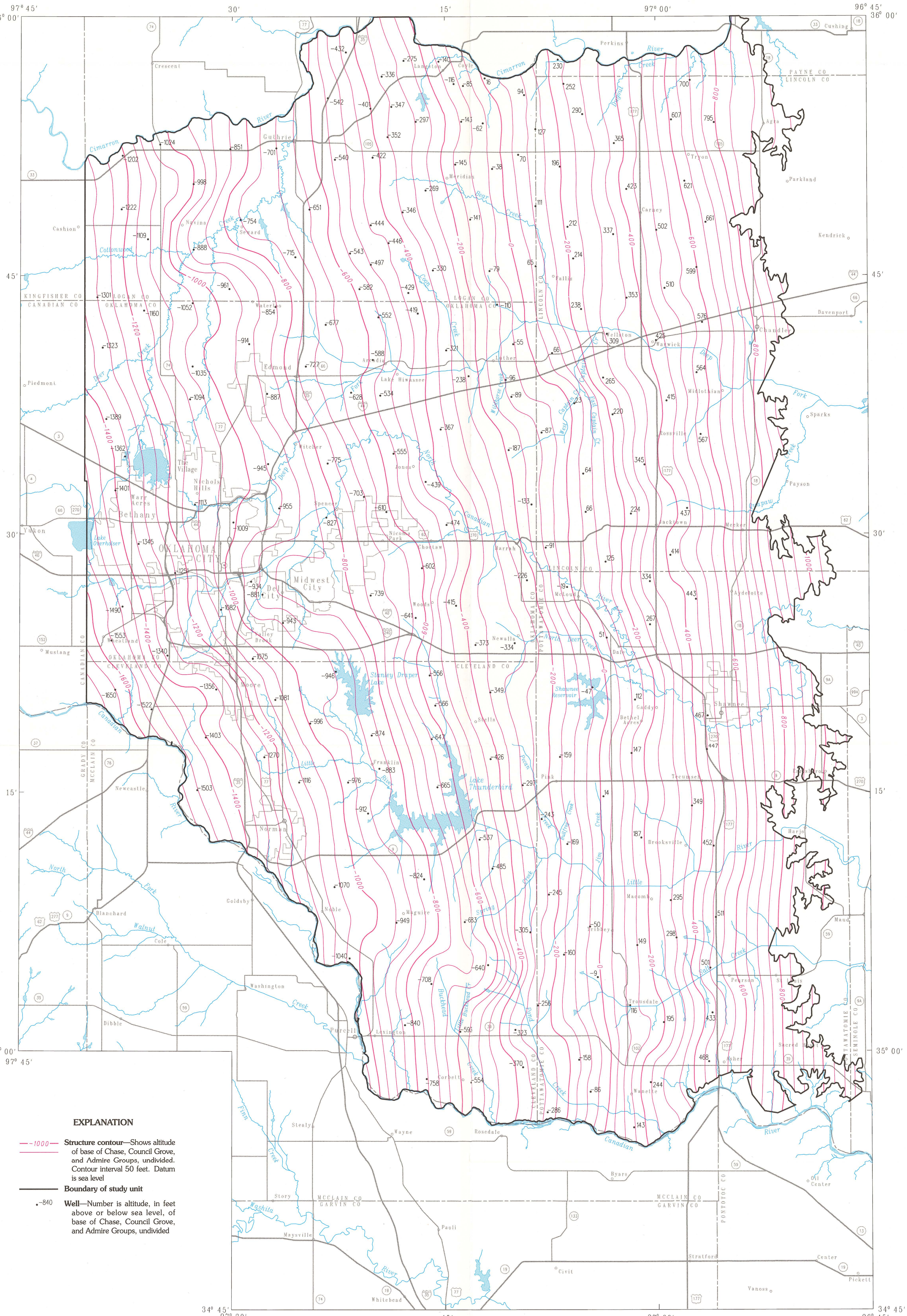
