

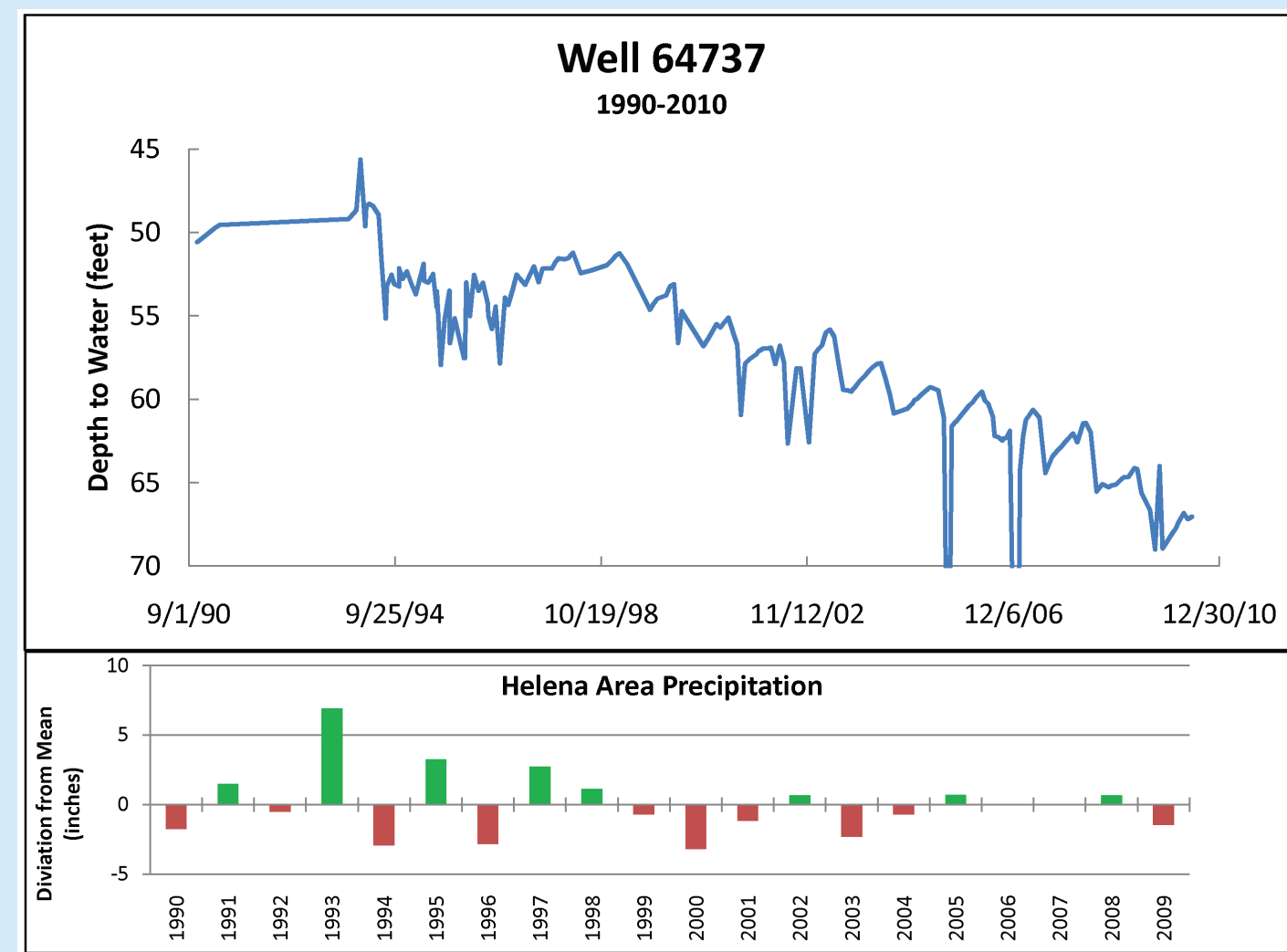


### Purpose

Controlled Groundwater Area (CGWA) established in 2008

### Major Concerns:

- Declining groundwater levels
- Continued groundwater development
- Individual septic systems in dense housing developments



