IRRIGATION WELL SITE SELECTION TECHNIQUES FOR THE GEORGIA PIEDMONT

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REFERENCE: Proceedings of the 1993 Georgia Water Resources Conference, held April 20 and 21, 1993, at The University of Georgia, Kathryn J. Hatcher, Editor, Institute of Natural Resources, The University of Georgia, Athens, Georgia.

INTRODUCTION

Abstract. The bedrock aquifers underlying the Georgia Piedmont have the potential to provide adequate ground water for irrigation purposes. In this example, 70 gallons per minute (gpm) would be adequate for landscape irrigation of the property. The problem is locating water bearing features (fractures, faults, rock contacts, etc.) within the bedrock. The well site selection techniques used in an irrigation project are illustrated and described in the poster display. The techniques and results of the site selection process are described below.

Topographic Setting. The site is located on the Georgia Piedmont and is underlain by interlayered amphibolite, gneiss, and schist rock. Streams in topographic draws border the site on three sides (east, south, and west). A wide topographic low area borders the site to the north.

Fracture Trace Mapping. The first site-selection technique utilized was fracture trace mapping. The topographic map of the area was studied for surficial features which may indicate subsurface water-bearing features. Stream courses and topographic draws are the most obvious features seen on the map, but the wide, low area is also interesting. Lines were drawn on the topographic map where fracture traces were interpreted to exist. The stream courses and the wide, low area were now targets of further investigation. Since the stream courses were off the property, the fracture trace drawn along the trend of the wide low area was the primary target for geophysical surveys.

Geophysical Surveys. Electrical resistivity (ER) surveys were conducted around the perimeter of the site. Building development prevented surveys in the center area of the site. A sounding was first conducted to a depth of the saprolite and the depth to water bearing zones. The Modified Wenner array was used in the ER sounding. In this array, the inner electrode spacing in the array closely approximates the depth of investigation. The sounding, conducted where the fracture trace was interpreted to cross the site, resulted in an interpretation of the saprolite/rock interface at approximately 30 ft deep, and a majority of the water bearing zones between 30 and 210 ft deep. An ER profile depth was then selected at 200 ft to map the occurrence of water bearing zones around the perimeter of the site. A Wenner profile depth of 200 ft measures the apparent resistivity of the subsurface between 150 and 200 ft deep. The results of the ER profile survey indicated a 600-foot-wide zone of relatively low resistivity values (less than 2,000 ohm-ft) on the northwest and southeast perimeter of the site. This ER low value trend corresponds to the fracture trace trend interpreted on the topographic map. Higher ER values (between 2,000 and 3,600 ohm-ft) were obtained at other points around the perimeter. Closer ER profile spacings were then conducted within the 600-foot wide zone to detail the well site selection.

The well site was selected at the point where the lowest ER profile value (1,000 ohm-ft) was obtained.

Well Installation. The well drilled at this location encountered saprolite to 35 ft, weathered rock from 35 to 62 ft and soft rock and/or water bearing zones at 85, 92, 120, 132, 140 and 203 ft deep. The well yielded 30 gpm with a drawdown of 124 ft during a 12-hour (hr) pumping test. Recovery was completed in approximately 1 hr.

Since the first well did not yield the total amount of water desired, a second well was drilled 200 ft east of the first well. This well was also drilled where a low ER value (1,100 ohm-ft) was obtained.

The second well encountered saprolite to 28 ft, weathered rock from 28 to 41 ft and soft rock and/or water bearing zones at 57, to 65, 69, 71, 80, 85, 95, 100, 105 to 125, 130 to 160, 164, 165 to 175, 184, 192, 193, 199 and 201 ft deep. The second well also yielded 30 gpm; the drawdown was 128 ft during a 12-hr pumping test. Recovery was also completed in approximately 1 hr.

Pumping Tests. The pumping test analyses for both wells indicated a recharge effect after approximately 200 minutes (min) into the test. This is interpreted to indicate a recharge zone relatively close to the site. The wide topographic low area seen on topographic map extends northwest of the site, and is probably the recharge zone for the ground water underlying the site.

SUMMARY

In summary, the techniques of fracture trace analyses and geophysical surveys are excellent techniques to use in selecting sites for irrigation wells on the Georgia Piedmont.

Although not every site on the Piedmont may yield the fully desired amount of water for irrigation purposes, the techniques for well site selection will ensure that the optimum amount possible from a site will be obtained. At this particular site, the wells are expected to yield a combined sustained yield of 60 gpm, which should be adequate for landscape irrigation.