GROUNDWATER SUPPLIES FOR GEORGIA'S POULTRY INDUSTRY

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REFERENCE: Proceedings of the 1995 Georgia Water Resources Conference, held April 11 and 12, 1995, at The University of Georgia, Kathryn J. Hatcher, Editor, Carl Vinson Institute of Government, The University of Georgia, Athens, Georgia.

Abstract. A large number of Georgia poultry farms are located in rural north Georgia and are underlain geologically by igneous and metamorphic rocks within which ground water movers through fractures and along contact zones. Location of water well sites are essential in the production of adequate water supplies.

This paper describes the geological and geophysical surveys conducted at two poultry farms to locate new and/or back-up water wells. These two farms are uniquely different in topography and geology, and well yields ranged from 50 to +150 gallons per minute (gpm).

INTRODUCTION

Poultry farming is one of Georgia's leading agricultural industries and was ranked second in the nation in 1993 with over three billion dollars worth of poultry products (Georgia Agricultural Statistics Service, 1994). These products, which include broilers, eggs and turkeys, are raised all over Georgia with a large number of poultry farms in rural north Georgia.

Water from ground-water supplies is an essential element in the successful production process. In hot weather, chickens can begin to die within one-half hour if water supplies are not adequate. Poultry farms, being in rural areas, must depend on water wells for their water supplies. Normally, a central water supply from a city or county is not available, and the cost of the central supplied water may be too high. Surface water cannot be used unless it is treated, which again increases costs for the farmers. Under most conditions, adequate groundwater supplies can be located on farms using the techniques described in this paper. These techniques can also be applied to other ground-water users.

In north Georgia, ground-water occurs within fractures in the igneous and metamorphic rock and along geologic contact zones between different types of rocks. Successful wells are dependent upon drilling into these fractures and/or contact zones. Normally, contact zones are easily observed at the ground surface by geologic mapping of an area, but sometimes the evidence of the zones are buried and can only be found by geophysical methods. Likewise, fractures are sometimes observed at the ground surface normally in topographic low areas or draws. But observing fractures at the surface does not always ensure that the fractures will exist at depth. Geophysical methods are used to find the fractures. Once the fractures and/or contact zones have been found, ground water is also likely to be found.

WATER WELL LOCATION METHODOLOGY

The methodology used to locate water wells for two poultry farms in rural north Georgia included field geologic mapping and geophysical surveys with the electrical resistivity (ER) technique. The ER technique is very effective because ground water conducts electricity more readily than does hard crystalline rock. The key is to find the horizontal and vertical location where the resistance is lowest. The following sections describe the search for water wells at two poultry farms.

Poultry Farm Number 1

Farm number 1, located in Monroe County, is underlain by a mica schist/gneiss/amphibolite complex and granite gneiss. The state geologic map indicates that contact zones are in the general area, but these zones are not exposed at the surface which is open level fields. Even the topographic draw has no rock outcrops. Only one outcrop of granite gneiss was observed in the northeast portion of the farm. figure 1 shows the placement of the profile stations over the property. Measurements were obtained between 150 and 200 feet deep using the Wenner electrode array. In this array, the metal probes are spaced equally apart. The lower resistivity values are in the northwest corner and along the southeast fence line; moderately low values are present within and near the topographic draw. These three areas are more favorable for wells than the area of the higher values.

Sounding number 1 (Figure 2) and sounding number 2 (Figure 3) illustrate the subsurface in the southeast and northwest areas, respectfully. Sounding were conducted using the Modified Wenner array (Carrington and Watson, 1981). The lower values are interpreted to be fractures through which ground water is moving.

Well number 1 was drilled at station P-17/S-1 and yielded 150 gpm. The driller's log indicates soft granite, a 12-minute rod and brittle and flaky granite and quartz as the water production zones. A 20-minute rod (20 feet long) drilling through rock is a normal drilling time; a 12-minute rod indicates very soft rock. The interpreted fractures correlate well with the actual drilling log.