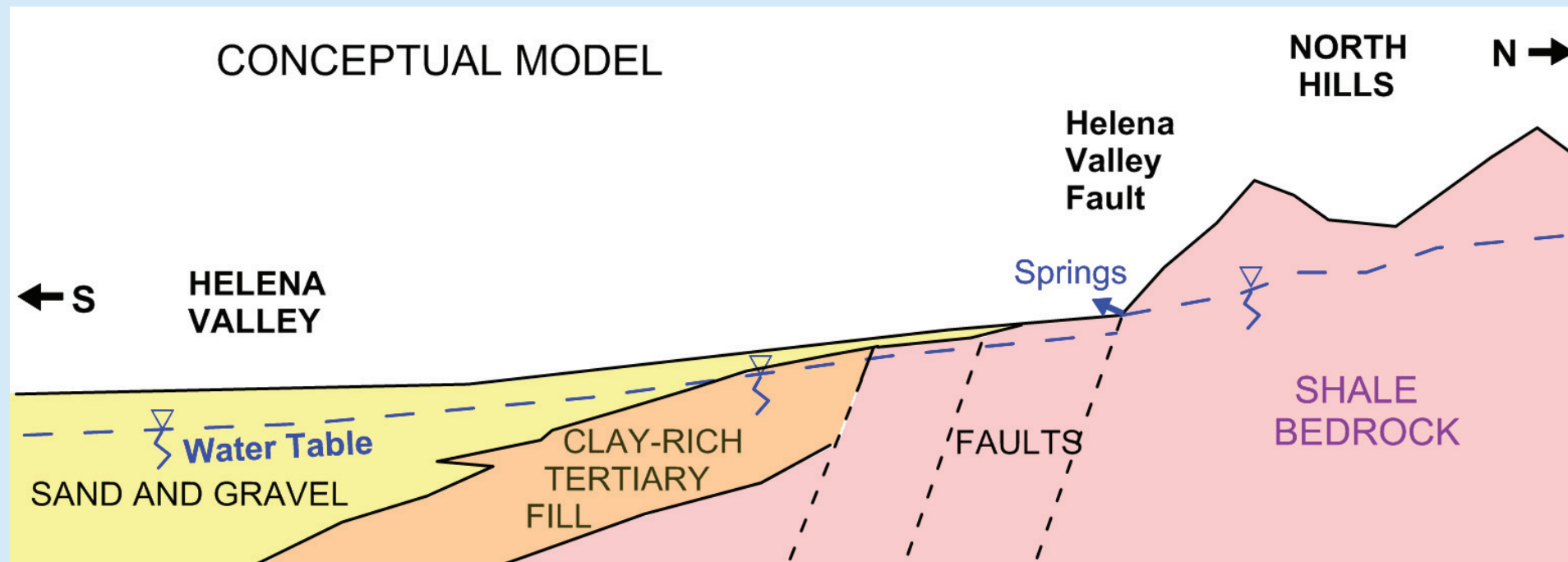
Some wells show decreases in groundwater levels relative to historical data which may partly be due to climatic conditions

### Previous Studies

**USGS:**  
1992: Hydrogeology of the Helena valley-fill aquifer system, west-central Montana (Briar and Madison; WRIR 92-4023)

2000: Hydrology of Helena-area bedrock, west-central Montana (Thamke; WRIR 00-4212)

**MBMG:**  
2006: Hydrogeology of the North Hills, Helena, Montana (Madison; MBMG 544)



### Hydrogeologic System

#### Principal Geologic Units:

- Shale/argillite bedrock
- Clay-rich Tertiary-age sedimentary deposits
- Sand and gravel valley-fill

#### Significant Hydrogeologic Features:

- Faults associated with the Lewis and Clark Fault Zone
- Helena Valley Irrigation District and associated canals and drains
- Silver Creek
- Lake Helena

### Acknowledgments

- Well owners
- Land owners
- DNRC, Water Resources Division
- Lewis and Clark County Water Quality Protection District
- Montana Tech Geophysical Department

# GROUND WATER INVESTIGATION PROGRAM

## North Hills Study Area

### Methods

- Groundwater levels
- Surface water monitoring
- Water-quality sampling
- Well installations
- Soil borings
- Aquifer tests
- Geophysical surveys
- Groundwater modeling



