

OBJECTIVES OF A CURRENT STUDY OF SALINE GROUND WATER IN THE
TULAROSA BASIN, NEW MEXICO

J. S. McLean^{1/}

The Tularosa Basin, a north-trending valley in south-central New Mexico, covers an area of 6,500 square miles and comprises about 5 percent of the Rio Grande drainage basin in the United States. The communities of Alamo-gordo, Tularosa, and Carrizozo with a total population of about 28,000 are in the basin, as are Holloman Air Force Base, White Sands National Monument, and part of White Sands Missile Range and Fort Bliss Military Reservation (fig. 1).

Average monthly temperatures in the central part of the basin range from 40°F in January to 79°F in July. Average rainfall ranges from about 8 inches in the central part of the basin to about 25 inches on the high mountain slopes.

The Tularosa Basin is bounded on the west by the Organ and San Andres Mountains, the Sierra Oscura, and Chupadera Mesa; on the east by the Hueco and Sacramento Mountains, Tucson Mountain, Gallinas Peak, and the Sierra Blanca; on the north by a high topographic divide; and on the south by a low, almost imperceptible topographic divide separating the Tularosa Basin from the Hueco Bolson in Texas (fig. 2).

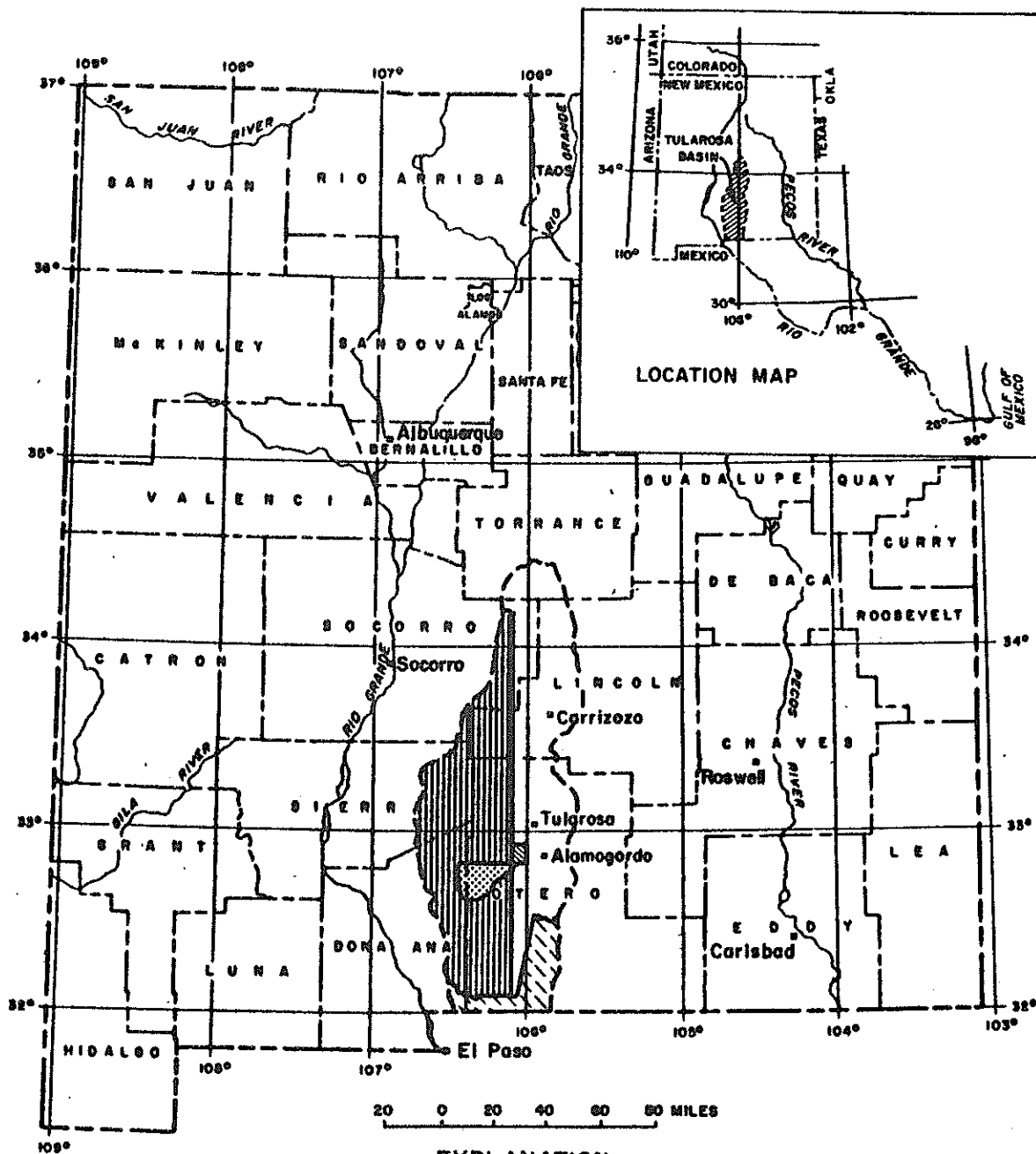
The Tularosa Basin is a structural trough, or graben, initiated in mid-Tertiary time in rocks ranging in age from Precambrian through early Tertiary (fig. 3). The trough has filled with alluvial detritus, some of which was ultimately deposited in lakes of mid-tertiary to Holocene in age. This alluvial fill, more than 6,000 feet thick in the south-central part, is the most important aquifer in the basin.

