ERWIN UTILITIES
Develops Cost-Effective Ground Water Supplies

There are numerous benefits of using ground water for public water supplies. The quality of ground water is usually superior to that of surface water. Consequently, the initial, as well as long term, treatment costs are lower for ground water. In addition, the quality of ground water fluctuates very little relative to surface water sources, thereby lowering the risk of waterborne diseases.

Erwin Utilities, located in upper east Tennessee, chose to first look for their own ground water supplies before resorting to filtration of springs or surface water. The investigation was conducted by Bradfield Environmental Services, Inc. of Franklin, Tennessee.

The investigation included review of the geology of the study area and discharge measurements at sites on surface streams in the vicinity of Erwin. Discharge measurements were made to identify those reaches of streams which gained water from the ground water system and those sections of streams which lost flow to the ground water system. Stream-flow data indicated the geologic formation most likely to produce substantial amounts of ground water in the study area was the Honaker Formation.

Sites for test wells were selected based on this hydrogeologic information and the layout of the existing distribution system. Seven wells were drilled in or near the Rock Creek and Dry Creek drainage basins underlain by the Honaker Formation (Figure 1). Streams that cross the Honaker Formation (shaded area on map) tended to lose water to the ground water system.

Despite the fact that most wells were drilled along strike, significant variations in local geologic conditions and well yields were observed. Wells 1 and 7 were drilled in solid, white to dark gray dolomite and had very low yields (<10 gallons per minute). Wells 3, 4, and 6 encountered brown shaley material with interbedded layers of gravel. These areas proved to be the most productive, with estimated well yields in excess of 500 gallons per minute.

Step-discharge aquifer tests were conducted on two of the most productive wells. Well #4 was pumped at 300, 400, and 500 gallons per minute for an 8-hour period (Figure 2). The total amount of drawdown during the aquifer test was 17.3 feet. Based on aquifer test data, this well is capable of producing 700 gallons per minute, equivalent to approximately one million gallons per day.

Well #6 appeared to be more productive during drilling and had a larger diameter casing than Well #4. Consequently, it was pumped at a higher rate. Well #6 was pumped for one hour at 500 gallons per minute followed by one hour at 600 gpm. The final step of 690 gpm was conducted for six hours, providing more data at the higher rate (Figure 3). The total drawdown due to pumping was only 7.95 feet after 8 hours of pumping. These data indicate well #6 can supply at least 1000 gallons per minute, equivalent to approximately 1.5 million gallons per day, for Erwin Utilities.

In addition to supplying the amount of water needed, the water from both wells appears to be of excellent quality. Concentrations of primary and secondary inorganic constituents were similar, suggesting the water is derived from a common aquifer. Ground water from the wells was low in concentrations of total dissolved solids (<140 mg/l), hardness (<180 mg/l), sulfate (<13 mg/l), and chloride (<13 mg/l). Water quality data did not indicate the presence of regulated organic compounds, volatile organic compounds, or pesticides.

Significant surface water influence on ground water can result in mandatory filtration to meet the requirements of the Surface Water Treatment Rule. Samples were also collected to determine if the ground water contained biological material that would indicate the wells are affected by surface conditions.

Particulate samples were collected from both wells after approximately 6 hours of pumping. Samples were processed immediately in the laboratory and analyzed for Giardia and Cryptosporidium according to ASTM protocol. Other organisms that may indicate that ground water is affected by surface conditions include the presence of nematodes, rotifers, crustaceans, and insects in the raw water.

Because water from both wells was still slightly turbid, (5-10 NTU), only a limited amount of material could be examined. The material collected in the particulate samples consisted entirely of fine sand and silt and fine amorphous debris. No biological material was observed. Based on these data, it does not appear that filtration will be required under the Surface Water Treatment Rule.

Summary and Recommendations

Bradfield Environmental Service's investigation included a review of the geology of the area and measurements of stream discharge. This information identified areas most likely to produce abundant ground water. Seven test wells were drilled, including several wells which produced hundreds of gallons of