Installing a well at the Helena Valley Fault Site

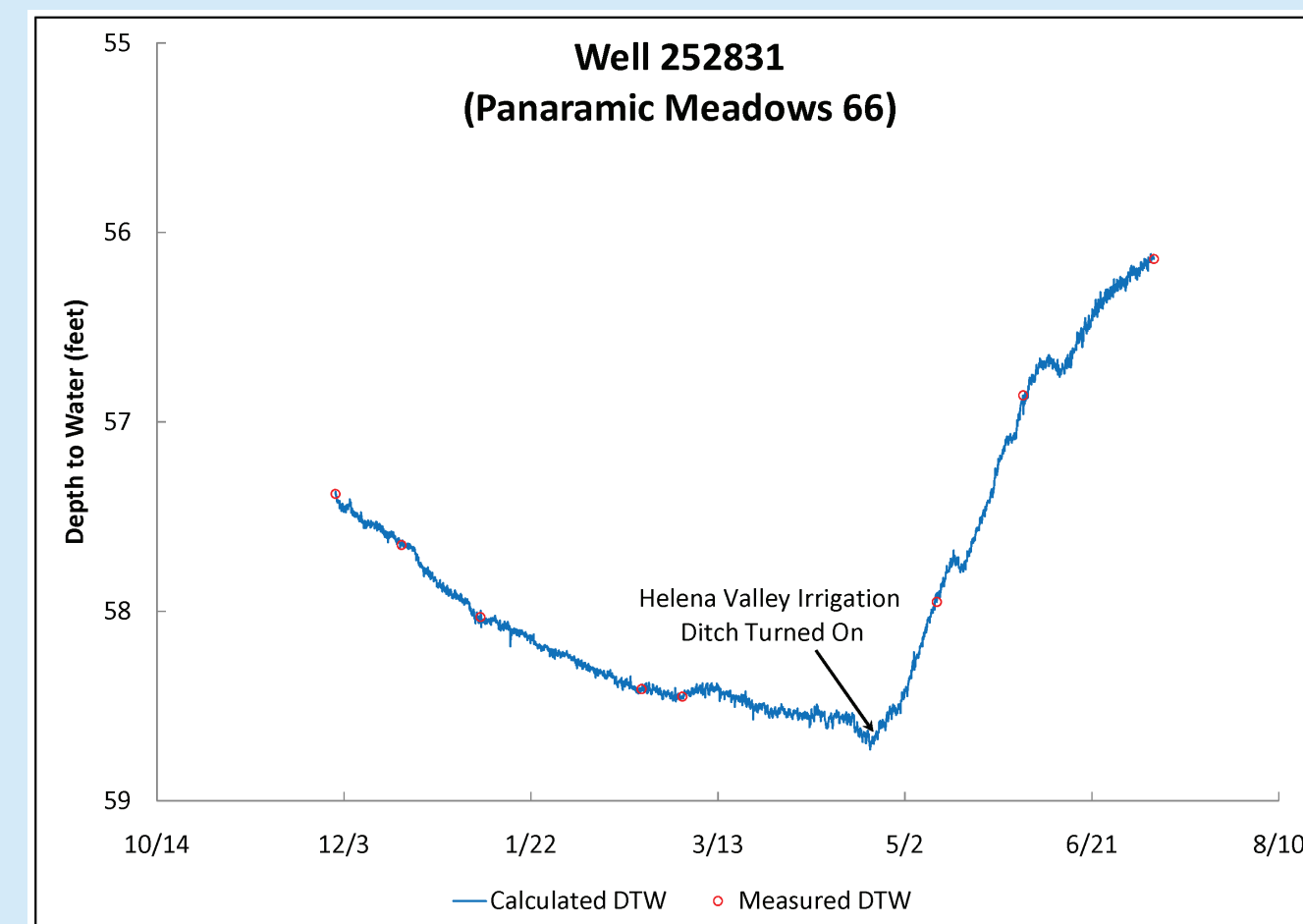
### Final products

- Conceptual Report
- Modeling Report
- Data Report
- GWIC Database (<http://mbmggwic.mtech.edu/>)



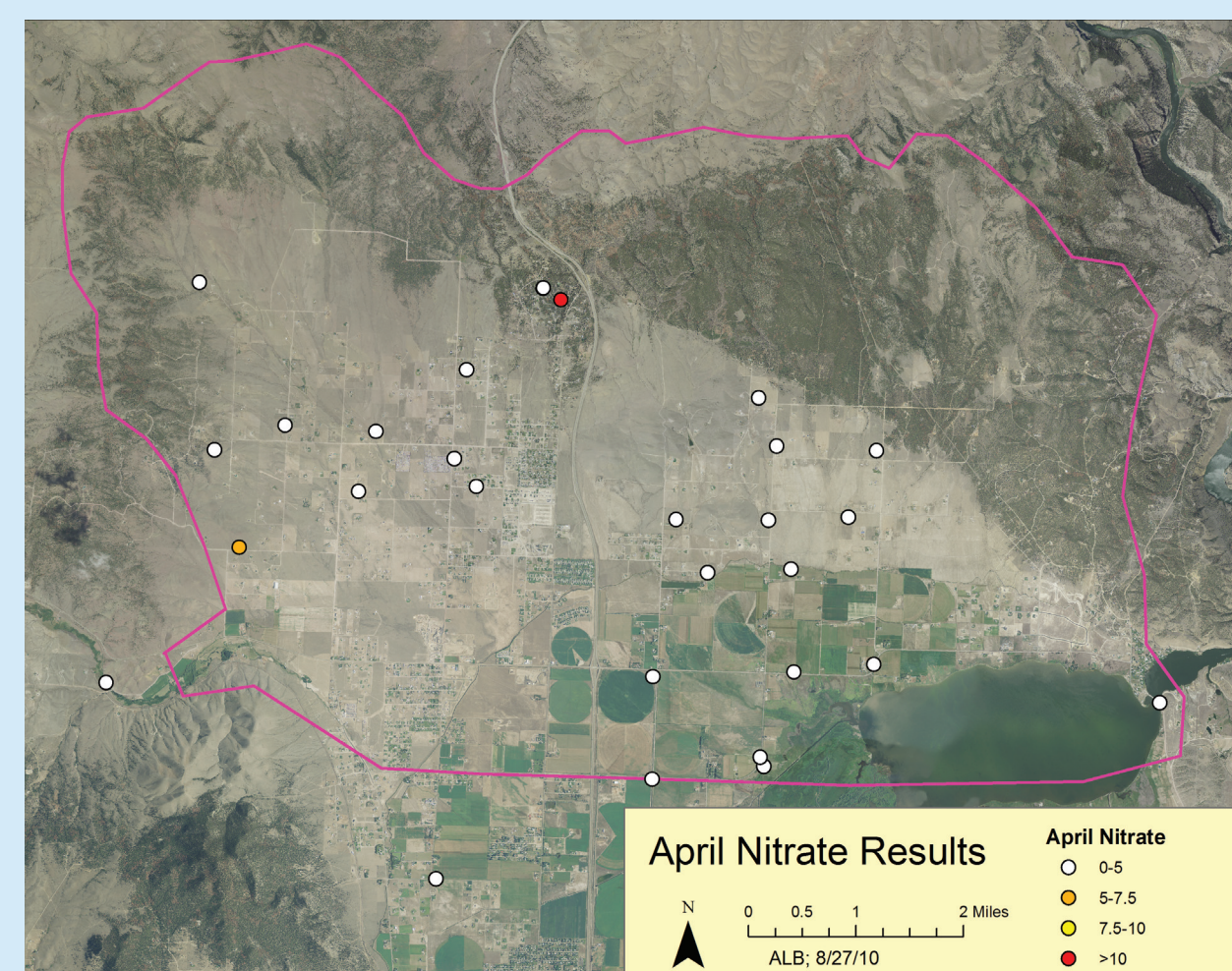
High density subdivisions have been, and are being, constructed in the North Hills

