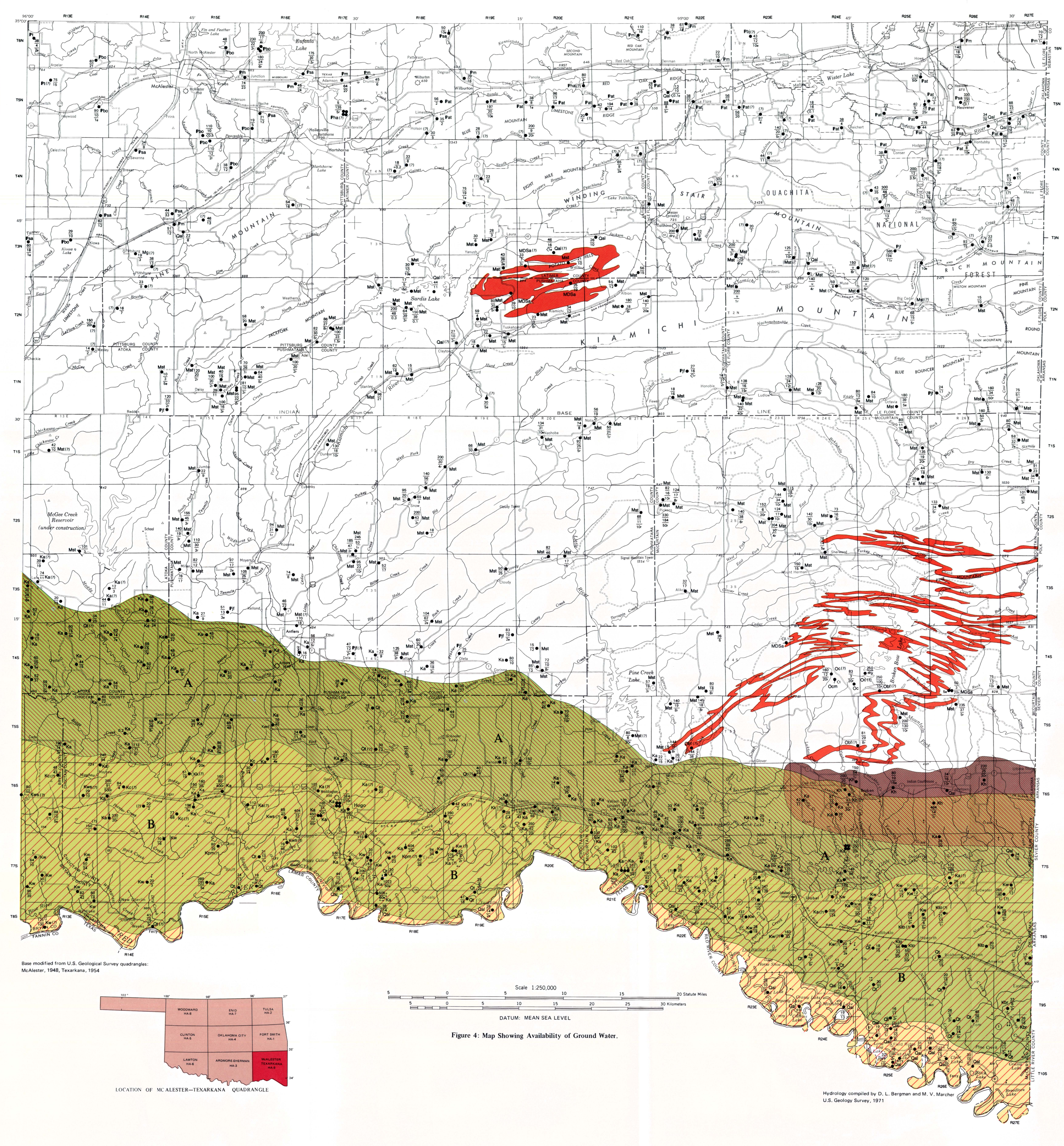

Base modified from U.S. Geological Survey quadrangles: McAlester, 1948, Texarkana, 1954

Scale 1:250,000

DATUM: MEAN SEA LEVEL

Figure 4: Map Showing Availability of Ground Water.