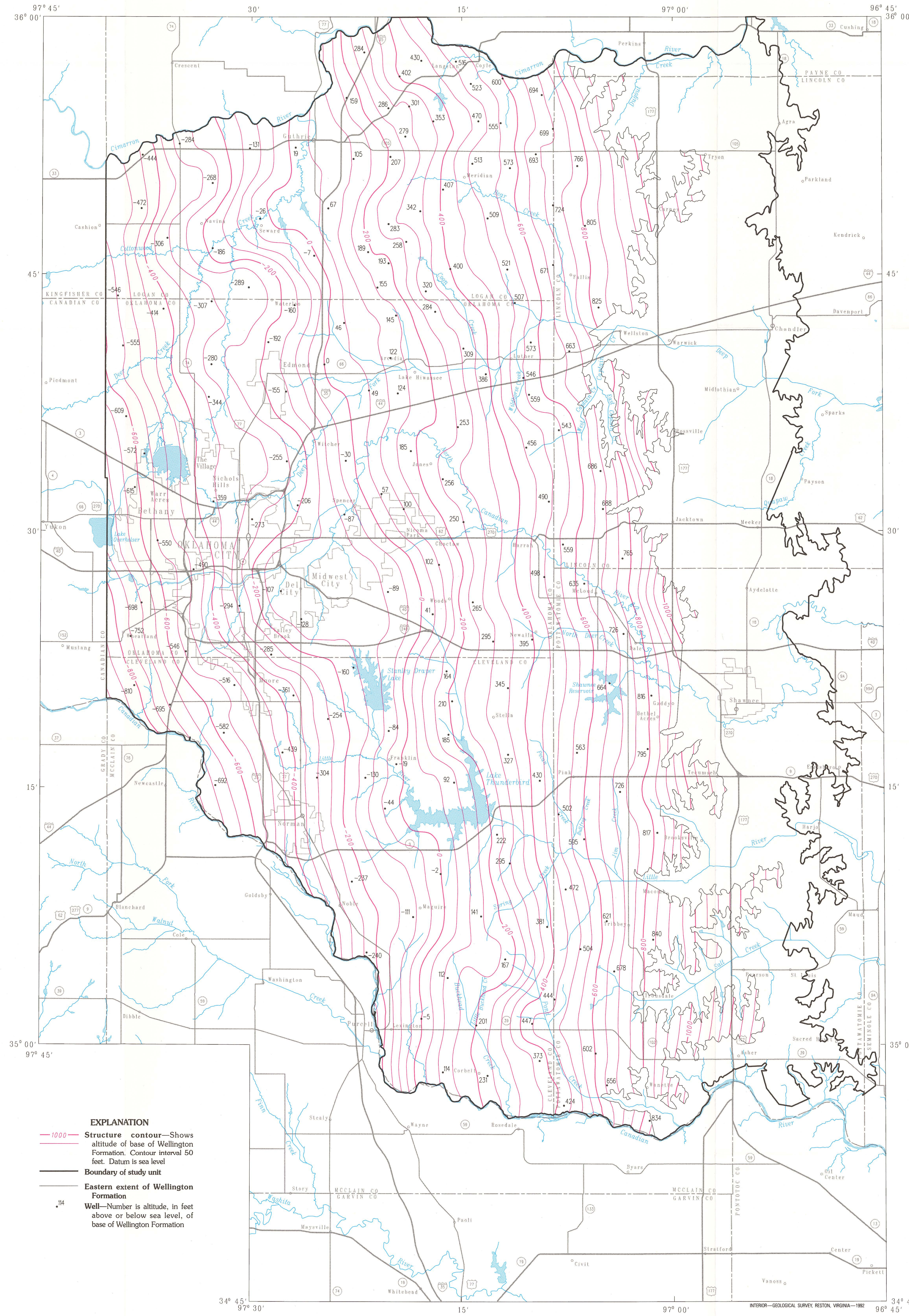


