WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: 2004WI82G

Title: Groundwater sustainability in a humid climate: Groundwater pumping, groundwater consumption, and land use change.

Project Type: Research

Focus Categories: Water Use, Groundwater, Management and Planning

Keywords: aquifer sustainability, groundwater use, hydrologic systems

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Congressional District: 2

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Abstract

Integration of groundwater use trends and forecasts with an evaluation of the sustainable yields of aquifers is necessary to convey principal concepts of hydrologic systems mass balance and base flow preservation to water-resource managers. Water use is a concern even in humid “water-rich” states, such as Wisconsin, where groundwater pumping causes severe declines in groundwater levels and reduces groundwater discharge to surface water.

In the proposed research, we will address relationships between groundwater use, land-use change, population change, and the sustainability of groundwater resources in a water-rich environment. The work will advance the process of integrating water-use data collection with the “science of water use” by evaluating accounting and estimating methods within research into the economic and social components that drive patterns of

water use. We will identify methods of reporting and estimating water use, with associated error analysis, that provide data of a quality sufficient to improve groundwater flow models used to forecast impacts of pumping on hydrologic systems.

One objective of the proposed research is to identify causes of observed exponential growth in groundwater pumping. This will be accomplished by developing a detailed understanding of water demand, consumption, and return for two study areas. One location is a rapidly urbanizing and suburbanizing county that has experienced a four-fold increase in population with a seven-fold increase in groundwater pumping, with significant increases in manufacturing and service sector employment. The second county is predominantly rural and has much lower rates of growth in water use, population, and economic development.

This information will allow us to integrate a detailed temporal and spatial database of groundwater withdrawal with existing groundwater flow models, yielding a tool to assess societal demands for economic growth and development in the context of water-resources planning and aquifer sustainability. Proposals for industrial, agricultural, commercial, and residential development may then be evaluated in the context of competing societal uses for groundwater. Forecasts of future water levels and baseflow may be based on realistic scenarios of land-use change, and consequently can be used by planners and managers to assess the impacts of land-use patterns on water resources.

We will also investigate the impact of current practice in Wisconsin for tracking groundwater use on estimates of groundwater use, and propose a model for collecting (and/or estimating) groundwater pumping and discharge data in the state. Project results will be of interest to communities across the Great Lakes region, where, although there is a seemingly abundant supply of fresh water from the Cambrian sandstone aquifer and the lakes themselves, local governments actively participate in regional efforts of ecosystem preservation and water-supply planning. Project results will also be framed within a series of specific recommendations regarding water use and water discharge reporting from well owners, leading to improved strategies for compiling, estimating and reporting water use by counties and economic sectors.