Form 9-014

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

GROUND-WATER CONDITIONS IN THE VICINITY OF BLACK RIVER VILLAGE, EDDY COUNTY, NEW MEXICO

By
Eugene H. Herrick

Prepared in cooperation with the
NEW MEXICO STATE ENGINEER

November 1951

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IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Ground Water Branch
Box 302, University Station
Albuquerque, N. Mex.

April 26, 1957

Mr. Steve E. Reynolds
State Engineer
P. O. Box 1079
Santa Fe, N. Mex.

Dear Steve:

Enclosed are the original and a carbon copy of a short report entitled "Ground-water conditions in the vicinity of Black River Village, Eddy County, New Mexico" by E. H. Herrick. The report has been approved by Washington for publication by your office if you should desire to include it among the short reports that Mr. Yates says are planned for publication by your office. You will note that the report was originally written in November 1951. That date has been retained because the data contained in the report, such as depths to water in wells, have not been revised. However, more recent work in the general area indicates that no marked changes have taken place since this report was written.

Yours very truly,

Clyde

Clyde S. Conover
District Engineer-GW

CSC:lb
Enclosure

UNITED STATES
DEPARTMENT OF THE INTERIOR
Geological Survey

GROUND-WATER CONDITIONS IN THE VICINITY OF BLACK RIVER VILLAGE, EDDY COUNTY, NEW MEXICO

By
Eugene H. Herrick
U. S. Geological Survey

November 1951

As a part of a statewide investigation of ground-water conditions in New Mexico carried on in cooperation with the New Mexico State Engineer, the writer, on August 9, 10, and 11, 1951, made a brief study of ground-water conditions in secs. 13, 14, 23, and 24, T. 24 S., R. 26 E., north and west of Black River Village in Eddy County, N. Mex., to determine whether withdrawals of ground water in that area would affect the flow of the Black River. During the investigation all known wells and several springs in the vicinity were visited, depths to water in the wells were measured, altitudes of the wells and springs were determined with an aneroid barometer, and the geology of the area was studied.

The land surface north and west of the Black River in this area slopes gently southeast, toward the river (fig. 1). The area is underlain by alluvium which in places has a thickness of nearly 100 feet. The alluvium consists of silty clay, sand, gravel, caliche, and, in places at the base, conglomerate which shows a great amount of slumping and fracturing where it is exposed along the Black River. Bretz and Horberg (1949) have presented evidence to show that the conglomerate, which is similar to the quartzose conglomerate of the Roswell basin, may represent the basal part of the Ogallala formation of Pliocene age, rather than a valley deposit of early Pleistocene age. Underlying the alluvium are gypseous strata of Permian age.

The Black River is a perennial stream below Blue Spring, from which it derives a large part of its flow (fig. 1). Blue Spring is actually a series of springs in secs. 27 and 28, T. 24 S., R. 26 E. These springs maintain a flow of 10 to 15 (cubic feet of water per second) (Hale, 1945). Some of the flow in the Black River originates in springs along the river above its junction with the flow from Blue Spring, and in several springs at and below Castle Spring in sec. 23. There are also a few small springs along the banks of the river in the vicinity of Black River Village in the western part of sec. 24. During the irrigation season the flow of Blue Spring to Black River is reduced considerably by diversion of some of the water to irrigate the 1,180 acres of land at Blue Spring Farm in the north-central part of sec. 23.

The attached sketch map (fig. 1) shows the location of the wells, contours on the land surface, and contours on the water table in the alluvium. The surface contours were taken from topographic maps of the U. S. Geological Survey. The contours on the water table are based on data obtained during the investigation and represent, so far as could be determined, the altitude of the water table when not affected by pumping. Some minor inaccuracies may exist in the detailed configuration of the water-table contours because of pumping effects, but the overall shape of the contours is believed to be essentially correct. In order to obtain a better picture of the water table it would be necessary to measure the depths to water in the various wells probably not less than 12 hours after all pumping has ceased, so that the water would have time to return more nearly to the nonpumping level. The pumps at the wells in the NW¼NW¼NW¼ and SW¼NW¼NW¼ sec. 24 and in the NW¼NE¼SE¼ sec. 23 were shut off at about 6:00 p.m. on August 9 and depths to water were measured in these wells between 5:00 and 6:00 a.m. on August 10. Wells in the NW¼NW¼SW¼ sec. 24 and SE¼NE¼ sec. 23 were pumped continuously; therefore the water-level measurements in them were affected by the pumping. However, nonpumping water levels in those two latter wells had been obtained previously and were used in plotting the altitude of the water table. Altitudes of the land surface determined at the wells and springs are believed to be accurate within 5 feet.

