Solving the Water Mystery: Field Well Water Reconnaissance Investigation in Unionville, Montana

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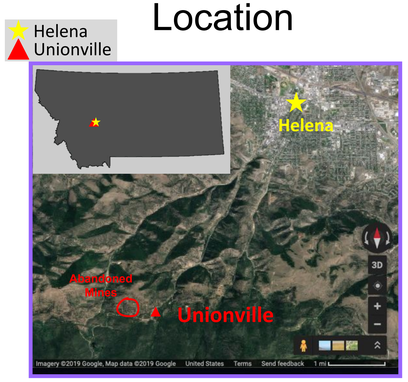
Location



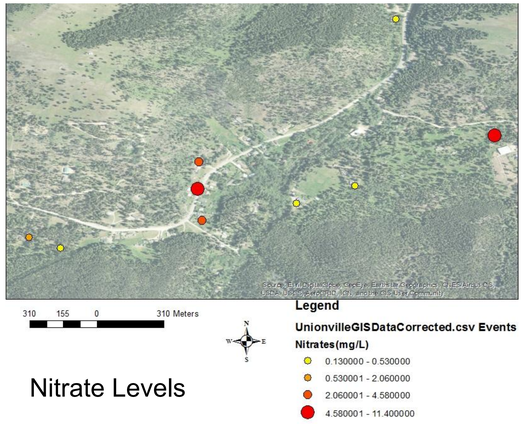
Background

Unionville is a small mining town south of downtown Helena. Almost all of its population has private wells for their water supply. Lewis and Clark County has very little groundwater information for the Unionville area. They suggested that we do a reconnaissance study to collect water-quality data and measure water levels in wells to better understand groundwater-flow patterns or potential water-quality problems in the area. Specifically, we wanted to see if there were any elevated levels of trace metals Arsenic and Uranium; or whether Nitrates were higher than the Department of Environmental Quality recommended standards.

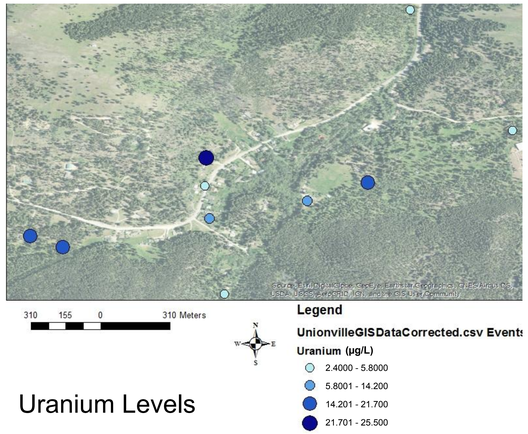
Question

Unionville was established because of mining activities. Are the residents who live there are at risk to elevated trace metals or nitrates? Elevated trace metals might show up in wells drilled into mineralized rock. Elevated nitrates as N may be sourced from the residue of explosives used in mining operations or from a lack of soils to attenuate septic effluent.

Study Area



Nitrate Levels



Uranium Levels

Arsenic Levels

The figures above show contaminants of concern that were measured at each well. The larger points represent larger values where as the smaller, lighter points are lower contaminant levels.

The DEQ recommended health standards are as listed below

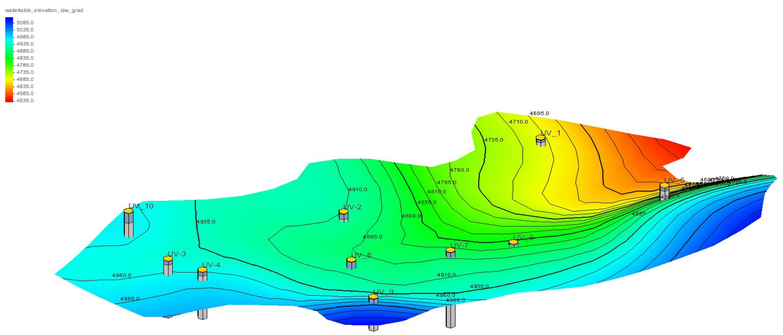
- Uranium - 30 µg/L
- Arsenic - 10 µg/L
- Nitrates - .01 mg/L

Methods

1. Greet the client/homeowner with a big smile, and GPS the well location, if not done previously,
2. Using a crescent wrench remove the well cap and obtain a SWL measurement.
3. Measure the stick-up of the casing above the ground, replace the well cap and secure the bolts.
4. Find an outside frost-free spigot, attach a “Y” shaped splitter to the spigot. One side allows flow at roughly 5 gpm and the other side has a tube where water can pass through the flow-through cell.
5. Measure flow rate and gently turn valve from the flow-through cell so laminar (non-turbulent) flow is maintained.
6. Insert the WQ meter into the flow-through cell and record the time and detected water-quality values.
7. Repeat, recording the time and water-quality values *every 5 minutes* until pH, Temp, and SC stabilize.
8. Collect the water samples from the tube side and add the nutrients to the bottles and place into the cooler.
9. Record all the required information on the Chain of Custody forms and return the samples to the laboratory.

Results

GroundWater Flow Map



Groundwater flow image with 25-foot contour intervals. Blue represents higher areas with flow moving to the northwest. Flow at UV_10 is moving to the east away from UV_3.The map was constructed in Groundwater Modeling Systems(GMS).

Discussion

Concerns of High Contaminants

The results indicate that there is an influence of mineralized rock in the Unionville area. Certain contaminants (U, As, and Nitrate as N) may pose a health risk to people that ingest them through their water supply. The wells that we sampled are the main source of drinking water for the residents we had the opportunity to meet.

Results to Homeowners

After the results from Energy Labs came back, copies were either hand delivered or emailed to homeowners. Neighboring well results were not shared with each other. Homeowners may or may not take further action to remediate their wells of contaminants, it is entirely up to them.

Acknowledgements

Thank you to Dr. Patricia Heiser for her guidance in putting together this project. We also thank Dr. Weight for his expertise in the field and instruction in carrying out water sampling techniques. He also put together topology data for us in groundwater modeling systems. We thank Lewis and Clark County for helping fund a large portion of this project and allowing our class the chance to partake in this research project. A special thanks to the landowners for their cooperation and for allowing us access to their wells.