Hydrology compiled by D. L. Bergman and M. V. Marcher U.S. Geology Survey, 1971

LOCATION OF MC ALESTER—TEXARKANA QUADRANGLE

EXPLANATION

AQUIFERS

ALLUVIUM

Alluvium along the Red River has a maximum thickness of about 110 feet and consists of clay and silt at the surface, grading downward into coarse sand and fine gravel at the base.

ANTLERS FORMATION

In area A, water in the Antlers Formation is under water-table conditions. The formation is mainly fine- to medium-grained sand that ranges in thickness from 0 to about 300 feet.

In area B, water in the Antlers Formation is under artesian conditions. The formation consists of fine- to medium-grained sand containing local beds of sandstone and extensive layers and lenses of clay. The formation ranges in thickness from about 300 feet at the northern edge of area B to a maximum of 880 feet in southeastern McCurtain County. The depth to the top of the formation ranges from about 100 feet along the northern edge of area B to about 1,400 feet in southeastern McCurtain County. In southeastern McCurtain County water in the Antlers Formation is too highly mineralized for most uses (see sheet 3).

HOLLY CREEK FORMATION

The Holly Creek Formation consists of lenticular beds of gravel, clay, and sandy clay and ranges in thickness from 30 to 100 feet on the outcrop. A short distance south of Little River, where the top of the formation is nearly 1,000 feet below the surface, water in the Holly Creek probably is saline.

ARKANSAS NOVACULITE AND BIGFORK CHERT

The Arkansas Novaculite and Bigfork Chert have a combined thickness of 850 to 1,200 feet and consist of highly fractured novaculite and chert with some interbedded shale and limestone.

WELL YIELDS

(gallons per minute)

100 to 500

50 to 100

10 to 50

Generally less than 10

Locally, individual wells in any of the areas shown on the map may yield more than is indicated for that area.

Approximate area boundary; dashed where two areas overlap

Mst 75/51/8r

Well

Upper number is depth of well in feet; middle number is depth to water in feet below land surface in 1970 and 1971; lower number is yield of well in gallons per minute; where only two numbers are shown they are well depth and depth to water. Letter symbol indicates geologic source of water; symbols are the same as those on the geologic map; query (?) indicates geologic source is not definitely known.

330/50e

Flowing well

Upper number is depth of well in feet; lower number is rate of flow in gallons per minute.

10/200/20r

Well field

Upper number is number of wells in field; middle number is average depth of wells in feet; lower number is average well yield in gallons per minute.

<0.1

Spring

Number beside spring symbol is yield in gallons per minute.

u = unknown
r = reported value
e = estimated
< = less than value shown
> = greater than value shown

AVAILABILITY OF GROUND WATER

The availability of ground water in any given part of the McAlester-Texarkana Quadrangle depends on the storage capacity and permeability of the underlying rocks. Of the various formations in the quadrangle, alluvium along the Red River, which consists of unconsolidated sand and some gravel, is one of the most favorable sources for large amounts of ground water (fig. 4). Except for a few domestic and stock wells, however, this aquifer is little used. As alluvium along other streams in the area is generally thin and contains a high proportion of silt and clay, it yields only small amounts of water, except possibly in a few local areas.

Terrace deposits are widespread along the Red River, but they provide only small supplies of water because of their high silt content and thinness, both of which greatly reduce the storage capacity. Terrace deposits in Pittsburg County consist of fairly clean, well-sorted sand, but these deposits are thin and go dry during periods of low rainfall.

The Antlers Formation is an important aquifer and has considerable potential for future development. According to Davis (1960, p. 29) the Antlers Formation (Paluxy Sand of Davis) in southern McCurtain County consists of about 55 percent sand with a few gravel lenses, 40 percent sandy shale and shale, and 5 percent limestone. The sand occurs more consistently in the lower part of the formation, and that part of the section should be the most favorable for large well yields. North of the outcrop of the Goodland Limestone, which is shown on the geologic map (sheet 1), the Antlers Formation crops out at the surface, and water in the formation is under water-table conditions. Few large-yield wells are known in this area, partly because wells do not penetrate deeply enough and partly because of inadequate well construction.

