USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Characterizing Ground Water Flow in a Vermont Upland Basin -- Geologic,

Geochemical and Hydrologic Approach to Aquifer Delineation and Protection (CONTINUATION, Year 2 of 2 year project)

Duration: September 1, 1996 - August 31, 1997

Federal Funds Requested: $25,500

Non Federal: $51,068

Principal Investigators:Dr. Paul R. Bierman, University of Vermont, Burlington, VT Co-Investigators: Dr. Jack Drake, Dr. Andrea Lini and Dr. Stephen Wright Student Investigators: Michael Abbott and Darlene Autery

Congressional District: 1 st District, State of Vermont

Need for Research

In much of New England, particularly the upland towns, citizens rely on bedrock wells and springs for potable water. In order to protect these water supplies from contamination and to manage responsibly what are in some cases limited ground water resources, aquifer geometries, recharge zones, flow paths and the residence time of ground water in rock need to be determined. The need for such information is particularly important in areas where development is occurring rapidly and the impact on groundwater resources both from potable water withdrawals and the addition of domestic wastewater is increasing.

This proposal requests funding for the second year of a two-year project which began in June of 1995 with first-year funding ($22,000) through the USGS State Water Institute Program grant (expired May, 1996). In order to understand groundwater flow paths, flow rates, and the sources of recharge in a typical New England upland watershed, the Browns River basin of Vermont, we have been using a variety of geochemical and isotopic techniques including:

1. stable oxygen isotope measurements in precipitation, snow melt, and groundwater, 2. measurement of major and trace elements and anions in groundwater, 3. modeling of groundwater isotopic composition using dynamic simulation (STELLA), 4. bedrock fracture trace analysis, and 5. well log analysis and compilation.

During the first year of the study, two MS students (Darlene Autery and Michael Abbott) have been supported by USGS funds to develop and implement a groundwater and

precipitation sampling plan which has generated nearly 600 samples, of which more than 80% have already been analyzed. Funding of the second year of this project (as originally planned) is very important in that it will allow us to gather nearly two years of continuous geochemical data, prerequisite to generating a more robust understanding of the groundwater flow system than the present, 9-month data set will allow.

Benefits of Study

This project will benefit both the New England region and the specific towns in which we are making our measurements. Due to the heterogeneous nature of groundwater flow in bedrock fractures, characterizing this type of hydrogeologic system is a complex and difficult effort. This study, the first of its kind in Vermont, represents an integrated, systematic approach to the problem, and has the potential to improve significantly our understanding of groundwater systems in such environments.

By employing a wide variety of investigative techniques and collecting a large amount of isotopic and geochemical data, we will develop a conceptual model of groundwater distribution, recharge, and flow in a typical, upland New England watershed. Our work characterizing the groundwater systems of Underhill, Jericho and Underhill Center, Vermont, will directly aid town planners. Furthermore, the results of our study will be useful for understanding flow systems in many other upland towns; while the design of our study may serve as a template for investigations elsewhere. Our study will also determine the usefulness of stable isotope and radionuclide tracing techniques in characterizing basin-scale upland groundwater flow in this type of geologic setting. Our methods should be transferable to other similar basins throughout the state and New England region, and should provide information pertinent for managing and protecting groundwater resources in many basins facing development pressures.