USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

SYNOPSIS

1.Title: HYDRAULIC CHARACTERIZATION OF THE STREAM-AQUIFER INTERFACE: THEORY, FIELD IMPLEMENTATION, AND PRACTICAL RAMIFICATIONS - A MULTI-STATE PROPOSAL

2. Focus Category: ground water (GW), methods (MET), water quantity (WQN)

3. Keywords: hydrogeology, surface-groundwater relationships, stream depletion, aquifer characteristics, field methods

4. Duration: 9/1/1998 to 8/31/2001

5. Federal Funds: $105,000

6. Non-Federal Funds Pledged: $323,261

7. Name and University of Principal Investigator:

Overall Coordinator and Principal Investigator for Nebraska

Vitaly A. Zlotnik, Dept. of Geosciences, University of Nebraska-Lincoln

Principal Investigator for Kansas

James J. Butler, Jr., Kansas Geological Survey, University of Kansas

8. Congressional District of University: University of Nebraska-Lincoln - Nebraska District #1

University of Kansas - Kansas District #3

9. Statement of Critical Regional or State Water Problem: Surface-ground water interactions are often a key component of the hydrologic budgets of aquifers and streams. In Nebraska and Kansas, as well as many other areas in the Great Plains and elsewhere in the United States, these interactions have very significant socio-economic and political ramifications. As illustrated by the numerous interstate conflicts that have arisen from disagreements concerning the impact of groundwater pumping on stream flow, there is a critical need to quantify the volumes involved in water exchanges between streams and aquifers. Given the potential magnitude of the financial stakes, it is imperative that this quantification be founded on methodology with a sound scientific basis.

A key element of efforts to quantify stream-aquifer interactions is the estimation of the impact of groundwater pumping on stream flows. Although several methods for estimation of pumping-induced water transfers (stream depletion) have been developed over the last 50 years, these methods are based on mathematical models of idealized flow systems that often bear little resemblance to stream-aquifer systems in the Great Plains. Recent work has shown that these simplistic models can introduce significant errors into estimates of the impact of groundwater pumping on stream flows as a result of their neglect of critical aspects of the stream-aquifer interface, such as the near-stream zone of altered hydraulic properties and the limited penetration of the aquifer by the stream channel. Clearly, there is a pressing need to develop field and modeling methods that can result in estimates of pumping-induced water transfers that are based on more realistic representations of the stream-aquifer system. The development of such methods is the primary purpose of the work outlined in this proposal.

10. Statement of Results or Benefits: The primary products of this research will be 1) new field methodology for hydraulic assessment of the stream-aquifer interface, and 2) a "tool set" of modeling procedures that can serve as the basis for stream-aquifer related administrative decisions. As indicated by these products, this work will be directed at the very practical goal of improving estimates of pumping-induced water transfers. However, this combined field and modeling study will also provide considerable insight into the fundamental controls on water movement between streams and aquifers, which will be of value to researchers interested in all aspects of stream-aquifer interactions.

Two full-time Ph.D. students, one each at UNL and KU, will be supported by this project. It is expected that the results of this research will be incorporated into courses in hydrogeology that are offered at UNL and KU. Note that V. Zlotnik and C. McElwee currently carry a full teaching load of hydrogeology courses at UNL and KU, respectively, while most of the other investigators participate in the academic program in hydrogeology at UNL and KU through teaching or advising of graduate students.