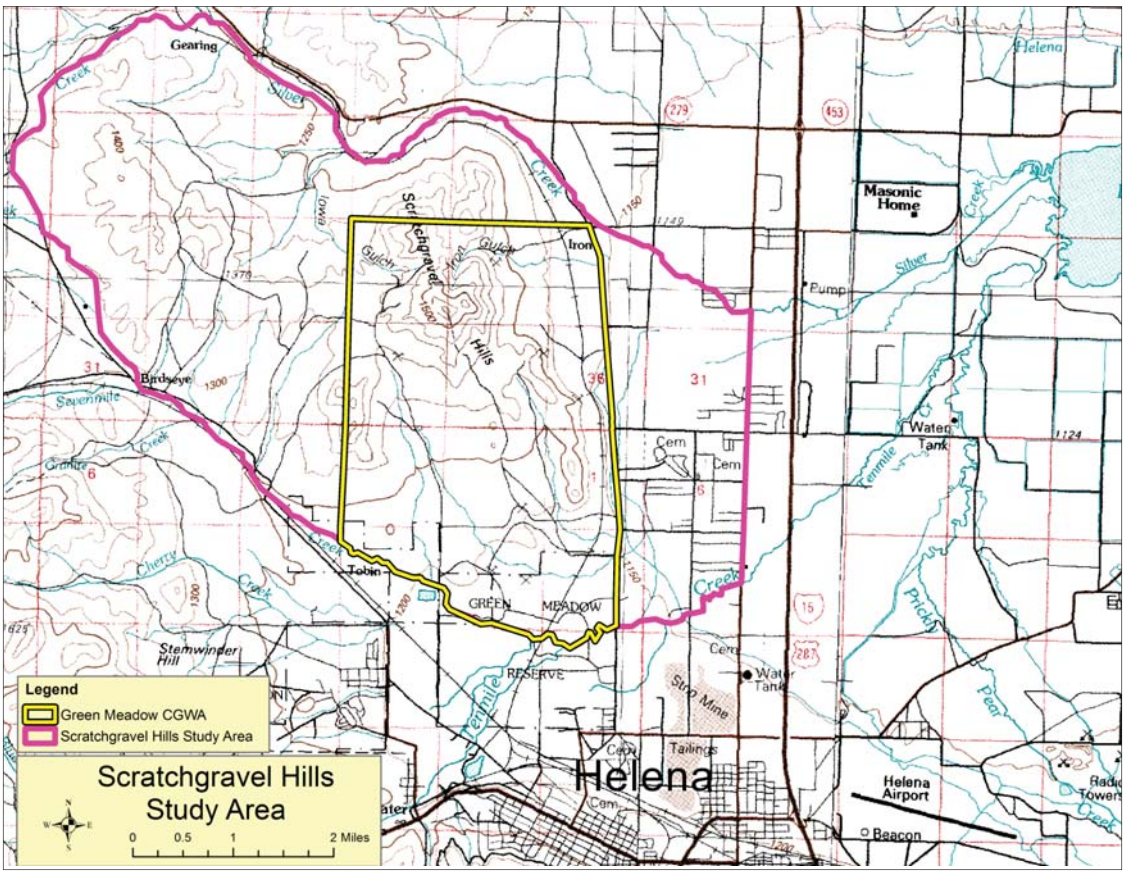
MBMG Ground Water Investigations Program

Scratchgravel Hills Study Area—Lewis and Clark County

Introduction

Proposed subdivisions in the Scratchgravel Hills have caused concern about how much development can occur, how densely homes can be spaced, and if restrictions on water usage are needed. Elevated nitrate levels have been seen in some wells, creating concerns about the use of individual septic systems in this area of thin soils and shallow fractured bedrock. These concerns resulted in the designation of the Green Meadow Temporary Controlled Groundwater Areas (CGWA) in April 2008.

An improved understanding of the geologic setting, aquifer properties, aquifer recharge, and aquifer discharge is being obtained through the collection of detailed hydrogeologic data. Monitoring of water levels has allowed the potentiometric surface to be better defined. Aquifer tests and water chemistry are being used to define aquifer properties, the degree to which aquifers are connected, and to evaluate water quality patterns. A numerical model of groundwater flow has been developed using these data. This model can be used to evaluate the impacts from various development scenarios.