South of its outcrop area, the Antlers is overlain by the nearly impermeable Goodland Limestone, and therefore the water is confined and is under artesian pressure. Under such conditions, water in wells penetrating the Antlers rises above the top of the Goodland Formation and some wells in topographically low areas may flow at the surface. Well yields in the artesian belt of the Antlers range from a few gallons per minute to 500 gpm. Large yields probably could be obtained throughout most of this belt if wells penetrated all or most of the formation and if better well-construction methods were used.

With the exception of the Antlers and Holly Creek Formations, rocks of Cretaceous age are generally fine grained and contain much silt and clay; consequently, they are unproductive of water in quantities greater than what is needed for household use.

North of the Choctaw Fault, the rocks are mainly shales which also generally yield only enough water for household use. Interbedded with the shales, however, are layers of sandstone, such as the Bluejacket and Hartshorne, as well as many sandstone units not shown on the map, which yield moderate amounts of water locally. In the vicinity of Heavener, for example, artesian wells in sandstone aquifers yield as much as 50 gpm. Static water levels in these wells are near the surface, and a few wells flow.

The Bigfork Chert and the Arkansas Novaculite in central McCurtain County and in the Potato Hills area are highly broken and fractured and probably are capable of storing and yielding moderate to large amounts of water. However, because of their remoteness few wells have been drilled into these formations, and their potential can only be inferred. Furthermore, these formations have been greatly folded and faulted, and selecting a well site would require careful study.

With the exception of the Bigfork Chert and the Arkansas Novaculite, bedrock in the area between the Choctaw Fault and the Cretaceous rocks consists mainly of shale, siliceous shale, and sandstone. These rocks have been subjected to low-grade dynamic metamorphism which has increased their brittleness so that they have been broken by folding and faulting. These factors all combine to increase permeability, particularly in the sandstone and siliceous shale.

Geologically, the most advantageous sites to drill wells into these rocks, in general order of favorability, are (1) on anticlinal noses, (2) on flanks of anticlines, (3) near the ends of synclinal troughs, and (4) on flanks of synclines. Fault zones in sandstones may be favorable, but similar zones in siliceous shales apparently are not significantly greater in productivity. Flat-lying or gently dipping rocks, particularly shale, are least productive. In general, the water-yielding capabilities of the rocks between the Choctaw Fault and the Cretaceous rocks differ markedly from place to place. Well yields range from a few gallons per minute to as much as 50 gpm, but in local areas yields are not sufficient even for household use.

Because of the low level of ground-water usage from the major aquifers, as compared with the amount available, problems of overdevelopment have not occurred, except possibly in some very local areas. Large-yielding wells too close together may cause excessive drawdown, decreasing well yields and increasing pumping costs. This problem can be prevented or alleviated by proper well spacing. Although withdrawals from the alluvial aquifer along the Red River are insignificant at present, the aquifer may be used in the future to provide supplemental irrigation. Pumpage from wells in the alluvium may lower the water level, thereby inducing water to flow from the river into the alluvium. Although streamflow is reduced by the amount of induced recharge, water in the aquifer is continually replenished as long as streamflow is available. The most significant problem that might result from inducing recharge is degradation of water quality in the aquifer if the river water is more highly mineralized than that in the aquifer or if it contains pollutants.

REFERENCE

Davis, L. V., 1960, Geology and ground-water resources of southern McCurtain County, Oklahoma: Oklahoma Geological Survey Bulletin 86, 108 p.

WATER-LEVEL FLUCTUATIONS

Although most precipitation falls during the spring and summer months, most ground-water recharge takes place during late winter and early spring months when vegetation is dead or dormant and evaporation and transpiration are at a minimum. Thus, water levels, as shown by the hydrographs (fig. 5), are highest in early spring and begin to decline in late spring or early summer. Water levels continue to decline during the summer until autumn, when they usually reach their annual low. In late autumn they begin to rise again as evaporation and transpiration decrease. During the summer months, intermittent rains of an inch or so generally produce only a slight, temporary rise in water levels.

Water-level hydrographs showing rapid response to rainfall and a decline almost as rapid indicate permeability sufficient to permit rapid recharge and lateral movement within the ground-water reservoir. The hydrographs of the wells in fractured shale near Tuskahoma and Daisy illustrate this rapid response. In contrast, the hydrograph of a well in the confined sand of the Woodbine Group near Idabel shows minimal response to rainfall, which indicates the source of recharge is at a considerable distance from the well. The hydrographs, from eight selected sites, illustrate the varying degrees of response to individual rains and seasonal trends of water levels in the ground-water reservoirs of the region.

