

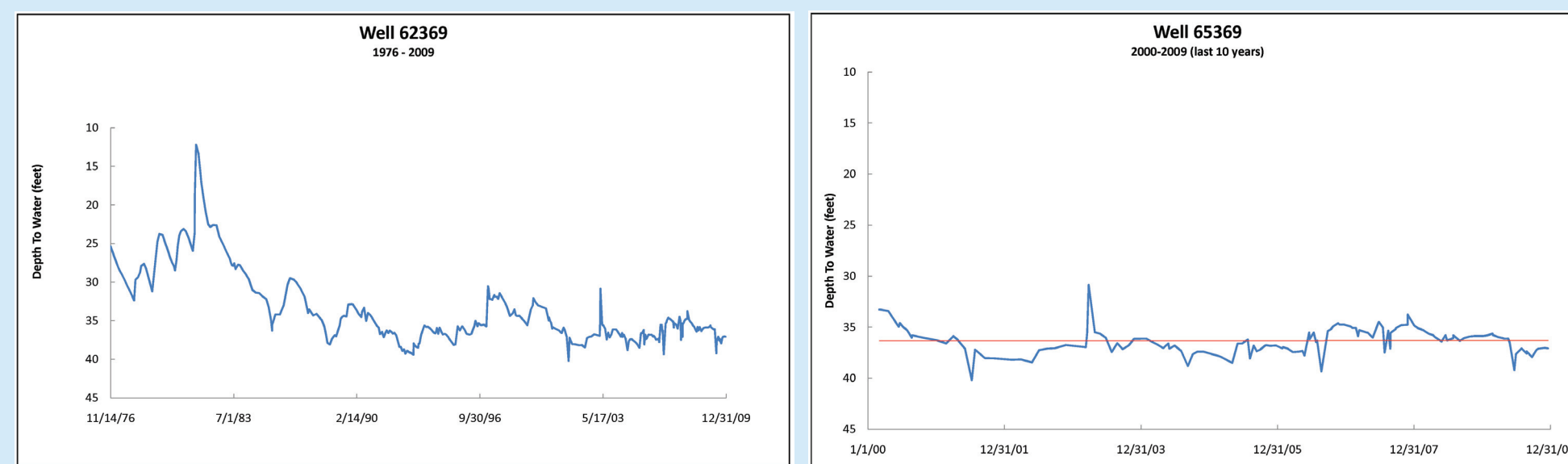


Purpose

Green Meadow Controlled Groundwater Area established in 2008

Major concerns:

- Declining groundwater levels
- Proposed high density subdivision
- Elevated nitrate levels