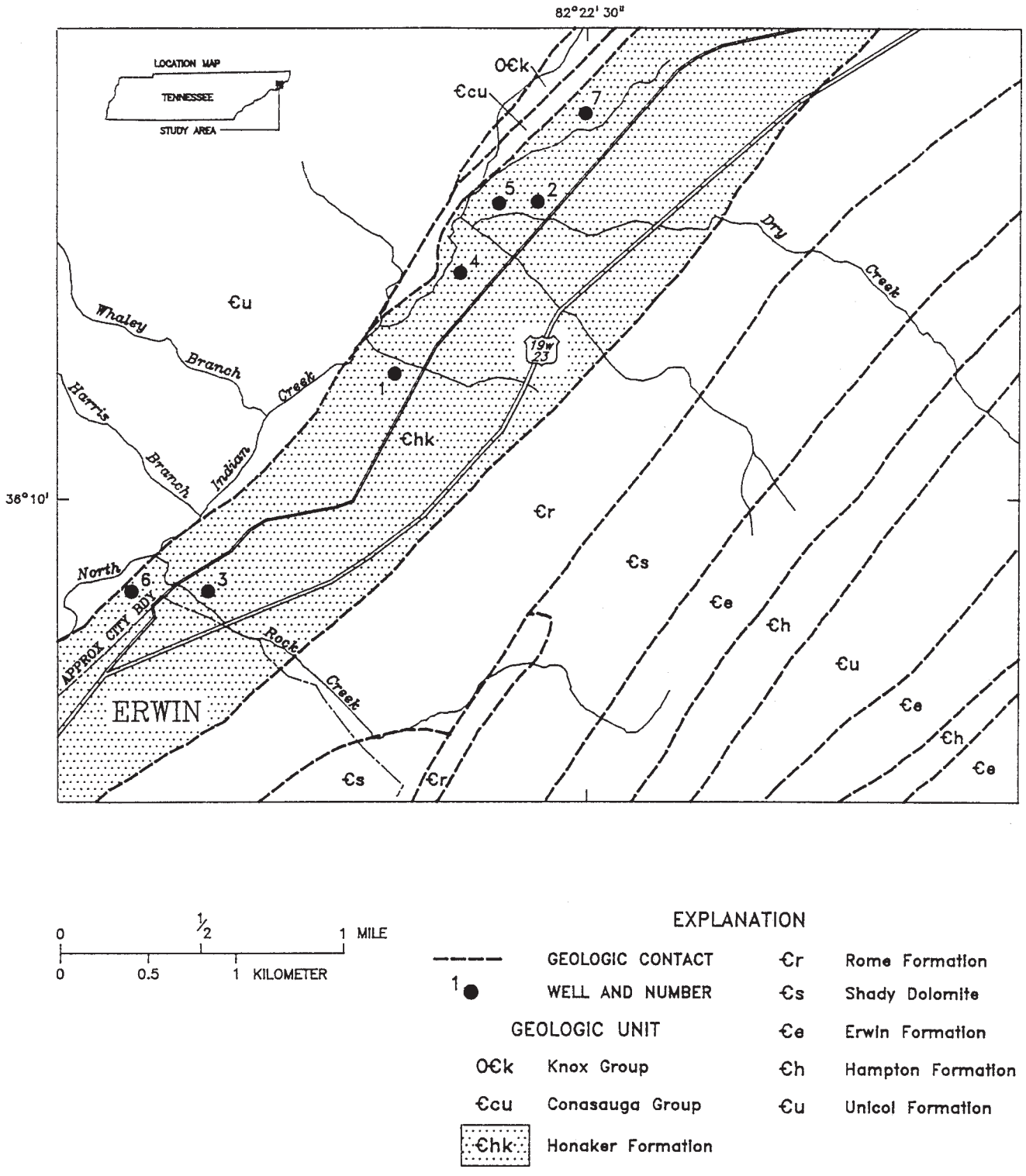

Figure 1: Location of study area and generalized geology near Erwin, Tennessee.