In cooperation with the Lewis & Clark County Local Water Quality Protection District

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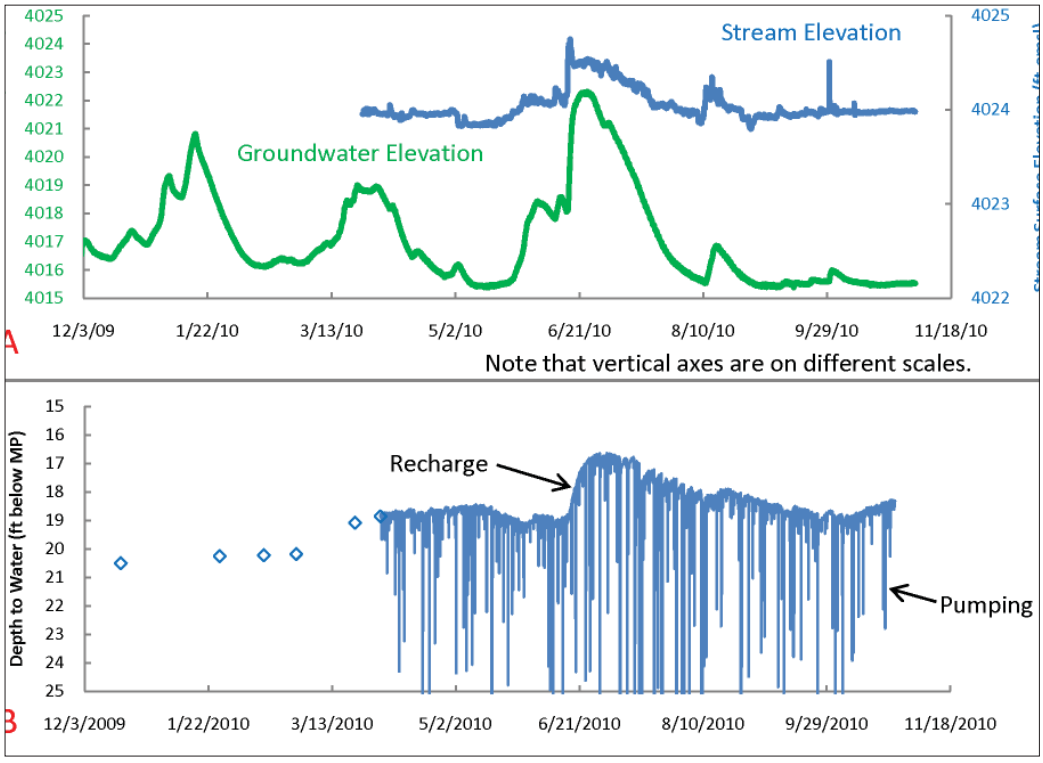
Project Issues:

- How much development can occur in the Scratchgravel Hills?
- Do septic systems need to be managed differently in the Scratchgravel Hills?
  - How densely can homes be spaced?
- Should future groundwater development within the CGWA be limited or ongoing monitoring be established?
  - MCA 85-2-506:
    - Will groundwater withdrawals reduce groundwater levels to the point that water rights holders cannot reasonably exercise their water rights?
    - Will groundwater withdrawals reduce surface water availability to the point that water rights holders cannot reasonably exercise their water rights?
    - Is the groundwater suited for beneficial use?
- How would prospective limitations of development benefit existing water users?
- What ongoing monitoring is needed and how could it be used to trigger prospective limitations of development within the CGWA?

