GROUND WATER IN THE BEGGS AREA, OKMULGEE COUNTY, OKLAHOMA

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This memorandum discusses the geology of the Beggs area in Okmulgee County, Oklahoma, as it is related to the availability of ground water. Geological reports and unpublished data from the files of the Oklahoma Geological Survey, together with local information furnished by R. W. Steinman, Beggs Water Superintendent, are the basis for the statements that follow.

Present Water Supply

The town of Beggs, which in 1940 had a population of 1,283, is in northwestern Okmulgee County, in an area where sandstone ridges have steep escarpments facing eastward, and relatively gentle westward slopes that correspond approximately with the dip of the rocks. The rather broad valleys between the ridges are underlain by shale[1].

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[1] Clark, R. W., Oil and gas in Oklahoma; Okmulgee County: Oklahoma Geol. Survey, Bull. 40, p. 46, 1926.

For many years the town has used surface water impounded in a reservoir in the SE¼ sec. 32, T. 15 N., R. 12 E., which covers about 19 acres and has an average depth of 12 feet. Through the years, the capacity of this reservoir has decreased because of silting and encroachment by weeds. When full, it contains enough water to last about

4 months without replenishment, but this is not sufficient to prevent a shortage of water in late summer and autumn. The maximum daily consumption of water by Beggs is about 108,000 gallons, and the average is about 75,000 gallons.[2] Before taking steps to augment the present supply of surface water, the city officials of Beggs are investigating the possibilities for developing a supply of water from wells.

[2] Steinman, R. W., oral communication.

Ground Water in Bedrock Formations

The bedrock formations that immediately underlie the surface in the Beggs area consist principally of alternating layers of shale and sandstone of Pennsylvanian age. The town is on the outcrop of the Holdenville shale which "has an average thickness of 180 feet", and "is predominantly clay shale with a few thin beds of sandstone".[3] The Holdenville includes a thin limestone that crops out near the top of the hill in the vicinity of the Beggs school.

[3] Clark, R. W., same reference, p. 47.

The Wewoka formation of Pennsylvanian age crops out east of Beggs and east of the Holdenville shale, and as the dip of the rocks is westward a well drilled in the town will encounter the Wewoka underneath the Holdenville. The Wewoka appears to be the most promising of the bedrock formations as a source of water supply. Clark[4] described it as follows:

[4] Clark, R. W., same reference, p. 48.

"The Wewoka formation is about 450 feet thick and is predominately a sandstone with beds of clay shale between the sandstone beds. The lowest member is a sandstone bed about six feet thick that is very persistent in its outcrop. The middle part of the formation is a massive sandstone member that can be traced continuously.....for many miles..... The upper part of the Wewoka formation is more cross-bedded and contains more shale and shaly sandstone than the middle and lower parts. It grades into the overlying Holdenville shale in such a manner as to make the contact quite indefinite."

The following summary of a geological section prepared by Norman D. Newell[5] is based on measurements made in the township north of Beggs.

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[5] Unpublished data, from files of the Oklahoma Geological Survey.

Although the thicknesses probably change as the beds are traced southward to Beggs, this section suggests the different layers that may be expected beginning from the base of the thin limestone in the hill near the school, previously mentioned.

Description of material	Thickness (feet)	Depth below limestone (feet)
1. Shale	7	7
2. Sandstone	43	50
3. Shale	100	150
4. Sandstone	40	190
5. Shale	85	275
6. Sandstone	80	355
7. Sandstone, shaly	40	395
8. Shale	145	540

Tests of wells. In the drilling of oil wells in the Beggs area, drillers have often had difficulty with water from subsurface formations, and this experience has led to the idea that the town might advantageously use wells. Accordingly, four wells were drilled near the present reservoir to prove the adequacy of the ground-water supply. When tested by bailing they seemed adequate, but they failed when pumped at relatively low rates, and the water-bearing sand therefore appears to be unable to furnish enough water for municipal supply.

Subsequently, it was suggested that the Simpson well be tested. This well is north of the northern limit of the town, near the middle of sec. 30, T. 15 N., R. 12 E., about a mile northwest of the reservoir and about 100 feet higher in altitude. It was drilled as an oil well, but proved to be a dry hole and was plugged back to the 310-foot level. Sandstone is reported beginning at about 280 feet, presumably extending downward to 310 feet, and is said to yield water that is soft and not salty. It could not be bailed dry, but on March 9, 1948, had not been tested adequately by pumping.

