Ground Water in the Anadarko Area, Oklahoma

by Stuart L. Schoff

1948

Open-File Report

OKLAHOMA GEOLOGICAL SURVEY
NORMAN, OKLAHOMA

SHEET NO. ______

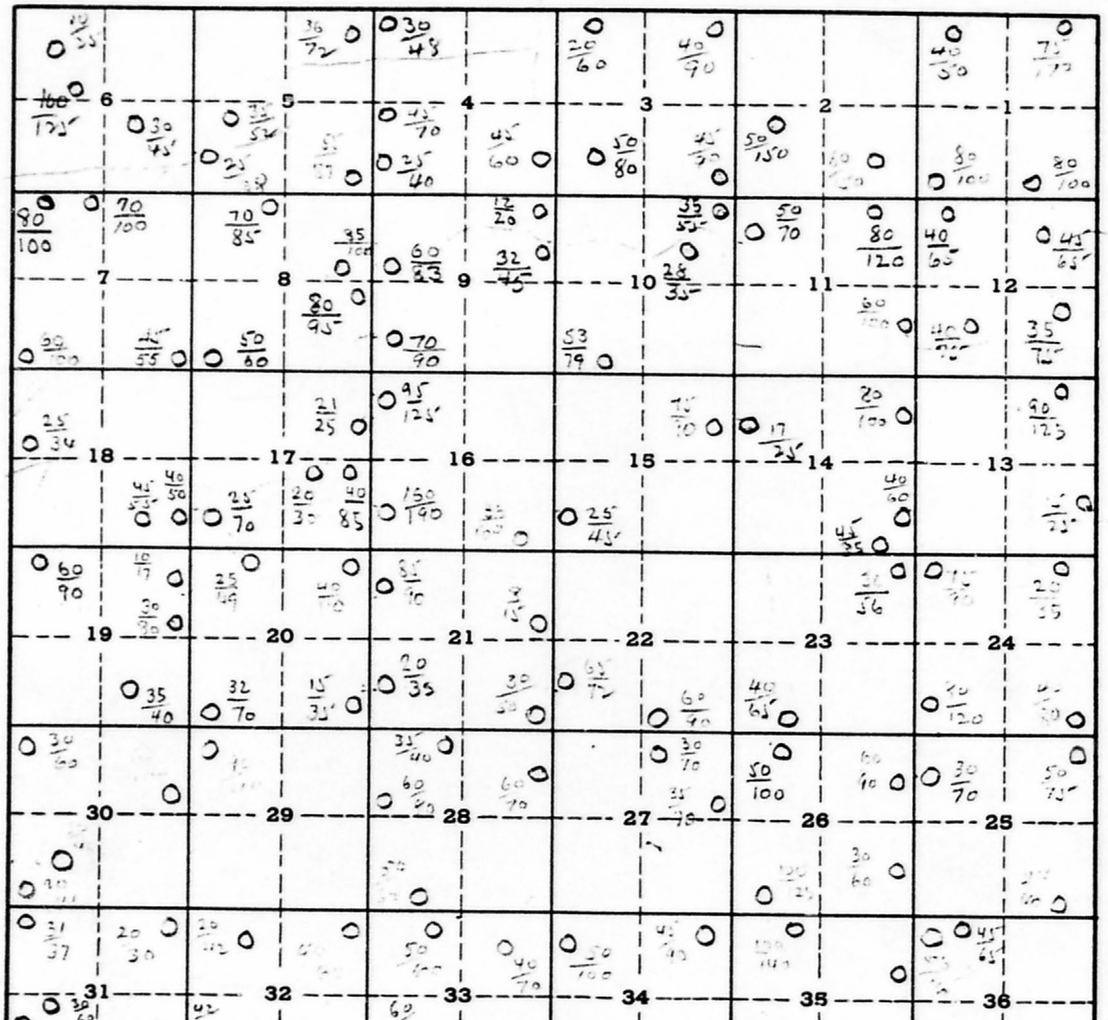
OBSERVER: Schoff DATE Sept 1947

INVESTIGATION: Ground Water for Anadarko BRANCH: ______
TITLE OR OBJECT — IRON ORE, WATER, CULTURE, ETC.

DETAILS HERE RECORDED: Wells rept. by WPA; depths, water levels; drainage; Cloud Chief)
SAMPLES, WELLS, OUTCROP OF VIOLA L. S., SHAPE AND SIZE OF DEPOSIT, ETC.