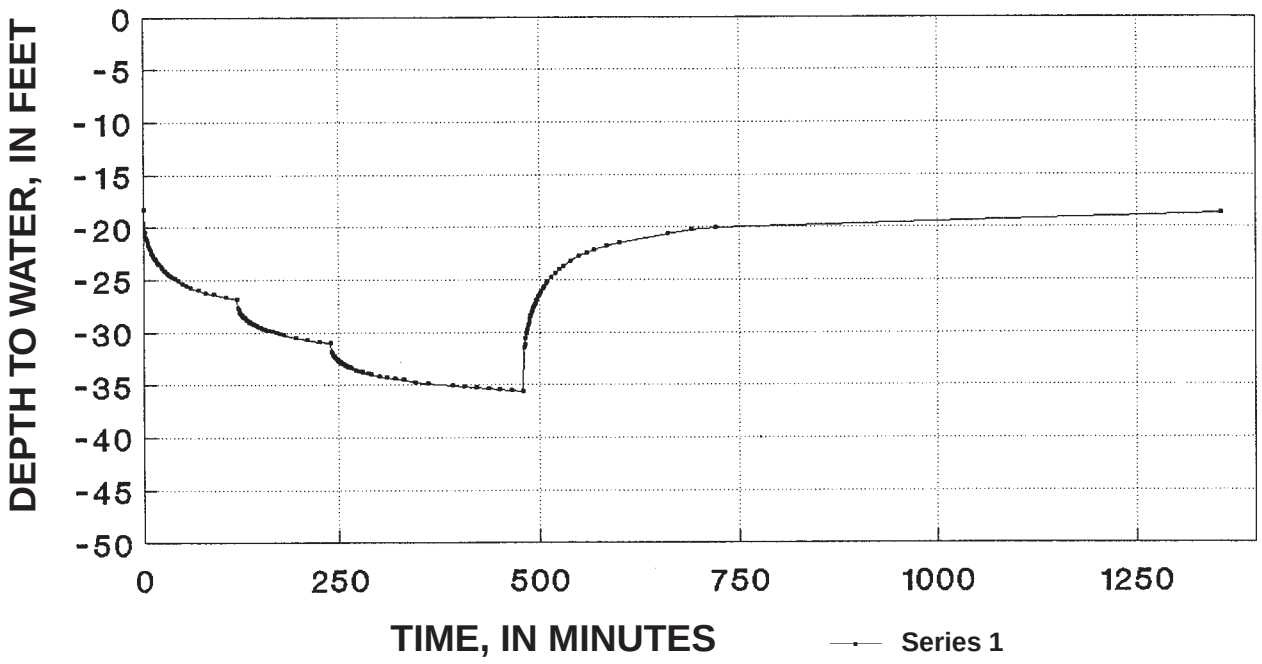

Figure 2: Plot showing depth to water during aquifer test on well #4. Pumping rates are 300, 400, and 500 gallons per minute.

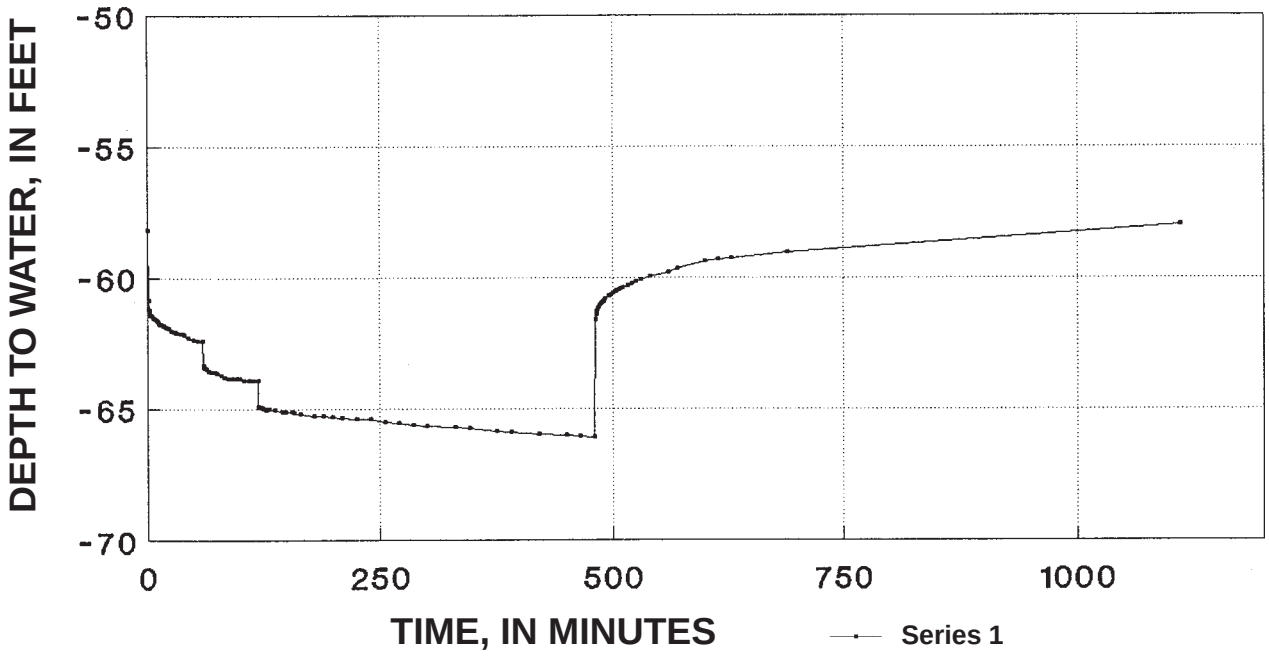

Figure 3: Plot showing depth to water during aquifer test on well #6. Pumping rates are 500, 600, and 690 gallons per minute.

water per minute. Aquifer tests indicated that two wells could supply approximately two million gallons of water per day for Erwin Utilities. The water appears to be of such quality that filtration may not be necessary.

Rather than relying on readily available surface water from springs or the Nolichucky River, Erwin Utilities chose to explore for ground water. The result was a reliable, high quality source of drinking water that will save the utility and their customers money for years to come. All public water systems would be wise to evaluate their available ground water resources before expanding a surface water plant or before filtering springs that have been determined to be under the influence of surface conditions. Sometimes, the solution to a water-supply problem is in your own back yard. ■

BY ARTHUR BRADFIELD