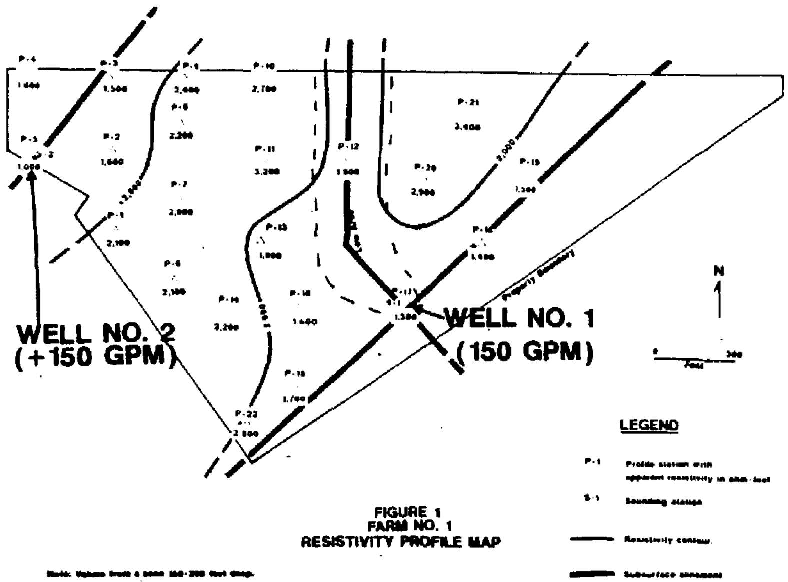

Figure 1. Resistivity Profile Map for Farm No. 1.
(Note: Values from a zone 150-200 feet deep.)

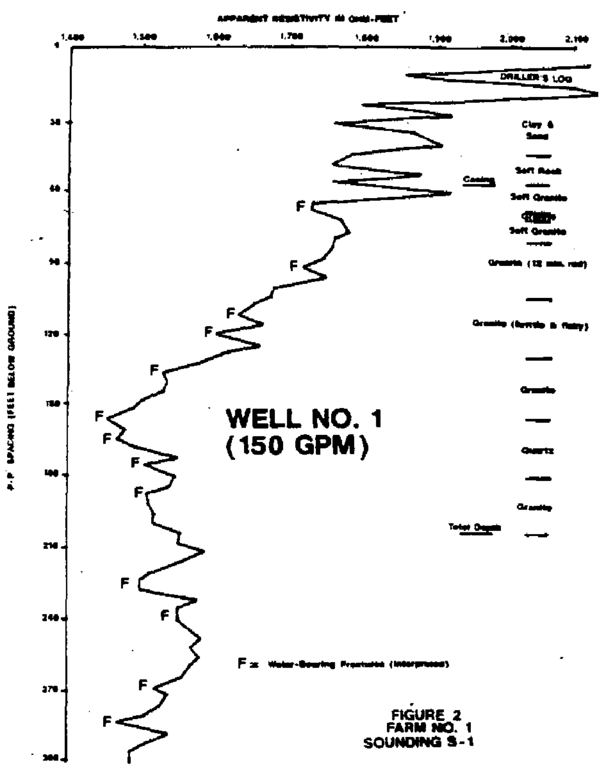

Figure 2. Sounding S-1 for Farm No. 2; Apparent resistivity in ohm-feet versus P-P' spacing in units of feet below ground. (F = Water-bearing fracture, as interpreted.)

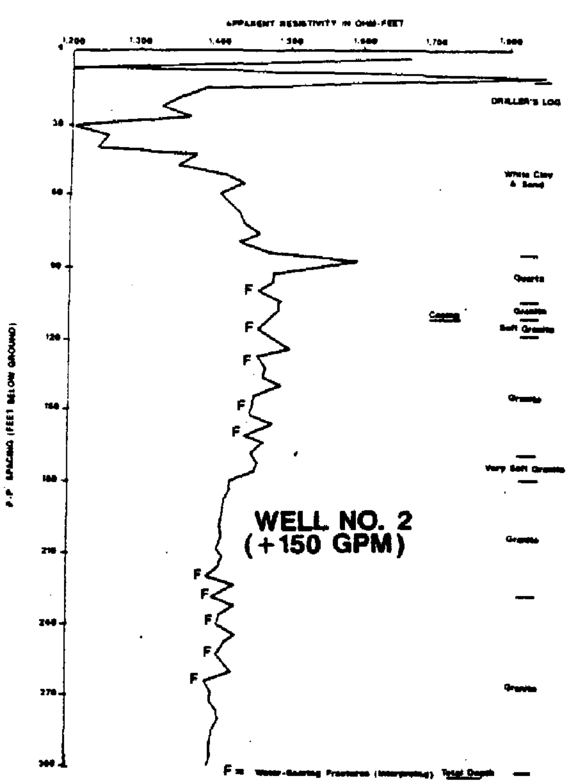

Figure 3. Sounding S-2 for Farm No. 1; Apparent resistivity in ohm-feet versus P-P' spacing in units of feet below ground.
(F = Water-bearing fracture, as interpreted.)