TOWNSHIP 6 N, RANGE 10 W, CADDO COUNTY

PLOTTED ON COUNTY BASE SHEET NO. ______ 19__, BY ______



FILING NOTATIONS:

NOTES IN DETAIL:

O 90/110 Well reported to WPA. Upper no. depth to water; lower no. total depth of well —

Blue — drainage

Green — Outcrop of Cloud Chief

TOWNSHIP PLAT
FORM F-3-1935

(CONTINUE ON REVERSE SIDE OR ON FORM F-4)

GROUND WATER IN THE ANADARKO AREA, OKLAHOMA

By
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Prepared in cooperation between the Oklahoma Geological Survey and the U. S. Geological Survey.

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Purpose and scope.— This report offers a preliminary interpretation of the geology and ground-water hydrology of the Anadarko area, Oklahoma. L. V. Davis prepared the accompanying map from aerial photographs and furnished much of the geologic information, and records of the State Mineral Survey (WPA) were used in the preparation of the section on the Rush Springs sandstone.

Present water supply and requirements.— Anadarko now gets its public water supply from the Washita River, which rises in the eastern part of the Texas Panhandle and crosses Permian red-bed formations, some of which contain gypsum, before reaching the Anadarko reservoir and dam. The water is usually highly mineralized and very hard. The average of four analyses made between 1932 and 1936[1] shows the following principal constituents:

[1] Smith, O. M., and Dott, R. H., Analyses of Oklahoma waters: Oklahoma Eng. Exp. Sta. Pub. 52, Stillwater, Okla., 1942.

	Parts per million
Calcium carbonate ($CaCO_3$)	151
Calcium sulfate ($CaSO_4$)	278
Magnesium sulfate ($MgSO_4$)	155
Sodium sulfate Na_2SO_4)	32
Sodium chloride (NaCl)	72
Total solids	793
Total hardness as $CaCO_3$	486

In addition to the objectionable hardness of the present water supply, the flavor caused by algae in the reservoir and the chlorination of the water is considered undesirable by many. The objective, therefore, is a softer water with better flavor.

The water requirement of Anadarko varies with the season, being greatest in summer. In August 1947, 27 million gallons was pumped, or approximately 900,000 gallons per day.

General geology.— Anadarko is on the flat bottom lands of the Washita River. Downstream from the city, the higher lands on either side of the valley are underlain by Permian shale with interbedded thin sandstones. These rocks do not yield water readily, hence are hardly a promising source from which to obtain a million gallons of water per day.

Upstream from Anadarko, the Whitehorse sandstone crops out to the north and south of the Washita Valley. The upper sandstone of the Whitehorse, known as the Rush Springs member, is a fairly good aquifer.

Ground water in alluvium and terrace deposits.— Considerable water is available in the alluvium of the Washita River, which consists of sand, gravel, and clay laid down in relatively recent time by the river itself, and the same is true of the terrace deposits, which were deposited by the river at an earlier time when its channel was at a higher level. As the river cut deeper, it removed part of its previous deposit, but left elevated benches or terraces. The lowest bottom along the river is the present flood plain and is underlain by the alluvium. The first terrace is the "second bottom," and is 3 to 5 feet above the flood plain. The second terrace is still higher.

The accompanying map shows the areas of alluvium and terrace deposits near Anadarko. A remnant of the first terrace extends northeastward from the southern part of section 21 through the western and northern part of the city to the river bank in the northern part of sec. 15, T. 7 N., R. 10 W., and totals about 850 acres. Another remnant of the same terrace extends northward and northwestward from the NE¼ sec. 26 to the river bank in the SW¼ sec. 11, and totals about 750 acres. An area of the second terrace occurs southwest of Anadarko in sec. 28 and the southern part of sec. 21, and totals about 900 acres. The rest of the bottom lands are the present flood plain and total about 4,700 acres in the area of the map. From what is known of other similar areas, it is probable that the ground water can communicate freely between the alluvium and the terrace deposits. Hence the terrace deposits and alluvium can be considered as one water-bearing formation.

The gravels in the alluvium and the terrace deposits are not uniformly distributed under the valley, but are generally in long narrow buried channels that can best be found by test drilling. The sandy portions will also yield water, although less readily than the gravel. Wells in sand may require special construction to exclude sand if they are to produce large volumes of water satisfactorily.

During floods the water from the river channel moves into the alluvium or the terrace deposits adjacent to the river, but in dry seasons the water drains back into the channel. Thus the ground water in the alluvium is likely to have about the same chemical characteristics as the river water, but it is somewhat more uniform at a given locality than the river water, both in chemical composition and temperature, and it is not subject to objectionable tastes and odors caused by algae. However, it is likely to be somewhat less mineralized and therefore better than river water because part of it comes from the rain that falls on the area, and because in places it receives water by underflow from streams draining the adjacent uplands. Tonkawa Creek, which drains about 16,860 acres and empties onto the flood plain about 1.5 miles south of Anadarko, may be expected to contribute good water to the alluvium in its vicinity. Some good water from seeps and springs at the base of the Rush Springs sandstone along the bluffs east of Tonkawa Creek may also percolate underground into the alluvium.

