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SALINE GROUND WATER IN THE TULAROSA BASIN, NEW MEXICO*

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The saline water in the Tularosa Basin has recently become of interest as a source of feed water for desalting plants. A study of this resource has been conducted by the U.S. Geological Survey for the Office of Saline Water (McLean, 1970). Some of the many previous studies include those of Conover and others (1955), Cooper (1965), Herrick and Davis (1965), and Garza and McLean (1972). Other studies and test drilling for White Sands Missile Range have provided data on the extent of the saline water zones.

The complexly faulted graben of the central Tularosa Basin contains more than 6,000 ft of bolson-fill deposits; more than 90 percent of these deposits are saturated with saline water.

Fresh water containing less than 1,000 mg/l (milligrams per litre) dissolved solids occurs only in two zones adjacent to the mountain fronts on the east and west sides of the south part of the basin (Fig. 1). These fresh-water zones supply White Sands Missile Range Headquarters and part of the water requirements of Alamogordo and Holloman Air Force Base. The slightly saline water zone (1,000 to 3,000 mg/l) is utilized by the towns of Carrizozo and Tularosa and also supplies part of the water for irrigation of about 2,500 acres near Tularosa (Garza and McLean, 1972). Water characterized as moderately saline, highly saline, or brine (containing 3,000-10,000, 10,000-35,000, and more than 35,000 mg/l dissolved solids, respectively) is not ordinarily used.

In the southern part of the basin, the slightly and moderately saline zones are zones of transition between the fresh-water lens in the alluvial fans and the moderately to highly saline water in the center of the basin (Fig. 2).

The bolson-fill aquifer is primarily recharged by the ephemeral streams which drain the surrounding mountains and discharge across the permeable alluvial fans at the mouths of steep canyons, and by underflow in these canyons which enters the alluvial fan directly. Flood waters which pass beyond toe of the alluvial fan are probably evaporated, with little infiltration taking place in the center of the basin.

The quality of the water in the bolson fill is directly related to the rock types exposed in adjacent drainage areas. The dissolved solids content of the water in streams is dependent on the solubility of the rocks in the drainage area. The alluvial fans into which the flood flows infiltrate are composed of alluvium derived from the same drainage area. This alluvium is a source of additional dissolved solids in the ground water. For example, the water in the Rio Tularosa usually contains 1,100-1,700 mg/l dissolved solids, while ground water in the alluvial deposits near Tularosa contains 2,000 to 4,000 mg/l. Figure 1 shows the relationship between water quality and ock types. The freshest water in the basin is at White Sands Missile Range headquarters where a calcium bicarbonate type water containing about 300 mg/l is adjacent to the quartz monzonite of the Organ Mountains. The bolson fill south of Alamogordo near the limestone, dolomite, and sandstone of Paleozoic age contains a calcium bicarbonate or calcium magnesium bicarbonate type water with variable amounts of calcium sulfate and an average dissolved solids concentration of about 700 mg/l. The slightly saline zone in the north part of the basin, adjacent to the gypsiferous upper part of the San Andres Limestone and the Yeso Formation is a calcium sulfate type water.

Some of the ground water moving through the alluvial fans discharges as springs near the toes of the fans. Evaporation from the shallow water table and from spring discharge produces a zone of variable salinity near the toes of the alluvial fans. Here more saline water locally overlies fresher water. The playa and playa-margin deposits in the center of the basin contain saline waters which have been highly concentrated by evaporation. Locally, some of these waters approach saturated sodium chloride brines. This concentration has been active in the past as indicated by the water samples from White Sands Missile Range test well T-14. This well was drilled to a depth of 6,015 ft about 4 mi northeast of the White Sands Missile Range headquarters. It penetrated mostly fine-grained lake-bed deposits to a depth of at least 5,200 ft. Below a depth of 360 ft, the water in these deposits contained from 44,300 to 112,000 mg/l of dissolved solids (Doty and Cooper, 1970). We may infer from this that deep drilling elsewhere in the basin would encounter mostly highly saline water to brine.

Well yields in the bolson deposits are variable and range from 1,400 gpm (gallons per minute) high on the alluvial fans to 100 gpm or less on the toes of the alluvial fans. The transmissivity of the fans is about 1,300 ft^2/day (feet squared per day). No aquifer tests have been conducted in the predominantly fine-grained deposits of the central part of the basin, but a wide range of transmissivities can be expected depending on whether silt and clay, fine sand, or bedded gypsum is encountered in test wells.

*Publication approved by Director, U.S. Geological Survey.

REFERENCES

Conover, C. S., Herrick, E. H., Hood, J. W., and Weir, J. E., Jr., 1955, The occurrence of ground water in south-central New Mexico, *in* South-Central New Mexico: New Mex. Geol. Soc. Guidebook 6, p. 108-120.

Cooper, J. B., 1965, Ground-water resources of the northern Tularosa Basin near Carrizozo, Lincoln County, New Mexico: U.S. Geol. Survey HA-193, 1 p.