### Interpretations



Hydrograph of a well near the Helena Valley Irrigation Ditch shows infiltration from ditch

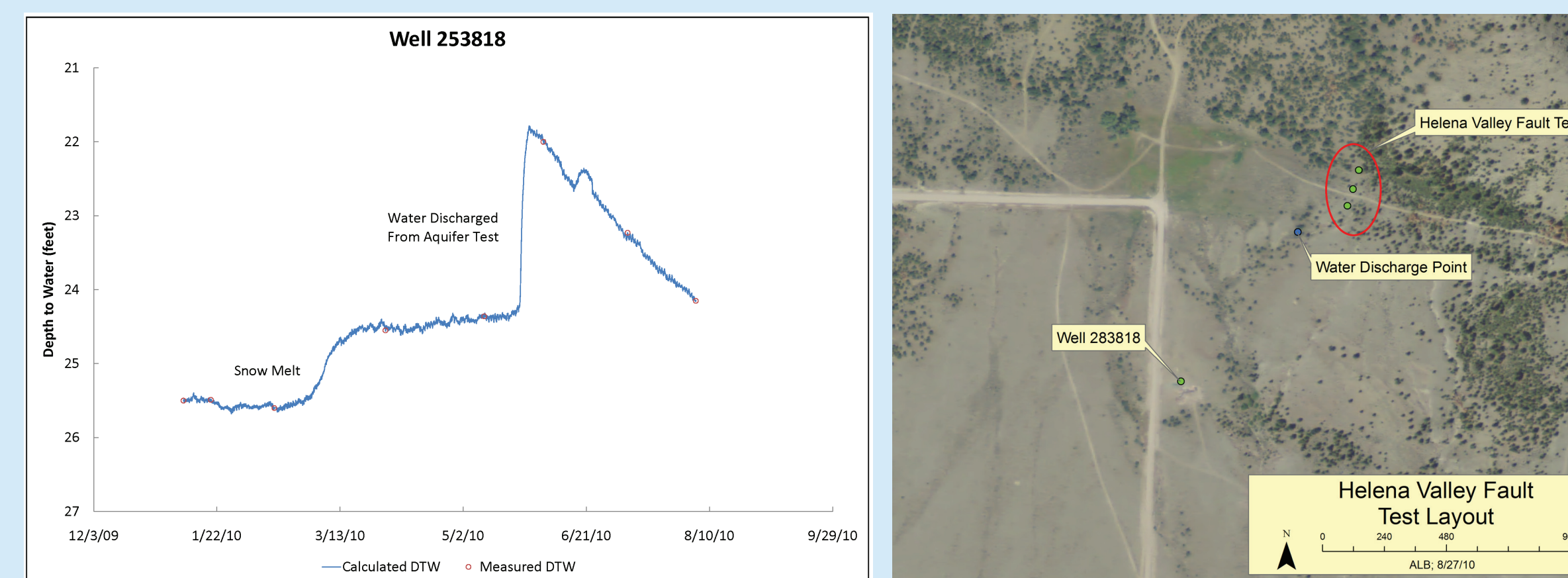
Silver Creek and irrigation recharge groundwater