The opportunity for replenishment of the ground water in the alluvium and terrace deposits should be fairly good. Surface runoff should be low because of the flat surfaces with low slopes. Also the areas with sandy soil should favor seepage of rain water into the ground. Occasionally, floods of Washita River may cause recharge to the water supply in the alluvium.

Water in the Rush Springs sandstone member.— The Rush Springs sandstone member underlies large areas both to the southwest and northwest of Anadarko and generally is a good aquifer, although the yield per well is not high. Within the last year the town of Binger has successfully developed two wells in this formation.

The Rush Springs receives water from precipitation in the outcrop area, and loses it naturally through springs, seeps, evaporation, and plant use. It also loses water artifically through wells, but the pumpage to date has been low. The amount of annual recharge to the Rush Springs is not known, but as the formation underlies several hundred square miles, at least a million gallons a day should be available if the wells cover a large area.

In developing the Rush Springs sandstone member, areas should be selected where it is thickest and where it is least dissected by streams into which the water can drain. Secs. 13-30, inclusive, T. 6 N., R. 10 W. (5 to 8 miles south of Anadarko), comprise about the nearest area that fulfills these conditions and is on the same side of the Washita River as the city. In this area the Rush Springs sandstone probably reaches its maximum thickness of about 250 feet. According to reports on farm water wells, the average depth to water is less than 100 feet, hence the saturated part of the formation may be about 150 feet thick. If the permeability of the formation is the same as at Binger and other known areas, a well may yield about 1.5 gallons per minute per foot of drawdown, and up to 100 gallons per minute per well may be obtained. Wells in the Rush Springs should be far enough apart to minimize interference between them. The appropriate spacing depends on the local characteristics of the formation and the output of the wells, which can best be determined by test pumping, but it probably will be on the order of 1,500 feet to 2,500 feet if the formation has the same characteristics as in areas of known conditions.

Deep wells.— Reports are common of wells in the Anadarko area that flowed at the surface, yielding plenty of good water, from depths down to 750 feet. Such reports, however, usually do not adequately indicate the quality of the water, nor do they show whether the quantity is sufficient for the city. In general, the water from such depths is too saline for municipal use, although in some places in Oklahoma good water comes from even greater depths. It is probable that the artesian water near Anadarko is found in the Duncan sandstone, which crops out at the surface near Chickasha. A pumping test made in a well in the Duncan south of Chickasha showed too low a permeability to justify development for the City of Chickasha.

Airport well.— The Anadarko airport is on the upper (second) terrace, and the airport well presumably taps water in the terrace deposit. An analysis of the water from this well should indicate the quality of the ground water in the deposit, and a pumping test of this well would serve to indicate the permeability of the water-bearing materials.

WPA deep well.— The well reported to have been dug for the City of Anadarko by the WPA is not listed in the Geological Survey files. Described as 2 miles west of the city, the well apparently is on the Washita bottoms. It probably taps alluvium or terrace deposits similar to those described above.

Quality of water.— As better water is the primary objective of the Anadarko water-supply committee, and as the quality of the ground water under the bottom lands is likely to differ considerably from place to place, analyses of several samples from the alluvium and from each terrace deposit would provide information on the quality of the water. Preliminary analyses including only the principal constituents of the water can be followed by more complete analyses of samples from especially favorable localities. As the water of the Rush Springs is less variable than that of the alluvial deposits, fewer analyses will be needed to indicate its quality.

Conclusions

There are three potential sources of ground water in the Anadarko area that merit further investigation. They are:

1. The alluvium in the area south and east of the city—about 4,700 acres—which may contain ground water better and softer than river water because of possible underflow from Tonkawa Creek.

2. Terrace deposits at two levels, west, north, and east of the city, that are replenished principally from precipitation and may therefore afford better water than the river or deposits near the river. They total about 2,500 acres.

3. The Rush Springs sandstone, which probably is thickest and least dissected in an area 5 to 8 miles south of Anadarko, will yield water of good quality, but less freely than the alluvium and terrace deposits.

Aquifers 1 and 2 can be developed separately or together. Their water is less mineralized than the river water. Wells in them probably need not be more than 100 feet deep, the pumping lifts will be relatively low, and the yield per well should be several hundred gallons per minute.

Aquifer 3 may contain better water than aquifers 1 and 2, but will yield less per well. Wells will be 200 to 250 feet deep, and pumping lifts will exceed 100 feet. It is expected that wells in aquifer 3 must be farther apart than those in aquifer 1 or 2 if mutual interference between wells is to be minimized.