



WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Hydraulic Conductivity and Specific Storage of the Maquoketa Shale

Focus Categories: GW, WQL

Keywords: Aquifers, Groundwater, Hydrogeologic parameters

Duration: March 1, 1999 - February 28, 2000

FY 1999 Federal Funds: \$28,401

FY 1999 Non-federal Funds: \$68,635

Principal Investigator(s): Herbert F. Wang Timothy T. Eaton

Congressional District: Second Wisconsin

Statement of Critical Regional or State Water Problems

The Maquoketa Formation is an important regional confining unit between the upper Silurian dolomite and the deep Cambrian and Ordovician "sandstone" aquifer in southeastern Wisconsin. Rapidly growing communities in the region rely on pumping municipal water supplies from the deep aquifer, which has caused the formerly upward vertical gradient across the shale to be reversed. The role that this confining unit plays in the regional hydrogeologic system needs to be better understood for the purpose of long-term groundwater management. For instance, any recharge to the deep aquifer that occurs in the eastern part of the region depends on vertical leakage through the Maquoketa. Concern about future groundwater management has led to the initiation of a joint project, under the auspices of the Southeastern Wisconsin Regional Planning Commission, by the Wisconsin Geological and Natural History Survey, the U.S. Geological Survey, the Wisconsin DNR, and cooperating local water utilities to construct a three-dimensional groundwater flow model of the region, for which this work will be an important contribution.

Statement of Results or Benefits

In spite of its importance as a regional aquitard in eastern Wisconsin, the hydrogeology of the Maquoketa has received little study in the past. According to Young (1992, p B45) "...Estimates of the vertical hydraulic conductivity K' of the Maquoketa confining unit are available only indirectly from flow-net analyses or digital models." Most estimates can be traced back to Walton (1960), who conducted a flow-net analysis of downward leakage to the Cambrian-Ordovician aquifer in the Chicago area. Two separate but related projects were funded in FY97-98 to investigate the hydraulic properties of the Maquoketa

Formation using fieldwork at two drilling sites in southeastern Wisconsin and laboratory measurements on recovered core samples. To our knowledge, this is the first research focused on direct measurement of hydraulic properties of this important confining unit. This project will enable us to build on our research using a slightly expanded multiple well configuration at the second site. Using this innovative configuration, we will collect new and more reliable information using improved field testing procedures. Comparison of expected results with previous data will be significant in determining whether these field sites are representative enough to warrant extrapolation of these results on a regional basis.

Nature, Scope and Objectives of the Research

The purpose of the research proposed here is to build on the results of two separate but related research projects from the previous year, and combine the research into one slightly expanded effort involving a multiple well pumping test. Investigators on these two projects approached the research problem: the hydraulic properties of the Maquoketa Formation, from different perspectives -- one from hydraulic and geochemical fieldwork, the other from laboratory measurements and computer modeling of poroelastic properties of core samples. A combined second year fieldwork-based effort by investigators from each project will allow new and more reliable information to be collected using improved field testing methods. The dual purpose design of the field site well configuration represents a cost-effective way of improving the understanding of the hydraulic properties of this important regional confining unit.