Nitrate levels measured in April, 2010

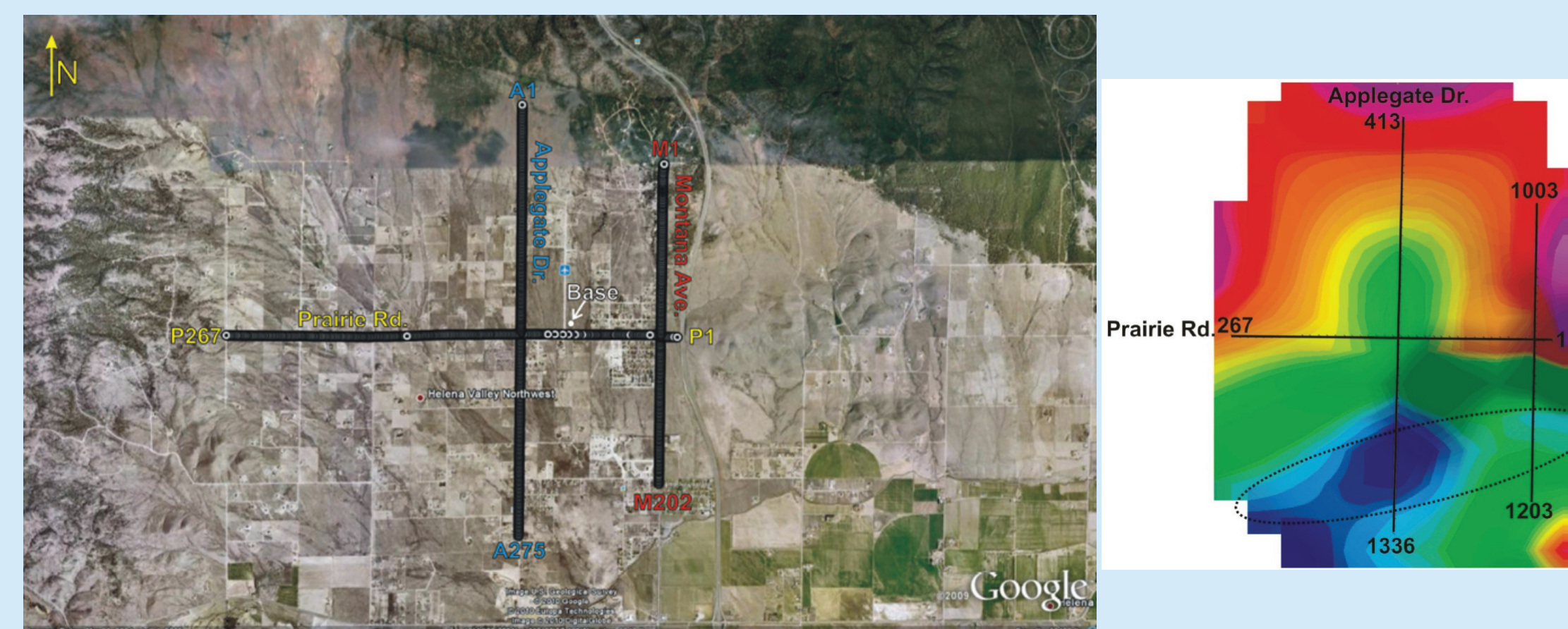
#### Water quality sampling in April and August:

- One nitrate sample exceeded the standard
- Isotopes analysis underway



Spring snowmelt recharge and recharge from nearby aquifer test can be clearly seen, indicating rapid infiltration