The contours on the water-table show that the ground water flows southeastward to the Black River. Apparently the ground water in the alluvium in this general region is derived by recharge directly from precipitation within the Black River drainage basin. However, in the particular area investigated, a considerable part of the recharge to the ground water is excess irrigation water diverted onto the land from Blue Spring. That this irrigation water must contribute appreciably to the local ground-water body is shown by the fluctuation, as reported locally, in the flow of the upper Castle Spring in the NW$\frac{1}{4}$SE$\frac{1}{4}$ sec. 23. During the irrigation season that spring yields somewhat less than 1 cubic foot of water per second, and a small pond forms where the flow of the spring is partially dammed. Local residents report that the upper spring nearly ceases to flow after irrigation ceases. It is reported also that the upper spring did not even exist until irrigation was commenced at Blue Spring Farm several years ago. Castle Spring proper, which lies several hundred feet down the draw from the upper spring, apparently is permanent, although it is reported that some seasonal fluctuation has been observed.

Approximately 1,600 acres of land in secs. 13, 14, 23, and 24 is under irrigation. The greater part of this area, about 1,180 acres, is irrigated by water diverted from Blue Spring. The remainder is irrigated with water from five shallow wells in the eastern part of sec. 23 and western part of sec. 24.

Records of the wells in the area are given in the attached table (table 1). It was not possible to obtain accurate logs of the wells, but, from information obtained from the owners of the wells, it is believed that all wells are producing water from the alluvium.

Pumping of the wells withdraws ground water that otherwise would be discharged naturally by the springs. Pumping is a new discharge imposed upon the ground-water system, and if it is to be perennial it must be made up by an equivalent decrease in the natural discharge from the system, by an increase in recharge to the system, or by a combination of the two. If the amount of pumping exceeds what can be made up by increased recharge and decreased spring discharge, the excess water will be derived from ground-water storage and the withdrawal will be manifested by a declining water table (Theis, 1940).

Because the direct recharge to the ground water in this area is dependent largely upon the amount of infiltration of irrigation water brought from Blue Spring and upon infiltration of precipitation, pumping cannot be expected to result in an increase in the recharge to the ground water. Thus the pumping will be made up mostly by a decrease in the discharge to the Black River.

The decrease in spring flow will not occur immediately because the movement of the ground water is slow, and generally considerable time is necessary for the effects of pumping to manifest themselves. Because of this lag and because of the general practice of pumping intermittently for irrigation, the effect upon the springs would be difficult to predict quantitatively. Such a determination would be further complicated by the lack of records of spring flow prior to the period of ground-water development and the fact that much of the ultimate development has already occurred. However, carefully controlled and properly interpreted pumping tests would aid in estimating the expected effects of the pumping.

Because of these conditions, it is concluded that additional pumping in the area will eventually result in a decrease in the ground water that now reaches the river by an amount equal to the total pumpage less that returned to the ground-water body by percolation from the land irrigated with ground water.

REFERENCES CITED

Bretz, J. H., and Horberg, C. L., 1949, The Ogallala formation west of the Llano Estacado: Jour. Geology, v. 57, no. 5, p. 478.

Hale, W. E., 1945, Ground-water conditions in the vicinity of Carlsbad, N. Mex.: ~~Unpublished report in the open files of the Ground Water Branch, U. S. Geol. Survey, Albuquerque, N. Mex., p. 9, 10.~~

Theis, C. V., 1940, The source of water derived from wells: Civil Eng., v. 10, no. 5, p. 277-280.

Table 1.--Records of wells in the vicinity of Black River Village, Eddy County, N. Mex.

Location	Owner	Year completed	Topographic situation	Altitude above sea level (feet) 1/	Depth of well (feet)	Water level: Depth below land surface (feet)	Water level: Date of measurement	Principal water-bearing bed	Method of lift 2/	Use of water 3/
T. 24 S., R. 26 E.										
NW(?)¼NE¼ sec. 23	A. J. Crawford	-	Terrace	3,270	-	24.5	8/10/51	Alluvium	EP	D,S
SE¼NE¼ sec. 23	do.	1937	do.	3,270	-	27.1	10/27/47	do.	EP	I
NW¼NE¼SE¼ sec. 23	Dean Smith	1945	do.	3,270	57	36.3	8/10/51	do.	EP	I
NW¼NW¼NW¼ sec. 24	do.	1951	do.	3,265	70	34.2	8/10/51	do.	GP	I
SW¼NW¼NW¼ sec. 24	do.	1947	do.	3,265	74	32.3	8/10/51	do.	GP	I
SW¼NW¼ sec. 24	Walker Hood	-	do.	3,230	31	14.0	8/10/51	do.	EP	D
NW¼NW¼SW¼ sec. 24	A. J. Crawford	-	do.	3,240	-	23.4	7/19/51	do.	EP	I
NE¼NW¼ sec. 32	Thomas-Jones	-	Plain	3,430	200	109.7	8/11/51	do.(?)	EP	D
T. 24 S., R. 27 E.										
SW¼SW¼SW¼ sec. 18	J. F. Forehand	1940	Terrace	3,200	38	28.1	7/19/51	Alluvium	GP	S,I

1/ Determined with an aneroid barometer to nearest 5 feet.