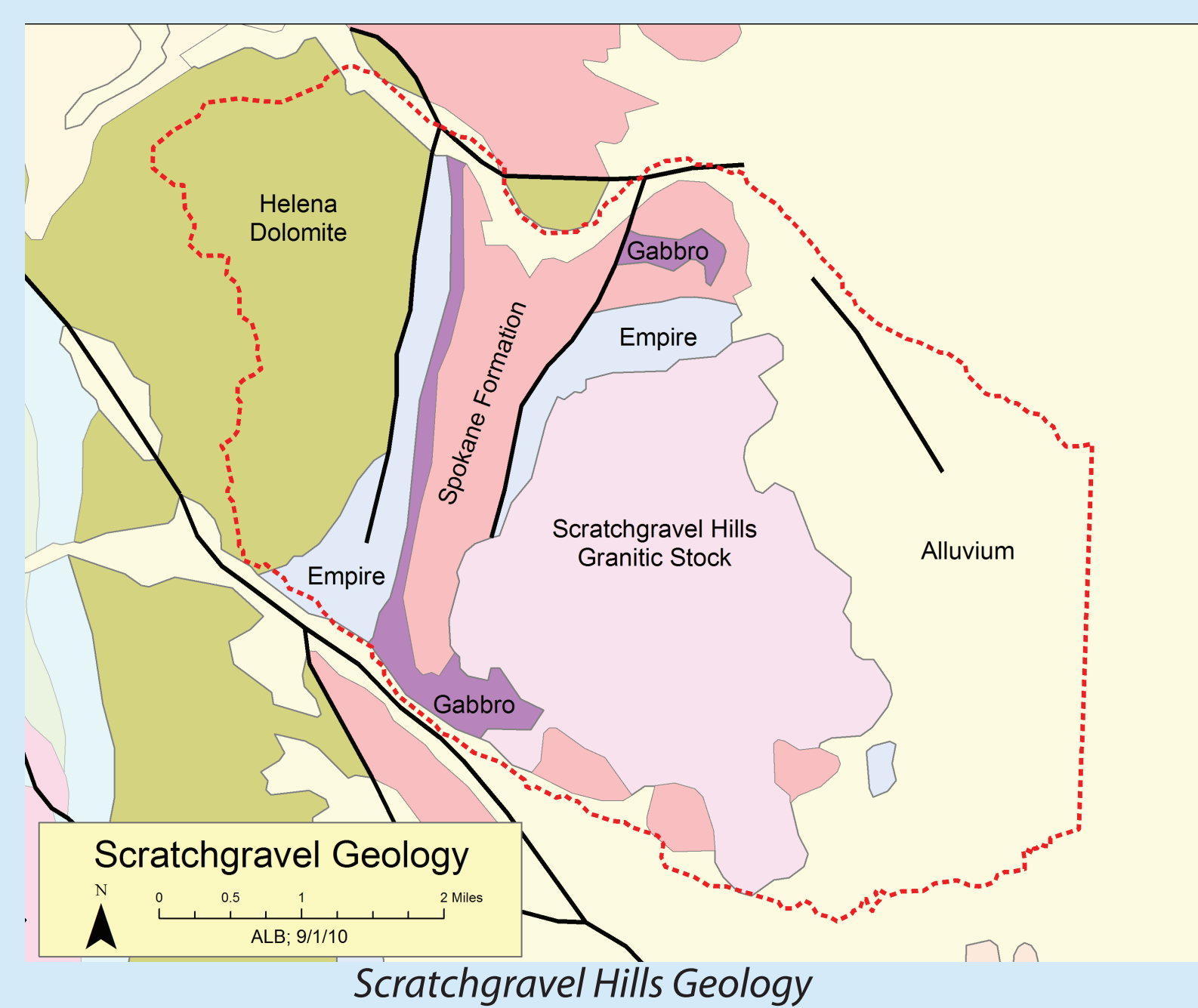
Some wells show declining groundwater level trends; however, there is no apparent trend over the last 10 years



Proposed High Density Sub-Division. Current zoning requires a 10-acre minimum lot size; however, size requirements could change in the future

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)



Hydrogeologic System

- | | |
|----------------------------------|---|
| Principal Geologic Units: | Significant Hydrogeologic Features: |
| Shale/argillite bedrock | Faults and fractures in bedrock |
| Granite bedrock | Helena Valley Irrigation District canals and drains |
| Limestone/dolomite bedrock | Creeks surrounding study area: |
| Sand and gravel valley-fill | Silver, Threemile, Sevenmile, Tenmile, and Park |