Rapid infiltration results in little runoff



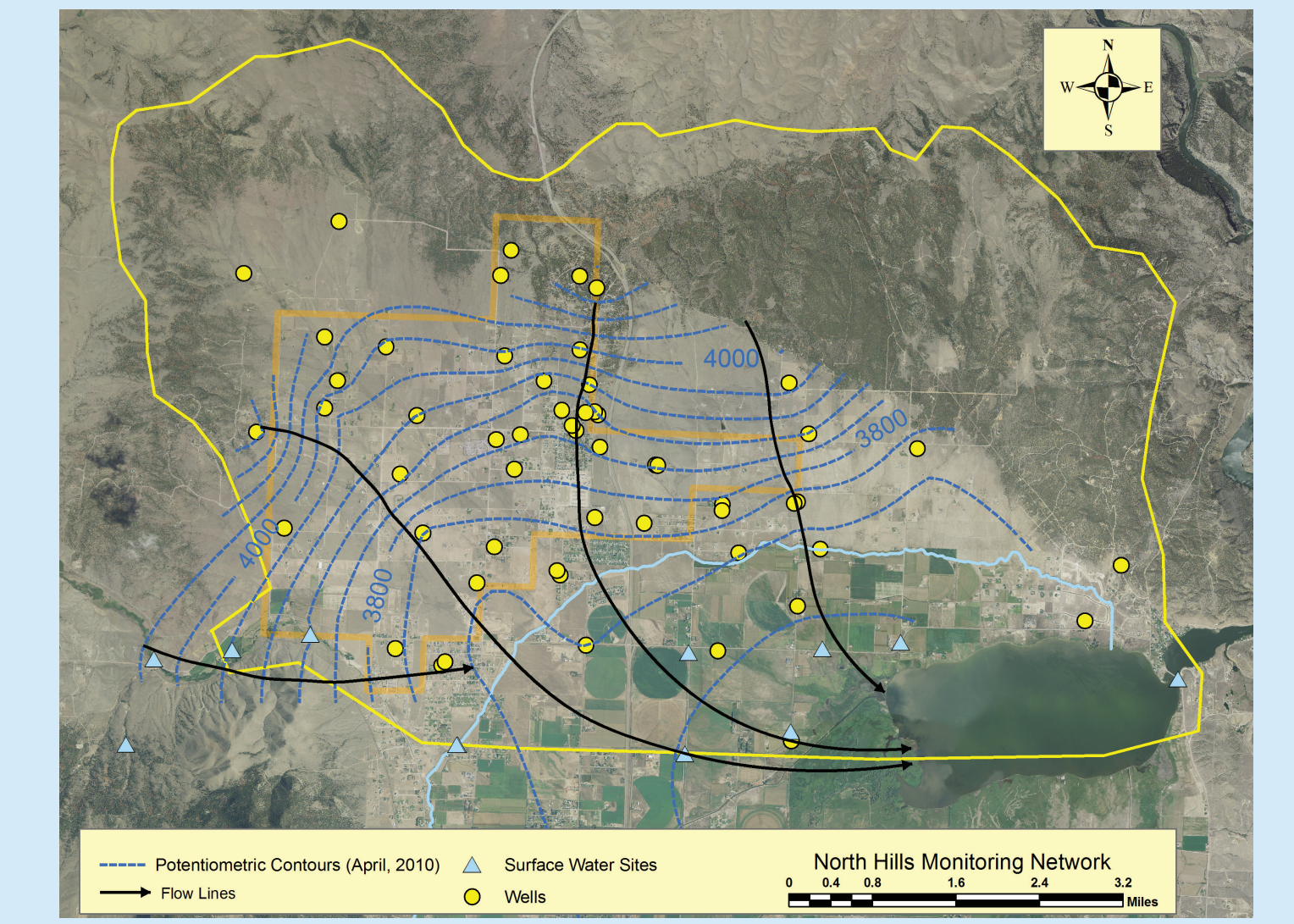
Maps showing the location and results of gravity survey

#### Geophysical Studies:

- Electrical resistivity
- Seismic profiles
- Gravity surveys
- Magnetic surveys

### Key Questions

- Is a Controlled Groundwater Area needed?
- What level of development is sustainable?
- Are changes in septic system requirements needed?