EXPLANATION

- Structure contour—Shows altitude of base of Chase, Council Grove, and Admire Groups, undivided. Contour interval 50 feet. Datum is sea level
- Boundary of study unit
- Well—Number is altitude, in feet above or below sea level, of base of Chase, Council Grove, and Admire Groups, undivided

Figure 4. Altitude of the base of the Chase, Council Grove, and Admire Groups, undivided



EXPLANATION

- Structure contour—Shows altitude of base of Wellington Formation. Contour interval 50 feet. Datum is sea level
- Boundary of study unit
- Eastern extent of Wellington Formation
- Well—Number is altitude, in feet above or below sea level, of base of Wellington Formation

Figure 5. Altitude of the base of the Wellington Formation

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1992

The transmissivities of the Garber Sandstone, Wellington Formation, and Chase, Council Grove, and Admire Groups decrease to the north and south, to the point where these geologic units no longer yield significant quantities of water to wells. The point where these geological units no longer yield significant quantities of water to wells ideally would be defined to be the limit of the Central Oklahoma aquifer. Unfortunately, there are not sufficient data to define the precise limits of the aquifer, as this would require the ability to determine well yields at every point in the aquifer. Therefore, defining the limits of the Central Oklahoma aquifer requires some inferences. The Cimarron River was defined to be the northern boundary of the aquifer because: (1) The Garber Sandstone, Wellington Formation, and Chase, Council Grove, and Admire Groups are less permeable north of the river; (2) few (if any) large-capacity wells are completed in these geologic units north of the river; and (3) it is expected that the river is a hydrologic boundary to ground-water flow, with little or no ground-water underflow from one side of the river to the other. The Canadian River was defined to be the southern boundary of the aquifer, for reasons similar to those cited above.

The eastern boundary of the aquifer is considered to be the eastern limit of the outcrop of the Chase, Council Grove, and Admire Groups. The Vanoss Formation, which underlies the Chase, Council Grove, and Admire Groups, has a lower transimissivity than the geological units of the Central Oklahoma aquifer. The western boundary of the study unit is considered to be where freshwater circulation in the aquifer becomes negligible. An increase in dissolved-solids concentration in the western part of the study unit is thought to indicate a decrease in the circulation of ground water. A dissolved-solids concentration of 5,000 mg/L (milligrams per liter) was established as the indicator of the increase in dissolved solids. A concentration of 5,000 mg/L was selected to be consistent with the work of Hart (1966). The position of ground water containing less than 5,000 mg/L dissolved solids can not be defined precisely but occurs at approximately the Oklahoma-Canadian County line (Hart, 1966). For this report, the Oklahoma-Canadian County line is defined to be the western boundary of the aquifer.

The lower boundary of the aquifer is considered to be as the lower limit of ground water containing less than 5,000 mg/L dissolved solids. Hart (1966) referred to this lower limit as the “base of fresh ground water” and this term is retained in this report. The base of the fresh ground water is deepest in south-central Oklahoma County near Midwest City, where the depth to the base of fresh ground water is about 1,000 feet. To the north, south, and east, the base of the fresh ground water slopes upward gradually, until it is only about 100 feet below land surface at the boundaries of the aquifer. To the west, the base of fresh ground water rises gradually to approximately the Oklahoma-Canadian County line. At that line, the depth to the base of fresh ground water decreases abruptly from about 800 feet to about 200 feet (Hart, 1966).

Alluvium

Alluvium deposited by streams is the youngest geologic unit in the study unit. The Quaternary-age alluvium constantly is being eroded, transported, and deposited by streams. Alluvium is present along most of the perennial streams in the study unit. The most extensive alluvium is present along the North Canadian and Canadian Rivers, where it is as much as 3 miles wide. The alluvium consists of lenticular beds of unconsolidated clay, silt, sand, and gravel. The thickness of the alluvium ranges from 0 to about 100 feet. Where the alluvium is thickest and contains beds of gravel, wells yield as much as 700 gallons per minute (Bingham and Moore, 1975).

Terrace Deposits

Terrace deposits associated with streams in the study unit are older alluvial deposits that occur where erosion has deepened the stream valleys and left the terrace deposits topographically above the present-day alluvium. In the study unit, the Quaternary-age terrace deposits occur along the Deep Fork, Canadian, and North Canadian Rivers, and are as much as 8 miles wide. Outside of the study unit, terrace deposits occur along the Cimarron and Little Rivers, but none are mapped along these streams within the study unit. Like the alluvium, the terrace deposits consist of lenticular beds of unconsolidated clay, silt, sand, and gravel. Thickness of the terrace deposits in the study unit ranges from 0 to 100 feet. Wells completed in the most productive terrace deposits may yield up to 300 gallons per minute (Bingham and Moore, 1975).

El Reno Group

Beneath the alluvium and terrace deposits are consolidated geologic units of Permian age. These strata generally are red or reddish-brown in color, and thus generally are referred to as “red beds.” The regional dip is to the west at about 50 feet per mile.

