Water supplies near Carrizozo, New Mexico

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WATER SUPPLIES NEAR CARRIZOZO, NEW MEXICO

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INTRODUCTION

The problem of a potable water supply has plagued the town of Carrizozo since the days of early settlement and has limited population growth and economic development of Carrizozo and also of adjacent areas within the northern part of the Tularosa Basin.

Perennial streams and permanent bodies of surface water are absent in the Carrizozo area. Most of the ground water in the area is saline and contains sulfate and chloride ions that give the water an objectionable taste; however, the water generally is suitable for stock and for irrigation uses. Gypsum, derived chiefly from the rocks of Permian age that ring the basin, is a common component of the formations that are aquifers near Carrizozo and is the chief source of the saline constituents in the ground water.

OCCURRENCE OF GROUND WATER

Ground water is relatively abundant near Carrizozo and occurs at shallow depths within the alluvium of Quaternary age. This alluvium covers older rocks of the basin floor between the mountains to the east and the Malpais (lava flow) to the west. Wells drilled into the alluvium to depths of 100 to 200 feet in this area yield as much as 400 gpm (gallons per minute). The underlying rocks of the Mesaverde Group of Late Cretaceous age contain sandstone beds that also are aquifers. Southwest of Carrizozo and near Nogal impermeable strata in the eastward-dipping rocks of Cretaceous age, and intrusive rocks of Tertiary age, commonly form ground-water barriers that raise the ground-water levels, and in places the water flows at the surface as springs.

Ground water in the alluvium is under water-table conditions. In rocks of Cretaceous age in the Carrizozo area the ground water is under different degrees of artesian pressure, although in much of the area the pressure is negligible. The shallower Cretaceous aquifers probably are in hydraulic connection with the alluvium. The water table slopes from the mountains toward the valley. Near the mountains the depth of water is about 100 feet. Away from the mountains, as the altitude of the land surface decreases, the depth to water is shallower. The ground water generally moves westward and northwestward towards the Malpais and thence generally southwestward beneath the lava, which occupies a topographic low near the middle of the basin.

The ground-water reservoir in the alluvium near Carrizozo is recharged by precipitation and by runoff from the mountains. About 40,000 acre-feet (13 billion gallons) of runoff water per year is available for recharge, but most of this runoff does not reach the aquifer because of evaporation and transpiration. Recharge to the Cretaceous aquifers is by precipitation on their outcrops, downward leakage from the alluvium, and from precipitation on the malpais where these rocks overlie sandstone. Annual precipitation on that part of the lava west of Carrizozo is about 20,000 acre-feet (6.5 billion gallons). Because of almost no runoff from the lava and the absence of vegetation, most of the precipitation is available for recharge.

HISTORY OF DEVELOPMENT

The first recorded attempt to obtain water of good quality at Carrizozo was made by the El Paso and Northeastern Railroad Co. (later to become part of the El Paso and Southwestern Railway Co. system). In 1901 a well was drilled in the railroad yards at Carrizozo to a depth of 895 feet. The well tapped Cretaceous sandstones, which yielded about 50 gpm from a pumping level of 400 feet below land surface. The non-pumping water level in the well was 90 feet below the surface. By 1906 the railway company had constructed two, and possibly three, additional wells at this location, the deepest of which was 1,125 feet. The water obtained from these wells is reported to have been softer and to have contained less sulfate and chloride than water from shallower aquifers; however, the presence of several hundred parts per million of sodium carbonate and sodium sulfate made it undesirable for drinking. The water was used by the railway company in locomotive boilers for several years.

In addition to the wells at Carrizozo the railway company drilled several other deep wells along its route from El Paso to Tucumcari during or shortly after construction of the railroad. Most of the wells yielded water of very poor quality. Water from the wells at Carrizozo was of better quality than that obtained from wells between Carrizozo and Santa Rosa, although the water was not ideal for boiler use. In a discussion of the water supply for this stretch of the railroad Campbell (1910, p. 164) states, "After the most thorough practicable treatment the well waters were still so bad that they caused violent foaming, low steam pressure, hard scaling, rapid destruction of boiler tubes, high coal consumption, extraordinary engine failures and repairs, small engine mileage, low train tonnage, excessive overtime, and a demoralized train service."

Mr. Campbell was directed by the railway company to find, if possible, a supply of good water. His efforts were successful, and by February 20, 1908 the Bonito pipeline was constructed and began supplying surface water of good quality to stations from Carrizozo north through Vaughn to Pastura, N. Mex.

The new source of water supply for the railroad, which was also made available in limited quantities to the inhabitants of settlements along the railroad, replaced the supply obtained from wells, and caused most of the wells to be abandoned and ultimately destroyed.

The source of the surface water was the South Fork of Rio Bonito, about 15 miles southeast of Carrizozo, on the eastern slope of Sierra Blanca. The stream was

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diverted by a small concrete dam into a pipeline that carried the water to storage in a natural basin about two miles southeast of the village of Nogal. The lake thus formed was first called Nogal Reservoir and later Nogal Lake. Nogal Lake was originally half a mile in diameter at the surface, a quarter of a mile in diameter on the bottom, had a depth of 36 feet, and had a storage capacity of 422 million gallons. The sides of the basin were puddled by working 300 to 400 cattle around the shore line until most of the leakage was eliminated. Campbell (1910, p. 176) states that the total puddling required two seasons and utilized 11,150 cow days.

