



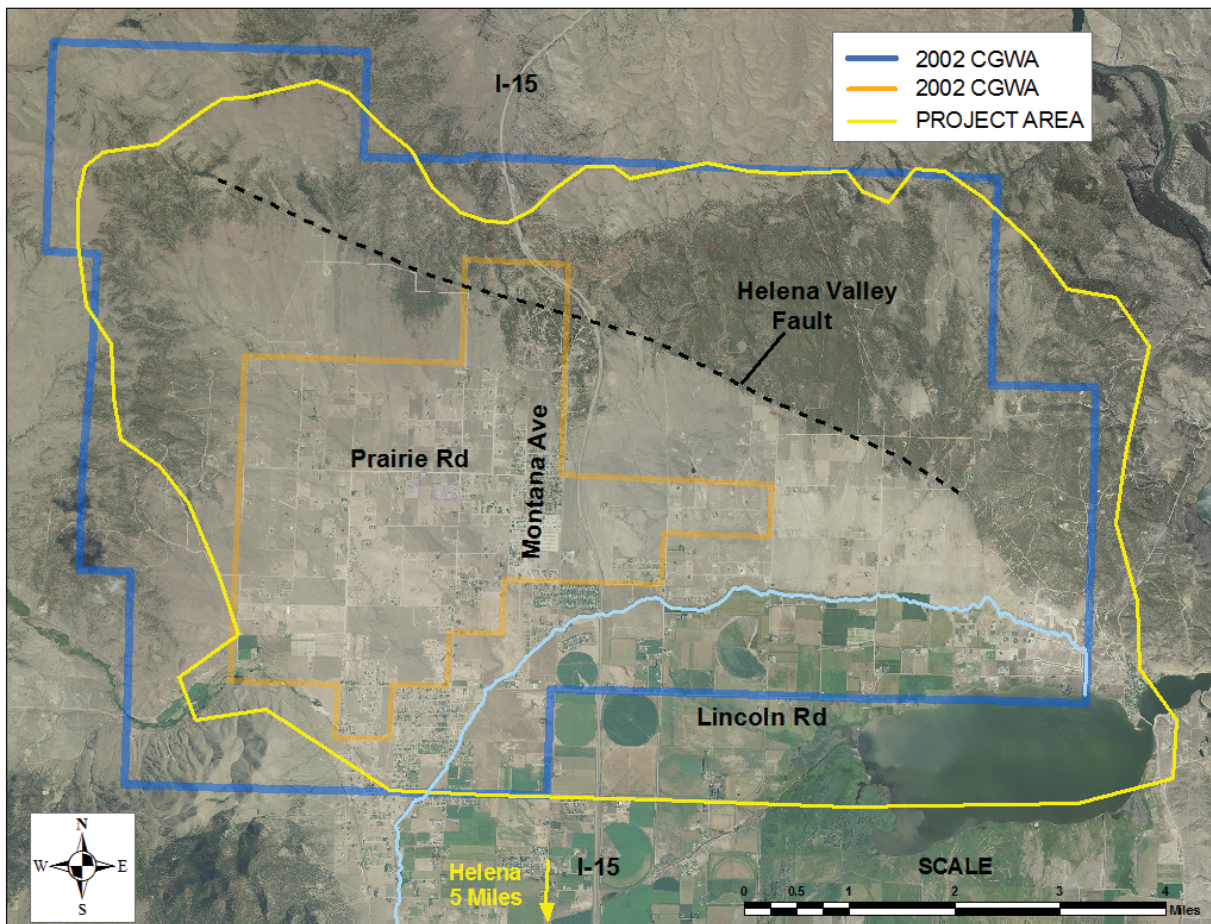
MBMG Ground Water Investigations Program

North Hills Study Area— Lewis and Clark County

Introduction

High-density subdivisions in the North Hills and declining groundwater levels 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 places where thin soils overlie shallow fractured bedrock. These concerns resulted in the designation of a Temporary Controlled Groundwater Area (CGWA) by the Montana Department of Natural Resources and Conservation (DNRC) in 2002 and again in 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 and the degree to which aquifers are connected, and to evaluate water-quality patterns. Numerical models of groundwater flow have been developed using these data. These models can be used to evaluate the impacts of various development scenarios.