The youngest Permian geologic unit in the study unit is the El Reno Group. The El Reno Group consists of red-brown fine-grained sandstone with some mudstone conglomerates and shales. The El Reno Group generally yields sufficient water for domestic and stock wells. The El Reno Group is not considered to be part of the Central Oklahoma aquifer because it is separated from the aquifer by the Hennessey Group, which is a confining unit. The El Reno Group is discussed in this report because a small outcrop of the El Reno Group exists within the study unit.

Hennessey Group

Stratigraphically below the El Reno Group are rocks of the Hennessey Group. The Hennessey Group is present in the western one-third of the study unit, but has been removed by erosion in the eastern two-thirds. The Hennessey Group consists of reddish-brown shales and mudstones with a few thin beds of very fine grained sandstone. Because the Hennessey Group is composed mainly of shale and mudstone, it has small transmissivity and, where present, is a confining unit. Even though it has little transmissivity, a few small-yield wells, for domestic and stock use, are completed in the Hennessey Group. The Hennessey Group is not considered to be part of the Central Oklahoma aquifer but is discussed in this report because it confines the Central Oklahoma aquifer and it crops out within the study unit.

Garber Sandstone and Wellington Formation

Stratigraphically below the Hennessey Group are the Garber Sandstone and the Wellington Formation. In central Oklahoma, the Garber Sandstone and the Wellington Formation have similar lithologies. These geologic units consist of lenticular beds of fine-grained, cross-bedded sandstone interbedded with siltstone and mudstone. The sand grains are predominantly quartz, and the sandstone is friable. In the central part of the study unit, the lithology of the Garber Sandstone is predominantly sandstone. However, away from the central part of the study unit, the Garber Sandstone becomes more of a mixture of sandstones, siltstones, and mudstones, and is difficult to distinguish from the underlying Wellington Formation. In southeastern Oklahoma County, about 75 percent of the total thickness of the Garber Sandstone and Wellington Formation is sandstone (Wood and Burton, 1968). In all directions from southeastern Oklahoma County, the percentage of sandstone decreases and the percentage of siltstone and mudstone increases. For example, in southern Cleveland County, only 25 percent of the total thickness is sandstone (Wood and Burton, 1968).

The Garber Sandstone and Wellington Formation are at the surface in the central part of the study unit, but have been removed by erosion in the east. Where a full section of the Garber Sandstone and Wellington Formation is present in wells examined for this study, their combined thickness ranges from 1,165 to 1,600 feet, with a median thickness of 1,510 feet. A few wells yield as much as 600 gallons per minute, but typical well yields generally range from 200 to 400 gallons per minute, in wells designed for maximum yield.

Chase, Council Grove, and Admire Groups

The Chase, Council Grove, and Admire Groups (undivided in this report) of Permian age consist of beds of fine-grained, cross-bedded sandstone, shale, and thin limestone. In surface exposures in the eastern part of the study unit, these Groups appear to have similar lithologies. East of their outcrop these geologic units have been removed by erosion. Where complete sections are present in wells examined for this study, the combined thickness of these Groups ranges from 570 to 940 feet with a median thickness of 745 feet. In the central part of the study unit, wells are completed in the Wellington Formation and in one or more of the underlying Chase, Council Grove, and Admire Groups. East of the outcrop of the Wellington Formation, wells that are completed only in the Chase, Council Grove, and Admire Groups can yield as much as 120 gallons per minute. Bingham and Moore (1975) referred to the Chase, Council Grove, and Admire Groups as the “Oscar Group,” and assigned it to the Pennsylvanian System. Although data from Bingham and Moore (1975) are cited frequently, the term “Oscar Group” is not used in this report. A recently published correlation chart by Lindberg (1987) refers to the Oscar Group as the Permian-age Chase, Council Grove, and Admire Groups. This terminology follows the usage of the U.S. Geological Survey and is used in this report.

SCALE 1:250 000

5 0 5 10 15 20 25 MILES

5 0 5 10 15 20 25 KILOMETERS

HYDROGEOLOGIC MAPS OF THE CENTRAL OKLAHOMA AQUIFER, OKLAHOMA

By
Scott C. Christenson, Robert B. Morton, and Benard A. Mesander

1992