GROUND WATER INVESTIGATION PROGRAM

Scratchgravel Hills Study Area

Methods

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



Installing a piezometer adjacent to Sevenmile Creek

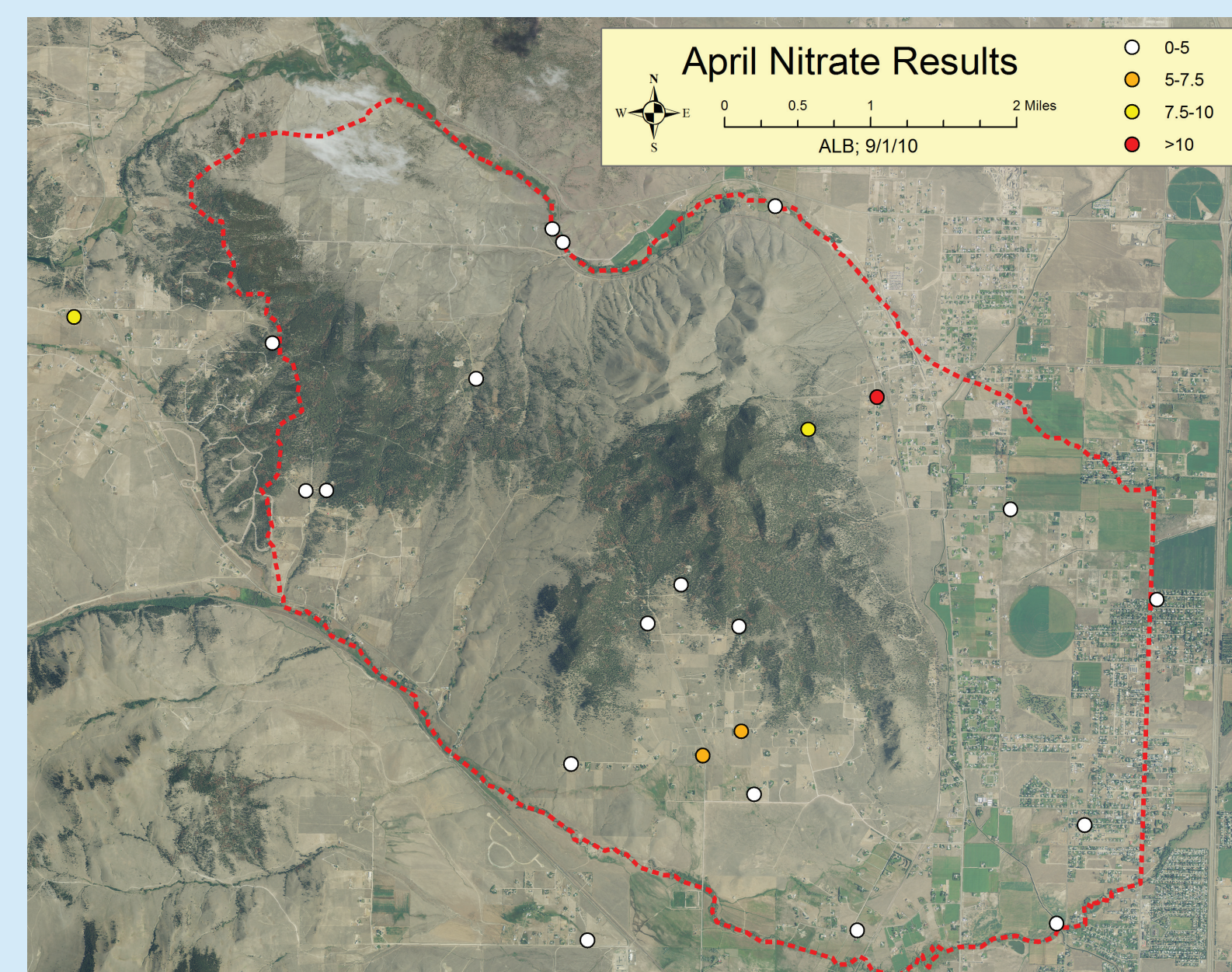
Team Members

- Kirk Waren – Project Manager
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- Andrew Bobst – Associate Hydrogeologist
- Julie Ahern – Assistant Hydrogeologist/Modeler
- Jane Madison – Professional Scientist
- Allie Brown – Student Assistant (MT Tech)

