

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

LOCATION OF SITES FOR IRRIGATION WELLS NEAR CHIU CHUISCHU,  
PAPAGO INDIAN RESERVATION, PINAL COUNTY, ARIZONA

By

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This memorandum report describes an investigation of the ground-water resources of an area in the vicinity of Chiu Chuischu, Papago Indian Reservation, Ariz. The investigation was undertaken by the Ground Water Branch of the United States Geological Survey at the request of the Office of Indian Affairs, United States Department of the Interior. Field work was done during the fall and winter of 1950-51 by H. E. Skibitzke, Coyd B. Yost, Jr., and A. E. Robinson. All work was under the direction of S. F. Turner, District Engineer, Ground Water.

Chiu Chuischu is in the northeastern part of the Papago Indian Reservation, within a mile of the boundary, and is 9 miles southwest of Casa Grande. An area of approximately 16 square miles, within a radius of 4 miles from Chiu Chuischu, was investigated. The area is drained by Quajote Wash, an intermittent stream tributary to Santa Rosa Wash. Quajote Wash flows northwest with a gradient of approximately 10 feet to the mile. Much of the land in the vicinity of Chiu Chuischu has an exceptionally smooth surface and is well adapted to cultivation.

In some parts of the Chiu Chuischu area lava flows or granite lie at relatively shallow depths beneath unconsolidated alluvial material. As the lava and granite in this area are only slightly permeable, they preclude the possibility of satisfactory yield from wells that encounter them at shallow depths. Because of this condition, several wells drilled for irrigation use at Chiu Chuischu have been unsuccessful.

The land adjoining the reservation north and east of Chiu Chuischu is irrigated with water from wells that did not encounter shallow hard rock. The success of these nearby wells indicated that satisfactory well sites probably could be found within the reservation boundaries. The unconsolidated surface soils showed no topographic or structural relation to the underlying bedrock; therefore, well locations could not be based upon surface observations. For this reason, resistivity probes were made to determine the depths to bedrock at various points in the area.

The geologic study of the area was made to aid in locating the sites for geophysical probes where maximum information would result, and to obtain data that would be useful in the location of new wells. Reconnaissance work was done in the Silver Reef Mountains and nearby outlying hills. Aerial photographs furnished by the Indian Service were used in the work, as well as topographic and geologic maps of the area. Prominent faults were mapped in order to determine structural trends that might have a bearing on the problem (see map, fig. 1).

It was found that there is a definite pattern of northwest-trending high-angle faults in the lava flows at the northeast end of

the Silver Reef Mountains. The mountains terminate along a reasonably straight northwest line which is probably the reflection of additional parallel faults beneath the alluvial surface. The few isolated lava hills northwest of Chiu Chuischu appear to conform to the line of the mountain front and may be the remnants of what was at one time a continuous lava-flow extending from the Silver Reef Mountains. These various topographic features suggest the presence of a major northwest-trending fault or fault series in the immediate vicinity of Chiu Chuischu, and it is indicated that the displacement must amount to several hundreds of feet, the downthrown block being on the northeast side. This assumption is strengthened by the logs of wells that have been drilled on both sides of the postulated fault or faults, and the geophysical probes furnished more corroborative evidence.

Most of the resistivity probes were made using an asymmetric configuration in which one current electrode approached an infinite distance. In nearly all the probes the electrode separations were extended to a distance of 1,500 feet, giving reliable data to depths of at least 600 feet. All interpretation was done by the use of three-layer type curves.<sup>1/</sup>

The locations of the resistivity probes are shown on the map, figure 1. Data resulting from the probes were used to show on this map the general character of subsurface materials to a depth of 600 feet. Three areas are outlined. One is an area in which bedrock is liable

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<sup>1/</sup> Wetzel, W. W., and McMurtry, Howard V., A set of curves to assist in the interpretation of the three layer resistivity problem: Geophysics, vol. 2, no. 4, October 1937.

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to be encountered at depths too shallow to permit successful well development. A second area is one in which wells may be drilled to depths of 300 feet to 600 feet with little likelihood of encountering bedrock, and the third and most favorable area is that in which bedrock probably will not be found at depths less than 600 feet.

The graph of a typical probe in the Chiu Chuischu area is shown in figure 2. This graph shows four distinct layers. The first layer is soil on or just beneath the surface. The second layer is relatively dry alluvium above the water table. The third layer is moist or saturated alluvium. The lowest layer is the bedrock below the alluvium. These resistance measurements show no differentiation between the various alluvial materials.

It should be noted that the absence of bedrock to a depth of 600 feet does not necessarily mean that wells will be highly productive. As stated above, the resistance measurements made in the Chiu Chuischu area did not show any differentiation between coarse and fine materials, and unless wells in the favorable area encounter coarse sands or gravels they may be only moderately productive. Some significance may be attached to the fact that wells directly east of Chiu Chuischu and outside the reservation boundary are in a highly productive zone of coarse alluvium, but that the wells to the northeast are much less productive, and several of them are reported to have encountered bedrock at comparatively shallow depths. North and northwest from Chiu Chuischu, there are successful wells on lands outside the reservation. It would appear, therefore, that the most favorable locations for irrigation wells would be due east and north to northwest from Chiu Chuischu, and

within the area shown as having more than 600 feet of alluvial fill.

Chiu Chuischu is immediately west of an intensively farmed area known as the Eloy area. This area derives its water entirely from wells, and as a result of heavy pumping the water levels have declined 30 feet since 1942 in the vicinity of Chui Chuischu. In 1949 the Arizona State Land Commissioner declared the area critical under the State ground-water code. This act limited further development within the area. However, as pumpage was already in excess of replenishment, water levels have continued to decline. North of Chiu Chuischu is another heavily pumped area. The State Land Commissioner declared that area critical in the spring of 1951. As in the Eloy area, most of the arable land is already under cultivation and the water levels probably will continue to decline. The water-level trends in both areas are shown in figure 3.

A test well was drilled in section 17, T. 8 S., R. 6 E., to check the resistivity work. The test showed sufficient coarse water-bearing material at depths between 100 and 300 feet to justify drilling an irrigation well, and therefore deeper testing was unnecessary. As shown on the map, figure 1, the investigation has proved that about 8 square miles of the reservation near Chiu Chuischu is underlain by at least 600 feet of alluvial fill. This depth of alluvial fill will usually furnish water in quantities sufficient for irrigation use. Because of the declining water levels, the irrigation wells should be drilled to a depth of at least 600 feet unless bedrock is encountered at a shallower depth. Although the water levels in this area are declining, it will probably be many years before they reach a depth that



will be beyond the economic pumping limit. If funds are available the area northwest and west of Chia Chuischu will be studied in the 1952 fiscal year.