From Nogal Lake the pipeline dropped abruptly to the alluvial plain, reached the railroad 12 miles north of Carrizozo at the station of Coyote, and extended from there northward. A branch line carried water to Carrizozo. The water-supply system included 116 miles of wood-stave pipe of diameters ranging from 16 down to 3½ inches, and 19 miles of iron pipe of 12-inch diameter. Service reservoirs of 2½ million gallons capacity were installed at Carrizozo, Coyote, Luna, and Corona and pumping plants were operated at Coyote and Luna.

By 1930-31 Nogal Lake had developed excessive leakage at high stages and its effective storage was reduced to about 163 million gallons. At this time the Southern Pacific Co., which had assumed operation of the railroad lines, constructed a dam across Rio Bonito below the junction of Bonito Creek and the South Fork of Rio Bonito to provide supplemental storage for the pipeline water system. The dam is constructed of rock with a concrete apron on the upstream face. It is 480 feet long on the crest and has a maximum height of 111 feet. The lake, called Bonito Lake, had an initial capacity of 400 million gallons. Since construction of Bonito Lake, only occasional use has been made of the water stored in Nogal Lake.

The conversion by the early 1950's to diesel locomotives made the operation of the water-supply system unnecessary by the railway companies. In 1955 the El Paso and Rock Island Railway Co., as owner, and the Southern Pacific Co., as lessee, made application to the State Engineer of New Mexico to make transfers of water rights from Bonito Lake. Permission was granted in July of 1955 for the transfer of about 1,450 acre-feet per year (470 million gallons) to the United States of America for the use of Holloman Development Center, and a like amount to the City of Alamogordo. The Town of Carrizozo was transferred rights to about 120 acre-feet per year (39 million gallons) and the Nogal Water Users Association received rights to 1.45 acre-feet per year (470 thousand gallons). Reserved to the railway companies were about 58 acre-feet per year (19 million gallons) to supply existing and long-standing water committments by the Southern Pacific Co. to water users associations, towns, villages, and communities northeast of Carrizozo to Pastura, N. Mex., by tank-car deliveries until such time as these water users could build their own water system.

In 1957, following the transfer of these water rights, a new iron pipeline was constructed by the U.S. Air Force for Holloman Air Development Center, from Bonito Lake along a route northwestward through Carrizozo and thence southwestward generally following U.S. Highway 54 to Alamogordo—a distance of about 80 miles. At Alamogordo the lake water is mixed with ground water of inferior quality (water that contains between 250 and 500 ppm of either sulfate or chloride ions and less than 750 ppm of the two together) to supply a larger quantity of water yet maintain a quality acceptable for most uses. The City of Alamogordo and Holloman Air Development Center share equally the water obtained through the pipeline from Bonito Lake. In addition to water from the lake, a private well near Carrizozo has been used on occasion to supplement flow in the pipeline.

PRESENT GROUND-WATER DEVELOPMENT

About 100 wells are in operation near Carrizozo. The wells range in depth from about 50 to 300 feet. The principal use of water is for public supply and for domestic and stock purposes. About a dozen wells are used for irrigation of crops. Use of water by industry is negligible. Stock and domestic wells are pumped at rates of only a few gpm. Irrigation and public-supply wells are pumped at rates of 60 to 500 gpm. The largest water withdrawal is at a locality about a mile south of Carrizozo, where two municipal wells and one private well tap a thick section of alluvium that yields 400 gpm or more to each well. All of the wells are finished in alluvium at depths of 140 feet. The water is hard and is high in sulfate ions; however, it is of better quality than ground water found at other locations within the area.

POTENTIAL GROUND-WATER DEVELOPMENT

On the basis of presently available information, about 20,000 acre-feet (6.5 billion gallons) per year of water could be obtained from wells in the Carrizozo area. Most of this water would be of inferior quality. As water-treatment processes become more refined and less costly, and as the population growth demands better economic development of thinly-settled areas, water now unused because of its quality may become a valuable resource.

SELECTED REFERENCES

Campbell, J. L., 1910, The water supply of the El Paso and Southwestern Railway from Carrizozo to Santa Rosa, N. Mex.: Am. Soc.-Civil Eng. Trans., Vol. 70, p. 164-189.

Cooper, J. B., 1959, Ground water in the vicinity of Carrizozo, Lincoln County, N. Mex.: U.S. Geol. Survey open-file rept., 45 p., 1 pl., 2 figs. (typewritten).

Dinwiddie, G. A., 1963, Municipal and community water supplies in southeastern N. Mex.: N. Mex. State Engineer Technical Rept. 29A, 140 p., 38 figs.

Hendrickson, G. E., 1949, Ground-water resources of the Carrizozo area, N. Mex.: U.S. Geol. Survey open-file rept., 14 p., 1 fig. (typewritten).

Meinzer, O. E. and Hare, R. F., 1915, Geology and water resources of Tularosa Basin, N. Mex.: U.S. Geol. Survey Water-Supply Paper 343, 317 p., 19 pls.