Monitoring network, potentiometric surface and flow lines

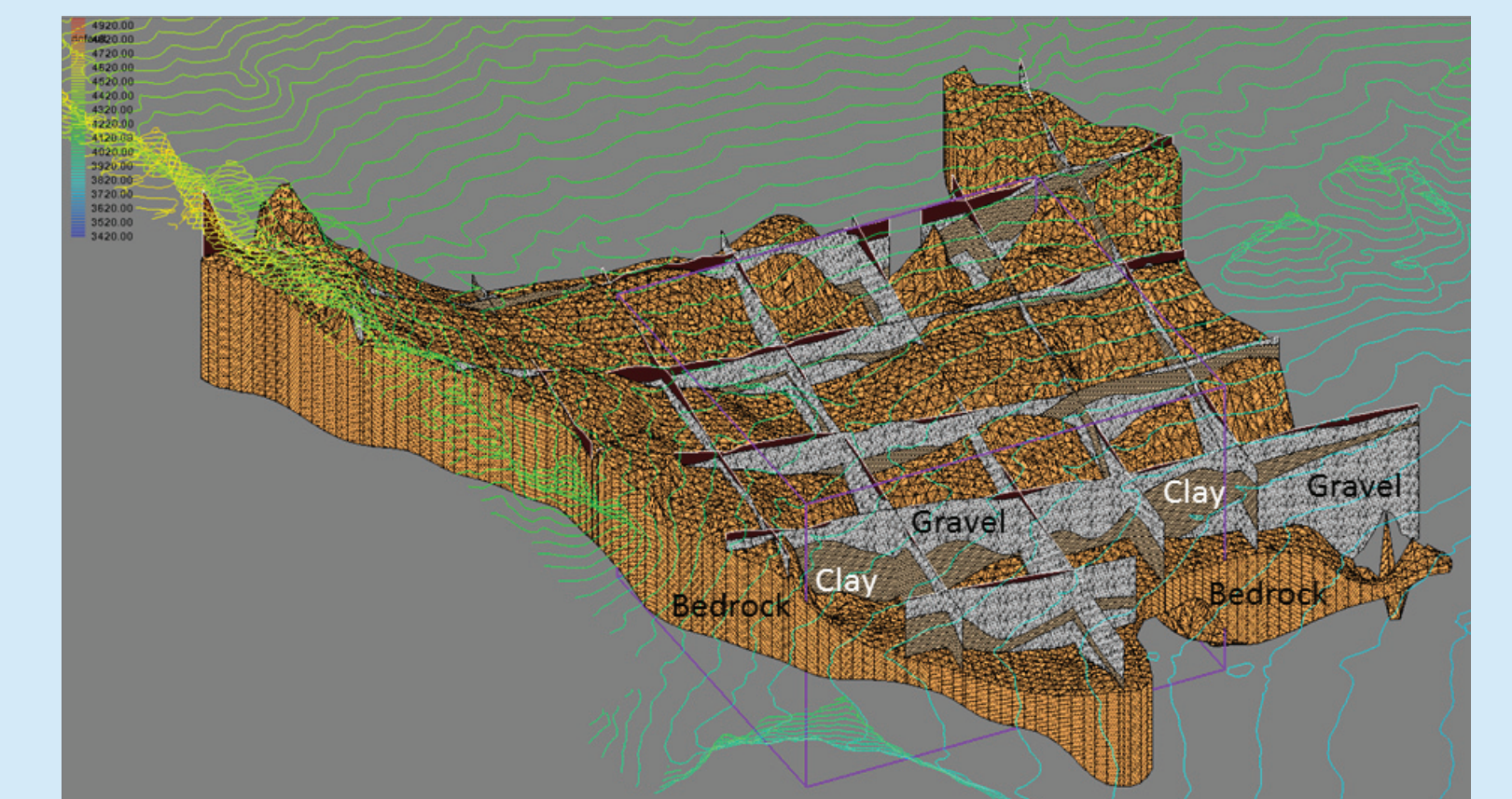
### Monitoring Network

- Existing and new wells
- Groundwater levels
- Surface water flows/stage
- Aquifer tests
- Monitoring data allows for model calibration

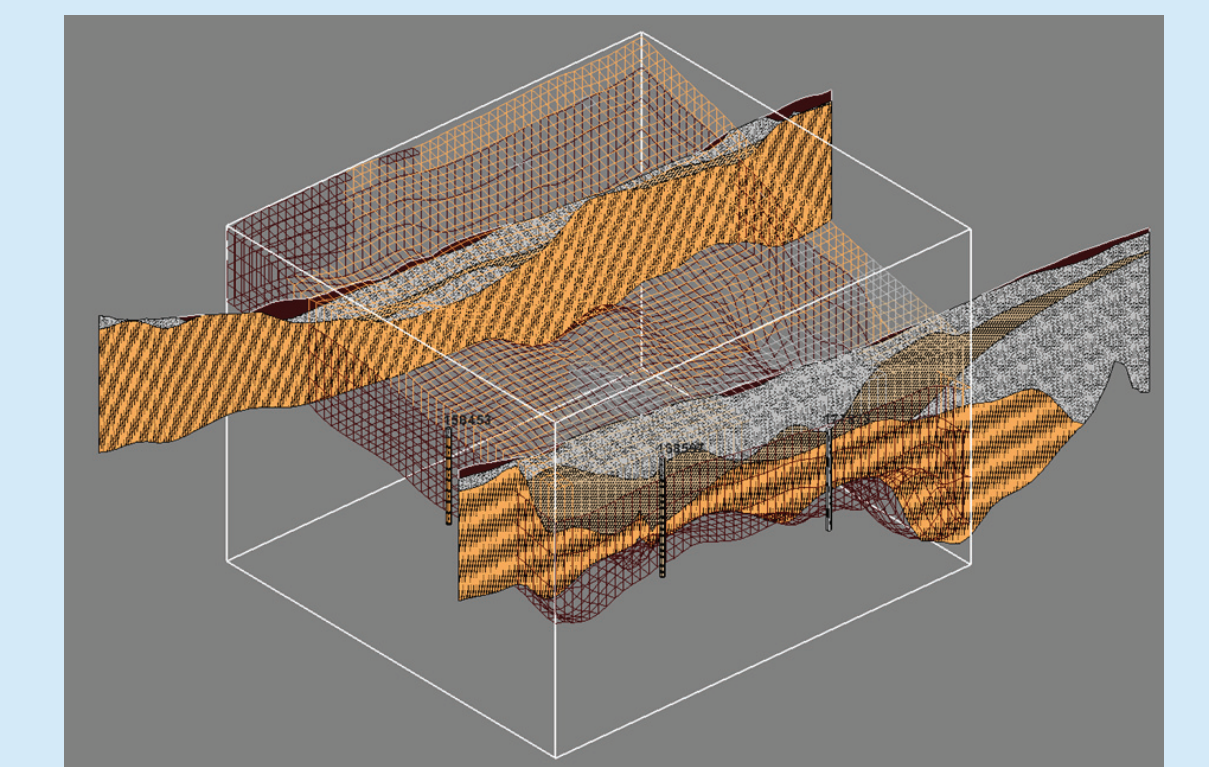
### Modeling

- Purpose:** Determine sustainable levels of groundwater development, Evaluate mitigation scenarios

