

Title: An Improved Hydrogeologic Model for the Token Creek Watershed

Project I.D.: DNR Project #160

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Period of Contract: 07/01/1999 through 06/30/01

Background/Need: The Token Creek watershed is an important contributor of water to the Yahara River and the Madison chain of lakes. Much of the baseflow for Token Creek comes from springs. These springs provide the cold baseflow that is important for aquatic habitats. However, the future of the springs is threatened by increased demand for groundwater due to local population growth. Development of an improved hydrogeologic model for this area is important both for estimating the impacts of increased groundwater pumping and for planning the placement of future wells to minimize this impact.

Objectives: To improve the local hydrogeologic model for the Token Creek watershed.

Methods: A field study was conducted at Culver Springs in the town of Token Creek from July 1999 to June of 2001. Groundwater level recording devices were placed in several shallow monitoring wells and recorded water levels continuously over a period of many months. Groundwater and surface water samples were taken and analyzed for major ions and stable isotopes. Three bedrock monitoring wells were drilled in order to obtain hydrostratigraphic information that would lead to a better understanding of the focusing mechanism for the springs.

Using data from the field study, the MODFLOW model for the Token Creek watershed was improved. Layers were added to better represent the local hydrostratigraphy, and high-discharge stream nodes were added to simulate the presence of springs in the watershed.

Results and Discussion: The field study revealed that there are several highly permeable layers in the bedrock that most likely provide the focusing mechanism for the springs. Adding these layers and high-discharge stream nodes to the MODFLOW model resulted in a good approximation to actual spring flow.

Conclusions/ Implications/ Recommendations: The packer testing and modeling results from this project suggest that the focusing mechanism for Culver Springs is the existence of relatively thin, high permeability zones in the St. Lawrence/Tunnel City Formations. These high permeability zones provide fast flowpaths for the water, which can explain the high nitrate content of the water at Culver Springs. The existence of high

permeability zones is thought to be the focusing mechanism for other springs complexes in Dane County, such as Nine Springs.

Modeling also shows that the impact of groundwater pumping on Culver Springs should be minimized by keeping pumping at a distance from the springs. However, while Sun Prairie wells are presently closest to the springs, the town of DeForest could have a great impact if pumping is moved closer to the springs.

Related

Publications:

Domber, 2000. An Improved Hydrogeologic Model for Groundwater Flow in the Token Creek Watershed. Master's Thesis, Department of Geology and Geophysics, University of Wisconsin, Madison, 78 p.

Key Words:

springs, MODFLOW, groundwater modeling

Funding:

This project was funded by the Wisconsin Department of Natural Resources

Final Report:

A final report containing more detailed information on this project is available for loan from Wisconsin's Water Library, University of Wisconsin-Madison, 1975 Willow Drive, Madison, Wisconsin 53706 (608) 262-3069.