Final products

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

Interpretations

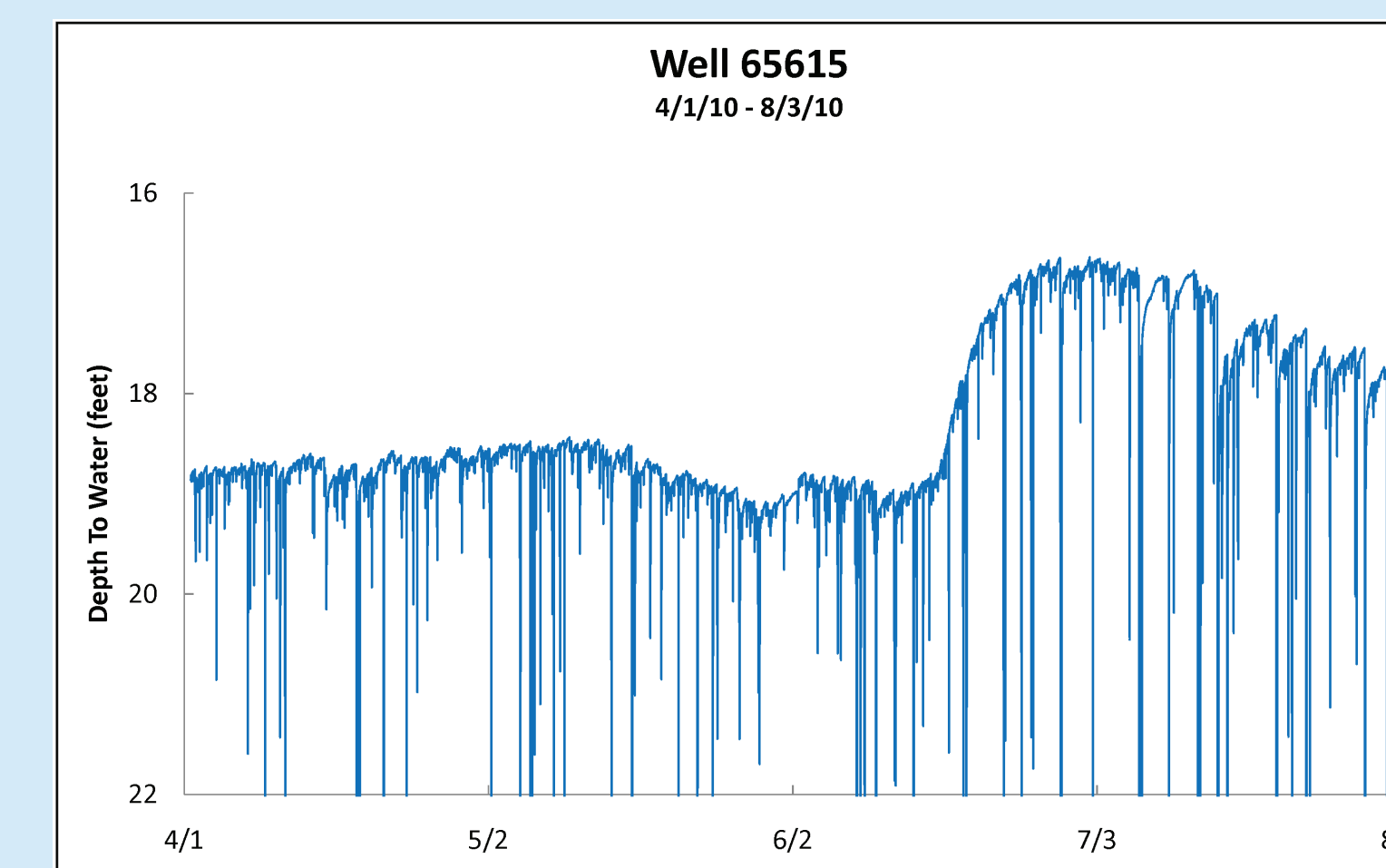


Nitrate levels detected in the April 2010 groundwater samples

Water Quality Sampling in April and August:
One nitrate sample exceeded standard
Isotope analysis underway to identify source

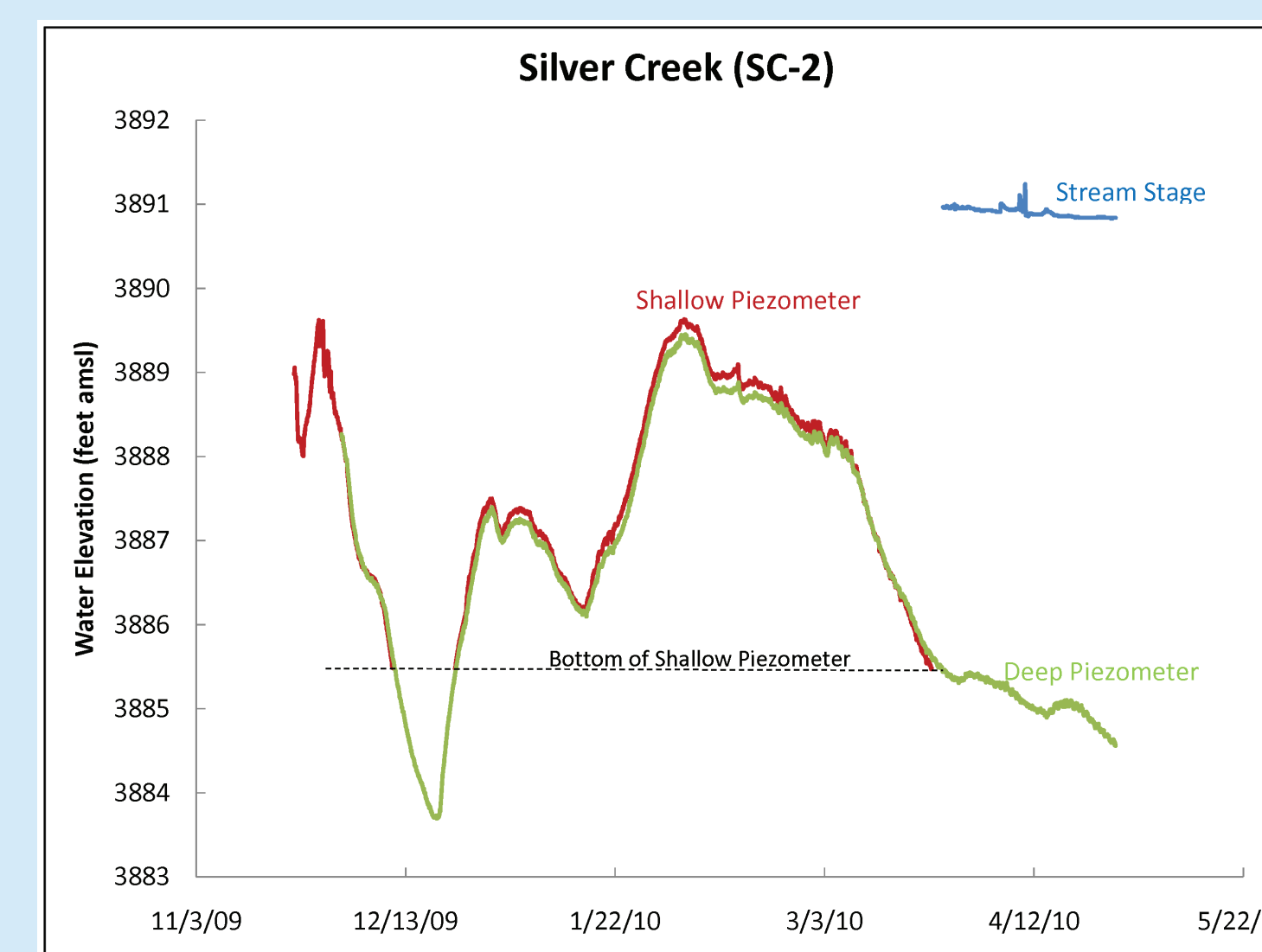
Groundwater Recharge:

- Local precipitation is primary source of recharge
- Little runoff, rapid infiltration
- Delayed response time (months)
- Creeks and irrigation are also sources of recharge

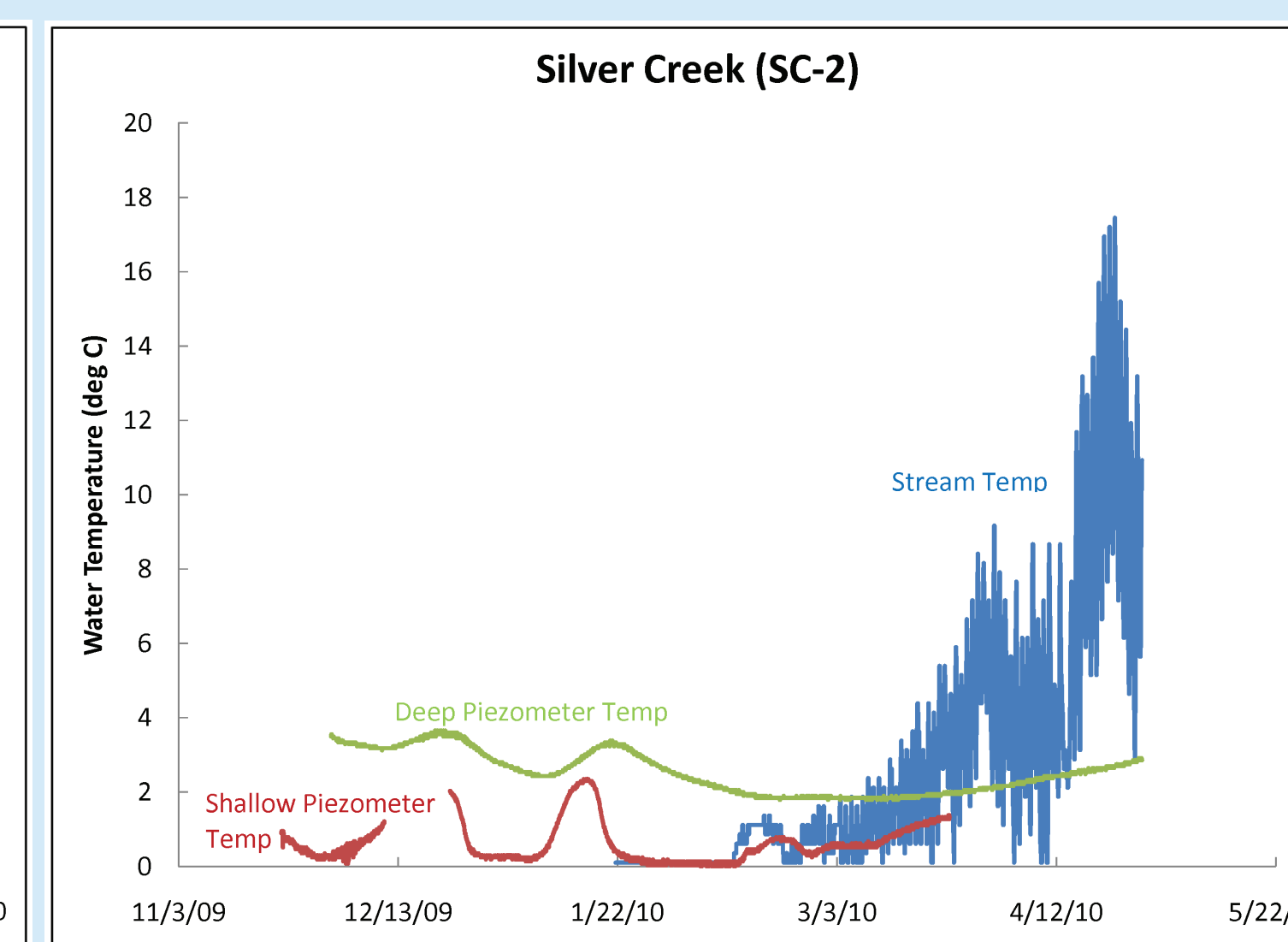


Spring recharge as evidenced in a house well. Note the water level did not rise until mid June