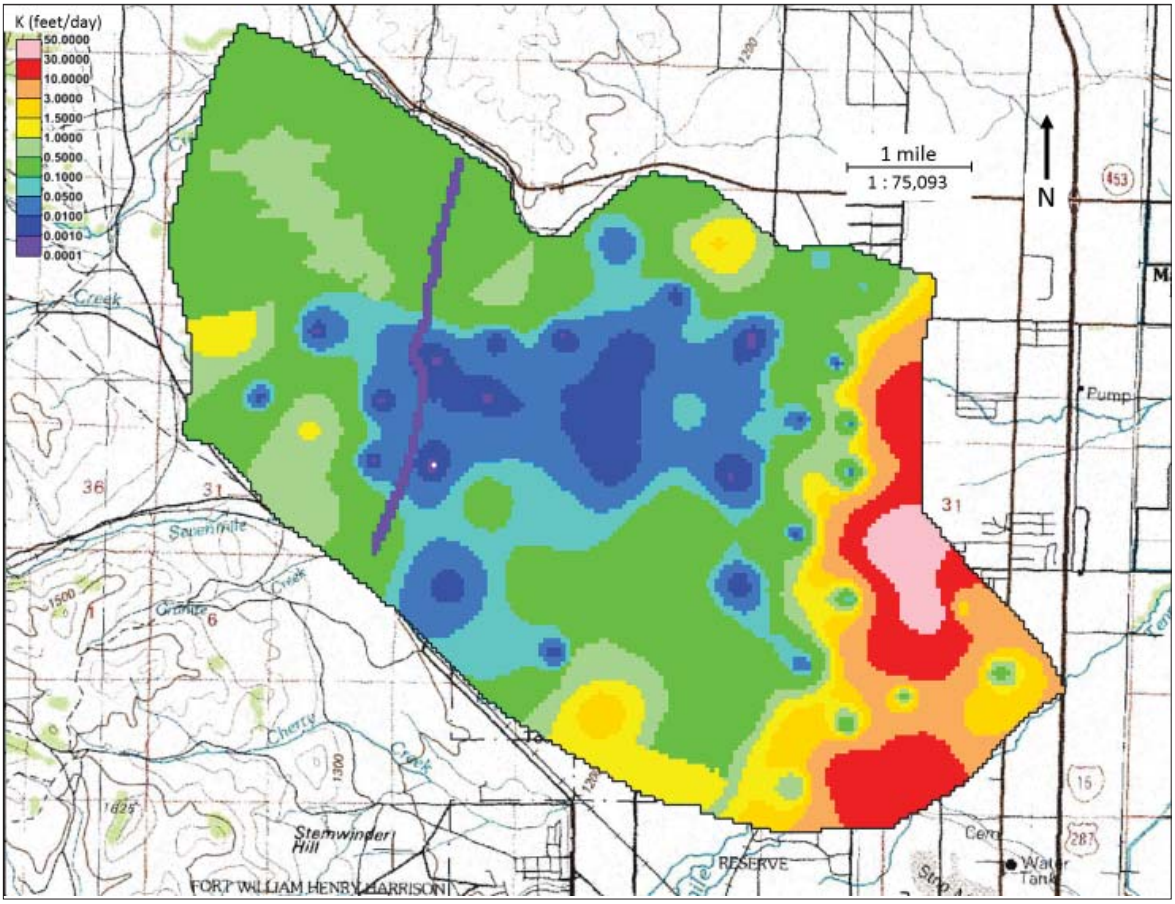
While these are primarily regulatory issues that must be addressed by the DNRC, DEQ, Lewis & Clark County, and others, the purpose of this investigation is to provide scientific information to assist decision making.

Approaches:

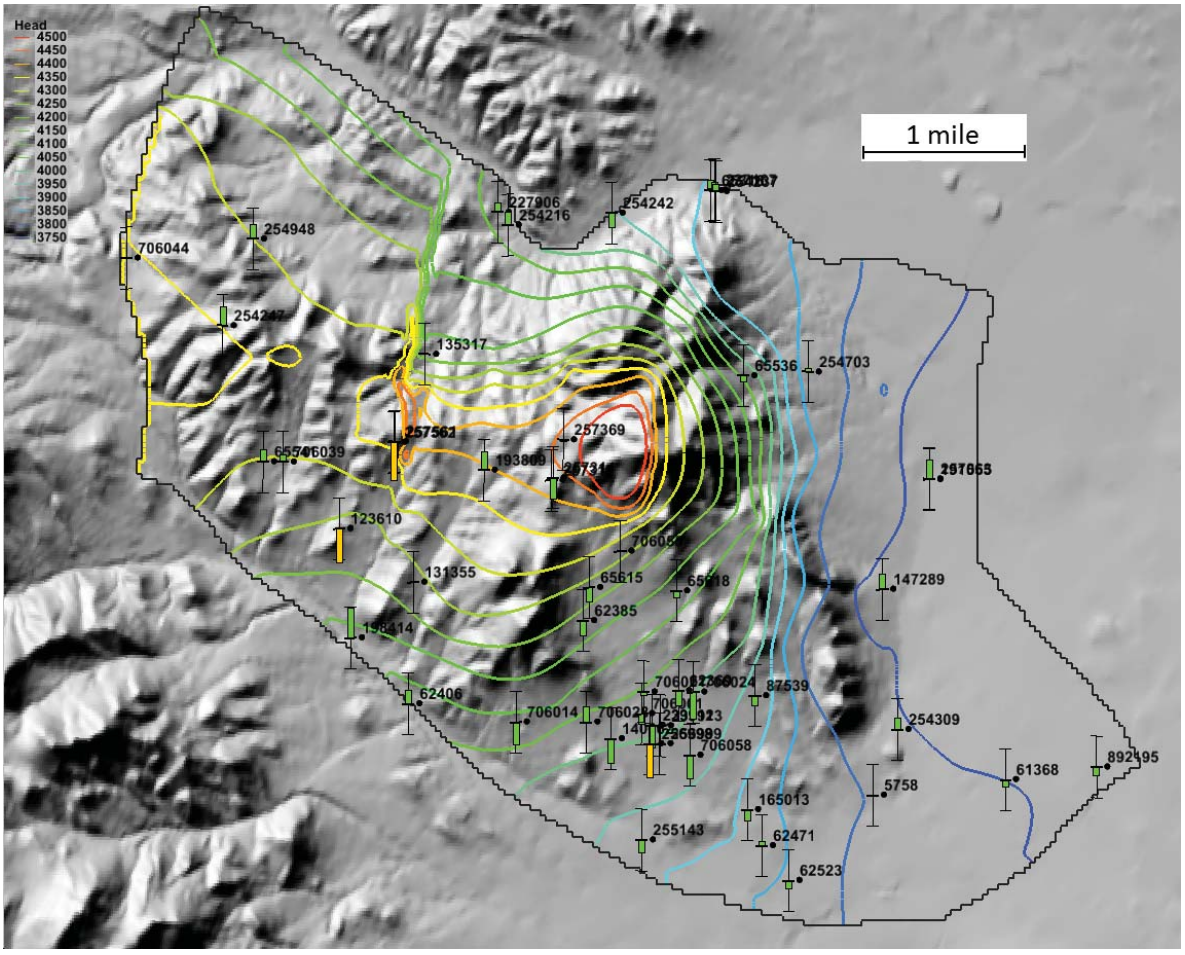
- Monitor groundwater elevations and spring discharges
- Conduct aquifer tests
- Document the water budget
- Develop a conceptual hydrogeologic model
- Prepare a numerical hydrogeologic model
  - Calibrate using monitoring data
  - Test development and mitigation scenarios