2/ EP - Electrically driven pump.
GP - Gasoline or natural-gas motor-driven pump.

3/ D - Domestic.
S - Stock.
I - Irrigation.

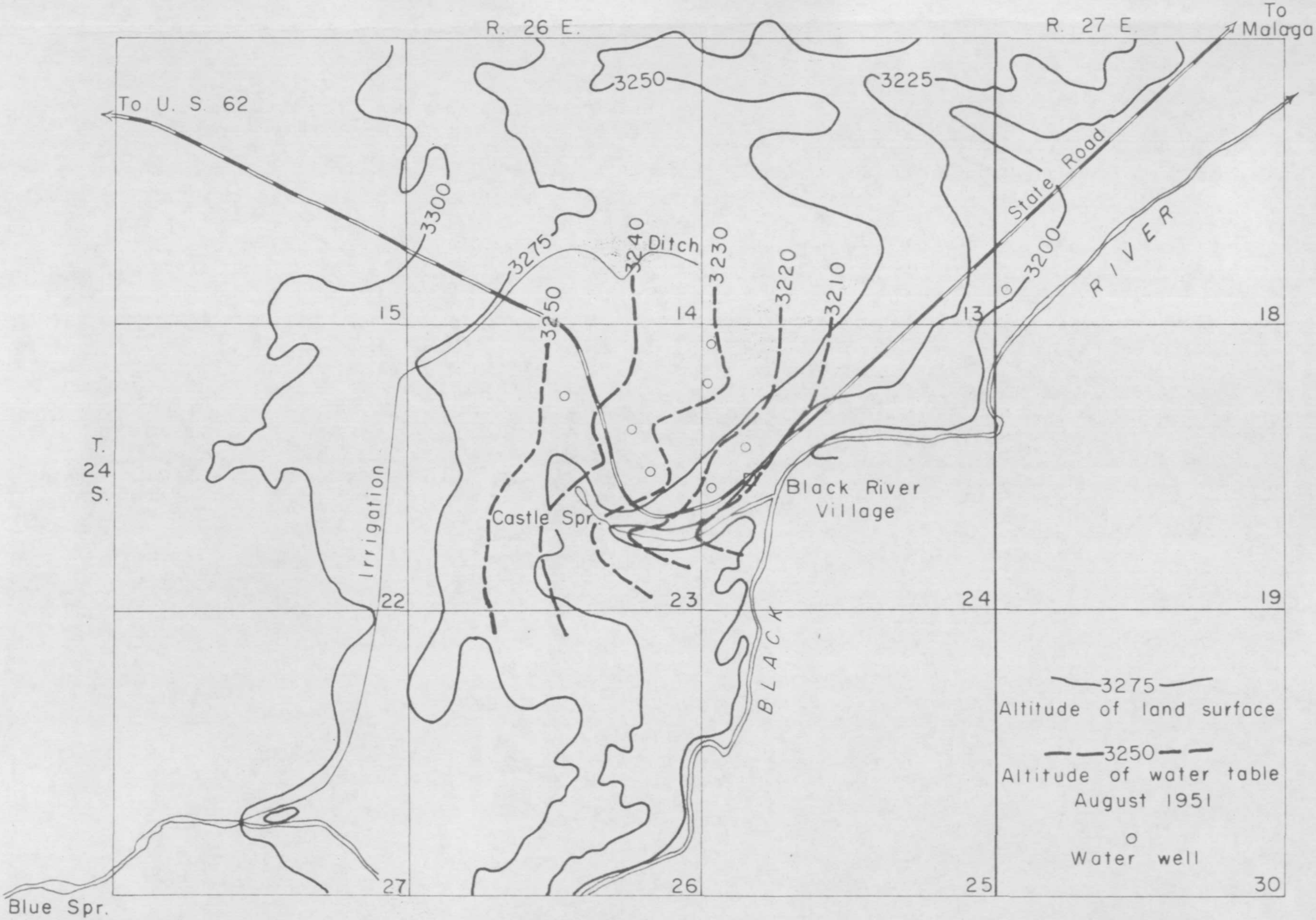

Figure 1.--Sketch map of topography and water table in vicinity of Black River Village, Eddy County, N. Mex.