Although the sandstones of the Beggs area are mostly fine-grained and fairly well cemented, and their permeabilities are correspondingly low, a pumping test of the Simpson well is probably justifiable because this well appears to tap a water-bearing sandstone different from that in the four wells near the Beggs reservoir. This conclusion necessarily involves some guessing, because many details are lacking. By using the altitudes shown on the Nuyaka quadrangle[6] and the reported depths of

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[6] U. S. Geol. Survey topographic map, edition of 1901, reprinted 1925.

wells and depths to sandstone beds, a comparative table was prepared, which indicates that the sandstone in the Simpson well is probably higher in the formation than the water-bearing sandstone at the reservoir.

Comparison of altitudes, Simpson well and wells at Beggs reservoir

	Simpson well	Wells at reservoir
Surface altitude (estimated)	800	700
Depth to top of water-bearing sand	280	250
Altitude of top of water-bearing sand	520	450
Depth to bottom of well	310	290
Altitude of bottom of well	490	410

As the dip of the rocks in the Beggs area is westward and the Simpson well is farther west than the reservoir, the sandstone in the wells at the reservoir probably is below the present bottom of the Simpson well.

It is estimated that the Simpson well begins about 20 feet above the base of the limestone that crops out near the Beggs school. Therefore the water-bearing sandstone 280 feet below the surface is about 260 feet below the base of the limestone. It may possibly correspond with unit 6 of Newell's section, and may also be the prominent cliff-forming sandstone that crops out 3 or 4 miles east of Beggs. As it is the thickest of the sandstones, it probably offers the best opportunity in the area for developing a supply of ground water from bedrock formations. Whether it was penetrated in the test wells at the Beggs reservoir and contributed water to them is not clear because drilling and casing records are inadequate, but even if it was, a pumping test in the Simpson well is

justifiable on the basis that in it the sandstone may be more permeable. The well offers a ready-made opportunity for a test that might otherwise be considered too expensive.

Ground Water in Alluvium

In many parts of Oklahoma where the bedrocks are too fine-grained or too well-cemented to yield water freely, enough water for small municipal supplies may be obtained from alluvium, which is the material deposited by a stream. It may consist of gravel, sand, and clay in any proportion, and it underlies the flood plain, or "bottom". It is generally thickest near the middle of a valley, and thinnest where the flood plain adjoins the bluffs. It may be more than 100 feet in thickness along major rivers, but only a few feet along small creeks. It generally is an excellent water-bearing formation, both because the coarser beds in it will transmit water freely and because replenishment of the ground-water supply is likely to be greater in the valley than in adjacent areas.

Alluvium that may be extensive enough and thick enough to yield an adequate supply of ground water may be found along Checkerboard Creek, between 2 and 3 miles west of Beggs. Information on the depth to the water in this area is not available, but, in general, ground water occurs at shallow depths in such locations. The quality of the water in alluvial deposits differs greatly from place to place, depending on local conditions, and no general statement can be made that is applicable to specific locations, such as Checkerboard Creek. In places, the disposal of oilfield brines into creeks has contaminated the ground water in the alluvium, but no evidence is at hand showing whether such contamination has occurred along Checkerboard Creek.

Conclusions

The town of Beggs is underlain by the Holdenville shale, which contains little coarse material and therefore is a poor water-bearing formation, but under it is the Wewoka formation, including several layers of sandstone.

Although in general the sandstones in the Beggs area are fine-grained and rather well cemented, and accordingly have low permeabilities, they are moderately thick and may yield enough water for a small municipal supply. Tests made in four wells at the town reservoir indicated the inadequacy of the sandstones penetrated by those wells, but the Simpson well, just north of the city limits, seems to penetrate a higher sandstone that may justify further testing. The sandstone in the Simpson well is said to have been encountered beginning a t a depth of 280 feet.

The alluvium along Checkerboard Creek is also a possible source of ground water in the Beggs area, but detailed information on the quality and quantity of water are lacking.