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

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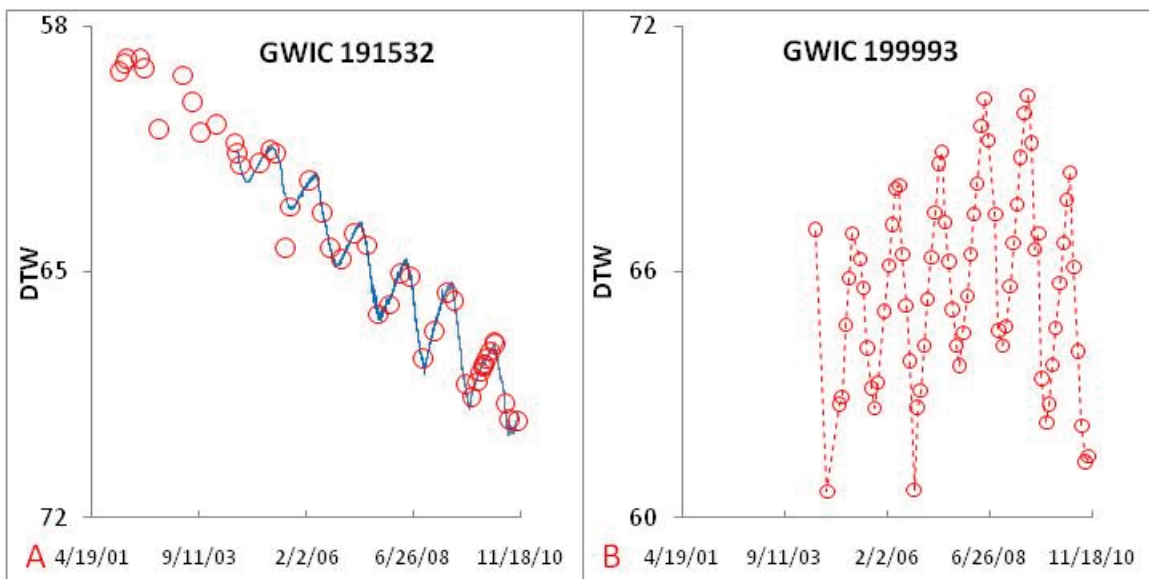
Project Issues:

- How much development can occur in the North Hills?
- Do septic systems need to be managed differently in the North Hills?
 - How densely can homes be spaced?
- Should future groundwater development within the area 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 area?

These are primarily regulatory issues, which must be addressed by the DNRC, Montana Department of Environmental Quality (DEQ), Lewis and Clark County, and others. The purpose of this investigation is to provide regulatory agencies and water policy experts with scientific information and products to assist in their decisions.

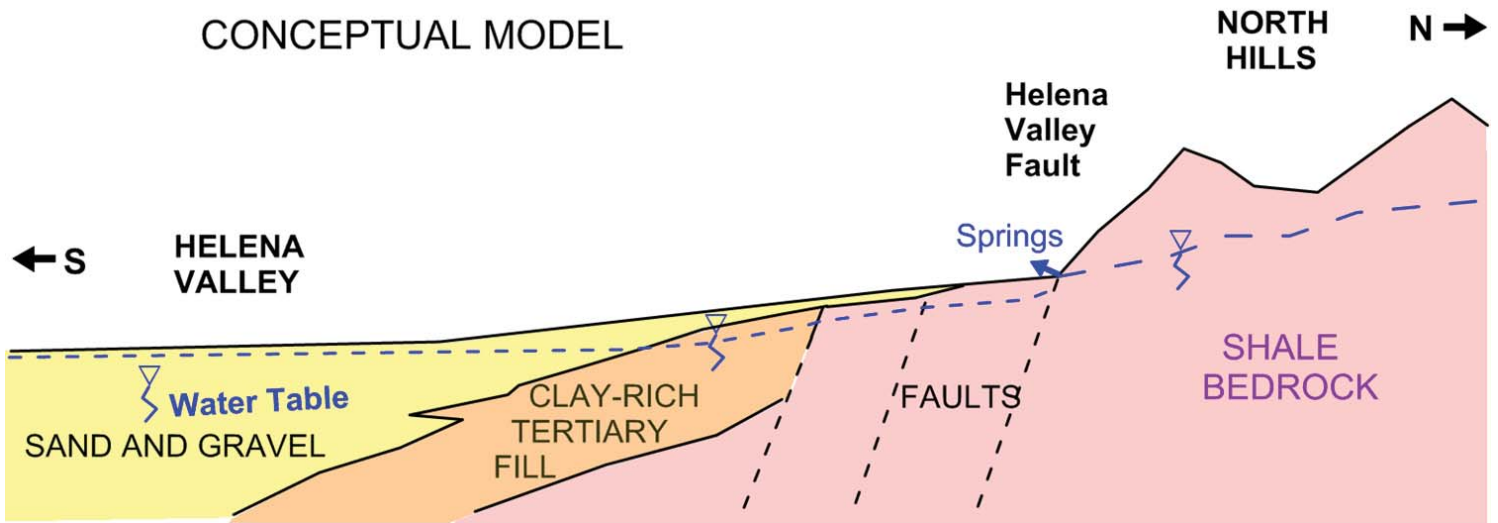
Approaches:

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



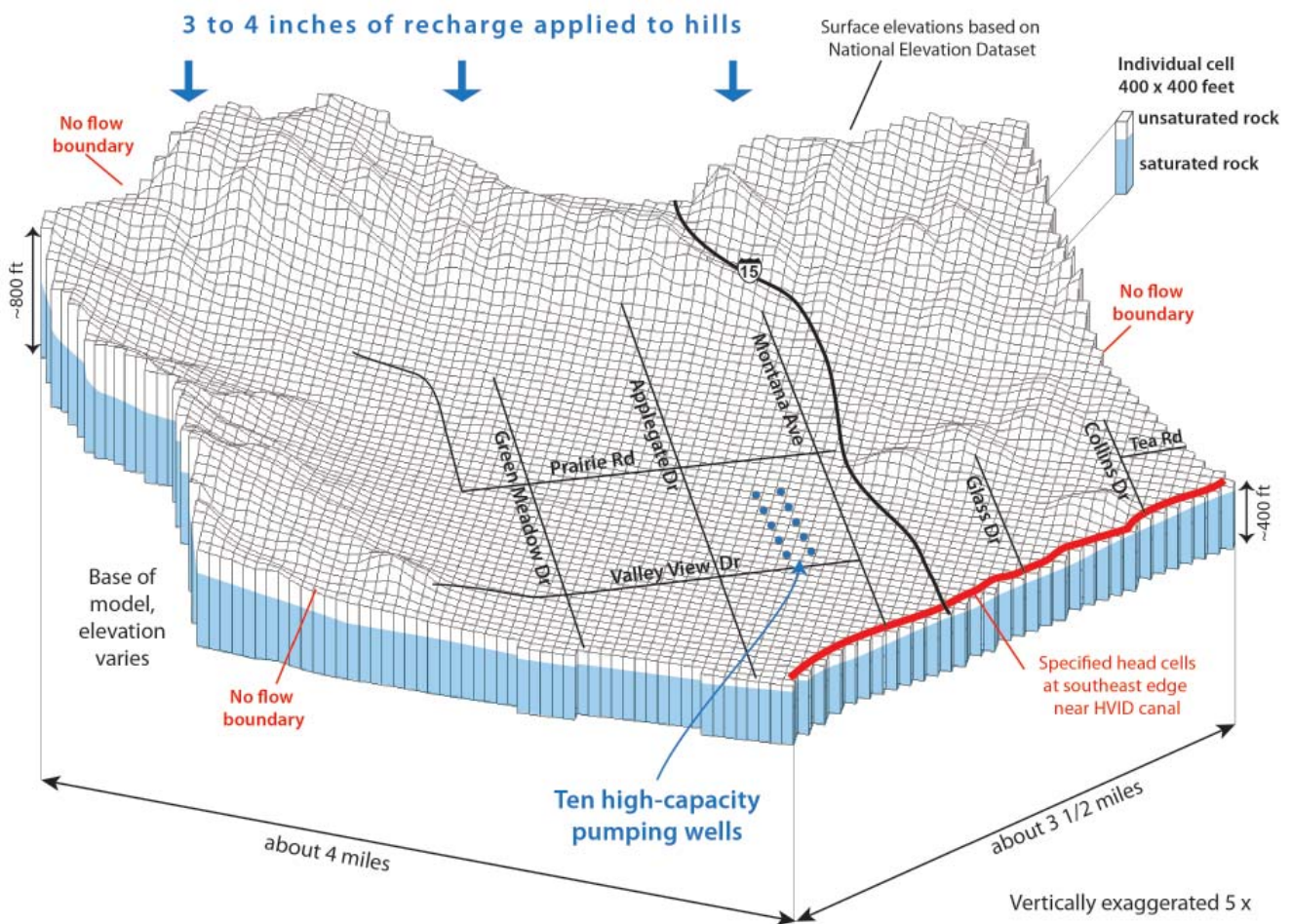
Groundwater levels are showing a consistent downward pattern in some portions of the North Hills (A). Some recovery occurs during the winter, when there is less pumping; however, maximum annual water levels have been consistently falling. In other areas, there is seasonal variation, but the overall pattern does not show increasing or decreasing trends (B).