Surface-Water Interaction:
Creeks and irrigations canals/ditches
Significant sources of recharge locally



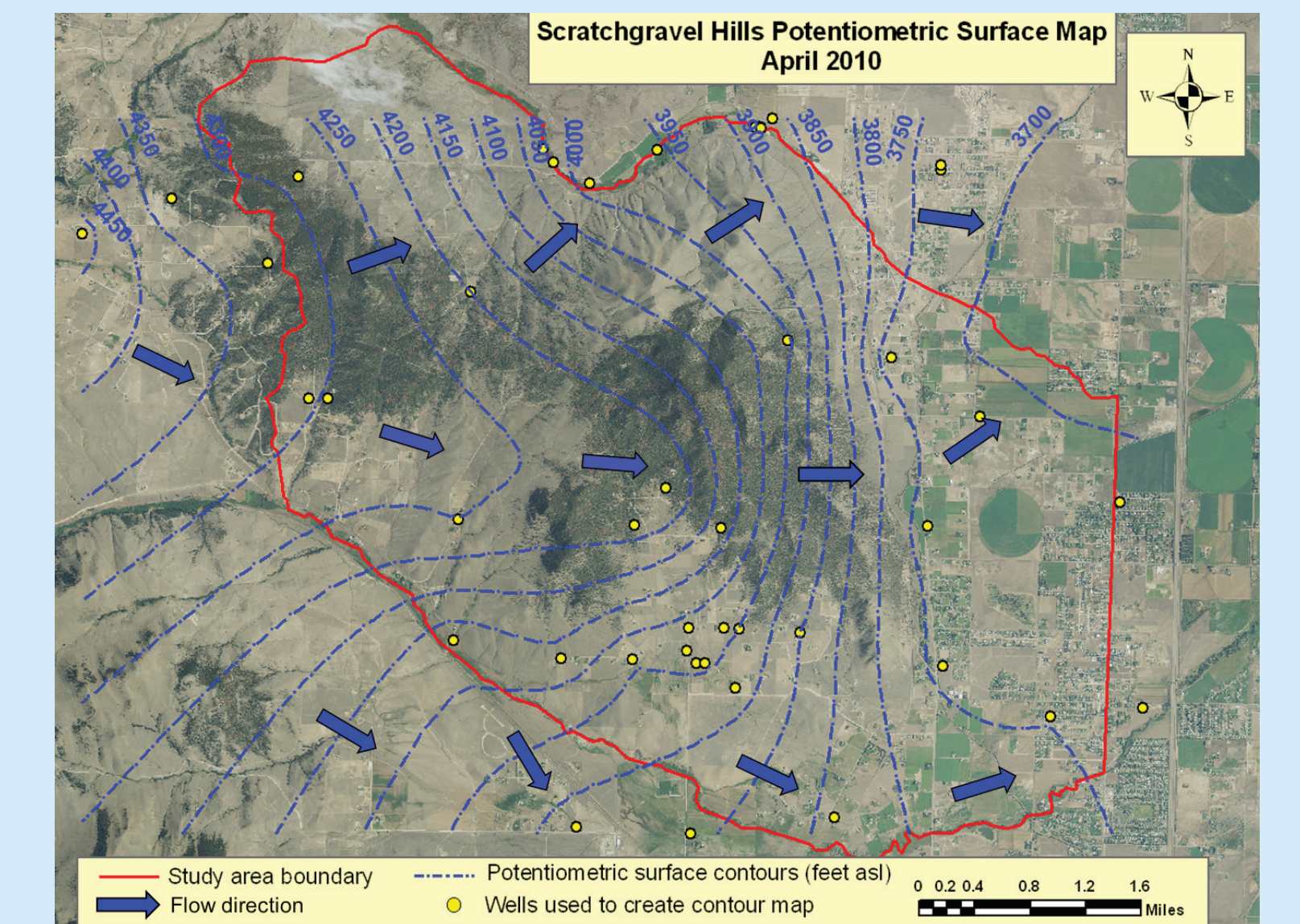
Groundwater elevations along Silver Creek are lower than the creek stage, indicating that Silver Creek is a losing stream