Doty, G. C., and Cooper, J. B., 1970, Stratigraphic test well T-14, Post Area, White Sands Missile Range, Dona Ana County, New Mexico: U.S. Geological Survey open-file report, 34 p.

Garza, Sergio, and McLean, J. S., 1972, Fresh-water resources of the east side of the Tularosa Basin, New Mexico: U.S. Geol. Survey open-file report, 126 p.

Herrick, E. H., and Davis, L. V., 1965, Availability of ground water in the Tularosa Basin and adjoining areas, New Mexico and Texas: U.S. Geol. Survey HA-191, 2 p.

McLean, J. S., 1970, Saline ground-water resources of the Tularosa Basin, New Mexico: Office of Saline Water Research and Devel. Prog. Rept. No. 561, 128 p.

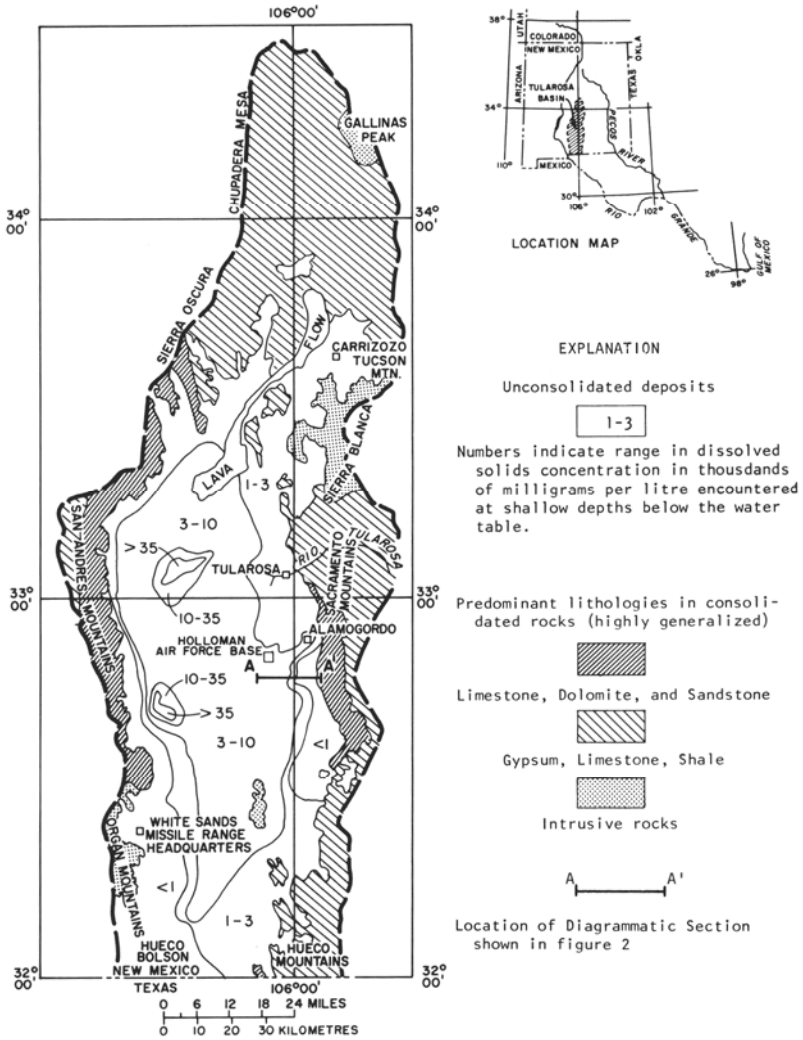

Figure 1. Water-quality zones and consolidated rock lithologies in the Tularosa Basin.

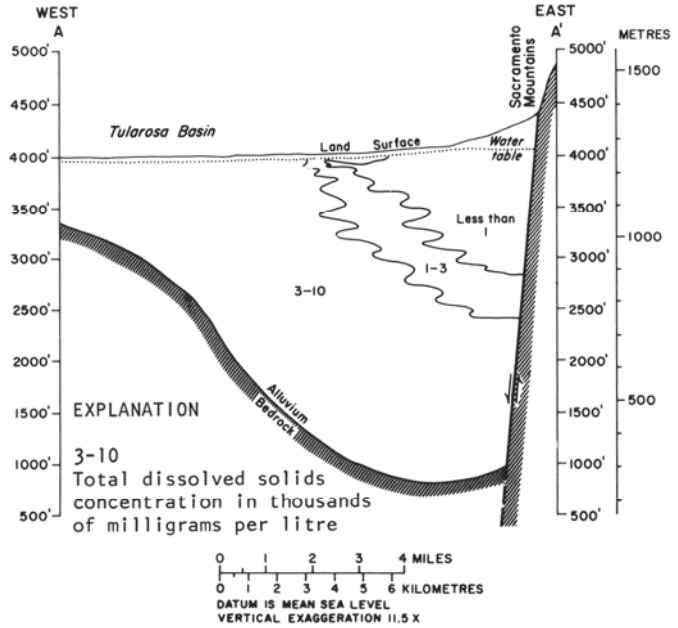

Figure 2. Diagrammatic section A-A: showing water-quality zones south of Alamogordo.