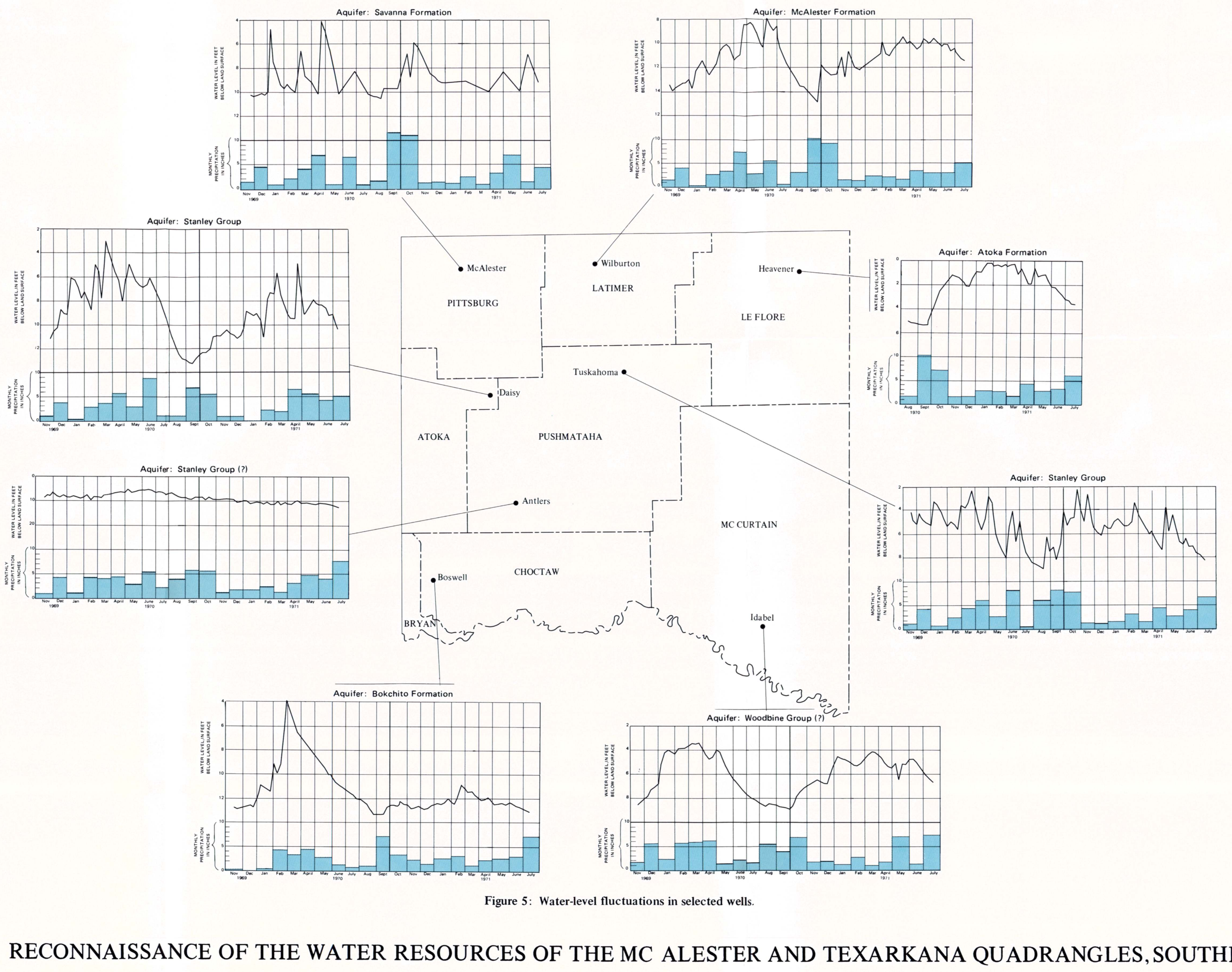

Figure 5: Water-level fluctuations in selected wells.

RECONNAISSANCE OF THE WATER RESOURCES OF THE MC ALESTER AND TEXARKANA QUADRANGLES, SOUTHEASTERN OKLAHOMA

By

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U.S. Geological Survey

1983