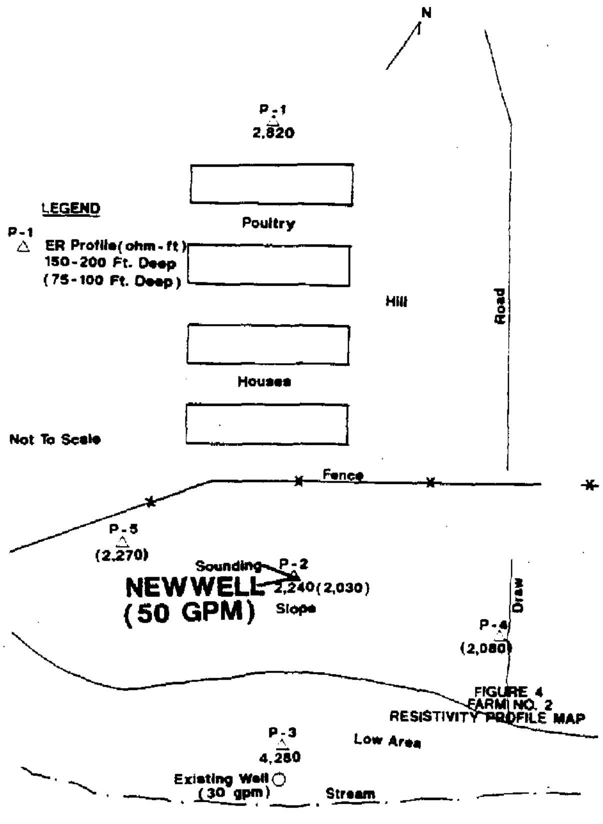

Figure 4. Resistivity Profile Map for Farm No. 2.

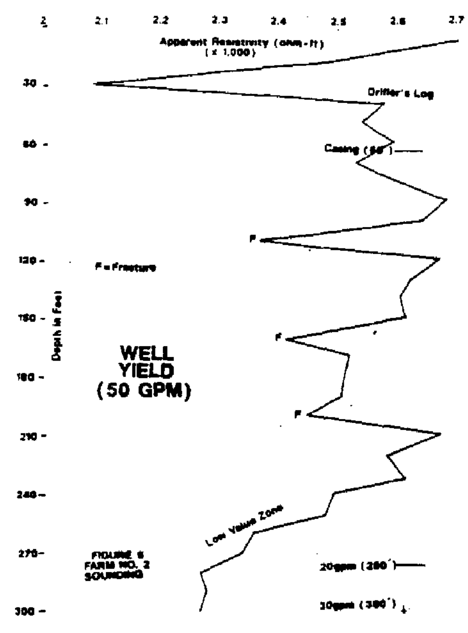

Figure 5. Sounding for Farm No. 2; Apparent resistivity in ohm-ft x1000 versus depth in feet.

Well number 2 was drilled at station P-5/S-2 and yielded +150 gpm. The driller's log is not as descriptive as the log for well number 1, but soft to very soft granite was encountered in the well. As expected, the farmer was well pleased with these two wells.

Poultry Farm Number 2

Poultry farm number 2, located in Banks County, is underlain by a hornblend gneiss/amphibolite complex with no major structural features near by. The site itself is a hill with sloping terrain toward a creek bottom. There were no rock outcrops in the creek. An existing well near the creek yields approximately 30 gpm.

The stations are plotted on Figure 4. Profiles were first conducted at a depth zone of 150-200 feet. Of these, station P-2 had the lowest value (2,240 ohm-feet). Due to surface constraints, profiles were then conducted at a depth zone of 75-100 feet. Of these, station P-5, which was co-located at P-2, also had the lowest value (2,030 ohm-feet).

Based on the profile data, a sounding was conducted at station P-2/P-5; the sounding is graphed in Figure 5. Fractures were interpreted at three depths and a low resistivity zone exists between 234 and 280 feet.

The back-up well was drilled at the sounding and yielded 50 gpm. The driller reported 20 gpm at 280 feet deep and an additional 30 gpm at 380 feet deep. The driller's log, although not descriptive of geologic features, did indicate an increase in water flow below 300 feet. The ER sounding indicated a significant reduction in values below 234 feet. The farmer was well pleased with this well.

CONCLUSION

Poultry farming is a big investment and dependable groundwater supplies are a must for success. The two examples presented in this paper illustrate the importance of proper well location before drilling.

Farm number 1, located in an area of geologic contacts, was supplied with two excellent water wells by locating them with the ER technique. The contact zones were not mappable at the surface.

Farm number 2, located on a hill with an existing primary well yielding 30 gpm, was supplied with a back-up well located on sloping terrain. The back-up well, located by the ER technique, yielded 50 gpm. The well, on the slope yielded more water than the primary well located in the creek bottom. Topography was not a determining factor in the presence of fractures at depth.

These two examples of proper well location indicate good success with the ER technique not only in locating where to drill but also how deep to expect the fractures.

The initial financial investments during poultry farm water supply planning can be greatly reduced and the well location process can be much less risky if the proper techniques are utilized. Electrical resistivity is an excellent technique for successful water well locations in north Georgia.

LITERATURE CITED

Carrington, T.J. and D.A. Watson, 1981. Preliminary Evaluation of an Alternate Electrode Array for Use in Shallow-Subsurface Electrical Resistivity Studies, *Ground Water*, January-February 1981, Vol. 10, No. 1, pp. 48-57.

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