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Geological Survey

Memorandum on possibility of developing ground water for irrigation along Toc Chinlin Wash near Rumasmal Mission, Navajo Indian Reservation, Apache County, Arizona.

By

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On November 21, 1949, the writers accompanied Mr. Chester Wilson of the Navajo Service Water Supply Office to Emmanuel Mission, Arizona, to investigate the adequacy of ground-water supplies adequate for irrigation along Toe Chinlin Wash. The investigation was made as part of the ground-water studies of the Geological Survey on the Navajo Indian Reservation.

About 250 acres of land is under cultivation along the wash, but the surface-water supply is reported to be sufficient to irrigate only about 20 percent of the land. Navajo Indians in the area prepared a petition requesting that the Navajo Service drill a well for an irrigation supply. A minimum supply of 500 gallons per minute is desired.

Emmanuel Mission, on the Navajo Indian Reservation is in Apache County, Arizona, about 65 miles by road west of Shiprock, New Mexico. The mission is reached by an unimproved road that branches sharply southward from the Shiprock-Kayenta highway about 20 miles west of Tes Nes Pas. Emmanuel Mission stands at the confluence of Toe Chinlin Wash and Walker Creek. Toe Chinlin Wash heads on the southwestern slope of the Carrizo Mountains, at an altitude of about 6,500 feet.

The region is dissected by many broad washes and shallow canyons radiating from the base of the Carrizo Mountains. Most of the streams are ephemeral, depending upon runoff from rainfall and melting snow on the flanks of the mountains. Along Toe Chinlin Wash, one major spring and several small seeps were observed and are reported to provide a perennial flow to the upper part of the wash.

The Morrison formation (Jurassic) is exposed in the walls of upper Toe Chinlin Canyon and underlies the land surface surrounding the laccolithic

intrusion that makes up the major part of the Carrizo Mountains. Where observed, the Morrison formation consists predominantly of variegated shales and interbedded thin sandstones. The sedimentary strata have been upwarped to form a truncated dome with dips as much as 20°. Dips decrease rapidly away from the center of the dome and within a short distance become very slight.

Several feet of alluvial fill has been deposited along Toc Chinlin Wash. The fill consists of coarse gravel and small boulders near the mountains, grading downstream into fine sand and silt. The land for 6 or 7 miles along the banks of the wash is cultivated by primitive irrigation systems which divert the water from the creek to the fields by means of earth dikes and dug ditches. During the dry summer months the lands along the lower reaches of the wash are without water. A dependable supply of water for this area would greatly increase the productivity of these lands.

The perennial flow in the upper part of Toc Chinlin Wash is supplied by springs and seeps in the alluvial fill of the canyon floor. The combined flow of these springs and seeps was estimated to be about 150 gallons per minute on November 21, 1949. Surface flow in the wash disappeared into the fill within a distance of 2 miles downstream. Downstream widening of the canyon and thickening of the fill permit the surface flow to percolate into the fill and disseminate throughout the finer gravel and sand. Shallow water supplies could be developed by digging wells in the alluvial fill in the areas where little or no surface water is available. Undoubtedly appreciable quantities of water would be obtained, but it is believed that the amount would not be sufficient to meet the minimum requirements for irrigation. The production of such wells may be expected to fluctuate seasonally and to be at a minimum during the dry summer

months when water is most needed.

The effect of the intrusive mass of the Carrizo Mountains upon the water-bearing properties of the Morrison formation and underlying strata is unknown, owing to the absence of deep drilled wells in the area. The igneous mass, which has uplifted and pierced the surrounding sediments, may effectively seal the upturned edges of the sediments and greatly restrict recharge on the upper slopes. Furthermore, the Morrison formation, which is the uppermost sedimentary formation in the area, except for the thin alluvium in the washes, consists in large part of shale which undoubtedly limits downward percolation of surface water into underlying Jurassic sandstones. Even under ideal conditions of recharge, no wells drilled into the Jurassic rocks in the region are known to yield quantities approaching the 500 gallons per minute desired in this locality.

The productiveness of a deep well in the area could be determined only by means of a test hole. Because of the somewhat complicated structural and stratigraphic relations along the southwestern flank of the Carrizo Mountains, the best location for such a hole would have to be determined by additional field studies. Information on the chemical quality of water from the alluvial fill, Morrison formation, and underlying water-bearing beds should also be obtained.