Fresh ground-water supplies in the Tularosa Basin are limited and will be insufficient for future needs if withdrawals continue at present rates or increase. Less than 2/10 of 1 percent of the alluvial fill in the basin is saturated with fresh water which is present in alluvial fan materials in the margins of the basin. The rest of the saturated alluvium contains saline water, with a dissolved-solids content as high as 112 grams per liter.

The large volumes of saline ground water present in the alluvial deposits in most of the basin are a potential source of water for desalting.

A study of the saline-water resources of the Tularosa Basin was begun in July 1968 by the U. S. Geological Survey in cooperation with the New Mexico State Engineer and the Office of Saline Water, Department of the Interior. This study is part of a joint effort by State and Federal agencies to prepare an analysis of the saline-water resources of the basin and an estimate of their potential for economic development. The economic

^{1/} Hydrologist, U. S. Geological Survey, Albuquerque, New Mexico



EXPLANATION

Tularosa Basin
watershed boundary





- | | | | |
|---|---|---|---|
|  |  |  |  |
| White Sands
National Monument | Holloman Air
Force Base | White Sands
Missile Range | Ft. Bliss Military
Reservation |

Figure 1.--Index map.

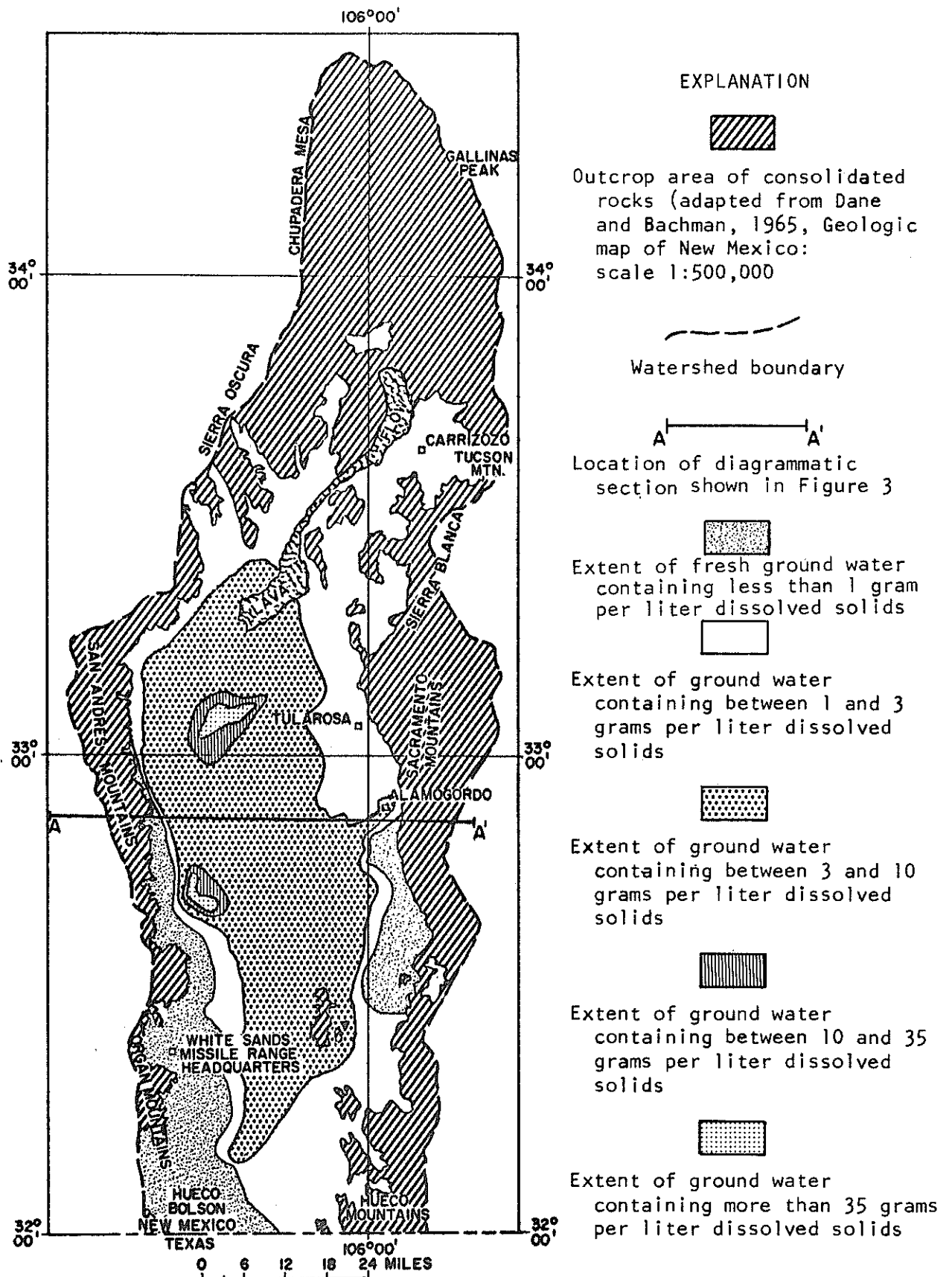
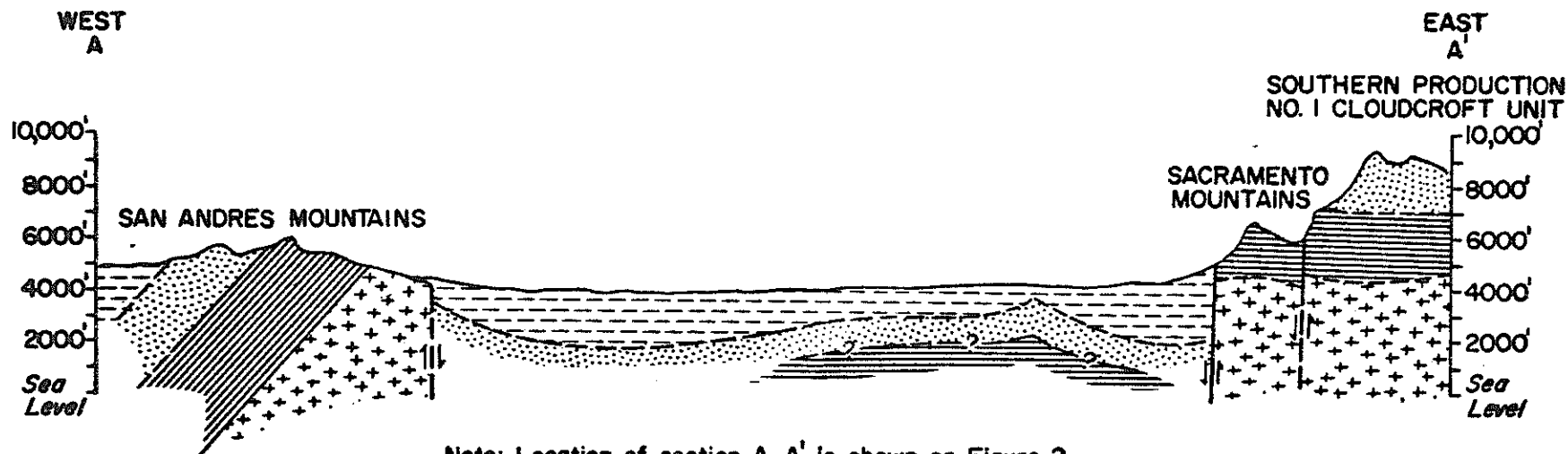


Figure 2.--Map of the Tularosa Basin, New Mexico showing the outcrop area of consolidated rocks and the extent of water-quality zones encountered immediately below the water table.