Temperature data provide further evidence that Silver Creek is a losing stream

Key Questions

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



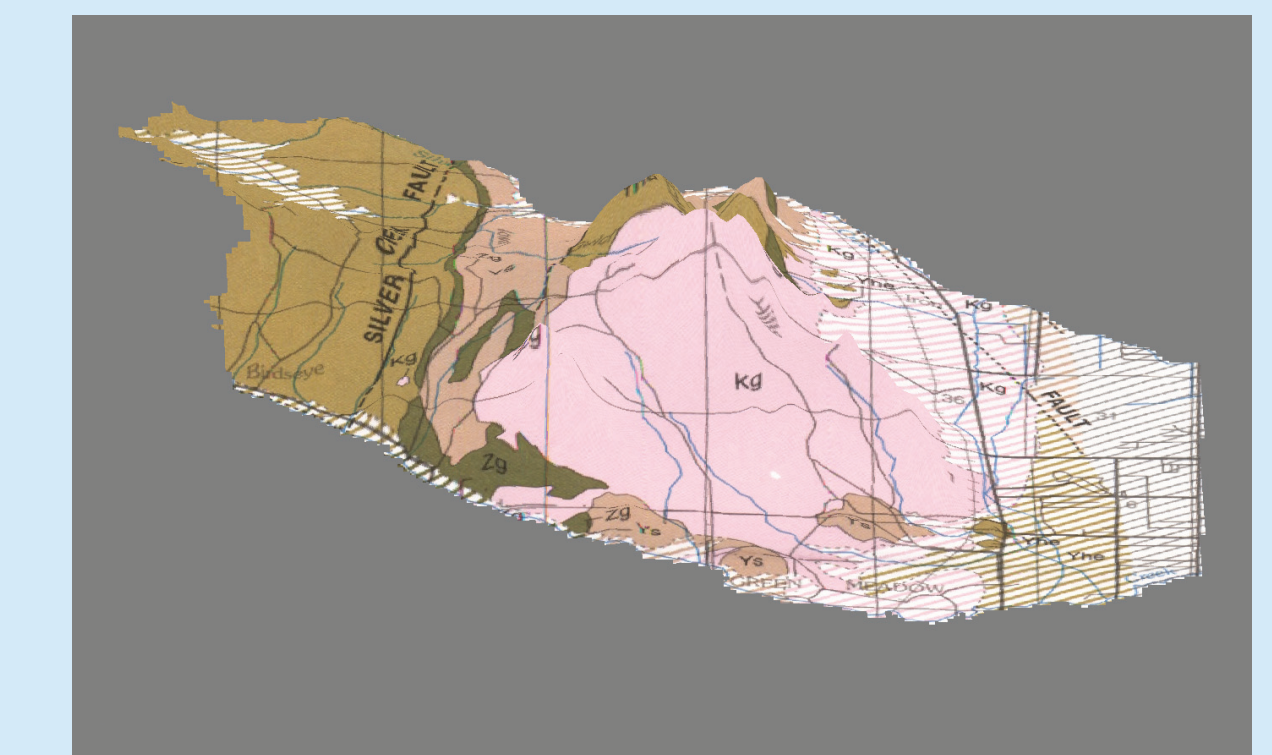
Potentiometric surface map. Water levels were measured April 20, 2010