CONCEPTUAL MODEL

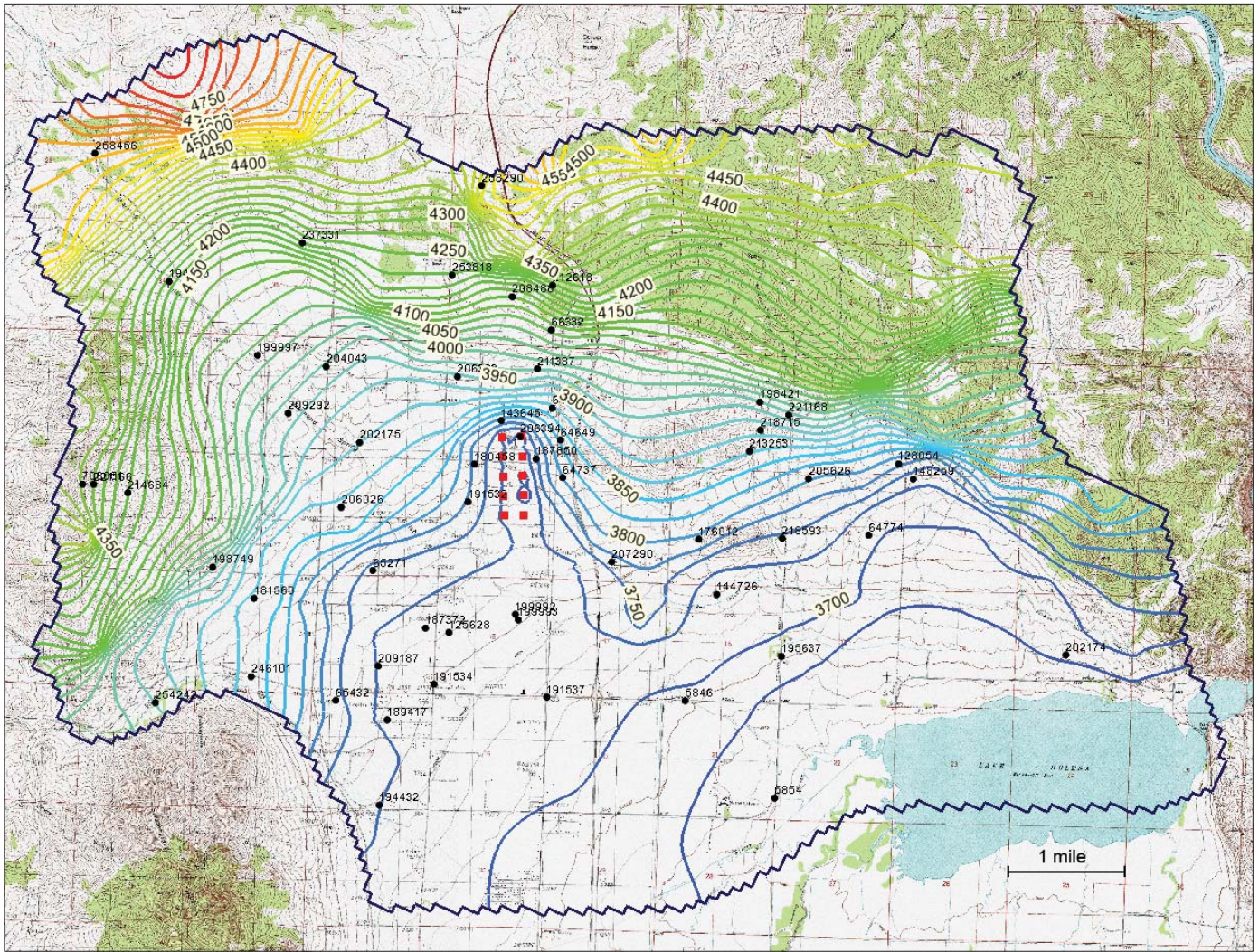


A basic conceptual hydrogeologic model for the North Hills, obtained by reviewing previous work in the North Hills.

North Hills Pediment Focus Model Schematic View



Two numerical groundwater models have been developed for the North Hills study area. The schematic diagram above shows the grid used for the Pediment Focus Model, a model that extends from the divide in the North Hills to the Helena Valley Irrigation District Canal. Another model, the North Hills Area Model, extends southeast to Lake Helena.



This map shows the groundwater surface calculated by the North Hills Area Model with four times the 2009 estimated groundwater withdrawals occurring in the vicinity of the denser subdivisions west of Montana Avenue and north of Valley View Drive. The amount of calculated drawdown and effects to Lake Helena can be analyzed using the groundwater flow model. The red squares are simulated pumping wells and the black dots are groundwater monitoring sites.

Project results include:

- Refined seasonal groundwater surface maps
- Aquifer test results
- Water-quality data
- Water budget estimates
- Effect of bedrock faults on the groundwater flow system
- Groundwater–surface water interactions evaluated
- Surveyed monitoring well and surface water monitoring network
- Calibrated numerical groundwater models 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.mbmgs.mtech.edu>.