Note: Location of section A-A' is shown on Figure 2.

-86-

0 5 10 MILES
Vertical exaggeration 6.35:1

EXPLANATION






- | | | | |
|---|--|--|--|
|  |  |  |  |
| Cambrian, Ordovician,
Silurian, Devonian
Mississippian, and
Pennsylvanian age | Permian age | Cenozoic alluvium
and lake deposits | Intrusive rocks of
Tertiary, Cretaceous
or Precambrian age |
| 
Fault
Dashed where approximate, arrows
indicate relative movement | | | |

Figure 3.--Section A-A' showing geologic divisions west to east through the Tularosa Basin

analysis of the development and use of the saline water resources is being conducted by the New Mexico Water Resources Research Institute under the direction of H. R. Stucky, in cooperation with the Office of Saline Water and the Office of Water Resources Research.

Other current studies which will contribute to the knowledge of the water resources in the Tularosa Basin are: a study of Lake Lucero, a large playa or "dry lake" in the center of the basin, by W. K. Summers of the New Mexico Institute of Mining and Technology; a pilot study of the saline ground water resources of the Rio Grande Basin by T. E. Kelly, B. N. Meyers, and L. A. Hershey of the U. S. Geological Survey in cooperation with the Office of Saline Water; and a study of the fresh-water resources of the eastern margin of the Tularosa Basin by S. Garza and J. S. McLean of the U. S. Geological Survey in cooperation with the New Mexico State Engineer.

The objectives of this study of the saline-water resources of the Tularosa Basin were to delineate the extent and volume of saline-water zones of specified ranges in concentration; to determine the yields of present wells; and to estimate the potential yields of future wells completed in the saline-water zones. For this study, fresh water was defined as water containing less than 1 gram per liter of dissolved solids. Water containing between 1 and 35 grams per liter was divided into the following ranges: 1 to 3; 3 to 10; and 10 to 35 grams per liter.

The range of water quality most commonly encountered immediately below the water table is shown in figure 2. Two fresh-water lenses occur in the alluvial fill adjacent to the mountains on the east and west sides of the southern part of the basin. The water in the alluvial fill increases in salinity with depth below these fresh-water lenses. Salinity also increases toward the center of the basin where water three times as saline as sea water has been found. The fresh-water lens on the east side of the basin, which contains about 3 million acre-feet of water, is being developed as a potable water source for Holloman Air Force Base, White Sands National Monument, the city of Alamogordo, and ranches in the area. The fresh-water lens on the west side of the basin contains about 7 million acre-feet of water and is used as a potable water source for White Sands Missile Range Headquarters.

Ground water containing 1 to 3 grams per liter of dissolved solids is used for municipal, domestic, stock, and irrigation supply in the Alamogordo, Tularosa, and Carrizozo areas. Unconsolidated alluvial deposits in the Tularosa Basin may contain about 30 million acre-feet of water in which the dissolved solids range from 1 to 3 grams per liter.

Ground water containing 3 to 10 grams per liter of dissolved solids is little used: only a few stock wells withdraw water from this zone.

Ground water containing 10 to 35 grams per liter of dissolved solids is unused in the basin.

Ground water containing more than 35 grams of dissolved solids per liter (about the salinity of sea water) is unused, but may be present in over 90 percent of the alluvial fill in the basin.

Wells in the basin yield from a few gallons per minute to 1,400 gallons per minute. Transmissivities range from about 100 to 47,000 ft²/day (squared feet per day; cubic feet per day flow through a section 1 foot wide and the full thickness of the aquifer under a hydraulic gradient of 100 percent).

Maps showing the distribution, extent and thickness, and yield of wells in these saline-water zones, will be presented in the final report "Saline Ground-Water Resources of the Tularosa Basin, New Mexico", to be published in an Office of Saline Water Report. Detailed maps of the Alamogordo, Tularosa, Carrizozo and western margin of the basin areas will also be presented in that report.