Monitoring Network

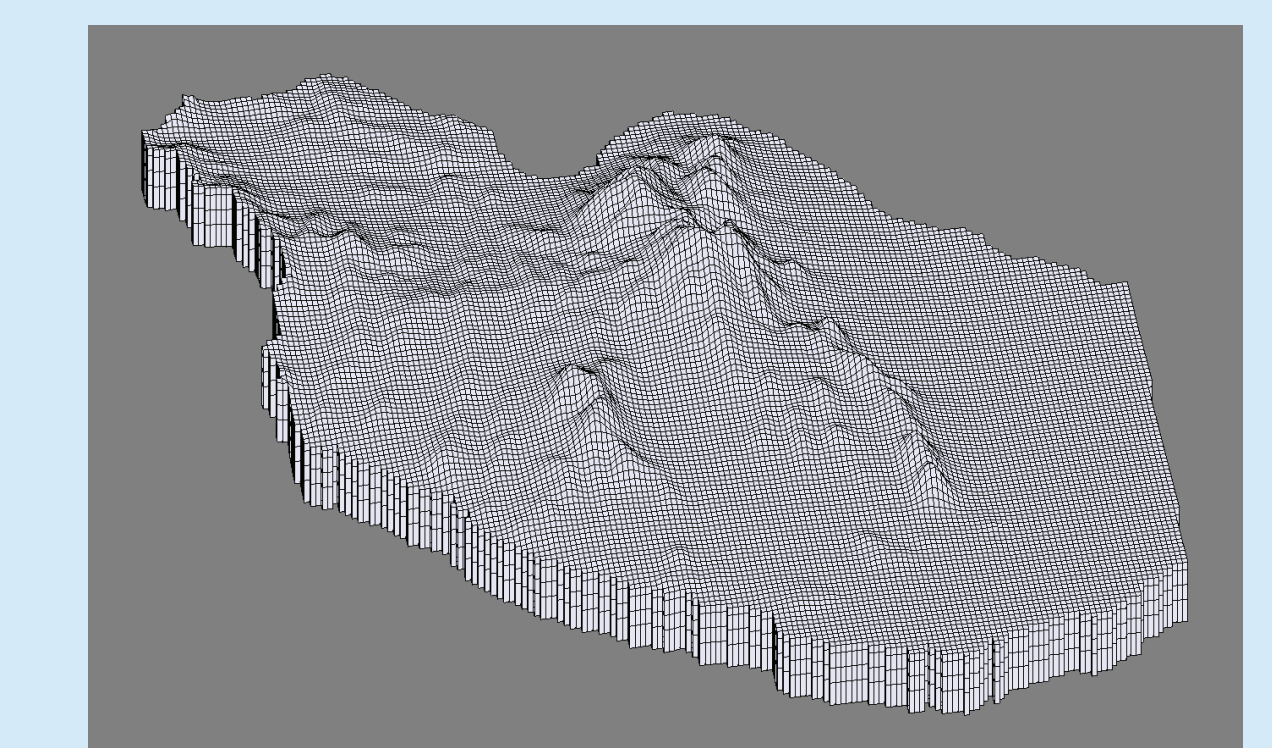
- Existing and new wells
- Groundwater levels
- Surface water flows/stage
- Aquifer tests
- Monitoring data allows for model calibration

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
Refining conceptual model based on data



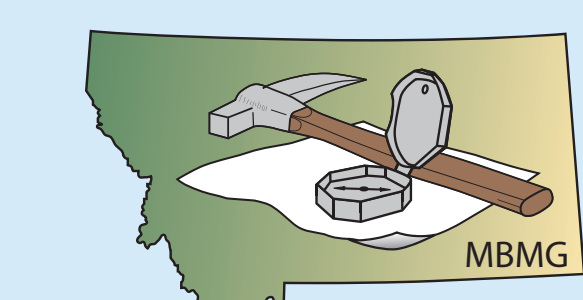
3-D angled view of geologic map of study area



3-D model grid, developed from hydrogeologic conceptual model

Acknowledgments

- Land owners
- DNRC, Water Resources Division
- Lewis and Clark County Water Quality Protection District
- BLM



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