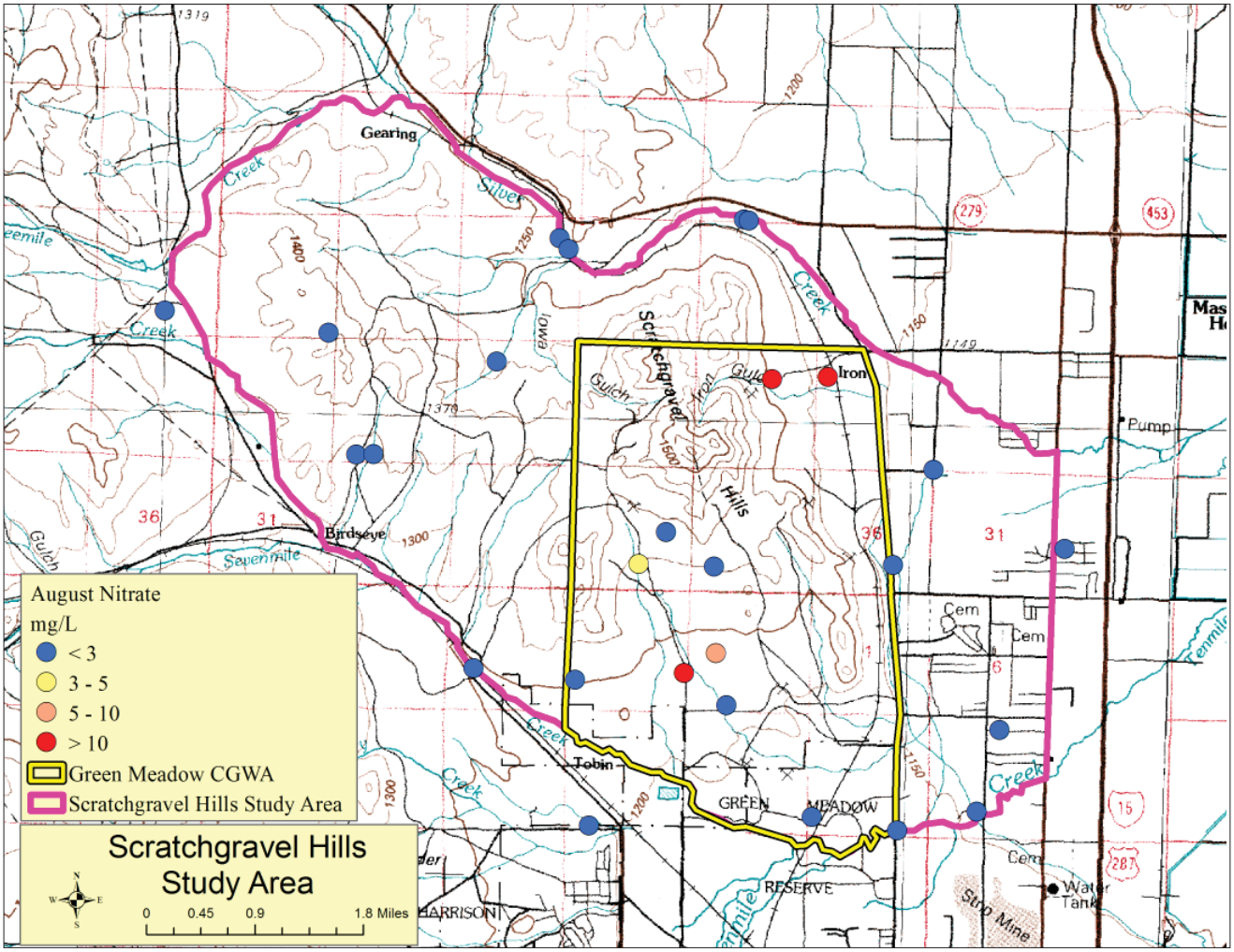
Groundwater levels and stream stage are closely correlated at the Upper Silver Creek site, and stream elevation is consistently higher than groundwater elevation (A). This same pattern is seen at all monitored surface water sites, which indicates that water flows from the streams to the groundwater, and that water does not flow from groundwater to surface water at these locations. Bedrock wells (B) respond to recharge events and pumping.



Distribution of hydraulic conductivity determined by pilot points in the Scratchgravel Hills steady-state model. The hydraulic connectivity determines how readily groundwater flows through an aquifer. Groundwater can flow readily through sands and gravel deposits in the Helena Valley, while it is more impeded in the fractured bedrock aquifer in the hills.



The modeled potentiometric surface resembles the actual mapped groundwater surface. The symbols at wells show that the model-generated value is either within the calibration range of 10 feet (green) or within twice that range (yellow).



Analysis of groundwater chemistry has shown that the standards for nitrate (above), arsenic, and manganese have been exceeded in some samples. The occurrence of these higher values appears to be localized.

Project results include:

- Refined seasonal groundwater surface maps
- Aquifer test results
- Water-quality data
- Water budget estimates
- Effect of bedrock faults on the groundwater fault system
- Groundwater–surface water interactions evaluated
- Surveyed monitoring well and surface-water monitoring network
- Calibrated numerical groundwater model available for use
- Improved groundwater monitoring network for continued use by the county

It is anticipated that this information will assist the DNRC, DEQ, and Lewis & Clark County in making necessary regulatory decisions. This information may also be used by the Legislature's Water Policy Interim Committee (WPIC) to determine if legislative actions are needed. Project reports and groundwater models will be available at the Montana Bureau of Mines and Geology website: http://www.mbmg.mtech.edu.