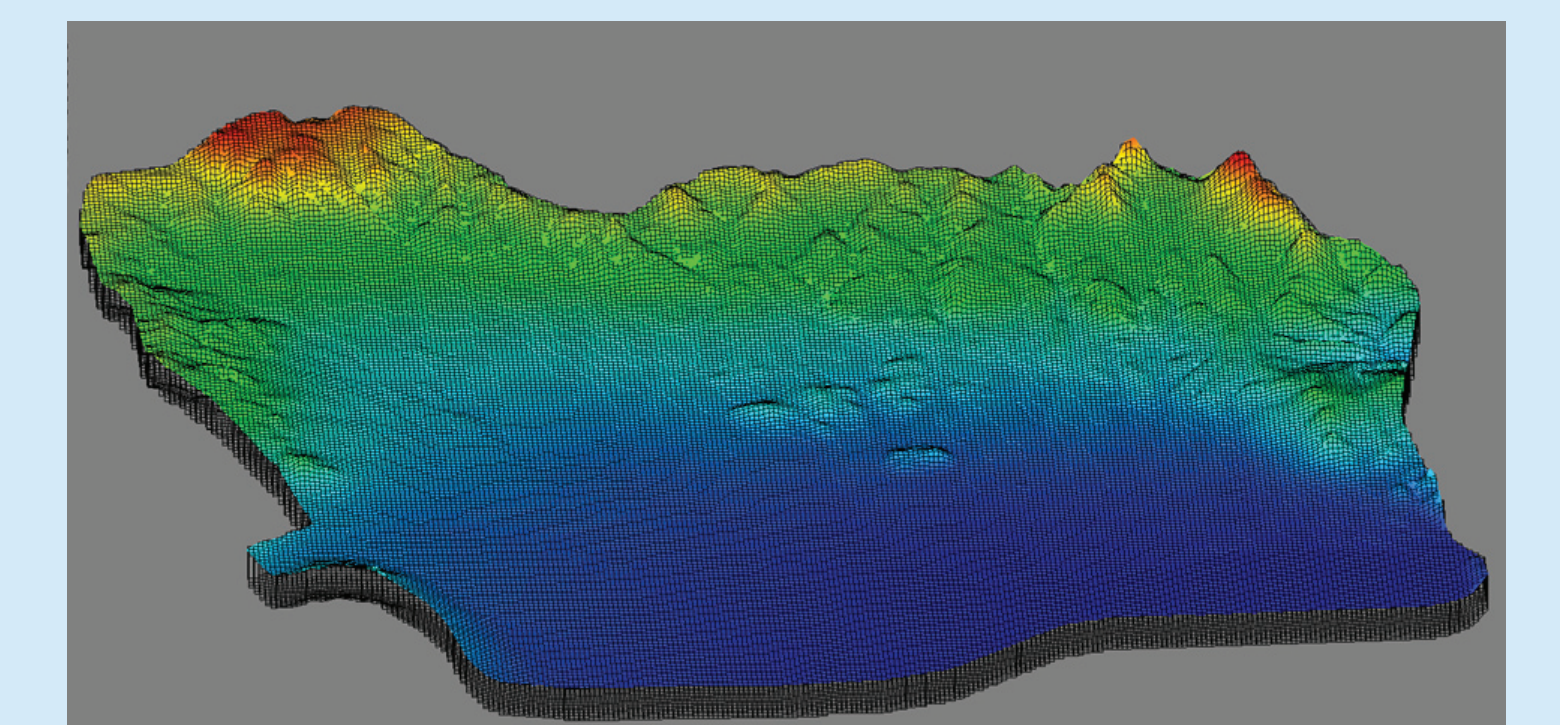
- Status:** 3D Geometry being developed using well logs and digital elevation data, Processing monitoring data for calibration



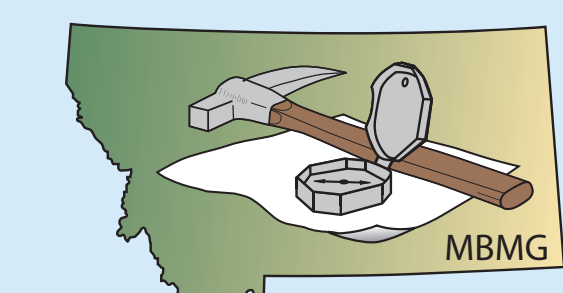
Geologic model based on well logs and digital elevation data



Groundwater model grid developed from geologic model



Groundwater model grid spacing



Visit the website <http://www.mbmgt.mtech.edu/gwip/gwip.asp> for more details about the GWIP program